Mutual Fund Investments in Private Firms

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Abstract:
Historically a key advantage of being a public firm was broader access to capital, from a disperse group of shareholders. In recent years such capital has increasingly become available to private firms as well. We document a dramatic increase over the past twenty years in the number of mutual funds participating in private markets and in the dollar value of these private firm investments. Consistent with theory, mutual funds rely heavily on the certification of intermediaries to evaluate these high information asymmetry, private firms. Consistent with the greater availability of capital changing the trade-off between private and public listing status, we find that mutual fund investments enable companies to stay private an average one to two years longer.

1. Introduction

While going public is without question a watershed event in the life of a firm, the lines between private and public listing status have become increasingly blurred in recent years. The number of publicly listed companies has decreased, but at the same time private companies are increasingly raising funding from investors who traditionally focused only on public companies, for example from mutual funds, hedge funds, pension funds and sovereign wealth funds.[1] These changing dynamics affect multiple parties: regulators who are faced with policies that are largely based on a relatively strict line between public and private listing status, firms who are faced with potential changes in both sources of capital and costs of capital, and investors who face changes in their investment opportunity set.

The first objective of this paper is to provide systematic evidence on these changing dynamics. We focus our analysis on a group of institutional investors that control a substantial portion of the equity capital within our economy: mutual funds. As of 2015, 25% of the public equity in the US was owned through mutual funds,[2] and as highlighted by Edmans, Goldstein, and Jiang (2012) mutual funds' allocation decisions can have real effects on the underlying firms. Among private firms, mutual funds potentially represent an attractive source of capital. They generally invest in conjunction with a venture round, thereby avoiding an additional funding round and the accompanying pressure for higher valuations. Also, as shown by Chernenko, Lerner, and Zeng (2017) mutual fund investments are generally not associated strong control rights such as Board representation. We investigate how the tendency of mutual funds to invest in private companies has changed over a 20-year time period.

Our second objective is to examine the types of private companies in which mutual funds

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[1] See, e,g., http://www.institutionalinvestor.com/blogarticle/3407394/blog/the-latest-trend-for-pension-funds-private-equity-investment.html#.WECtwdUrLRY and http://www.wsj.com/articles/pension-funds-lambast-private-equity-firms-for-large-fees-1416562426

[2] 2016 Investment company fact book, Investment Company Institute.

invest. We consider both the characteristics of the company and the characteristics of institutions that serve as intermediaries. Because mutual funds' expertise is primarily in evaluating public companies, we conjecture that they will rely heavily on the certification of an intermediary. As modeled by Booth and Smith (1986) and extended by Megginson and Weiss (1991), intermediaries such as underwriters and venture capitalists can certify firm quality, thereby preventing a market failure of the type identified by Akerlof (1970). We thus predict that mutual funds tend to invest in private firms backed by high quality venture capitalists.

Mutual funds' choices regarding the companies in which to invest will also be influenced by their skill set, their investment horizon, and their liquidity position. On the one hand, mutual funds' uncertainty regarding future withdrawals should lead them to invest in companies for which expected liquidity is higher, e.g., a higher probability of going public or being acquired in the nearer term. In addition, their inexperience with extremely young companies should lead to a focus on private firms at later stages of development. However, the fact that they are not pressured to exit all investments by a specific date, as is the case for VC funds, combined with the fact that a relatively small percent of their portfolio is invested in private firms, potentially gives funds greater flexibility to invest in earlier stage companies.

Our third objective is to consider the effects of this increased availability of capital. We conjecture that mutual fund investments will enable private companies to stay private longer. Typically, factors such as capital for investments, increased liquidity, and a broader shareholder base influence companies' decisions to go public (see, e.g., Brau and Fawcett (2006), Lowry (2003)). If pre-IPO mutual fund investments lessen the advantages of public listing along any of these dimensions, then we would expect increases in these financings to cause more companies to stay private longer.

Our findings provide strong evidence that an increasing number of IPO firms have raised capital from mutual funds prior to going public. Between 1995 and 2010, less than 5% of venture

capital-backed IPO firms had mutual fund investments prior to the IPO. In contrast, this percentage increased to 19% in 2014, 24% in 2015, and 36% in 2016.

While these statistics suggest an increasing trend of mutual funds investing in private companies, focusing only on those companies that have gone public potentially provides a biased perspective. To obtain a more comprehensive picture of the extent of mutual investments across a broad sample of private firms, including those that are still private, we hand-collect detailed holdings data on 16 mutual fund families. The funds in our sample include predominantly the largest fund families (e.g., Fidelity, Blackrock, and Vanguard) as larger families are significantly more likely to invest in private firms, but also some smaller fund families (e.g., SunAmerica Asset Management and Wasatch).

Through an intensive data-gathering process, we determine that 149 funds across these 16 families held shares in venture-backed private firms, over the 1995 – 2016 period.[3] This practice has become increasingly widespread: less than 14 funds invested in private companies each year through 2000, compared to over 90 unique funds in 2014 and 2015.[4] We note that this trend may be driven by increases in the supply or in the demand for mutual fund capital. Increases in supply would be consistent with lower costs of learning about private firms, and in recent years by the search for higher returns in a low interest rate environment by diversifying into new asset classes. Increases in demand would be consistent with private firms seeking to stay private longer as a way to avoid the regulatory and shareholder-induced pressures of being a public firm.

These 149 mutual funds invested in 269 unique companies during 1995-2016. Given that our sample is based on a subset of fund families, this represents a lower bound for the extent of firms with mutual fund investments. As a basis of comparison, these 269 companies represent 1% of all

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[3] We focus on venture-backed private companies as a way to eliminate private companies that seek to remain private and independent.

[4] The number of unique mutual funds investing in private firms dropped slightly in 2016, to 89 funds.

venture-backed companies over our 1995 – 2016 sample period. However, this percentage is much higher in later years and among firms that have progressed beyond the earliest stages. As noted earlier, 36% of firms going public in 2016 received mutual fund financing prior to their IPO.

Consistent with fund managers' expertise and with liquidity concerns, mutual funds focus on the set of private firms that are more similar to the public firms in which they generally invest: among the private companies in which mutual funds invest, 39.8% first receive this financing in later stage rounds. However, it is noteworthy that we also find an increasing trend toward investing in companies at earlier stages of development. We also find some evidence to support the prediction that mutual funds rely on the certification effects of intermediaries, for example concentrating investments in firms backed by higher quality venture capitalists.

Finally, we consider whether mutual fund financing facilitates companies staying private longer. As a first step, we examine whether funds provide a 'meaningful' amount of capital, i.e., whether they provide sufficient capital to feasibly enable a rapidly growing company to remain private. We find that among rounds in which mutual funds participated, the funds provide an average 33% of the total financing raised (median = 29%), over the 2011 – 2016 period. The capital provided by mutual funds appears to be incremental to that provided by the VCs, i.e., not to represent a substitute in the sense of enabling VCs to stop funding the company at an earlier point.

Our last analysis seeks to isolate the causal effects of mutual funds' investments on private firms. Our choice of an instrument is based on the importance of relationships as conduits of information (see, e.g., Cohen, Frazzini and Malloy (2010), Engelberg, Gao and Parsons (2012)). We conjecture that a mutual fund that has a prior relationship with a venture capitalist, for example through an investment in a private company backed by that VC, will be more likely to remain in communication with that VC. It follows that this fund would be more likely to be aware of subsequent private companies backed by this same VC.[5] Consistent with this intuition, we find a

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[5] see, e.g., https://www.cbinsights.com/blog/mutual-fund-vc-syndicates/

strong positive relation between the likelihood of a firm receiving mutual fund investment and an indicator for whether that company was backed by a VC with a prior interaction with mutual funds.

Using this instrument, a wide array of regression specifications suggests that mutual fund financing enables companies to stay private longer. Among those companies that successfully exit, our findings suggest that mutual fund financing enables companies to stay private 2.4 years longer. Across our entire sample of VC-backed companies, those with mutual fund financing have a higher probability of ultimately exiting via either IPO or acquisition, but this source of financing lowers the probability of exit within a given quarter by 6%. Finally, our findings indicate that companies with mutual fund financing are more likely to go public but less likely to be acquired, an insightful difference given the greater stage of development of firms going public. As highlighted by Gao, Ritter and Zhu (2013), there has been a pronounced shift away from small IPOs since 2000.

Our study sheds new light on the financing choices and decisions of private firms. First, we provide systematic evidence on one of the ways in which the lines between public and private status are becoming increasingly blurred, i.e., on the extent to which a class of investors that has traditionally focused on public firms is increasingly investing in private firms. Chernenko et al (2017) similarly analyze mutual fund investments in private firms, but unlike us they focus on the governance aspects of these investments. Our finding that increased mutual fund capital is flowing to private firms is intriguing when compared to the decline in the number of IPOs and the decrease in the number of publicly listed firms (see, e.g., Gao, Ritter and Zhou (2013), Doidge Karolyi and Stulz (2015), and Grullon, Larkin, and Michaely (2017)). Prior literature suggests that a variety of factors contribute to these trends, including for example the increased propensity of private firms to be acquired rather than go public. In addition to these factors, any increases in the availability of financing to private firms decrease the net benefits of being public and thereby influence firms' decisions regarding public listing.

Second, a growing body of literature has contrasted the benefits of private versus public

listing, with both Brav (2009) and Gilje and Taillard (2016) concluding that public firms have lower costs of capital and greater ability to raise capital to fund new projects. Our findings suggest that the magnitude of these differences may have decreased over time.

Third, several papers have established the importance of networks within the venture capital industry. Hochberg, Ljungqvist and Lu (2007) find that more centralized venture capitalists perform significantly better, and Gorman and Sahlman (1989) and Sahlman (1990) discuss the ways in which VCs rely on their connections with head hunters, patent lawyers, and investment bankers, among others, to increase the company's likelihood of success. Our findings suggest that relationships between venture capitalists and mutual funds may becoming increasingly important. The fact that VCs generally have substantial board representation in the private firms in which they invest suggests that they view these mutual fund investments favorably.

2. Data

2.1 Private firm sample

Our sample of private firms consists of firms that received venture capital backing, as listed in the SDC VentureXpert database, over the 1990 – 2016 period.[6] Our focus on private firms with venture backing is motivated by several factors. First, the set of venture-backed firms represents a set of firms with the clear objective of exiting private status within a certain amount of time. As discussed by Metrick and Yasuda (2011) and Ibrahim (2012), VC firms raise funds that are designed to last 10 – 12 years; they seek to exit investments within this period and return money to their investors. In contrast, many non VC-backed private companies have no definite plan for exit, making it difficult if not impossible to assess whether mutual fund investment causes firms to delay going public (or being acquired).[7] Second, while nearly all private firms have some equity investors, the identity of these

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[6] We also download data from prior to 1990 to calculate rolling averages over previous three-year periods, as defined later.

[7] We frequently see many non VC-backed private companies that stay private for a very long time. To name a few, McKinsey & Company (founded 1926), Fidelity Investments (founded 1946), and SAS Institute (founded 1976).

investors is frequently unknown among non-venture backed firms. Third, many mutual fund managers focus their private firm investments on firms backed by venture capital. For example, based on 2015 filings, Fidelity Contrafund contains 21 unique restricted holdings, of which 17 (81%) represent VC-backed companies.

We restrict the sample of VC-backed companies along several dimensions. Firms must be private and US-based, and financing-round and firm information must be internally consistent.[8] Firms must receive an investment from at least one fund with the investment type 'Venture Capital' in the VentureXpert database, thereby excluding firms whose financing is solely real estate, mezzanine finance, or private equity. We require these portfolio companies to be founded after 1980, and to have the first venture capital funding round in 1990 or later. Firms that received mutual fund financing prior to venture capital financing are excluded. Our final sample includes 28,637 VC-backed private firms.

From the SDC New Issues Database and the SDC VentureXpert Mergers and Acquisitions Database, we determine exit outcomes. For each private firm in our sample, we determine whether the firm went public or was acquired. We obtain the industry of each firm and financing-round information on the dollar amount invested, the date of each investment round, and the identity of the investors from VentureXpert. Looking at Panel A of Table 1, Columns 1 and 2 show the number of companies receiving VC financing for the first time each year, as well as the number that subsequently exited via either IPO or acquisition. Columns 7 and 8, in Panel B, show the number of exits by exit year.

2.2. Mutual Fund Holdings

Mutual funds holding shares in private firms are required to list them as restricted securities.[9] While standard data sources such as the CRSP Mutual Fund database and Thomson-Reuters Mutual Fund Holdings database only cover investments in public companies, the SEC requires mutual funds

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[8] For example, we drop cases in which the company's earliest round date is earlier than the variable 'Date Company Received First Investment' and cases where the first VC funding round occurs prior to the firm's founding year.
[9] The SEC defines restricted securities as securities acquired in an unregistered, private sale from the issuing company or from an affiliate of the issuer.

to disclose their complete portfolio holdings, regardless of the companies' listing status, through periodical filings. Electronic filings are available from EDGAR starting around 1995, and by regulation all reporting companies, including mutual funds, have been required to file electronically through EDGAR since May 1996. Through 2004 mutual funds disclosed their portfolio holdings semi-annually, and starting in 2005 the requirement was changed to a quarterly interval.[10] To ensure consistency across our entire sample period and due to the high costs of the data collection, we collect data semi-annually for all years. Specifically, we extract restricted holdings from Form N-30D for the period 1995-2004 and from form N-Q for the period 2005-2016.

We parse through the above-described filings for a designated set of mutual funds, in order to extract restricted holdings. Mutual funds usually use footnotes to indicate whether each security is restricted. For example, Fidelity Series Opportunistic Insights Fund holds shares of Airbnb, Dropbox, Uber Technologies, etc. as of Sep 2015. It puts superscript (d) on each restricted security, and the legend describes (d) as: "Restricted securities - Investment in securities not registered under the Securities Act of 1933 (excluding 144A issues)." Appendix I provides an example. However, different funds use different superscripts and different text to designate restricted securities, meaning there is no universal way to search across all funds.

Due to the extremely high costs of collecting data on every mutual fund, we collect data on a subset of funds. Our primary interest is to characterize the trends in mutual fund investments and assess the impact of mutual fund investments on private companies, and we therefore seek to identify fund families that have the willingness and infrastructure to invest in private companies. To identify such a subset, we first identify all IPOs between 2006 and 2015, excluding REITs, ADRs, banks, utilities, previous LBO firms, and offerings with an offer price less than $5. We then search by IPO

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[10] Starting from May 2004, the SEC requires mutual funds to file Form N-CSR (Certified Shareholder Report) at the end of the second and fourth fiscal quarters and Form N-Q (Quarterly Schedule of portfolio holdings) at the end of the first and third fiscal quarters (Agarwal et al., 2015).

company name through the universe of mutual fund filings over this same period, to determine which mutual funds owned any of these firms prior to the IPO. Filings are made at the CIK level (where each CIK generally includes multiple funds). We identify 91 CIKs for which at least one mutual fund invests in a company prior to its IPO; in total these CIKs include approximately 1,500 funds.

Our goal is to identify the universe of mutual funds that invest in venture capital-backed private firms. One potential concern is that this approach will fail to identify funds that have invested in private firms, but none of these firms have gone public. To assess the severity of this factor, we compare our list of mutual funds with those listed in the Wall Street Journal Startup Stock Tracker, which includes private firms held by mutual funds with valuations of $1 billion or more as of the end of 2016.[11] We find that our algorithm captures all fund families included in this list.

Across these 91 CIKs, 75 are associated with open-end funds and 16 with closed-end funds. We first provide an overview of these fund families that invest in private firms, compared to the broader universe of mutual fund families. Across the 75 CIKs that correspond to open-end mutual funds, we are able to match 72 with Thomson-Reuters Mutual Fund Holdings. Across these 72 CIKs, 68 CIKs are associated with funds in decile ten (largest), 3 with funds in decile nine, and 1 with a fund in decile seven (where the deciles are based on grouping the 12,956 unique funds listed in Thomson-Reuters by management company, and ranking management companies into deciles according to total assets).[12] In sum, larger fund families are substantially more likely to invest in private companies, a finding that is consistent with both Chernenko et al (2017) and with a 2016 Morningstar Report.[13] We note that this is consistent with these families having superior abilities and/or capabilities to evaluate this set of

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[11] http://graphics.wsj.com/tech-startup-stocks-to-watch/
[12] We 3 CIKs we cannot match include: AMERICAN FUNDS INSURANCE SERIES (CIK: 729528), GREAT-WEST FUNDS INC (CIK: 356476), and Voya INVESTORS TRUST (CIK: 837276). The matching of funds within these CIKs to Thomson-Reuters Mutual Fund Holdings deciles is based on the registrant fund within each CIK, as designated on the EDGAR filing.
[13] Morningstar Manager Research, (2016). Unicorn hunting: mutual fund ownership of private companies is a relevant, but minor, concern for most investors. December 2016.

more informationally opaque companies.

Due to the high costs of data collection, we collect mutual fund holdings for a subset of 59 CIKs, which belong to 16 different fund families.[14] Specifically, we select 14 families from decile ten (Blackrock, Fidelity, Vanguard, etc.), one from decile nine (Wasatch), and one that is not in the CRSP Mutual Fund Database (Great-West Funds). This distribution is consistent with the overall distribution of CIKs, as described above. We extract information on each fund's holdings of restricted securities using Python as well as extensive hand collection and verification. We distinguish equity holding from debt holding, as more fully described in Appendix I. We collect company names, number of shares, valuations, acquisition dates, acquisition costs, and security types. Additional details on the process of extracting mutual funds' holdings of private firms, as well as the full list of mutual fund families for which we collect data, are provided in Appendix I.

