The Evolution of the Private Equity Market and the Decline in IPOs

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Abstract

Despite the large drop in the number of initial public offerings (IPOs) in the United States, privately-held firms backed by venture capital continue to raise capital, achieve high revenues and hire at rates historically available only to their public peers. We show that this ability to finance and grow at older ages stems from a positive shock to the supply of private capital to high-growth entrepreneurial firms. This shock manifests itself in three ways. Since 1996, non-traditional investors have played an increasing role in the late-stage venture capital market. Next, consistent with technological changes lower search costs, we find that investors are farther away from their portfolio companies in the last 15 years. Third, the increased participation of these investors coincides with the passage of a major securities law in 1996 that removed frictions in raising private capital by both firms and their financiers. The collection of evidence demonstrates that the lower volume of IPOs for VC-backed firms most likely stems from their founders/managers choosing to remain private, rather than a market failure leading to frictions in the going public process.

Key words: Initial Public Offerings (IPOs), Venture Capital, Private Equity, Founder Equity, NSMIA.

JEL classification: G32; G24; G28.

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Recent years have seen a sharp decline in the number of initial public offerings (IPOs) in the U.S. (Doidge, Karolyi, and Stulz (2013, 2017); Gao, Ritter, and Zhu (2013)). While this decline has garnered considerable attention both in academic and policy circles and in the press,[1] its causes remain unclear. In particular, Gao, Ritter, and Zhu (2013) argue that the drop in IPOs follows from technological changes where "the advantages of selling out to a larger organization [...] have increased relative to the benefits of operating as an independent firm" (p. 1663). By contrast, Doidge, Karolyi, and Stulz (2017) note that the U.S.-centric nature of the IPO decline rules out "explanations that focus on technological change that affects firms regardless of their country of domicile" (p. 465). At the same time, Gao, Ritter, and Zhu (2013) and Doidge et al. (2013; 2017) agree that the Sarbanes-Oxley Act and other early 2000s changes in the regulatory environment surrounding public firms cannot explain the decline.

The debate on the causes behind the dearth of IPOs has been accompanied by a no less intense debate on its consequences for the U.S. entrepreneurial finance market. To illustrate, prior to 1997, over 80% of venture capital (VC)-backed startups that raised over $150 million did so by tapping the public-equity markets, fueling concerns that the lack of IPOs may hinder successful startups ability to fund their growth. Indeed, Doidge, Karolyi, and Stulz (2013) conclude that while the low IPO rate is "consistent with the view that U.S. financial markets became less hospitable for young, small firms, direct tests of this view, while needed, are beyond the scope" of their study (p. 571). Our paper helps fill this gap by shedding light on the extent to which the decline in IPOs has impacted U.S. startups' ability to finance their growth. Unlike most prior work, which has examined the changes in the public-equity markets that have accompanied the IPO decline, we do so by analyzing how the private markets have responded – and contributed – to this decline.

Throughout the paper, we focus on VC-backed startups, which have traditionally been a major player both in the IPO market (58% of technology IPOs; Ritter (2017)) and the production of innovation (e.g., Gornall and Strebulaev (2015)), and for which (pre-IPO) financing data are widely available. We begin by examining whether the decline in IPOs has been made up by an increase in acquisitions. If this were the case and the acquirers were public firms, startups'

[1]For recent examples see "IPO Drought Scorches Wall Street" (`https://www.wsj.com/articles/ipo-drought-scorches-wall-street-1474634214`) and "Uncuffing capitalism" (`http://www.economist.com/node/21551481`).

ultimate ability to rely on public capital to fund their growth would remain unchanged – even if they would no longer do so as independent firms. In fact, the fraction of VC-backed startups that are acquired 7 or 10 years after their initial funding round has remained roughly constant since the early 1990s. Instead, the decline in IPOs has been accompanied by an increase in the fraction of startups that stay independent and privately-held long after they first raise capital.