We describe the time-series of companies with mutual fund financing in several ways: by year in which these companies first received VC financing (Panel A of Table 1, cols 4 – 6), by year in which a mutual fund first provided financing to a firm (Figure 2), and by year of exit (Panel B of Table 1, cols 9 – 10). Section 2.4 focuses on discussing descriptive statistics.

For several analyses, we are interested in contrasting the capital provided by mutual funds versus VCs. For such purposes, we strive to match mutual fund investment with investment rounds in either VentureXpert or CrunchBase. Each of these data sources offers different advantages. VentureXpert provides all funding rounds but does not report round series information (series A, series B, etc.). On the other hand, Crunchbase provides round series information, but the data are less comprehensive in the sense that they include fewer firms. As discussed further in later sections, we define a mutual fund investment to have been part of a funding round if the absolute value of the difference between the mutual fund's acquisition date (as reported in mutual fund filings) and the

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[14] A 2016 Morningstar report lists 26 fund families holding private firms as of 2016, however the families included in their list for which we do not collect data are all substantially smaller.

venture round date (as reported in either VentureXpert or CrunchBase) is less than 30 days.

2.3 Patent Data

Very little financial information is generally available for private firms, and for this reason we focus on patent activity as a metric of a firm's level of development. The majority of the venture-backed firms in our sample are in technology-focused industries, where patenting tends to be important. Thus, for each of the 28,637 private venture-capital backed firms in our sample, we seek to determine the extent of patent activity. The official source for patent data is the USPTO (United States Patent and Trademark Office), which provides information on granted patents on a weekly basis. Bulk download is available through Google and Reed Tech at no charge.

Following Denes (2017), we use Python scripts to download and convert all patent files into a machine-readable format. We extract patent number, assignee name, assignee city, assignee state, application date, and grant date. We cross-check our patent data with previous literature and confirm that the numbers are consistent. For example, Hall, Jaffe, and Trajtenberg (2001) document that there are approximately 70,000 applied patents in 1985 (Figure 1 in Hall et al., 2001). In our sample, the number is 78,643. Also, they document that there are approximately 90,000 granted patents in 1990 (Figure 2 in Hall et al., 2001), and we have 99,275 granted patents in this year.

Because there is no common identifier between the patent data and VentureXpert, we name-match the two databases. We first normalize patent assignee names by removing punctuations and legal suffixes and then implement the cosine similarity algorithm developed by Denes (2017) to name-match patent assignee names with VC-backed companies in VentureXpert. The algorithm gives us the matching quality with a scale of 0 to 1. We match patents with VentureXpert if one of the following criteria is met: 1) match quality is higher than 0.9, or 2) match quality is higher than 0.8 conditional on having the same city. The matching gives us 260,494 patents matched to 11,101 VC-backed companies in our VentureXpert sample.

There are two dates for each patent: application date and grant date. As noted by Lerner and

Seru (2015), the patent literature has generally focused on analyzing patent filing by the application year. The economic motivation for this measure is that firms will tend to file for patents soon after the discoveries are made. However, we observe patent applications only if they are granted. Therefore, counting number of patents based on application year will mechanically create a truncation problem. Hall, Jaffe, and Trajtenberg (2001) and Bernstein (2015), among others, correct this truncation bias by dividing each patent by the average number of applied patents of all firms in the same year and technology class. In the same spirit, we scale each patent by the average number of patents of all VC-backed companies in the same year and industry, using the industry grouping provided in VentureXpert as tabulated in Table 2.

2.4 Descriptive Statistics

Descriptive statistics on these 28,637 venture-backed companies are provided in Table 2, where the first column focuses on the 269 companies that received mutual fund investment prior to exit (i.e., prior to going public or being acquired), and the second column focuses on companies that did not receive such investment.

The first set of rows shows the characteristics of the VCs providing funding in the first round: VC firm age, the number of companies and the number of rounds in which the VC invested during the past three years, and the number of companies funded by the VC that had an IPO or were acquired during the past three years. When there are multiple VCs in the first round, we take the average of these characteristics. These metrics are generally perceived to capture aspects of firm quality (see, e.g., Lerner (1994), Hochberg, Ljungqvist, and Lu (2007), Nahata (2008)). Across all five of these measures, firms that are ultimately funded by mutual funds are backed by higher quality VCs during the first round of financing. This is consistent with our conjecture that mutual funds rely on the certification of an intermediary, when selecting private companies in which to invest.

The second set of rows focuses on the extent of VC funding. Because we are interested in the decision of mutual funds to invest in firms, we measure these variables prior to the first mutual fund

financing for the sample of 269 firms that received such financing and prior to exit (or as of the last financing round) for all other firms. This approach is based on the intuition that funds had the choice to invest in these other firms at each point in time (up to ultimate exit or to the last observed round), but never did. Rounds received represents the number of venture capital financing rounds, and VC syndicate size represents the number of VCs that have invested in the firm, at these points in time. We see that firms that receive mutual fund financing receive an average 3.70 rounds of VC financing prior to the mutual fund providing capital, compared to an average 2.95 rounds of VC financing among other firms. Much of this difference is driven by the fact that the failure rate is higher among those firms without mutual fund financing. For similar reasons, we also observe that the average syndicate size and the total VC capital raised of firms that receive mutual fund financing is significantly higher.

The third set of rows shows measures of patenting activity. We find that as of the last VC round, companies with mutual fund financing have applied for significantly more patents (where the set of patents is restricted to those that are ultimately granted) than those without: 8.5 versus 2.9 in raw terms, and 1.4 versus 0.6 after adjusting for year and industry. Similarly, firms with mutual fund financing are significantly more likely to have applied for and to have been granted at least one patent.

The fourth set of rows shows the industry distribution of the two sets of firms. Industry definitions are taken from VentureXpert. Across both groups, the largest percent of firms belong to the computer industry, between 5 and 10% to the medical industry, and slightly more than 10% to the communication industry. While these percentages are relatively similar across the two groups, there is a marked concentration of mutual-fund backed firms in the biotech industry: 25% of firms receiving mutual fund financing belong to the biotech industry, compared to only 6% of non-mutual fund backed firms. As highlighted by Dambra, Gustafson and Field (2015), biotech firms have high proprietary disclosure costs, suggesting they may benefit from staying private longer to delay the provision of sensitive information to competitors.

The fifth set of rows shows the geographical distribution of the two sets of firms. The most

notable difference is within California: 50% of firms with mutual fund financing are located in California, compared to only 35% of other firms.

Finally, the sixth set of rows describes the outcomes of each group of firms. Those firms that receive mutual fund financing are significantly more likely to exit (51% versus 29%), and in particular to exit via an IPO (32% versus 5%). Interestingly, firms that receive mutual fund financing are less likely to exit via acquisition (18% versus 23%). Finally, the firms that receive mutual fund financing also remain private significantly longer, measured as time to exit from first VC round: 6.51 years versus 4.92 years. This could be driven by differences in the types of firms that go public or by the mutual fund financing enabling these firms to delay going public.

3. The time trend of mutual fund investments in private companies

Figures 1, 2, and 3 provide evidence on the prevalence of mutual fund financing in private companies, as well as the ways in which it has evolved over the past 20 years. These figures show time trends in the number of private companies with mutual fund financing as well as trends in the number of mutual funds participating in this market.

Panel A of Figure 1 shows that there have been dramatic increases in: the number of mutual funds participating in these private markets and in the number of private companies with mutual fund investments. Between 1995 and 2000, less than fifteen mutual funds had investments in private firms, compared to 97 in 2014. The number of private firms receiving mutual fund investment has followed a similar trajectory. Interestingly, both series exhibit a decrease in 2016.

Contemporaneous with the increased number of funds investing in private firms, Panel B shows that the aggregate value of these investments has increased from less than $70 million dollars prior to 2000 to $7.5 billion in 2015 and $7.2 billion in 2016. This increase in valuations is driven by appreciation of prior investments and by new investments. The bars plot the latter, and they show that in 2015 alone mutual funds invested nearly $4 billion into private, VC-backed firms. However,

consistent with the evidence in Panel A of a slowdown in the most recent year, Panel B shows that there was only $1.2 billion in new investments in 2016.

We find that mutual funds typically invest alongside venture capitalists in funding rounds (commonly referred to as Series A, Series B, etc.). Panel C of Figure 1 shows that the capital provided by mutual funds represents an increasing percentage of total financing obtained through these funding rounds. In the 1995 – 2005 period, mutual funds provided an average 11.3% (median 5.4%) of capital in funding rounds. This increased to an average of 29.7% over the 2005 – 2010 period and 33.4% over the 2011 – 2016 period (medians = 17.4% and 28.7%).

A portion of the time trends in Figure 1 represent the cumulative effects of prior investments, i.e., if a fund invests in two firms per year and doesn't divest any of these investments then after three years it will have investments in six private firms. To separate these effects, Panel A of Figure 2 focuses on the number of companies receiving mutual fund financing for the first time each year. Panel B shows the median amount of capital invested by a mutual fund in a private firm. Several conclusions emerge. First, there have been time-series fluctuations in these metrics, but not a steady increase. The number of new companies receiving this type of financing equaled 35 at the height of the Internet Bubble, decreased to approximately ten or fewer per year over the subsequent decade and then has increased again in more recent years to a high of 44 companies in 2015. Consistent with evidence in Figure 1, there is a stark decrease in 2016, with only 6 new private companies received mutual fund financing. However, the typical amount of capital provided was substantially less in these earlier years. As shown in Panel B, the median funding amounts were relatively low during the Internet Bubble years, increased markedly in the years following the Financial Crisis, and remain relatively high today. The conclusion that funds are investing more capital holds across all development stages: early stage, expansion stage, and later stage. Second, Panel A shows that mutual funds are increasingly investing in earlier stage companies, which is perhaps surprising given

their presumably greater expertise in later stage companies.[15] More consistent with expectations,

Panel B shows that in dollar terms the amount of capital devoted to early stage companies remains

relatively small. The tendency to invest small dollar amounts across a number of early stage

companies is consistent with what Ewens, Nanda, and Rhodes-Kropf (2017) refer to as a 'spray and

pray' approach that has become increasingly common among venture capitalists.

It also appears that the number of mutual fund investments in private companies is positively

correlated with other cycles in the financing of private firms. The number of companies receiving

mutual fund financing for the first time (shown in Panel A of Figure 2) commoves with the number

of IPOs, with a correlation of 0.34. Interestingly, the number of companies receiving mutual fund

financing for the first time appears to be somewhat higher prior to market crashes, e.g., at the height

of the Internet Bubble in 1999 and 2000 and prior to the Financial Crisis in 2008, but the amount of

capital invested is substantially higher in the immediate wake of these events, e.g., in 2001 and 2009

– 2011. We conjecture that this latter effect reflects the infeasibility of going public in these years

combined with a demand for capital to survive. We also find that the number of private companies in

which mutual funds have investments is positively related to the number of private companies in

which VC firms have active investments (not tabulated).

Figure 3 highlights the extent to which the most successful venture-backed private companies

relied on mutual fund financing. Specifically, the sample is restricted to those VC-backed firms that

successfully went public, and for each year the bar graph depicts the number of such firms that

received mutual fund financing prior to the IPO (bottom, dark-shaded portion of each bar) versus

those that did not (top, lightly-shaded portion). The overlaid line shows VC-backed IPO firms that

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[15] One factor potentially driving mutual funds to increasingly invest in early stages is a search for more risk, for investments that are less correlated with public firms. This argument is highlighted in 'Desperate For Returns, Mutual Funds Add Risk By Investing In Private Startups':
http://www.forbes.com/sites/thomaslandstreet/2015/12/08/desperate-for-returns-mutual-funds-add-risk-by-investing-in-private-startups/#429f6586d5a8

received mutual financing prior to the IPO (bottom portion of each bar) as a percent of all VC-backed IPO firms (total bar). This percent ranges between 0 – 5% in the years prior to 2010, and has increased substantially in recent years, to 24% in 2015 and 36% in 2016.

These figures highlight that while articles in the popular press have focused on mutual fund investments in several high profile companies, for example Uber and Airbnb, the practice is in fact considerably more wide-spread. While these figures are merely descriptive, they are consistent with several underlying dynamics. First, there are reasons to believe that the costs of investing in private firms have decreased. The development of the internet has substantially decreased the costs of nearly all forms of information collection, and firms with the highest information asymmetry are likely to be the biggest beneficiaries of such changes. Also, there is a growing market for the shares of private firms. According to the New York Times, secondary sales of stakes in funds — including private equity funds, venture capital funds and real estate funds — totaled $47 billion in 2014[16]. The Nasdaq Private Market launched in March 2014 enables private companies to raise capital and manage secondary transactions. Second, the fall in the number of companies going public since 2000 (see, e.g., Gao, Ritter, and Zhu, 2013) means that mutual funds are less able to gain exposure to one sector of the market, i.e., to small, high growth firms. For reasons related to diversification and/or to fund mission, funds with incentives to gain such exposure will be increasingly likely to turn toward private firms. Third, anecdotal evidence suggests that incentives to earn higher returns in a low-interest rate environment may have pushed mutual funds to mimic successful strategies of hedge funds and other institutional investors to embrace alternative investments including private equity.[17]

4. Mutual funds' choice of companies in which to invest

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[16] A Boom in Private Equity's Secondary Market, Feb 15, 2015 (http://dealbook.nytimes.com/2015/02/18/a-boom-in-private-equitys-secondary-market/?_r=0)
[17] http://www.barrons.com/articles/alternative-investments-surfing-the-market-1445664165

4.1 In which private companies do mutual fund invest?

Private firms are characterized by enormously high information asymmetry, and the set of possible private firms in which funds can potentially invest is enormous. Our first prediction is that mutual funds will concentrate on firms that have demonstrated some level of success. Fund managers have developed skillsets in evaluating publicly traded firms, and they have incentives to focus on private firms at sufficient levels of development that these types of valuation skills are relevant. Our second prediction is that mutual funds are more likely to invest in firms backed by more reputable venture capitalists. Higher ranked VCs both select higher quality companies in which to invest and provide higher quality advising and monitoring, as shown by Sorenson (2007). Our third prediction is that mutual funds tend to invest in firms that are located either in close proximity to themselves or in a location with a high concentration of private companies. Prior literature provides strong evidence regarding the benefits of geographic proximity (see, e.g., Chen, Gompers, Kovner, and Lerner (2010) for evidence on VCs, and Hong, Kubik, and Stein (2005) and Coval and Moskowitz (2001) for evidence on mutual funds). To the extent that many mutual funds are located in places without a large concentration of private companies, the second best option would be for the fund to invest in companies that are all located in one 'far-away' location.[18] It is more efficient for a fund manager to make one trip to Silicon Valley and visit 20 different companies, versus making trips to five different locations and visiting just a few companies at each. As one example, T. Rowe Price fund manager Henry Ellenbogen states that he spends an average 100 days a year on the road, emphasizing the importance of in person due diligence.[19]

Consistent with the descriptive evidence previously presented in Table 2, the regressions in Table 3 largely support these predictions. Table 3 shows cross-sectional OLS regressions, where

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[18] Many of the largest funds are on the east coast, whereas the largest concentration of private companies is on the west coast.
[19] http://www.bloomberg.com/news/articles/2015-07-08/how-t-rowe-s-ellenbogen-started-the-flood-of-cash-into-startups

each VC-backed private company represents one observation and the dependent variable equals one if that company received mutual fund financing prior to either the end of the sample period or to exit, where exit is defined as either going public via an IPO or being acquired. Column 1 focuses on the full sample of 28,637 private VC-backed companies that first received VC financing in the 1990 - 2015 sample period, of which 269 companies received mutual fund financing. Columns 2 and 3 restrict the sample along various dimensions, in an effort to limit the sample of firms to those on which mutual funds might more likely focus their attention. In each case, we determine whether the company received mutual fund financing subsequent to the criteria being satisfied. For example, Column 2 limits the sample to companies with at least two rounds of venture capital financing, and Column 3 adds the requirement that companies be funded by a minimum of two venture capitalists prior to mutual fund investment. Finally, Column 4 shows results over the 1995 – 2010 period both because there were relatively few mutual fund investments prior to 1995 and to allow time for companies to exit. Stage level (e.g., early, expansion, or later stage), industry, and first VC round year fixed effects are included in all specifications. Consistent with Table 2, variables that vary over time are defined as of the quarter end preceding the first mutual fund investment for firms that obtained mutual fund investment, and as of the last VC round date for all other firms.

Results highlight the importance of a company's stage of development as perhaps the most important determinant of mutual funds' investments. Mutual funds are significantly more likely to invest in companies that have applied for more patents. In addition, they are also significantly more likely to invest in companies that have raised more money in prior rounds, a finding that likely captures several effects. First, it proxies for the quality of the firm, as VCs make larger dollar investments into firms they perceive to have a higher probability of successful exit. Second, mutual funds are more likely to recoup the fixed costs of researching a private company if they can make a larger dollar investment. Third, it is likely easier to obtain information on larger companies.

We find some support for the certification effects of intermediaries. In Column 3, when we

limit the sample to those cases that mutual funds are most likely to seriously consider (a minimum if

two VC rounds and participation by at least two different VCs), we find that mutual funds are

significantly more likely to invest in firms that are backed by VCs with more successful exits. A one

standard deviation increase in the number of exits by the funding VC(s) is associated with a 0.47

percentage point increase in the probability of a mutual fund investing in that company.[20]

Finally, Table 3 also indicates that geography is a relevant criteria. We include dummies for

five states: California, Massachusetts, New York, Texas, and Pennsylvania. Consistent with mutual

funds finding it more efficient to focus on geographically clustered companies, we find that

companies are more likely to receive mutual fund financing if they are located in California, and

significantly less likely if they are located in Texas.

Results are also robust to limiting the regression sample to companies that received their first

funding round over the 2005 – 2016 period (not tabulated). This suggests that mutual funds continue

to invest in these same types of companies in more recent years.

4.2 In which IPO companies did mutual funds invest prior to IPO?

To provide a different perspective on the companies in which mutual funds choose to invest,

Figure 4 and Table 4 focus on a set of companies that were ex post successful, i.e., that went public

via an IPO. Looking first at Figure 4, we examine various financial characteristics in the years prior

to and following the IPO. In each panel, year 0 is the fiscal year that includes the IPO.   Panels A

through D examine total assets, net sales, expenditures (= CapEx + R&D + SG&A), and gross

margin, respectively. Together these panels suggest that the companies in which mutual funds have

invested are characterized by higher growth.

Looking first at Panel A, those companies with mutual fund investment have slightly larger

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[20] The standard deviation of # Exits is 1.38. Based on the column 3 estimates, the probability(receiving mutual fund investment) increases by 0.0034*1.38 = 0.00469, or 0.47%. When compared to the unconditional mean 0.94% of receiving mutual fund financing, this represents a 50% increase in probability.

assets two years prior to the IPO ($39 million versus $22 million, a difference of 79%), but this difference increases substantially over the next 4 years. The companies in which mutual funds invest are 155% larger in terms of assets at the end of the fiscal year prior to the IPO and 226% larger two years later. Similar conclusions emerge from Panel B, which focuses on sales. Panel C suggests that much of this higher growth is coming from higher expenditures. Two years prior to the IPO, the expenditures of the companies in which mutual funds invest are approximately 64% larger (41 million versus 25 million), and by two years after the IPO the differential has increased to 186% (229 mil versus 80 million). Finally, Panel D indicates that this higher growth trajectory of the companies in which mutual funds invest is also manifested in lower profits for an extended period of time. The combination of both higher sales and higher expenditures of the mutual-fund backed companies, but no difference in gross margin is consistent with anecdotal evidence suggesting that many high growth companies are not focused on profit.[21]

Table 4 examines the statistical significance of these patterns. We restrict the sample to the 1,315 venture-backed firms that went public between 1992 and 2014, of which 56 received mutual fund financing, for fiscal years two years prior through two years following the IPO.[22] The dependent variable in columns 1 – 4 equal each of the variables examined in Figure 4: total assets, net sales, expenditures, and gross margin. Independent variables include a dummy equal to one if the firm received mutual fund investment, a dummy equal to one in the IPO years and beyond, and an interaction term between the mutual fund investment dummy and the event time dummy. Control variables similar to those in Table 3 are also included. The significantly positive coefficient on the interaction terms in the assets, sales, and expenditures regressions as well as the marginally

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[21] For example, a general partner at Accel Partners downplays the importance of profitability, stating "You can decide when you want to make a business profitable by simply growing more slowly" Sharing Economy Firms Like Uber And Airbnb Are Burning Cash At A Phenomenal Rate, Dec 8, 2015, Business Insider
[22] Results are similar in economic terms but statistically stronger if we extend the sample through 2016 (i.e., the sample represented in Figure 4). This approximately doubles the number of IPO firms with mutual fund financing but includes firms for which we do not have two full years of post-IPO data.

significant negative coefficient in the gross margin regression are consistent with conclusions from Figure 3.

Table 4 also includes two additional regressions, where the dependent variable equals expenditures as a fraction of assets and cash as a fraction of assets. If companies were wasting the capital provided by mutual funds through non-productive expenditures or holding onto the cash as a safety net, we would expect to find significantly positive coefficients on the mutual fund investment dummy * IPO year and beyond dummy. The insignificance of this coefficient in the scaled expenditures regression and the marginally significant negative coefficient in the cash regression provides no support for these conjectures.

In sum, both Figure 4 and the regressions in Table 4 suggest that mutual funds are concentrating their investments in a set of high-growth companies. Such companies tend to have high demands for capital, and if they want to delay going public they may find it difficult to raise sufficient financing from venture capital. First, individual venture capital funds avoid investing too much money in any one company, for reasons related to diversification. Second, there are frictions associated with having too many venture capitalists funding a company, for reasons related to contracting and control. Mutual funds willing to invest in the company potentially provide a solution to this problem. In this way, mutual fund financing provides benefits similar to those discussed by Hochberg et al (2016) for venture debt.

5. Do companies obtain 'incremental capital' from mutual funds?

In an effort to understand the ways in which mutual fund investments potentially benefit companies, we seek in this section to understand the extent to which these investments provide new capital and/or additional liquidity to the underlying companies.

5.1 Primary shares or secondary shares?

We first investigate whether mutual fund investments predominantly represent primary

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shares or secondary shares. To the extent that companies seeking mutual fund investments are high

growth companies with high demands for capital, as suggested in the prior section, primary share

investments will be particularly beneficial. However, it is important to note that purchases of

secondary shares can also be valuable, for example if the increased liquidity enables existing

shareholders to sell at least a portion of their holdings and thereby lessens pressure to go public

before the company is ready. Several factors, including for example the emergence of the Nasdaq

Private Market, have arguably increased the liquidity of private company shares.[23]

Because mutual funds do not report whether their investments were primary or secondary

shares, we employ the following procedure. First, we match each mutual fund investment with

reported rounds in VentureXpert. We find that 72.4% of the 1,051 mutual fund investments in our

sample (where each of these 1,051 observations represents an investment by one fund in one

company at one date) are within 30 days of a reported VentureXpert round. As shown in Panel A of

Figure 5, the vast majority of these 72% of cases are in the days preceding the round closing date, a

pattern that is consistent with funds investing in the weeks leading up to the final round close date.

The remaining 28% of cases potentially represent a combination of primary shares (e.g., if the mutual

fund purchased the shares more than 30 days prior to the round closing date or if the round date in

VentureXpert is reported with error) and secondary shares. To shed further light on these issues, we:

(1) compare the dollar size of the mutual fund investment across the 72% of cases in which we can

confirm they are primary shares and the 28% other cases, and (2) conduct a set of Google searches on

a random sample of cases falling into the 28% uncertain category. As reported in Panel B of Figure

5, the dollar investment amount of the two groups is similar.[24] The similarity in investment

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[23] For example, when Intel invested $740 million into Cloudera in 2013, a portion of this investment represented secondary share purchases and thus provided no new capital to the company.
https://techcrunch.com/2014/04/01/much-of-intels-740m-cloudera-investment-likely-went-to-existing-shareholders/
[24] The sample in Panel B is restricted to those cases in which funds report acquisition costs; across our sample 95% of mutual fund investments report this information.

decreases the possibility that the two groups represent fundamentally different types of investment. In addition, our manual Google searches confirm 84% of cases as being primary shares. In sum, we conclude that the vast majority of the mutual fund investments in our sample are part of funding rounds of primary shares.[25]

5.2 Do mutual fund investments increase total capital raised?

The popular press regularly suggests that mutual fund investments enable companies to stay private longer. While possible, this is based on the underlying assumption that the capital provided by mutual funds is incremental to any investments that VCs would have made. Alternatively, if the capital provided by mutual funds simply substitutes for capital that would otherwise have been provided by VCs, then there is no reason to believe that this capital would enable the company to stay private longer. There are several reasons to believe that mutual funds may provide funds over and above that which VCs are willing to provide. First, for diversification reasons, there is an upper bound on the amount of money that a VC is willing to invest in a single company. Second, existing investors may not want a new VC to take an ownership stake in the company because this new VC would likely demand control rights. As discussed earlier, mutual funds rarely demand control rights.

As a first step towards investigating this issue, Figure 6 restricts the sample to companies that obtain mutual fund financing in at least one round, and compares round size among those rounds with versus without mutual fund participation. Panel A is based on matching mutual fund investments to venture financing rounds using CrunchBase, as this source provides detail on the series (e.g., Series A, Series B, etc), and Panel B is based on matching the mutual fund investments to rounds in VentureXpert, as this source provides a more comprehensive sample of venture

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[25] Anecdotal evidence indicates that there are some cases in which a mutual fund purchased secondary shares at the same time that primary shares were issued. To investigate the likely frequency of this, we focus on the subset of mutual fund investments for which Series information is available. For these cases, CrunchBase provides the date on which the round closed, thereby enabling us to ascertain whether they are primary or secondary shares. An analysis of these cases similarly suggests that the phenomenon of a fund buying secondary shares contemporaneous with a primary share funding round is relatively rare.

financing rounds. In both cases, among companies with mutual fund investments, we match the rounds reported in the mutual funds' filings with the venture round if the mutual fund acquisition date is within 30 days of the venture round date.

As shown in Panel A of Figure 6, we find that rounds that include mutual fund participation are substantially larger than those that do not, across every series.[26] For example, among Series B financings, the median round amount of rounds with versus without mutual fund participation is $60 million versus $16 million.[27]

Panel B of Figure 6 provides similar evidence, across the entire distribution of rounds. We again restrict the sample to companies that receive mutual fund financing in at least one round, and we plot the kernel density of round sizes across rounds with mutual fund financing versus those without.[28] As shown in the figure, the distribution of rounds with mutual fund participation lies solidly to the right of those without. In sum, evidence from Figure 6 suggests that the capital provided by mutual funds is incremental to that provided by venture capitalists.

Table 5 provides further evidence on the extent to which mutual investments provide incremental capital to companies, rather than just substituting for capital that venture capitalists would otherwise have provided. Across all specifications, the dependent variable is the natural log of the round amount, and the independent variable of interest is a dummy equal to one if the round included participation by mutual funds. We similarly conduct the analysis using both the more comprehensive VentureXpert data (Col 1, which contains all rounds) and the more detailed CrunchBase data (Cols 2 – 4, which include series fixed effects). Columns 1 and 2 show OLS regressions, while Columns 3 and 4 show the first and second stages, respectively, of a 2SLS

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[26] Because relatively few companies have series F, G, and beyond, we merge them into a single category.
[27] The larger round amounts of rounds with mutual fund financings is NOT driven by the fact that such rounds are predominantly the last round a company raises. In fact, only 55% of rounds with mutual fund participation represent the last round a company raises.
[28] Because this figure does not require detail on the series, which is not available for all mutual fund investments, we match to VentureXpert to better enable us to use all available data.

specification to control for endogeneity.

Across all specifications, conclusions are similar to those from the figures: mutual funds appear to be providing incremental capital to companies, rather than merely representing a substitute for VC investments. Across the full sample of 74,839 VC rounds, of which 183 include mutual fund investment, Column 1 indicates that rounds with mutual fund participation are significantly higher. Columns 2 – 4 restrict the sample to the 537 funding rounds across the 121 unique VC-backed companies with mutual fund investments that we are able to match to financing rounds listed in CrunchBase. Across these 537 funding rounds, 136 include mutual fund participation.[29] Column 2, which like Column 1 shows an OLS regression, similarly shows that rounds with mutual fund participation are significantly higher.

To control for the possibility that the rounds in which mutual funds participate are larger for reasons other than the mutual funds' participation per se, Columns 3 and 4 utilize a 2SLS approach. We note that the most likely source of endogeneity in this context is correlated omitted variables, i.e., if the investment by the mutual fund is correlated with other factors that we do not observe and which cause round size to be larger. Because the sample is defined such that every firm has mutual fund investment at some point, time-invariant correlated omitted variables should not be a concern. Thus, we require an instrument that is correlated with mutual funds' decision of whether to participate in a round (the relevance condition) but not correlated with firm characteristics that potentially affect the round amount (the exclusion condition). We argue that the existence of connections between mutual funds and the VC(s) that have provided funding to the firm as of a particular point in time satisfy these conditions. The relevance condition is satisfied by the fact that a prior relationship with a VC lowers mutual funds' research costs: a prior relationship facilitates

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[29] The decreased number of rounds with mutual fund participation in Col 2 compared to Col 1 stems from the lower coverage of CrunchBase versus VentureXpert + restricting sample to firms with mutual fund investment at some point.

efficient communication between the VC and the mutual fund manager, and reputation effects combined with trust built through prior interactions should make such information credible. In terms of the exclusion condition, we can think of no reason that a relationship between a company's VC and a mutual fund manager would independently be related to company characteristics in ways that would influence affect the company's round amount.[30]

To quantify each VC's connections with mutual funds, we do the following. For each VC-quarter, we determine whether the VC has jointly invested with mutual funds in the past. For each company-quarter (the observation level in regressions), we count the number of VCs that have syndicated with mutual funds in the past. Thus, this measure varies both as a function of the VC(s) backing the firm and of time. Column 3 shows the first stage regression, where the dependent variable equals one if the mutual fund participated, zero otherwise. Conclusions from the second-stage regression are consistent with those from the OLS specifications. Round amounts that include mutual fund participation are significantly higher.

6. Relation between mutual funds' investments on companies' decisions to stay private

To the extent that funds provided by mutual funds represent an incremental source of capital, as suggested by findings in the prior section, it should be the case that this funding enables companies to stay private longer. While greater access to capital is commonly viewed as a key benefit of going public, if a company can more easily access capital from other sources while still private then the company has less of an incentive to go public. Viewing the decision to go public as a trade-off between the benefits of public listing versus the benefits of private status, a decrease in the benefits of public listing should tilt the scale toward staying private longer. As discussed by

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[30] Note that because all firms in this sample receive mutual fund financing at some point, the identification comes from changes over time in the identity of the VCs financing the firm. As a result, the F-statistic of 9.4 is somewhat low. Subsequent analyses that employ this instrument in broader samples have substantially stronger identification, yet importantly lead to the same overall conclusion.

Asker, Farre-Mensa and Ljungqvist (2015) and Farre-Mensa (2015), the benefits to being private are substantial, e.g., fewer regulatory requirements, fewer mandated filings, less pressure from investors to meet short-term targets, etc.

We examine this conjecture in a series of steps. First, we examine if companies in which mutual funds have invested have a higher probability of successfully exiting, via either IPO or M&A (Table 6). Second, we examine if conditional on exiting, mutual fund financing enables companies to stay private longer (Table 7). Finally, we extend our analysis to the entire sample, which includes companies that have successfully exited, active private companies, and companies that are defunct (Tables 8 and 9). Throughout we estimate both OLS regressions to obtain a sense of the strength and direction of association and 2SLS specifications that control for endogeneity.

We begin in Table 6 by examining the relation between mutual fund investments and company outcomes. All else equal, we expect mutual funds to invest in companies that are less likely to fail. This prediction is based on several factors. First, to the extent that VCs have a repeated game relationship with mutual funds, the VCs are unlikely to recommend firms with a high probability of failure. Second, results in earlier sections demonstrated that mutual funds tend to invest in companies with stronger indications of success, for example as proxied by patenting activity.

Table 6 shows cross-sectional regressions, where the sample consists of the 28,637 venture-backed private firms as described earlier. We employ three measures of company outcome: IPO, M&A, and failure, which is defined as not having either exited or received a financing round for four consecutive years. The decision to classify firms as failed if they do not receive a financing round for four consecutive years is based on the distribution of financing rounds across our sample. The median time between rounds is 0.8 years, and the 90% percentile is 2.26 years. It is unavoidable, however, that this classification produces both Type I and Type II errors. Some companies actually fail within a relatively short amount of time after the last financing round, meaning for example that

a company with a financing round in 2013 could have failed by 2014, yet we would not define it as such. In addition, there are some cases where a company successfully exits after the four-year cutoff, but is still classified as failed according to our algorithm. Across the 13,424 cases that our definition classifies as failures, 1,175 (8.75%) actually successfully exit, i.e., they exit more than four years after the last financing round.

The dependent variables in Columns 1, 2, and 3 are dummy variables equal to one if the company failed, exited via IPO, and exited via M&A, respectively, and these regressions employ the full sample of 28,637 companies that received their first VC financing round during the 1990 – 2016 period. Columns 4 – 6 show analogous regressions, but are limited to the 1995 – 2010 period, as there were few mutual fund investments in the earlier years and ending in 2010 gives companies more time to successfully exit. Independent variables previously used in Table 3 are included as controls.

Consistent with predictions, Columns 1 and 4 show that companies with mutual fund financing are significantly less likely to fail. As these are OLS regressions, this potentially incorporates two effects: a selection effect under which mutual funds are less likely to invest in companies that subsequently fail, and a treatment effect under which the capital provided by mutual funds gives companies more flexibility to continue operations until they can successfully exit.[31]

Additional columns in Table 6 also provide strong evidence that companies with mutual fund financing are significantly more likely to exit via IPO but significantly less likely to exit via M&A. This again potentially reflects both a selection effect and a treatment effect. Regarding the former, mutual funds likely strive to invest in those companies that will ultimately provide the largest payoffs, i.e., in companies that will go public via IPO. However, there is also a possible treatment effect where the money provided by mutual funds enables companies to develop to a scale necessary

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[31] The concentration of mutual fund investments in the years following the Crash of the Internet Bubble and following the Financial Crisis provide some support for a treatment effect.

to survive as an independent public firm.[32] Gao et al. (2013) suggest that changes in the market since 2000, for example globalization and the rapid pace of change that necessitates an ability to bring new products to market quickly, have made it very difficult for small companies to operate as independent public firms. Companies have to reach a later stage of development and also a larger size before they can viably go public through an IPO. In contrast, publicly traded firms often purchase small private firms as a way to fuel growth. Our findings are consistent with the capital provided by mutual funds assisting companies to stay private long enough to go public via an IPO, and therefore with the companies that strive to follow this course seeking out this type of financing.

Figure 7 and Table 7 examine whether those companies with mutual fund financing were private for a longer time prior to exit. Looking first at Panel A of Figure 7, we classify companies into one of four categories: companies with their first VC financing round over the 1990 – 2000 and 2001 – 2010 periods that exited via IPO, and companies over each of these periods that exited via M&A. Across all four groups, the companies with mutual fund financing stayed private substantially longer.   Panel B shows a kernel density plot of time to exit among companies without (solid line) and with (dashed line) mutual fund financing. Consistent with conclusions from Panel A, the density of companies with mutual fund financing lies to the right, indicating that these companies tend to stay private longer.

Table 7 examines these relations in a multiple regression framework, using either the full sample of venture-backed companies that have exited via IPO or M&A (cols 1 – 3) or a matched sample where companies with mutual fund financing are matched with those that never obtained

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[32] There is also anecdotal evidence that in more recent years, mutual funds investing in private companies have included ratchet clauses and blocking rights in the funding agreements, which provide mutual funds with certain downside protections. Ratchet clauses require companies to issue mutual funds additional shares if the IPO price is below a certain level, and blocking rights mean that investors' preferred stock only converts automatically into common stock if the IPO price is above a certain level. See, e,g., Square Pays $93 Million Penalty to Some Investors in IPO, Nov 18, 2015, WSJ (http://blogs.wsj.com/digits/2015/11/18/square-pays-93-million-penalty-to-some-investors-in-ipo/) and http://www.law360.com/articles/758292/unicorn-investors-securing-safety-nets-in-shaky-ipo-market .

such financing (cols 4 – 9). To form the matched sample, we employ a propensity score approach based on the regression in Column 1 of Table 3. We match each firm with mutual fund investment to the five firms without mutual fund investment that have the closest fitted values, subject to the additional requirement that treated firms and control firms have the same first VC round year and be in the same industry; we do not use repeated sampling. Columns 1 – 6 employ OLS regressions, and columns 7 – 9 represent 2SLS regressions that control for endogeneity using the number of VCs with mutual fund interaction in the past as an instrument, as defined previously.[33]

Across all specifications, the dependent variable is the log of time to exit, measured as the number of years between the first VC round and either IPO or M&A. We employ three measures of mutual fund participation: a dummy equal to one if a mutual fund invested in the company at some point (cols 1, 4, and 7), the log of the amount of capital invested by mutual funds (cols 2, 5, and 8; note that these columns have fewer observations because some mutual funds do not report acquisition cost), and the number of mutual funds that invested in the company (cols 3, 6, and 9). Each regression includes control variables and fixed effects used in previous tables.   In addition, the full sample regressions also include lead VC fixed effects. We define the lead VC as the VC that participated in the first round and made the largest total investment in the company across all rounds of funding (see Nahata, 2008). When there are ties (multiple VCs participate in the first VC round and invest the same amount across all rounds), we choose the VC that participated in a greater number of rounds.[34]

The OLS regressions in columns 1 and 4 indicate that companies with mutual fund

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[33] We employ the matched sample in our 2SLS analysis because the higher power provides stronger identification. Here, the exclusion criterion requires that mutual funds' relationships with VCs not directly affect time to exit. One concern might be that higher quality VCs would be more likely to have such relationships. However, such an effect would likely bias us *against* finding that mutual fund financing enables companies to stay private longer: Hochberg et al (2007) and Nahata (2008) find that higher quality VCs take their portfolio companies faster.

[34] Because we use lead VC fixed effects, we drop a small number of cases in which a VC served as lead for only one company - we need at least 2 observations per lead VC. We do not include lead VC fixed effects in the matched sample regressions because this sample contains many instances in which a lead VC is only represented one time, meaning we would lose a substantial number of observations.

investment stay private 19 – 20% longer, which translates into approximately one year (based on a mean time to exit of 4.9 years). As discussed previously, this includes both a selection effect and a treatment effect, whereas the 2SLS regression in Column 7 isolates the treatment effect. Looking at Column 7, our finding that the 2SLS coefficient is greater than the OLS coefficient provides some evidence that the selection effect is negative, i.e., funds are choosing to invest in companies that would tend to go public sooner.[35] This would be consistent with mutual funds focusing on high growth companies that (in the absence of other sources of financing) would seek to go public relatively soon in order to obtain capital to fund positive NPV opportunities. The 2SLS specification suggests that the mutual fund investment enables these companies to stay private for approximately 2.35 more years. This is equivalent to staying private through 1 – 2 more funding rounds, a seemingly plausible magnitude. In fact, among the companies that exited via IPO or M&A during our sample period, the 136 companies with pre-IPO mutual fund financing have an average (median) of 5.86 (5.0) rounds, compared to 3.64 (3.0) rounds for the firms without pre-IPO mutual fund financing.

Results in other columns present consistent conclusions. Greater capital invested by mutual funds and participation by a greater number of mutual funds both are associated with longer time to exit (as indicated by the OLS specifications) and specifically enable the company to stay private longer (as indicated by the 2SLS specifications).

Table 8 presents an even stronger test of the effects of mutual fund investment on time spent in private status. Table 8 shows panel regressions, where the sample consists of the 571,793 company-quarter observations across the 28,637 private companies that received VC financing for the first time over the 1990 – 2016 period. The panel regression specification is an alternative to

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[35] It is also possible that the finite sample bias of 2SLS contributes to the higher coefficient in the 2SLS specification. However, back-of-the-envelope calculations based on derivations in Hahn and Hausman (2005) suggest this is unlikely to be a major factor.

duration models (see, e.g., Shumway 2001) that enables the use of a two-stage approach to control for endogeneity.[36] Each period, the dependent variable equals one if the company successfully exited that period and zero if the company is still an 'active private company', which is defined as having had a VC round within the prior four years and not having exited. Companies leave the sample after they either exit or go four years without a funding round.[37]

We employ the same three measures of mutual fund participation as were used in Table 7: a dummy equal to one if at least one mutual fund provided financing to the company, the log of capital invested by mutual funds in the company, and the number of mutual fund investors in the company. For each, we first estimate a first-stage regression using the number of VCs with a mutual fund connection as the instrument, as defined earlier. In each of these first-stage regressions, the instrument is significant at the 1% level and the F-statistic for identification is well above the critical value of 10. The second-stage regressions show consistent evidence of mutual fund participation contributing to the company staying private longer. In economic terms, Column 2 suggests that a company with mutual fund financing has a 6.03% lower probability of exiting in any given quarter. Column 2 suggests that $10 million funding by mutual funds decreases the probability of going public in a quarter by 6.5%.[38] Finally, one additional mutual fund investing in the company decreases the probability of going public in a quarter by 1.4%. These results that mutual fund financing contributes to a lower probability of exit in any one quarter, combined with previous results in Table 6 showing that companies with mutual fund investment are more likely to successfully exit, provide strong basis to conclude that mutual fund investments enable companies to stay private longer.

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[36] To enable the inclusion of fixed effects, we employ OLS rather than the logit specification used by Shumway.
[37] As discussed earlier, this results in some misclassifications, e.g., companies that fail less than 4 years after the prior funding round will be classified as 'active' for too long, and companies that successfully exit after 4 years will be incorrectly classified as 'failed'. In addition, it also causes us to incorrectly identify 20 firms as never having received mutual fund financing, because they received this financing more than 4 years after the previous financing round; thus the sample identifies 239 firms (instead of 259) as having mutual fund financing. Such misclassifications lessen the power of our tests by increasing standard errors, but should not bias results in any one direction.
[38] $Ln(10 + 1)*-0.027 = -0.06474$.

One potential weakness of the Table 8 analysis relates to our inability to definitely determine when a company has failed. To avoid misclassifying too many firms as failed when they actually successfully exit, we allow firms to go four years without a funding round before they are classified as failed. However, the probability of failure increases dramatically as the time since last funding round increases over 2 years. Table 9 attempts to address this issue through the use of an ordered probit model. Similar to Table 8, our sample represents a panel of all company-quarter observations, and we use the same three measures of mutual fund participation. However, in the ordered probit the dependent variable takes one of four possible values: 1 if the company fails (defined as having the last funding round more than four years ago and not having exited during this period), 2 if the company's outcome is uncertain at that point in time (defined as not having exited, and having the last funding round more than two years ago but less than four years ago), 3 if the company is still private and active (defined as having the last funding round within the past two years), and 4 if the company exits via IPO or acquisition. Figure 8 shows the distribution of these four outcomes, across those firms with versus without mutual fund participation.

In addition to producing a coefficient on each measure of mutual fund participation, the ordered probit generates cutoff values. As indicated at the bottom of Table 9, mutual fund participation is associated with a lower probability of being in the uncertain status and a higher probability of being active but still private.   By design, most firm-quarters are designated as either uncertain or active. Each firm can only fail or exit once, meaning that for each firm only only one quarter will be identified as failure or exit and all other quarters will be identified as active or uncertain. Thus, the finding that mutual fund investments are associated with a higher probability of being in active status is consistent with these companies both having a higher probability of ultimately successfully exiting but taking a longer time to do so.

7. Conclusion

Public listing status offers both advantages and disadvantages. Public firms potentially benefit from greater availability of capital, including for example a lower cost of capital (Brav, 2009; Gilje and Taillard, 2016). However, increased regulatory burdens and pressure from investors for short-term results can represent nontrivial costs for public firms (Asker, Farre-Mensa and Ljungqvist, 2015). Firms' decisions of when to go public represent a trade-off between the benefits and costs and public listing. It follows that if the benefits of going public fall for a private firm, then that firm should opt to stay private longer.

Consistent with greater capital availability being a benefit of public listing, Lowry (2003) concludes that more companies go public during periods when firms' demands for capital are higher. However, results in this paper demonstrate that the availability of capital to private firms in the form of investments by mutual funds has increased dramatically over the past 15 years. We note that this trend is consistent with changes in the financial landscape over this time period, including both regulatory changes and decreasing costs of collecting information about opaque firms. This increased availability of capital to private firms suggests that demands for capital should motivate fewer companies to go public at any point in time. The drop in the number of companies going public is consistent with this conjecture.

Appendix I

A. Additional details on obtaining mutual funds' holdings in private firms

The process of matching mutual funds' holdings of restricted securities to our sample of private, venture-backed firms involves many complications, beyond those described within the main body of the paper. The purpose of this appendix is to provide additional detail, which may be helpful to future researchers.

In addition to verifying that a mutual fund has an investment in a private company, we also need to determine if the investment represents equity. While mutual funds' investments in private startups are classified as restricted securities, not all restricted securities are investments in private companies. For example, PIPEs (Private Investment in Public Equity), newly public firms' shares before the lockup expiration date, corporate bonds or notes with restricted conditions, investments in foreign countries, etc., are all classified under restricted securities. Using Python programming, we create a debt dummy = 1 if the filing contains wordings such as bond, note, term loan, tranche, etc. in the neighborhood of company name. In a similar way, we create an equity dummy = 1 if the filing contains wordings such as common, class A, class B, preferred, etc., in the neighborhood of company name. After creating these dummies, we manually check whether the investments are equity investments. Through this combination of Python and hand verification, we isolate equity investments.

In addition to matching fund holdings with firms on a semi-annual basis, we also wish to track individual funds over time. This is complicated by several issues: multiple funds report their holdings within a single filing (i.e., the reported filing is based on the CIK level rather than the fund level) and funds can change their names. To overcome this problem, we use the EDGAR-assigned series number provided to each fund, as this series number remains the same even if the fund changes names.[39] For example, CIK 0000024238 corresponds to Fidelity Contrafund. There are 4 funds that report filings under this CIK: Fidelity Advisor New Insights Fund (S000006036), Fidelity Contrafund (S000006037), Fidelity Series Opportunistic Insights Fund (S000039220), and Fidelity Advisor Series Opportunistic Insights Fund (S000039221). The characters in parenthesis represent series numbers. Because series numbers are provided beginning in 2006, we backfill series numbers for funds for the period 1995-2005. In cases where names are similar but not exact, we verify manually. This backfill is only possible if the same fund exists before and after 2005. If a fund only exists prior to 2005, we assign a pseudo series number.

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[39] This is confirmed by David Marcinkus, the branch chief at the SEC as of August 2016.

B. An example: Fidelity Series Opportunistic Insights Fund, Sept 2015 Form N-Q

Shown below is a screenshot from Fidelity Series Opportunistic Insights Fund's filing, for which the full filing can be found here: https://www.sec.gov/Archives/edgar/data/24238/000137949115001530/filing706.htm

Legend

(a) Non-income producing

(b) Security or a portion of the security is on loan at period end.

(c) Investment is owned by an entity that is treated as a corporation for U.S. tax purposes and is wholly-owned by the Fund.

(d) Restricted securities - Investment in securities not registered under the Securities Act of 1933 (excluding 144A issues). At the end of the period, the value of restricted securities (excluding 144A issues) amounted to $175,667,666 or 3.1% of net assets.

(e) Coupon rates for floating and adjustable rate securities reflect the rates in effect at period end.

(f) Affiliated fund that is generally available only to investment companies and other accounts managed by Fidelity Investments. The rate quoted is the annualized seven-day yield of the fund at period end. A complete unaudited listing of the fund's holdings as of its most recent quarter end is available upon request. In addition, each Fidelity Central Fund's financial statements are available on the SEC's website or upon request.

(g) Investment made with cash collateral received from securities on loan.

Additional information on each restricted holding is as follows:

Security	Acquisition Date	Acquisition Cost
23andMe, Inc. Series E	6/18/15	$444,005
Airbnb, Inc. Series D	4/16/14	$1,259,254
Airbnb, Inc. Series E	6/29/15	$1,299,970
Altiostar Networks, Inc. Series D	1/7/15	$1,800,006
ASAC II LP	10/10/13	$17,881,600
Blu Homes, Inc. Series A, 5.00%	6/10/13 - 12/30/14	$6,232,491
Blue Apron, Inc. Series D	5/18/15	$3,200,002
Cloudera, Inc. Series F	2/5/14	$1,019,782
Cloudflare, Inc. Series D	11/5/14 - 6/24/15	$1,533,709
Delphix Corp. Series D	7/10/15	$1,843,875
Dropbox, Inc. Series C	1/30/14	$7,540,008
Legend Pictures LLC	10/15/14 - 6/10/15	$11,580,173
Magic Leap, Inc. Series B, 8.00%	10/17/14	$19,369,901
Nutanix, Inc. Series E	8/26/14	$2,303,662
Oportun Finance Corp. Series H	2/6/15	$6,756,617
Pinterest, Inc. Series E, 8.00%	10/23/13	$7,538,571
Pinterest, Inc. Series F, 8.00%	5/15/14	$7,211,381
Pinterest, Inc. Series G, 8.00%	2/27/15	$2,651,490
Pure Storage, Inc. Series E	8/22/13	$642,037
Space Exploration Technologies Corp. Series G	1/20/15	$2,483,832
SurveyMonkey	12/15/14	$7,534,725
Twilio, Inc. Series E	4/24/15	$1,833,453
Uber Technologies, Inc. Series D, 8.00%	6/6/14	$4,110,027
WeWork Companies, Inc. Class A	6/23/15	$1,184,189
WeWork Companies, Inc. Series E	6/23/15	$10,657,799

C. A potential alternative approach

Our goal is to obtain mutual fund investments in private companies. Since SEC filings contain complete portfolio holdings and CRSP/Thomson-Reuters provides portfolio holdings for public companies, one might consider the following strategy: join public holdings to complete portfolio holdings and take the unmatched residuals. Unfortunately, a number of facts make this simple strategy complicated and inefficient.

First, while CRSP or Thomson-Reuters report data on fund level, mutual fund filings are based on the Central Index Key (CIK) level. For example, the CIK 319108 corresponds to BlackRock Series Fund, Inc., and there are eight individual funds under this CIK as of 2015.[40] To map these eight funds with CRSP or Thomson-Reuters, we need some type of fund identifier. However, there is no common identifier between fund in SEC filing and fund in CRSP/Thomson-Reuters. This implies that we would have to name-match fund names in CRSP or Thomson-Reuters with fund names in SEC filings. In addition, different funds use different names for the same company or security in their SEC filings. And of course, there is no company- or security- identifier in SEC filings. This implies that we would have to name-match every single security in Thomson to SEC filing.

D. Mutual Fund Families for which we collect data
- Allianz
- Anchor
- Blackrock
- Fidelity
- Great-west
- Hartford
- John Hancock
- Morgan Stanley
- Seligman
- Smallcap World
- Sun America Asset Management
- T. Rowe Price
- Thomas Lee Putnam investment.
- UBS Juniper
- Vanguard
- Wasatch

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[40] The list of 8 funds are: Blackrock Balanced Capital Portfolio, Blackrock Large Cap Core Portfolio, Blackrock Total Return Portfolio, Blackrock Global Allocation Portfolio, Blackrock Capital Appreciation Portfolio, Blackrock High Yield Portfolio, Blackrock U.S. Government Bond Portfolio, and Blackrock Money Market Portfolio.

Appendix II – Variable Descriptions

Variables	Definition
Characteristics of VC(s) providing funding	
VC Firm Age	VC firm's age in years since firm founding year.
# Companies Funded	Number of portfolio companies in which the VC invested within the past three years. This is calculated at the time of the firm's first VC round, and is scaled by the average across all VCs (for the same time period).
# Rounds Invested	Number of financing rounds participated within past three years.
# IPOs	Number of portfolio companies that received financing from the VC and exited via IPO within the past three years. This is calculated at the time of the firm's first VC round, and is scaled by the average across all VCs (for the same time period).
# Trade sales	Number of unique portfolio companies that received financing from the VC and exited via M&A within the past three years. This is calculated at the time of the firm's first VC round, and is scaled by the average across all VCs (for the same time period).
# Exits	Number of unique portfolio companies that received financing from the VC and exited via either IPO or M&A, within the past three years. This is calculated at the time of the firm's first VC round, and is scaled by the average across all VCs (for the same time period).
Characteristics of firm	
I(MF investment)	Equals one if company received investment from mutual funds before exit.
Amount invested by MF ($ mil)	Total dollar amount invested in company by mutual funds before exit. Measure is truncated at 12/31/2015.
MF Syndicate Size	Total number of unique mutual funds that invested in a company before exit. Count is truncated at 12/31/2015.
Time b/w 1st and 2nd VC rounds	Duration between the first VC round and the second VC round. This variable is measured for companies with at least 2 VC financing rounds.
# Patents applied	# patents for which the firm applied as of a given date, conditional on patent being granted by the end of 2016. Descriptive statistics include values of this variable on a raw basis and on an industry-year adjusted basis. Industry and year-adjusted measures are used in all regressions.
# Patents granted	# patents granted to a firm as of a given date.
Relation between firm and VC(s)	
Rounds Received	Total number of VC financing rounds a company received before exit. Count is truncated at the last financing round or first date a company receives investment from mutual funds, whichever comes first.

VC Syndicate Size	Total number of VCs that invested in a company. Count is truncated at the last financing round or first date a company receives investment from mutual funds, whichever comes first.
Amount raised ($ mil)	Total dollar amount a company raised in VC financing rounds before exit. Measure is truncated at the last financing round or first date a company receives investment from mutual funds, whichever comes first.

Exit Performance

I(=1 if exited)	Equals one if company exits via either IPO and trade sale before 12/31/2015.
I(=1 if exited via IPO)	Equals one if company exits via IPO before 12/31/2015.
I(=1 if exited via M&A)	Equals one if company exits via M&A before 12/31/2015.
Time to Exit	(Exit date - first round VC financing date) / 365, where exit date is either IPO date or acquired date.

Fixed effects (Dummy Variables)

Vintage Year	The year when a portfolio company received its first round VC financing.
Stage Level	Stage level has 3 categories: Early stage, Expansion stage, and Later stage.
Company Location	Company location has 6 categories: CA, MA, NY, TX, PA, and Other state.
Industry	Industry has 6 categories: Computer, Medical, Biotech, Communication, OtherElect, and NonHighTech.

Panel regression variables[41] (all variables are measured quarterly)

MF Financing dummy	Equals one if company is held by mutual funds.
Amount Invested by MF ($ mil)	Cumulative dollar amount invested in company by mutual funds
MF Syndicate Size	Cumulative number of unique mutual funds that invested in a company
Last Round Inside Round	Equals one if last VC financing round was an inside round. Round t is an inside round if all investors participating in round t have invested at least once in previous rounds. See Ewens, Rhodes-Kropf, and Strebulaev (2016).
Last Round Fraction Insiders	The fraction of insiders at previous VC financing round. Investors that contributed capital in at least one prior round are insiders. See Ewens, Rhodes-Kropf, and Strebulaev (2016).

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[41] # Companies Funded, # Exits, Cumulative # Rounds Received, Cumulative VC Syndicate Size, and Cumulative Amount Raised in VC Rounds are all defined in a similar manner as in cross-sectional analysis variables, except that they are measured quarterly. Time Since First VC Round, Time Since Last VC Round are self-explanatory.

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Figure 1: Mutual fund investments in private companies.

Panel A shows the number of mutual funds holdings shares in VC-backed companies and the number of VC-backed companies held by mutual funds. Panel B shows the amount of new money invested by funds each year, as indicated by reported acquisition costs, and also the aggregate of mutual funds' reported valuations of these investments each year. The valuations of mutual funds' investments is based on the last available filing date in each year, and it is calculated by aggregating funds' valuations across their investments in VC-backed companies. Data is based on mutual funds' restricted holdings extracted from EDGAR Form N-30Ds (1995-2005) and Form N-Qs (2006-2016). Panel C shows the percentage of capital provided by mutual funds within each financing round, conditional on financing rounds having at least one mutual fund as a participating investor. Mutual fund investments are matched with funding round information in VentureXpert, where the absolute difference between the mutual fund's reported acquisition date and the VentureXpert round date is less than 30 days.

Panel A: Number of mutual funds and private companies
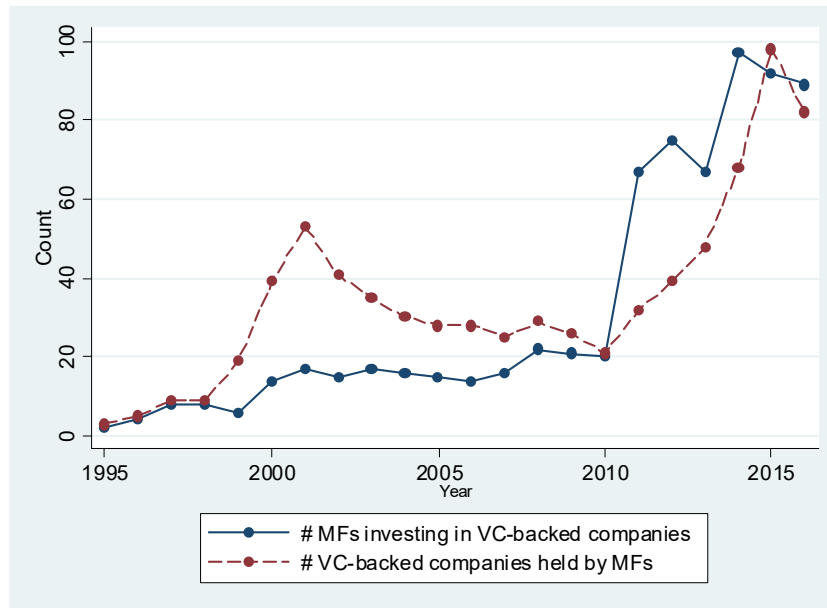
Panel B: Dollar Values
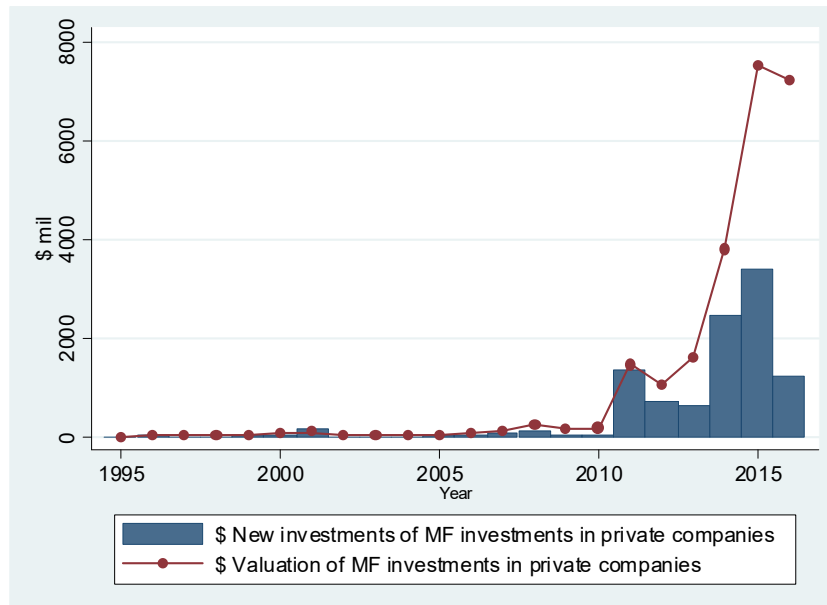
Panel C: Percentage of capital provided by mutual funds within each financing round.
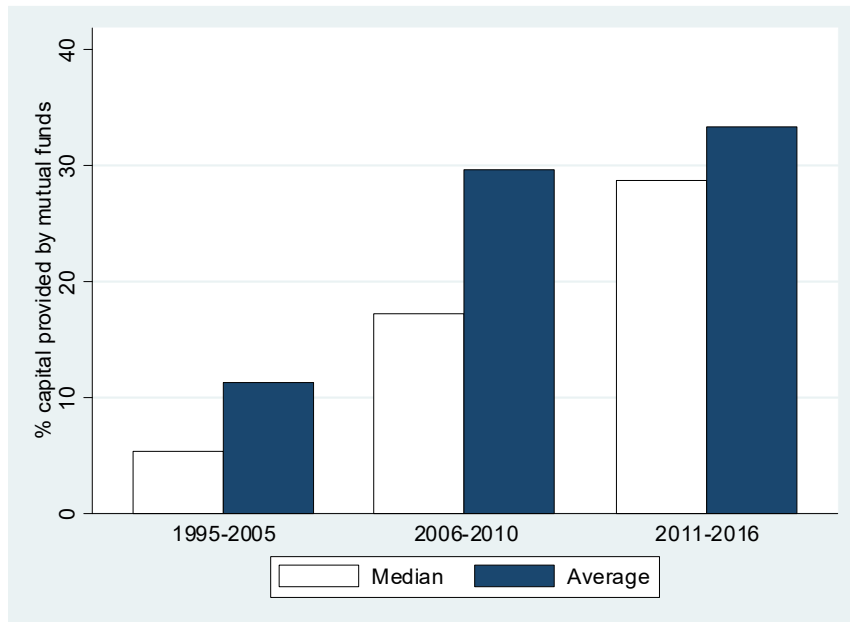
Figure 2: Mutual fund investments in private companies by stage.

Panel A shows the number of VC-backed companies receiving mutual fund investments for the first time, decomposed by stage level. Panel B shows the median amount invested (proxied by the valuation at the time of the first available reporting date in cases where acquisition cost is not available) of VC-backed companies receiving mutual fund investments for the first time, decomposed by stage level. A company is classified as early stage if the company was at either seed or early stage (defined by VentureXpert database) when it first received investment from mutual funds. Similarly, a company is classified as expansion stage (later stage) if the company was at expansion stage (later stage or buyout/acquisition stage) when it first received investment from mutual funds. The sample consists of 269 unique companies for both figures.

Panel A: Number of VC-backed companies receiving mutual fund investments.
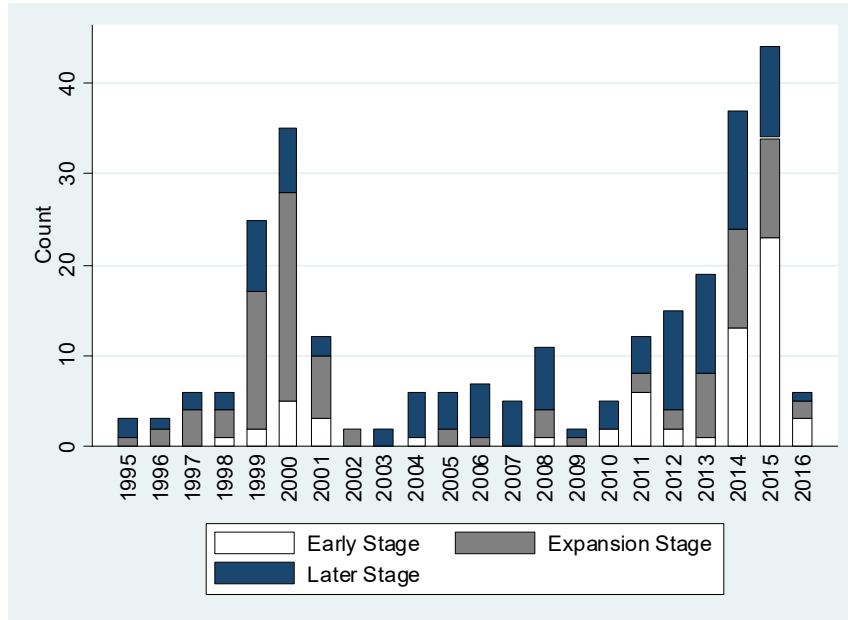
Panel B: Median dollar amount invested by mutual funds in VC-backed private companies, at the time of the company's first mutual fund investment.
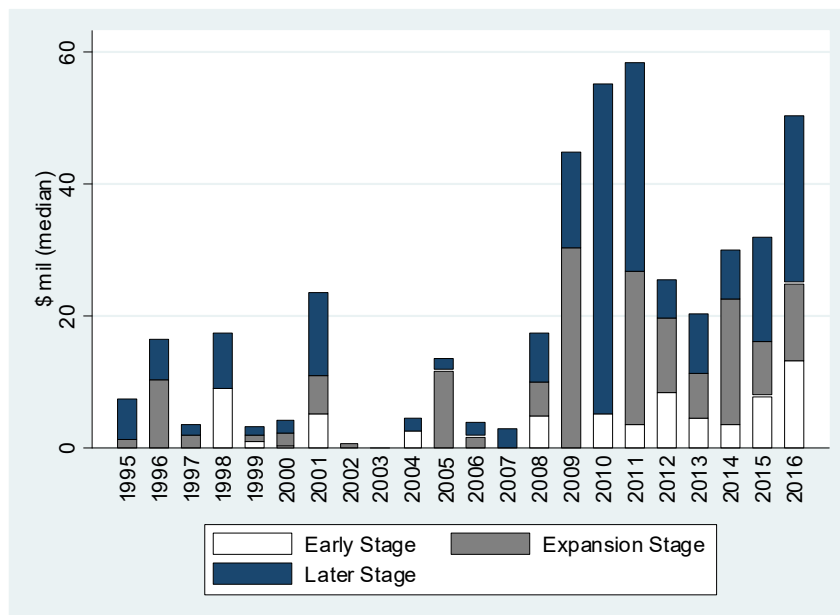
Figure 3: Mutual fund investments in private companies that subsequently went public.

The bars show the number of VC-backed IPOs with (dark-shaded) and without (lightly-shaded) mutual fund investments. The line shows the fraction of VC-backed IPOs that also received pre-IPO investments from mutual funds. Companies founded prior to 1980, companies that received their first round of VC financing prior to 1990, and companies that received mutual fund investments before VC financing are excluded. The sample consists of 1,421 IPOs, where 87 IPOs have pre-IPO investments from mutual funds.
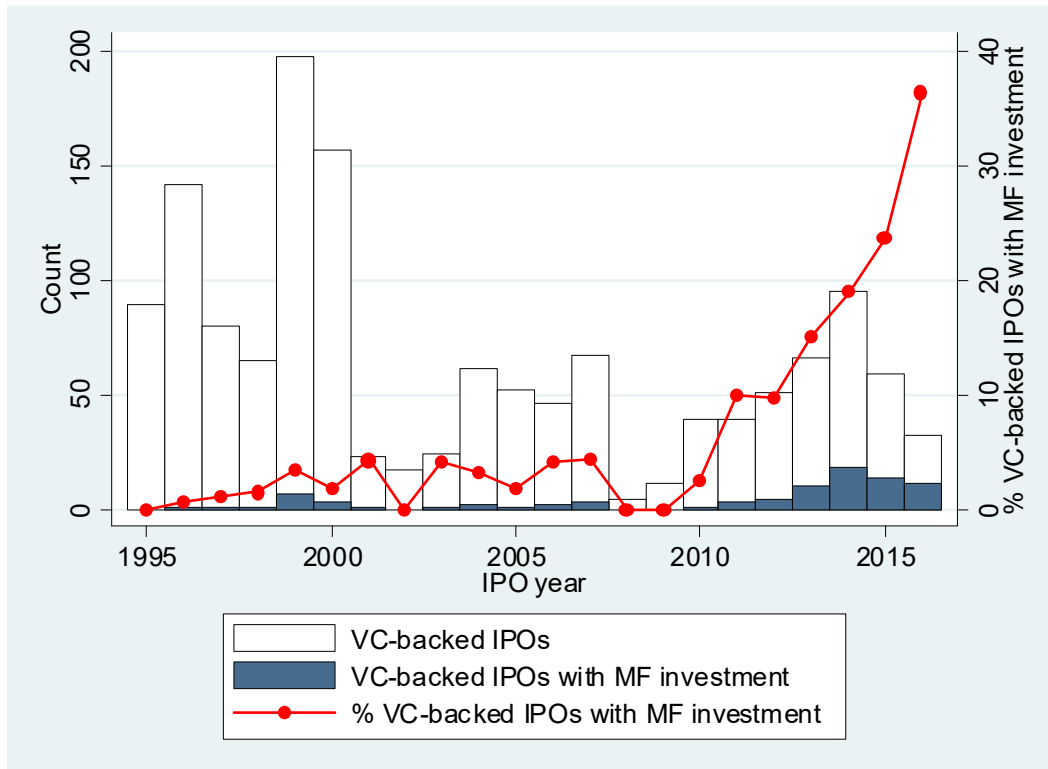
Figure 4: Types of private companies in which mutual funds invest.

Each panel compares companies that receive mutual fund investments pre-IPO with companies that do not. There are 1,417 VC-backed IPOs over the 1990 – 2016 period with available Compustat data, of which 81 received mutual fund investments prior to the IPO. Panel A, B, C, and D show total asset, sales, expenditures (CAPEX + R&D + SG&A), and gross margin [(Sales – COGS) / Sales], respectively for each fiscal year, starting two years prior to the IPO and ending two years after the IPO. Year 0 is the year that includes the IPO. All numbers represent median.

Panel A: Total assets
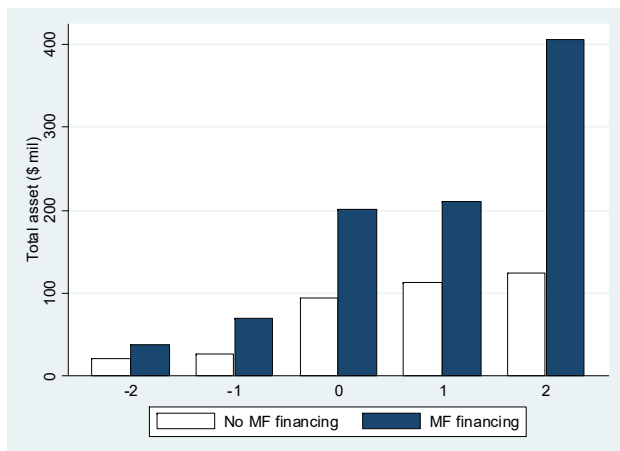
Panel B: Net sales
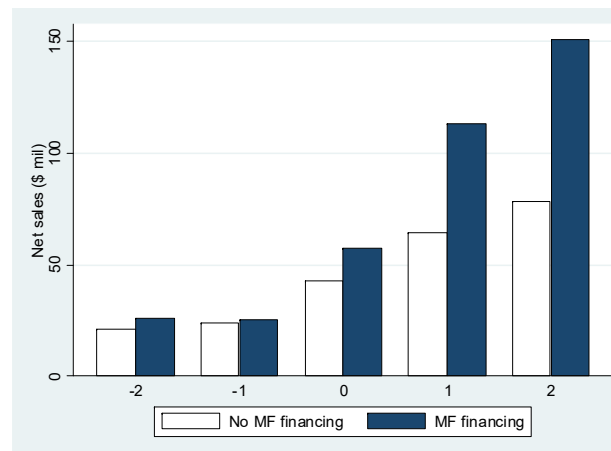
Panel C: Expenditures
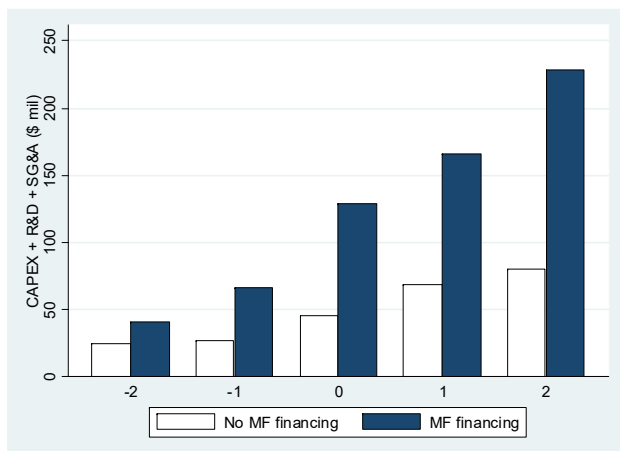
Panel D: Gross margin
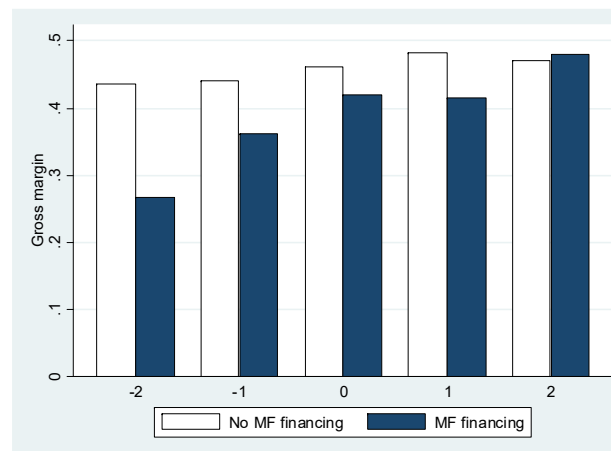
Figure 5: Venture capital round vs. secondary market transaction.

Mutual fund investments are matched with round dates in VentureXpert if the absolute difference between security acquisition date in mutual fund investments (form N-30Ds and form N-Qs) and the round date in VentureXpert are less than 30 days. Panel A shows the distribution of difference between round date in VentureXpert and the acquisition date in mutual fund investments, conditional on matching. The sample consists of 1,051 unique mutual fund-company-acquisition date-tuple. Panel B shows the distribution of mutual fund investment amount, across investments within- and outside-30days around VC round. We drop cases where mutual funds do not report acquisition costs. The sample consists of 992 unique mutual fund-company-acquisition date-tuple.

Panel A: Distribution of difference between venture round and mutual fund acquisition date.
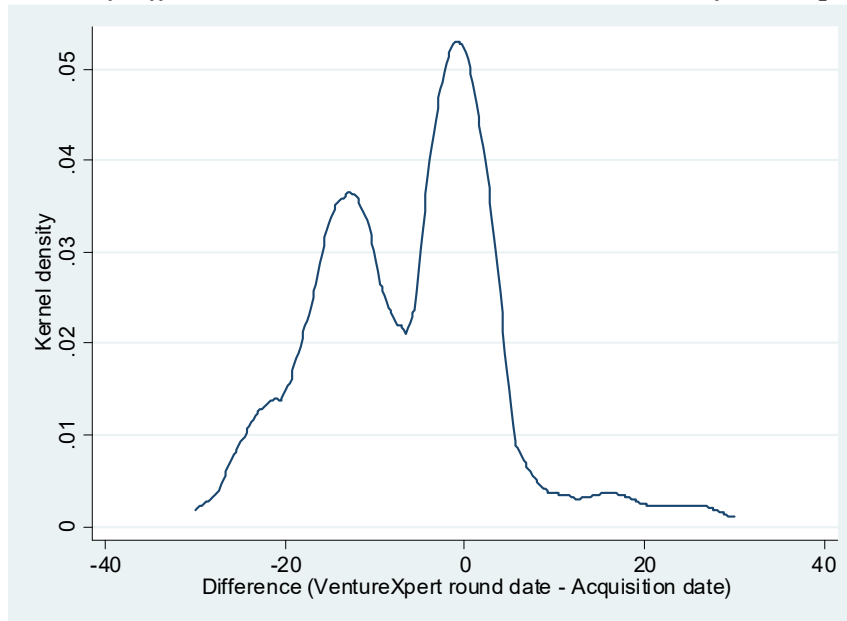
Panel B: Distribution of mutual fund investment amount.
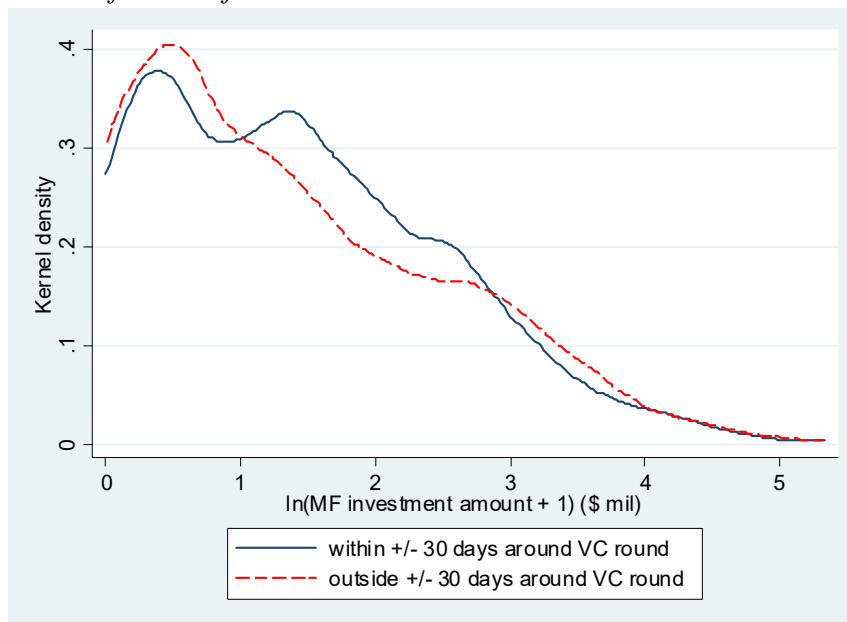
Figure 6: Capital invested in private company funding rounds.

Panel A shows the median amount of capital raised in each venture round. Mutual fund investments, as reported on Form N-30D (1995-2005) and Form N-Q (2006-2016) filings in EDGAR, are matched with funding round information in Crunchbase. The sample consists of the 574 financing rounds across 121 unique private VC-backed companies for which the absolute difference between the mutual fund's reported acquisition date (which must be non-missing) and the Crunchbase round date is less than 30 days. Panel B shows a kernel density plot across the 1,282 unique funding rounds of 183 unique companies that: received mutual fund financing at some point, whose rounds can be matched to VentureXpert within a 30-day window (where mutual fund acquisition date must similarly be non-missing). All rounds of these companies are divided into those that include mutual fund financing versus those that do not. All funding rounds of these 183 companies are obtained from VentureXpert, and a round is defined as having mutual fund participation if the absolute difference between the mutual fund's reported acquisition date and the VentureXpert round date is less than 30 days.

Panel A: Amount of capital raised in venture rounds.
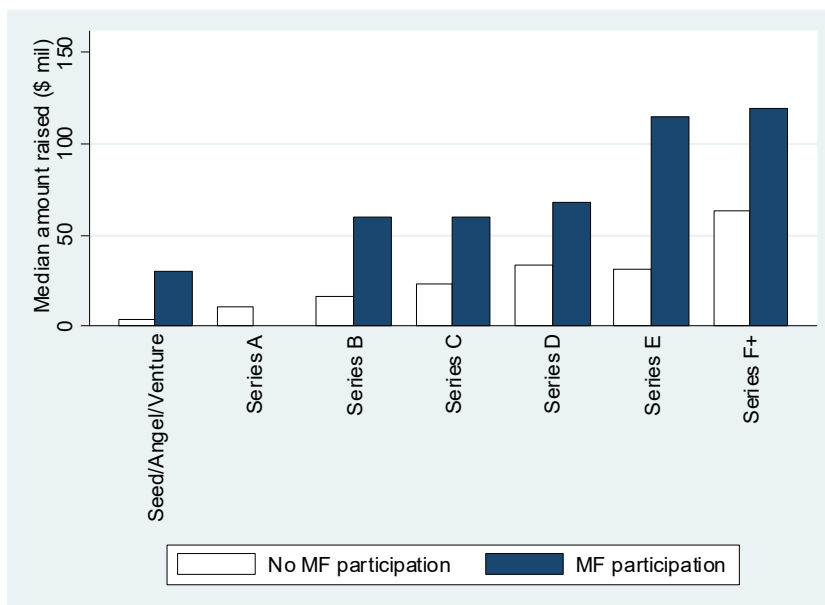
Panel B: Round amounts, across rounds with and without mutual fund participation
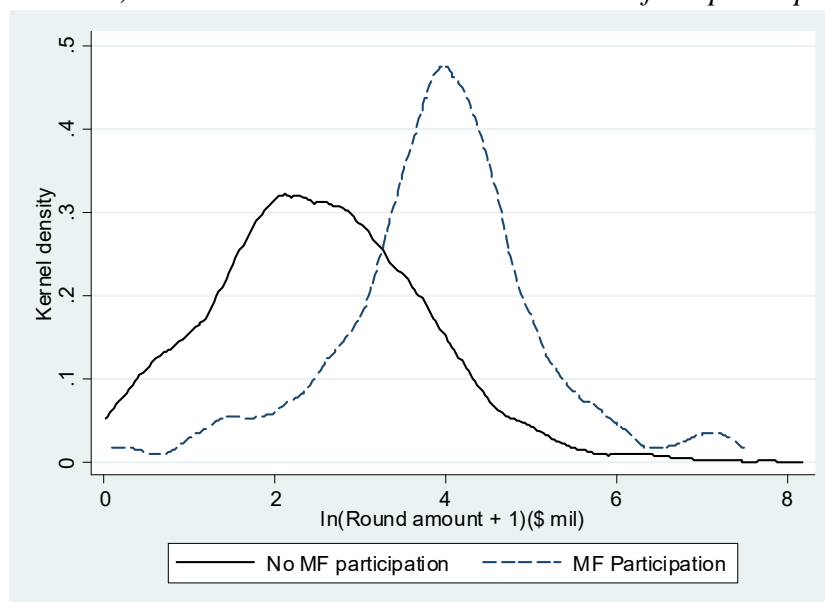
Figure 7: Do companies receiving mutual fund investments stay private longer?

Across all VC-backed companies that exit via either IPO or trade sale, Panel A compares median time to exit from the first VC round, for firms with versus without mutual fund financing. The first and second (third and fourth) sets of bars show time to exit for companies that first received VC financing during 1990-2000 (2001-2010). Panel B shows a kernel density plot of time to exit for companies with and without mutual fund financing. The sample consists of 7,605 unique companies that received their first VC financing in 1990 – 2010 and that exited. Among these 7,605 companies, 115 companies received at least one investment from mutual funds. All numbers represent medians.

Panel A: Time to exit from first VC round (based on first VC round year).
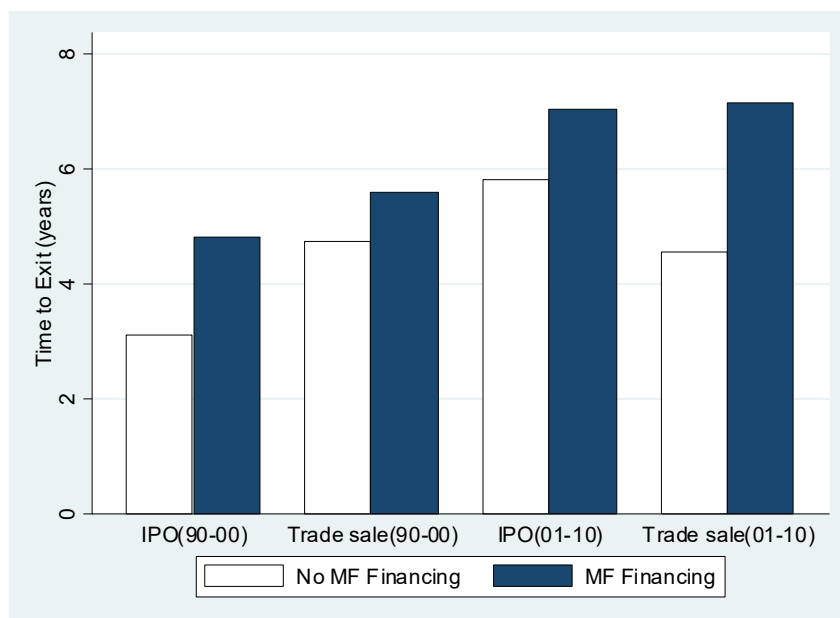
Panel B: Time to exit from first VC round (kernel density plot).
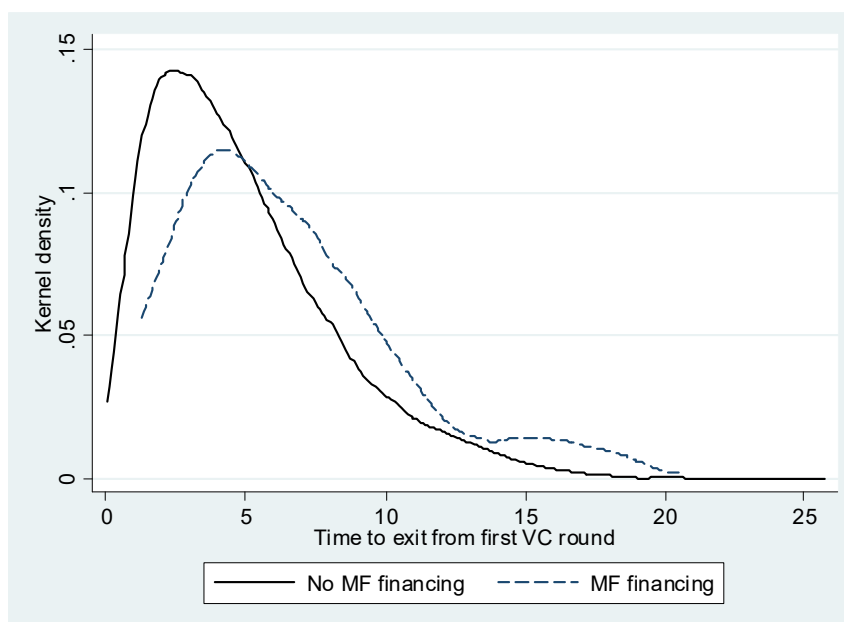
Figure 8: Company outcomes.

The following graphs are generated from 13,950 companies that received first VC round between 2006 and 2016. Company status is tracked quarterly. Company status is defined as exited if it exits via either IPO or M&A. Company status is defined as active if time since last round is less than 2 years. Company status is defined as uncertain if time since last round is between 2 and 4 years. Company status is defined as defunct if time since last round is greater than 4 years[42]. To keep the number of companies the same in each quarter, companies remain in the sample even after they exit or become defunct. Panel A shows the distribution of company status over time for companies that did not receive mutual fund financing in our sample period. Panel B shows the distribution of company status over time for companies that received at least one mutual fund financing in our sample period.

Panel A: Companies without mutual fund financing.   *Panel B: Companies with mutual fund financing.*
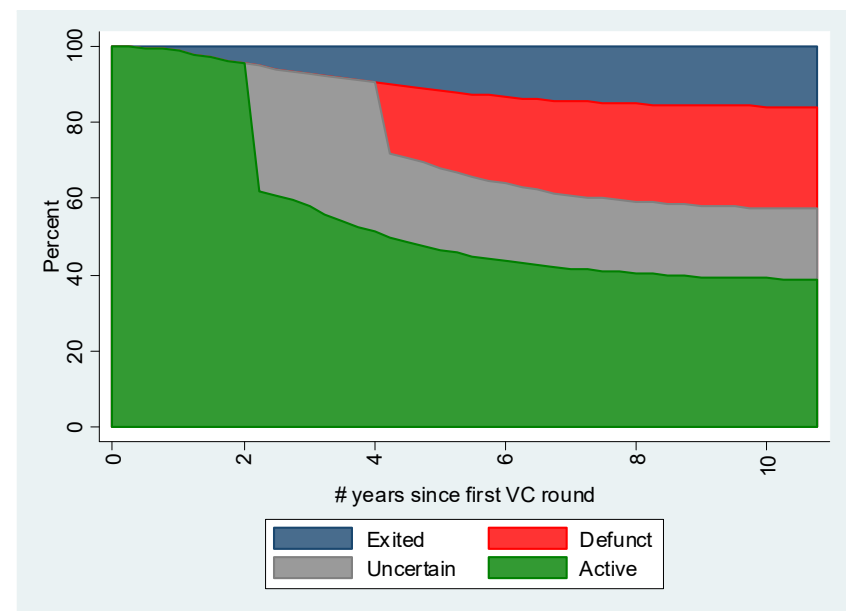
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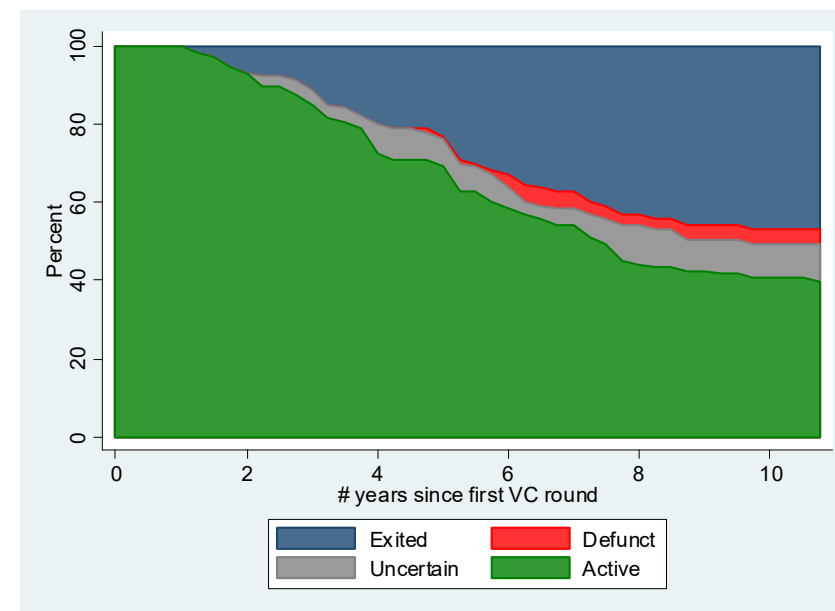
[42] To be consistent, we apply the definition of status regardless of the actual outcome. For 13,950 unique companies that received first VC round between 2006-2015, 2,256 companies actually have exited. However, our definition of status treats 208 companies (2 companies with mutual fund financing and 206 companies without mutual fund financing) out of 2,256 companies as defunct because they stayed more than 4 years after the last financing round.

Table 1: Sample Description

Panel A: # companies receiving their first financing from venture capital or mutual funds

Year of Fin'g	From Venture Capital, each year			From Mutual Funds, each year		
	Total	# that subsequently		Total	# that subsequently	
		Exit	Receive MF Fin'g		exit via IPO	exit via M&A
	(1)	(2)	(3)	(4)	(5)	(6)
1990	346	139	2			
1991	247	124	1			
1992	384	193	6			
1993	312	172	3			
1994	374	208	2			
1995	725	335	10	3	1	2
1996	892	430	16	3	1	0
1997	1070	464	18	6	1	4
1998	1322	470	17	6	3	0
1999	1910	719	24	25	8	6
2000	2716	918	12	35	3	12
2001	987	394	9	12	2	2
2002	714	341	5	2	0	1
2003	735	311	6	2	2	0
2004	918	370	9	6	2	3
2005	1035	379	16	6	0	1
2006	1198	408	9	7	3	0
2007	1409	428	13	5	2	2
2008	1305	341	15	11	3	4
2009	790	205	12	2	2	0
2010	1004	256	10	5	4	0
2011	1328	218	17	12	9	1
2012	1362	173	11	15	6	2
2013	1520	134	13	19	7	2
2014	1450	67	9	37	16	3
2015	1447	22	3	44	12	3
2016	1137	4	1	6	0	1
Full Sample						
1990 - 2016	28,637	8,223	269	269	87	49
Partial Samples						
1990 – 2010	20,393	7,605	215	136	37	37
1995 – 2016	26,974	7,387	255	269	87	49
1995 – 2010	18,730	6,769	201	136	37	37

Panel B: # Exits Each year

Year of Exit	by VC-backed co's		By VC-backed co's with MF investments	
	Via IPO	Via M&A	Via IPO	Via M&A
	(7)	(8)	(9)	(10)
1990	1	0		
1991	10	1		
1992	27	12		
1993	27	21		
1994	46	34		
1995	89	60		
1996	142	75	1	
1997	80	112	1	1
1998	65	147	1	2
1999	197	185	7	1
2000	156	295	3	4
2001	23	306	1	3
2002	17	275	0	1
2003	24	265	1	1
2004	62	323	2	4
2005	52	353	1	5
2006	47	387	2	3
2007	67	413	3	1
2008	5	350	0	2
2009	12	294	0	1
2010	39	458	1	2
2011	40	445	4	0
2012	51	438	5	2
2013	66	361	10	5
2014	95	463	18	1
2015	59	341	14	4
2016	33	277	12	6
Full Sample:				
1990 – 2016	1,532	6,691	87	49
Partial Samples				
1990 – 2010	1,188	4,366	24	31
1995 – 2016	1,421	6,623	87	49
1995 – 2010	1,077	4,298	24	31

Table 2: Descriptive statistics.

	With Mutual Fund Financing Obs = 269	Without Mutual Fund Financing Obs = 28,368	Difference
First-round VC characteristics			
VC Firm Age	16.86	13.91	2.947***
# Cos Invested$_{t-3, t-1}$	24.99	20.38	4.611***
# Rounds Participated $_{t-3, t-1}$	64.35	45.10	19.26***
# IPO Exits $_{t-3, t-1}$	3.51	1.93	1.587***
# M&A Exits $_{t-3, t-1}$	6.47	4.11	2.361***
VC funding characteristics			
Rounds Received	3.70	2.95	0.752***
VC Syndicate Size	4.34	2.86	1.482***
Amount raised ($ mil)	67.94	22.83	45.12***
Patenting activity			
Patents applied$_{Last\ VC\ round}$ (raw)	8.52	2.89	5.631***
Patents applied$_{Last\ VC\ round}$ (scaled by ind-year)	1.39	0.58	0.815***
At least one patent applied$_{Last\ VC\ round}$	0.56	0.29	0.265***
At least one patent granted$_{Last\ VC\ round}$	0.30	0.21	0.0893***
Industry			
Computer	0.44	0.51	-0.0652**
Medical	0.05	0.10	-0.0465**
Biotech	0.25	0.06	0.185***
Communication	0.13	0.11	0.02
OtherElect	0.04	0.05	-0.01
NonHighTech	0.09	0.17	-0.0845***
Geographical location			
CA	0.50	0.35	0.147***
MA	0.15	0.09	0.0622***
NY	0.07	0.08	-0.00253
TX	0.01	0.05	-0.0405***
PA	0.01	0.05	-0.0355***
Exit Performance			
Dummy = 1 if exited	0.51	0.29	0.221***
Dummy = 1 if exited via IPO	0.32	0.05	0.272***
Dummy = 1 if exited via M&A	0.18	0.23	-0.0520**
Time To Exit From First VC Round	6.51	4.92	1.598***
Time To IPO From First VC Round	6.10	4.35	1.753***
Time To Trade sale From First VC Round	7.24	5.04	2.205***

The sample consists of 28,637 unique companies that received venture capital financing between 1990 and 2016. Companies founded prior to 1980, companies that received their first round of VC financing prior to 1990, and companies that received mutual fund investments before VC financing are excluded. First round VC characteristics are calculated based on the average value of each variable across all VCs that provided funding in the first round.

Time To Exit From First VC Round is based on the smaller subset of companies that successfully exit via either IPO or acquisition: 136 companies with mutual fund financing and 8,087 companies without. Patenting activity variables are measured as of the quarter end prior to the mutual fund financing for companies with such financing, and as of the last VC round for all other companies. Means are shown for all variables, and variable definitions are in the Appendix.

Table 3: Determinants of mutual fund investments.

The sample consists of 28,637 unique companies that received first VC financing round over the 1990 – 2016 period. Each column shows an OLS regression, where the dependent variable equals 1 if the firm received mutual fund financing while private, zero otherwise. The sample in column 1 equals the full sample of 28,637 private companies. In column 2, the sample is restricted to companies with a minimum of two rounds of venture capital financing. Column 3 adds the additional requirement that there are two or more VCs in the syndicate. Full variable descriptions are provided in the appendix. All regressions include stage level fixed effects (defined as of the time of first VC financing) and also industry and first VC round year fixed effects. Robust *t*-statistics are reported in parenthesis. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

VARIABLES	Dummy = 1 if Company received MF Financing			
VC firm age	0.0000	0.0000	0.0000	0.0000
	(0.6207)	(0.1263)	(0.2129)	(0.0592)
# Companies funded	0.0004	-0.0003	-0.0019	0.0006
	(0.4458)	(-0.2543)	(-1.2111)	(0.5032)
# Exits	0.0013*	0.0019	0.0034**	0.0018*
	(1.7628)	(1.5651)	(2.3540)	(1.6741)
VC Syndicate Size	-0.0004	-0.0004	-0.0004	0.0000
	(-0.9331)	(-0.9186)	(-0.7438)	(0.0710)
ln(Amount Raised + 1) ($ mil)	0.0050***	0.0069***	0.0071***	0.0040***
	(7.8497)	(7.3196)	(6.3438)	(5.1988)
ln(Patents applied (scaled by ind-year) + 1)	0.0063***	0.0062**	0.0060**	0.0092***
	(3.3153)	(2.5036)	(2.2019)	(3.7822)
Time b/w 1st and 2nd VC round		-0.0011*	-0.0011	
		(-1.8669)	(-1.5605)	
CA	0.0025*	0.0045**	0.0035	0.0036*
	(1.8148)	(2.2421)	(1.4780)	(1.9073)
MA	0.0041	0.0049	0.0025	-0.0001
	(1.6101)	(1.4803)	(0.6614)	(-0.0284)
NY	0.0028	0.0031	0.0033	0.0029
	(1.2965)	(0.9772)	(0.8629)	(0.9534)
TX	-0.0051***	-0.0055**	-0.0063**	-0.0056***
	(-3.5488)	(-2.4749)	(-2.2423)	(-2.8059)
PA	-0.0012	-0.0005	-0.0026	-0.0026
	(-0.7109)	(-0.1992)	(-0.6779)	(-1.1073)
Observations	28,637	17,545	14,144	18,730
R-squared	0.0170	0.0192	0.0190	0.0145
Specification	OLS	OLS	OLS	OLS
First VC round	1990-2016	1990-2016	1990-2016	1995-2010
Co's with MF investment	269	218	200	201
Stage level FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
First VC round year FE	Yes	Yes	Yes	Yes
Restriction	None	Min 2 VC rounds	Min 2 VC rounds + VC Syn >= 2	None

Table 4: Type of IPO firm in which mutual funds invested prior to the IPO.

The sample consist of 1,315 VC-backed IPOs over the 1992-2014 period with available Compustat data in the sample, of which 56 received mutual fund investments prior to the IPO. Analysis is based on observations having non-missing values for each dependent variable. Issuers are matched with Compustat using CUSIP and name. Columns 1 - 6 compare the variables around the IPO (year -2 through +2, where year 0 is the fiscal year that includes the IPO). I(IPO and beyond) is a dummy variable that equals to 1 in the IPO year and beyond, 0 otherwise. Stage level, location, industry, as well as first VC round year and IPO year fixed effects are also included in all specifications. Total assets and sales are in $ million. Robust *t*-statistics are reported in parenthesis. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

	Total Assets	Net Sales	Expenditure	Gross Margin	Expenditure (scaled)	Cash
I(MF financing)	-279.500	38.021	24.830	14.082*	-0.113	0.052**
	(-1.440)	(0.674)	(0.878)	(1.950)	(-0.894)	(2.326)
I(IPO and beyond)	144.821***	66.924***	48.202***	0.808	-0.622***	0.083***
	(4.050)	(5.472)	(8.236)	(0.212)	(-17.882)	(12.219)
I(MF financing)*I(IPO and beyond)	569.857*	194.705*	346.142***	-38.627*	0.108	-0.052*
	(1.703)	(1.688)	(2.658)	(-1.951)	(0.752)	(-1.874)
VC firm age	2.794	2.058***	0.399	0.373	0.001	-0.001***
	(1.397)	(2.618)	(1.143)	(1.358)	(0.556)	(-3.780)
# Companies funded	-36.758	-56.008***	20.342**	5.672	0.096***	0.024***
	(-1.186)	(-3.472)	(2.225)	(1.315)	(2.745)	(2.872)
# Exits	-21.253	28.762**	-10.444	-1.426	-0.086***	-0.007
	(-0.659)	(2.121)	(-1.626)	(-0.799)	(-3.086)	(-1.056)
# VC investors	-13.764	-6.866**	2.742	-0.178	0.007	0.014***
	(-1.466)	(-2.205)	(1.581)	(-0.532)	(1.578)	(12.059)
ln(Amount Raised + 1) ($ mil)	174.934***	50.675***	23.470***	2.626	-0.015	-0.012***
	(3.559)	(2.958)	(4.285)	(0.887)	(-0.923)	(-3.863)
ln(Patents applied (scaled by ind-year) + 1)	117.191**	79.269***	63.931***	-0.020	-0.054***	0.017***
	(2.194)	(3.122)	(3.373)	(-0.011)	(-2.705)	(3.368)
Observations	5,532	5,495	3,593	5,110	3,593	5,528
R-squared	0.133	0.163	0.215	0.027	0.144	0.403
Specification	OLS	OLS	OLS	OLS	OLS	OLS
IPO years	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014
Co's with MF investment	56	56	40	52	40	56
Stage level FE	Yes	Yes	Yes	Yes	Yes	Yes
Location FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
First VC round year FE	Yes	Yes	Yes	Yes	Yes	Yes
IPO year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 5: Do mutual fund investments increase total capital raised?

Column 1 is based on all VentureXpert financing rounds between 1990 and 2016 with non-missing round amounts, leaving 74,839 funding rounds by 25,943 unique companies. Within this sample, there are 183 unique companies with a mutual fund investment that we are able to match to one of these venture rounds, i.e., for which the absolute difference between the mutual fund's reported acquisition date and the VentureXpert's round date is less than 30 days. Column 2, 3, and 4 are based on 537 financing rounds of 121 unique VC-backed companies that we are able to match with Crunchbase, i.e., for which the absolute difference between the mutual fund's reported acquisition date and the Crunchbase round date is less than 30 days. Across all specifications, round amounts are expressed in millions of dollars, and standard errors are clustered at firm level. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

	All VC Rounds	MF inv't rounds matched with non-MF inv't rounds		
Sample				
Dependent Variable =	ln(Round amount + 1)	ln(Round amount + 1)	I(MF in round)	ln(Round amount + 1)
I(MF in round)	1.4141***	0.7348***		4.6491***
	(18.2070)	(8.5408)		(3.2866)
# VCs with MF connection			0.0404***	
			(2.9186)	
VC firm age	0.0034***	0.0003	0.0046**	-0.0211
	(7.2352)	(0.0464)	(2.4696)	(-1.5778)
# Companies funded	-0.1227***	0.1687	-0.0271	0.2982*
	(-23.4559)	(1.6209)	(-0.8122)	(1.7532)
# Exits	0.2258***	-0.0271	-0.0291	0.0445
	(34.5054)	(-0.2642)	(-0.9206)	(0.2679)
Time since first VC round	-0.0140***	0.0486	-0.0359	0.1887
	(-2.6154)	(0.4167)	(-0.7029)	(0.7717)
Time since last round	-0.2055***	-0.0070	-0.0706**	0.3449
	(-16.2776)	(-0.0562)	(-2.2772)	(1.5506)
# Rounds received	-0.1372***	0.0326	-0.0150	0.0991
	(-21.4638)	(0.7446)	(-0.7980)	(1.3453)
# VC investors	-0.0169***	0.0559*	-0.0176	0.0575
	(-3.5768)	(1.7949)	(-0.8774)	(0.7485)
Last round syndicate size	0.0170***	-0.0191	0.0034	-0.0346
	(7.8711)	(-1.3426)	(0.3939)	(-1.0341)
ln(Amount Raised + 1) ($ mil)	0.3232***	0.2151***	0.0469***	0.0227
	(48.2798)	(4.1693)	(2.6315)	(0.2422)
Last round = inside round	-0.1399***	0.2537*	-0.0434	0.4253
	(-6.7817)	(1.7543)	(-0.6055)	(1.4779)
Last round insider %	-0.1552***	-0.3510*	0.0428	-0.4823
	(-6.3484)	(-1.8734)	(0.4714)	(-1.3879)
ln(Patents applied (scaled by ind-year) + 1)	0.1696***	0.0860	0.0051	0.0192
	(13.5839)	(0.9644)	(0.1061)	(0.1111)
Observations	74,839	537	537	537
R-squared	0.2898	0.6661	0.4115	-0.4352
Specification	OLS	OLS	OLS	2SLS
Rounds with MF inv't	183	136	136	136
Series FE	No	Yes	Yes	Yes
Stage level, Location, Industry, Year, First VC Round year FE	Yes	Yes	Yes	Yes
Kleibergen-Paap rk Wald F statistic			9.371	

Table 6: Do companies receiving investment from mutual funds have higher probability of exit?

The sample consists of 28,637 unique companies that received first VC financing round over the 1990 – 2016 period, of which 269 companies received at least one investment from mutual funds. Column 1 and 4 shows OLS regressions where the dependent variable equals one if the firm does not exit for 4 years since the last financing round. Column 2 and 4, and column 3 and 6 show probability of IPO exit and M&A exit, respectively. Stage, location, industry, and first VC round year fixed effects are included in all regressions. Robust t-statistics are reported in parenthesis. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

| VARIABLES | 1990 - 2016 | | | 1995 - 2010 | | |
	Failure	Exited via IPO	Exited via M&A	Failure	Exited via IPO	Exited via M&A
I(MF financing)	-0.0661***	0.2099***	-0.1164***	-0.0819***	0.1995***	-0.1511***
	(-2.6510)	(7.4705)	(-4.7433)	(-2.6919)	(6.2317)	(-4.8646)
VC firm age	0.0002	-0.0000	-0.0004*	0.0003	0.0001	-0.0003
	(0.9809)	(-0.0788)	(-1.7884)	(1.1366)	(0.7745)	(-1.0305)
# Companies funded	0.0081**	-0.0002	-0.0172***	0.0271***	-0.0029	-0.0254***
	(2.4575)	(-0.1282)	(-5.2058)	(5.6678)	(-1.2055)	(-5.1655)
# Exits	-0.0131***	0.0037**	0.0218***	-0.0282***	0.0063***	0.0273***
	(-4.5496)	(2.3278)	(7.5059)	(-6.7702)	(2.8435)	(6.4967)
VC Syndicate Size	-0.0237***	0.0042***	0.0123***	-0.0254***	0.0042***	0.0141***
	(-16.6756)	(4.4108)	(8.8355)	(-13.7762)	(3.4874)	(7.7484)
ln(Amount Raised + 1) ($ mil)	-0.0732***	0.0176***	0.0160***	-0.0840***	0.0229***	0.0255***
	(-32.3364)	(12.7918)	(7.3334)	(-27.3429)	(12.6130)	(8.4806)
ln(Patents applied + 1)	-0.0502***	0.0436***	0.0121**	-0.0499***	0.0395***	0.0131*
	(-8.3371)	(9.4211)	(2.0545)	(-6.8651)	(7.4283)	(1.8007)
CA	0.0057	-0.0069**	0.0067	-0.0069	-0.0073*	0.0072
	(0.9729)	(-2.2145)	(1.1356)	(-0.8720)	(-1.8520)	(0.8968)
MA	-0.0179*	-0.0124**	0.0270***	-0.0276**	-0.0152**	0.0271**
	(-1.9399)	(-2.4896)	(2.8595)	(-2.2849)	(-2.5044)	(2.1753)
NY	0.0190**	0.0011	-0.0205**	0.0129	0.0045	-0.0359***
	(2.1633)	(0.2615)	(-2.2890)	(0.9943)	(0.7169)	(-2.7018)
TX	0.0037	0.0047	-0.0002	0.0011	0.0021	-0.0039
	(0.3256)	(0.7431)	(-0.0138)	(0.0786)	(0.2697)	(-0.2621)
PA	-0.0462***	0.0016	0.0143	-0.0295*	0.0027	0.0104
	(-4.2263)	(0.3091)	(1.3517)	(-1.9274)	(0.3809)	(0.6694)
Observations	28,637	28,637	28,637	18,730	18,730	18,730
R-squared	0.3689	0.1408	0.1074	0.1965	0.1118	0.0604
Specification	OLS	OLS	OLS	OLS	OLS	OLS
First VC round	1990-2016	1990-2016	1990-2016	1995-2010	1995-2010	1995-2010
Co's with MF investment	269	269	269	201	201	201
Stage level FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
First VC round year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: Do companies receiving investment from mutual funds stay private longer? (Cross-sectional analysis)

The sample consists of 8,223 unique VC-backed companies that received their first round of VC financing over the 1990 – 2016 period, and exited via either IPO or M&A. Among these 8,223 companies, 136 companies received at least one investment from mutual funds. Columns 1 – 3 show OLS regressions based on the full sample. We include lead VC fixed effects, which reduces the sample because we require at least two observations per each lead VC. Columns 4 – 6 show OLS regression results based on a matched sample constructed as follows: we use the specification shown in column (1) of Table 3 as the first stage, with the exception that we use logit instead of OLS to obtain reasonable fitted values (i.e., propensity scores). For each firm with mutual fund investment we select the 5 firms (or the maximum possible if less than 5 firms meet the criteria) without mutual fund investment with the closest fitted values, subject to the additional requirement that treated firms and control firms have the same first VC round year and be in the same industry. We do not use repeated sampling. Columns 7 – 9 show two-stage least squares regressions based on the matched sample and using the number of VCs providing funding to the firm and with a mutual fund interaction in the past as an instrument. Across all panels, regressions include stage, location, industry, and first VC round year fixed effects. Robust t-statistics are reported in parenthesis. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable = ln(Time to exit + 1)								
I(MF financing)	0.1925***			0.2073***			0.4715***		
	(4.5891)			(4.8844)			(2.7803)		
ln(Amount invested by MF + 1) ($ mil)		0.0433***			0.0536***			0.2438***	
		(2.5963)			(3.1446)			(3.1516)	
# MF investors			0.0009**			0.0010***			0.0033***
			(2.2224)			(2.8278)			(3.1640)
VC firm age	-0.0001	-0.0001	-0.0001	-0.0016	-0.0020	-0.0021	-0.0013	-0.0022	-0.0027*
	(-0.0525)	(-0.0760)	(-0.0606)	(-1.0401)	(-1.2110)	(-1.3402)	(-0.8402)	(-1.2797)	(-1.6890)
# Companies funded	-0.0118	-0.0114	-0.0115	-0.0415	-0.0290	-0.0320	-0.0516	-0.0333	-0.0284
	(-0.9682)	(-0.9374)	(-0.9473)	(-1.3625)	(-0.8798)	(-1.0344)	(-1.6436)	(-0.9312)	(-0.8975)
# Exits	0.0127	0.0126	0.0123	-0.0021	-0.0078	-0.0063	0.0020	-0.0021	-0.0088
	(1.3578)	(1.3458)	(1.3051)	(-0.0995)	(-0.3513)	(-0.2985)	(0.0943)	(-0.0807)	(-0.4023)
VC Syndicate Size	0.0292***	0.0292***	0.0292***	0.0262***	0.0263***	0.0273***	0.0270***	0.0328***	0.0315***
	(9.9524)	(9.9283)	(9.9385)	(3.2150)	(3.0078)	(3.3119)	(3.3670)	(3.5213)	(3.7797)
ln(Amount Raised + 1) ($ mil)	0.1467***	0.1475***	0.1471***	0.1116***	0.1200***	0.1037***	0.1138***	0.0899***	0.0895***
	(18.3204)	(18.3530)	(18.2683)	(4.3353)	(4.1605)	(3.9743)	(4.5266)	(2.7792)	(3.3441)
ln(Patents applied + 1)	0.1168***	0.1170***	0.1164***	0.1368***	0.1310***	0.1330***	0.1296***	0.1157***	0.1110***
	(10.4649)	(10.3670)	(10.4087)	(4.0914)	(3.5229)	(3.9198)	(3.8135)	(2.7807)	(2.9480)
Observations	7,292	7,259	7,292	589	551	589	589	551	589
R-squared	0.2856	0.2855	0.2844	0.3978	0.3929	0.3848	0.3576	0.2415	0.3218
Specification	OLS	OLS	OLS	OLS	OLS	OLS	2SLS	2SLS	2SLS
Kleibergen-Paap rk Wald F statistic							24.677	17.257	35.391
First VC round	1990-2016	1990-2016	1990-2016	1990-2016	1990-2016	1990-2016	1990-2016	1990-2016	1990-2016
Co's with MF investment	127	94	127	136	98	136	136	98	136
Stage, Location, Industry, First VC round year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of leadvcfe	965	965	965	None	None	None	None	None	None
Restriction				Match Samp	Match Samp	Match Samp	Match Samp	Match Samp	Match Samp

Table 8: Do companies receiving investment from mutual funds stay private longer? (Panel data analysis)

The sample consists of 28,637 unique VC-backed companies that received their first round of VC financing over the 1990 – 2016 period. The observation level is company-quarter. Among these 28,637 companies, 269 received at least one investment from mutual funds. Each period the dependent variable equals one if the company exits and zero if the company is still an active private company, which is defined as having had a funding round within the prior four years and not having exited. Companies leave the sample after they either exit or go four years without a funding round. The measure of mutual fund funding is: a dummy variable equals to one if at least one mutual fund provided financing to the company (col 2), the log of capital invested by mutual funds in the company (col 4), and the number of mutual fund investors in the company (col 6). Columns 1, 3, and 5 report the first stage regressions for columns 2, 4, and 6, respectively. Across all columns, regressions include stage, location, industry, and first VC round year fixed effects. Standard errors are clustered at firm level. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) I(MF financing)	(2) P(exit)	(3) ln(Amount invested by MF + 1) ($ mil)	(4) P(exit)	(5) # MF investors	(6) P(exit)
# VCs with MF connection	0.0035***		0.0071***		0.0153***	
	(6.1864)		(5.8004)		(4.7915)	
I(MF financing)		-0.0603**				
		(-2.2569)				
ln(Amount invested by MF + 1) ($ mil)				-0.0267*		
				(-1.9597)		
# MF investors						-0.0137**
						(-2.1367)
	(0.1451)	(-2.1848)	(1.4596)	(-1.9287)	(0.8601)	(-2.1182)
# Companies funded	0.0008***	-0.0003**	0.0016**	-0.0003*	0.0038***	-0.0003**
	(2.9251)	(-2.0117)	(2.5698)	(-1.8381)	(3.3415)	(-1.9734)
# Exits	-0.0017***	0.0011***	-0.0042***	0.0011***	-0.0078***	0.0011***
	(-4.0525)	(5.6995)	(-4.2563)	(5.5256)	(-3.4934)	(5.6667)
Time since first VC round	-0.0006	-0.0000	-0.0006	0.0000	-0.0037	-0.0000
	(-0.9043)	(-0.1407)	(-0.3825)	(0.0790)	(-1.2266)	(-0.2166)
Time since last round	0.0014**	0.0012***	0.0011	0.0011***	0.0048*	0.0012***
	(2.5142)	(6.3390)	(0.8662)	(5.8314)	(1.9308)	(6.2989)
# Rounds received	0.0008	0.0000	0.0021	0.0000	0.0093*	0.0001
	(1.1628)	(0.0796)	(1.0479)	(0.0720)	(1.7502)	(0.4235)
# VC investors	0.0031***	0.0013***	0.0022	0.0012***	0.0078*	0.0013***
	(3.7351)	(6.0234)	(1.4966)	(5.8248)	(1.8039)	(6.0260)
Last round syndicate size	-0.0003	0.0001	-0.0000	0.0001	-0.0016	0.0001
	(-0.9310)	(0.8979)	(-0.0052)	(1.0727)	(-0.8343)	(0.8439)
ln(Amount Raised + 1) ($ mil)	0.0034***	0.0032***	0.0098***	0.0033***	0.0193***	0.0032***
	(4.9575)	(15.8781)	(6.0838)	(14.7120)	(5.1064)	(15.1145)
Last round = inside round	0.0093***	0.0025**	0.0128*	0.0020**	0.0523**	0.0026***
	(3.2205)	(2.5003)	(1.8607)	(2.0757)	(2.5112)	(2.5944)
Last round insider %	-0.0150***	-0.0011	-0.0291***	-0.0008	-0.0897***	-0.0014
	(-4.5900)	(-0.9849)	(-3.4765)	(-0.7029)	(-3.3697)	(-1.2096)
ln(Patents applied (scaled by ind-year) + 1)	0.0056***	0.0011**	0.0132***	0.0011**	0.0349***	0.0012**
	(2.7377)	(2.4212)	(3.3073)	(2.3574)	(2.7048)	(2.5423)
Observations	571,793	571,793	566,720	566,720	571,793	571,793
R-squared	0.0394	0.0047	0.0307	0.0044	0.0234	0.0036
Specification	OLS	2SLS	OLS	2SLS	OLS	2SLS
Kleibergen-Paap rk Wald F statistic	38.272		33.644		22.959	
First VC round	1990-2016	1990-2016	1990-2016	1990-2016	1990-2016	1990-2016
Co's with MF investment	247	247	247	247	247	247
Stage level, Location, Industry, First VC round year, Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Table 9: Do companies receiving investment from mutual funds stay private longer? (full sample with ordered probit model)

The sample consists of 28,637 unique VC-backed companies that received their first round of VC financing over the 1990 – 2016 period. Observation level is company-quarter. Among these 28,637 companies, 269 companies received at least one investment from mutual funds. Each period the dependent variable takes one of four possible values: 1 if the company fails (defined as having the last funding round more than four years ago and not having exited during this period), 2 if the company's outcome is uncertain at that point in time (defined as not having exited, and having the last funding round more than two years ago but less than four years ago), 3 if the company is still private and active (defined as having the last funding round within the past two years), and 4 if the company exits via IPO or acquisition. Companies leave the sample after they either exit or go four years without a funding round. This classification drops some companies that do not receive follow-up financing for more than four years since last funding round. Ordered probit regressions are estimated, where the dependent variable is a measure of firm status defined above. Columns 1 – 3 are based on full sample and columns 4 – 6 are based on matched sample. We use the specification shown in column (1) of Table 3 as the first stage, with the exception that we use logit instead of OLS to obtain reasonable fitted values (i.e., propensity scores). For each firm with mutual fund investment we select the 5 firms without mutual fund investment (or the maximum available if less than 5 satisfy the criteria) with the closest fitted values, subject to the additional requirement that treated firms and control firms have the same first VC round year and be in the same industry. We do not use repeated sampling. Across all columns, regressions include stage, location, industry, and first VC round year fixed effects. Standard errors are clustered at firm level. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

VARIABLES	(1) Status	(2) Status	(3) Status	(4) Status	(5) Status	(6) Status
I(MF financing)	0.224***			0.288***		
	(5.216)			(5.946)		
ln(Amount invested by MF + 1) ($ mil)		0.076***			0.092***	
		(4.324)			(4.780)	
# MF investors			0.020***			0.025***
			(3.154)			(3.610)
VC firm age	-0.001***	-0.001***	-0.001***	-0.001	-0.001	-0.001
	(-3.170)	(-3.042)	(-3.153)	(-1.461)	(-1.429)	(-1.452)
# Companies funded	0.014***	0.015***	0.014***	0.000	0.009	0.001
	(5.432)	(5.645)	(5.467)	(0.018)	(0.552)	(0.088)
# Exits	-0.007**	-0.007**	-0.007**	0.011	0.003	0.011
	(-2.013)	(-2.164)	(-2.024)	(0.764)	(0.169)	(0.763)
Time since first VC round	-0.017***	-0.017***	-0.018***	-0.012	0.003	-0.013
	(-6.533)	(-6.491)	(-6.586)	(-0.776)	(0.186)	(-0.810)
Time since last round	-1.510***	-1.512***	-1.510***	-1.377***	-1.387***	-1.369***
	(-145.757)	(-145.231)	(-145.780)	(-39.722)	(-38.355)	(-39.752)
# Rounds received	0.037***	0.037***	0.037***	0.013	0.014	0.012
	(13.802)	(13.918)	(13.789)	(1.423)	(1.493)	(1.364)
# VC investors	0.038***	0.039***	0.038***	-0.000	0.006	0.008
	(14.456)	(14.933)	(14.799)	(-0.023)	(0.700)	(0.948)
Last round syndicate size	-0.011***	-0.012***	-0.011***	0.002	-0.000	0.001

	(1)	(2)	(3)	(4)	(5)	(6)
	(-9.806)	(-10.048)	(-9.836)	(0.501)	(-0.057)	(0.298)
ln(Amount Raised + 1) ($ mil)	0.077***	0.077***	0.077***	0.099***	0.106***	0.104***
	(28.626)	(28.723)	(28.787)	(8.996)	(8.993)	(9.482)
Last round = inside round	-0.051***	-0.051***	-0.050***	-0.106**	-0.102**	-0.097**
	(-3.504)	(-3.439)	(-3.434)	(-2.289)	(-2.028)	(-2.108)
Last round insider %	0.083***	0.082***	0.081***	0.137***	0.129**	0.120**
	(5.192)	(5.071)	(5.091)	(2.597)	(2.291)	(2.278)
ln(Patents applied (scaled by ind-year) + 1)	0.034***	0.034***	0.035***	0.031	0.027	0.032
	(5.534)	(5.530)	(5.610)	(1.317)	(1.079)	(1.371)
Constant cut1	-6.141***	-6.142***	-6.139***	-5.633***	-5.610***	-5.609***
	(-137.935)	(-137.332)	(-137.990)	(-44.161)	(-42.252)	(-44.461)
Constant cut2	-2.630***	-2.627***	-2.628***	-2.460***	-2.416***	-2.446***
	(-78.432)	(-77.998)	(-78.450)	(-29.658)	(-28.182)	(-29.824)
Constant cut3	2.125***	2.125***	2.126***	2.249***	2.239***	2.253***
	(67.566)	(67.265)	(67.625)	(29.681)	(28.735)	(29.921)
Observations	571,793	566,720	571,793	35,910	30,837	35,910
Specification	Ordered probit	Ordered probit	Ordered probit	Ordered probit	Ordered probit	Ordered probit
First VC round	1990-2016	1990-2016	1990-2016	1990-2016	1990-2016	1990-2016
Co's with MF investment	247	247	247	247	247	247
Stage level, Location, Industry, First VC round year, and Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Restriction	Uncond. on exit	Uncond. on exit	Uncond. on exit	Uncond. on exit with Matched sample	Uncond. on exit with Matched sample	Uncond. on exit with Matched sample
Change in prob(status) when	I(MF): 0 → 1	$ mil: 0 → 40	# MFs: 1 → 6.5	I(MF): 0 → 1	$ mil: 0 → 40	# MFs: 1 → 6.5
Defunct	-0.00%	-0.00%	-0.00%	-0.00%	-0.00%	-0.00%
Uncertain	-3.33%	-4.06%	-2.09%	-2.01%	-2.54%	-1.06%
Active	3.32%	4.01%	1.90%	1.90%	2.23%	0.98%
Exit	0.03%	0.05%	0.02%	0.20%	0.27%	0.09%