Crucially, in recent years, these late-stage startups that remain privately-held continue to finance their growth in ways unseen prior to the 2000s. The age of the average startup raising private capital has almost doubled since 2000, from just under two years old in 2000 to close to four years old in 2005. This trend is even more pronounced if we weigh firm age by the dollar amount raised, thus highlighting the large size of these late rounds. Relatedly, as startups stay private longer, they raise an increasing number of private rounds: Only 4% of startups that raised their first round in 1992, at the beginning of our sample, went on to raise seven or more rounds over the following 10 years; by contrast, of those startups raising their initial round in 2005, 10% had raised a seventh round 10 years later.

Of course, even in 1996, when public listings were at their peak (Doidge, Karolyi, and Stulz (2017)), an IPO was an option only for the most successful startups. Thus, in order to understand the extent to which private investors have filled up the gap left by the decline of IPOs, we need to investigate whether they are able to finance the growth of the largest startups. Our evidence suggests they are. Of those startups whose first round was before 1997 and went on to raise over $150 million in the following seven years, 83% did so by going public; by contrast, only 36% of startups reaching that scale since 2000 were public - even though the annual number of startups raising over $150 million has not changed. If we instead focus on startups that reach a large size as measured by real variables like employment or sales, a similar picture emerges: In the pre-1997 cohorts, 87% of startups with more than 200 employees and 67% of those with over $40 million in sales had gone public; since 2000, these fractions have been more halved, standing at 29% and 30%, respectively. Simply put, VC-backed startups now appear able to raise large amounts of capital and grow in employment and sales without going public.

The above results suggest private investors have filled much, if not all, of the void left by the drought in IPOs. We next study the sources of this capital going to late-stage startups. The

amount of private capital raised by startups four or more years past their first VC round–an age at which successful firms would traditionally consider an IPO–has grown by a factor of 20 since 1992, surpassing $30 billion in 2015. Approximately 40% of this growth has been driven by traditional venture capital funds, which appear increasingly willing to both invest in mature startups and to make these investments later in the fund's life. The remaining 60% has been fueled by less traditional startup investors such as private equity (PE) funds, family offices, hedge funds, and, particularly since 2010, mutual funds.[2]

What explains the growth in the supply of private capital to late-stage startups? As is often the case with such macroeconomic changes, a variety of factors are likely at play. Kahle and Stulz (2016) note that the Internet has reduced search costs for firms searching for investors (and vice versa), thus reducing one of the fundamental advantages of centralized stock exchanges. A number of regulatory changes affecting private firms and their investors have also facilitated the process of raising capital privately (e.g., de Fontenay (2017)). One notable change was the National Securities Markets Improvement Act (NSMIA) of 1996. The NSMIA made it easier for private firms to sell securities to "qualified purchasers" (e.g., institutions or accredited investors) in different states by exempting those sales from state-level regulations known as blue-sky laws (public firms have long been exempt from these state laws). In addition, the NSMIA made it easier for unregistered funds such as VC and PE funds to raise capital by also exempting them from blue-sky laws and by introducing news exclusions from registration that effectively increased the maximum number of investors in a fund.[3] This exclusion was particularly important for funds investing in late-stage startups, which tend to be larger and have more investors to meet mature startups' higher capital needs.

Consistent with the NSMIA being a positive shock to the supply of late-stage private capital, our difference-in-difference analysis that compares U.S. and non-U.S.-based funds reveals that the size of funds increased relatively more in the U.S. around the passage of the NSMIA. More importantly, when we compare late-stage to early-stage funds in the U.S. around the law

[2]In contemporaneous work, Chernenko, Lerner, and Zeng (2017) and Kwon, Lowry, and Qian (2017) also find that mutual funds have taken an increased role in funding VC-backed startups. We show this growth of mutual fund is part of a larger trend that has seen non-VC investments in late-stage startups grow from $1.5 billion in 1992 to $32 billion in 2015; the fraction of these non-VC investments made by mutual funds peaked in 2011 at 14.8%.

[3]Prior to the NSMIA, only funds with 100 or fewer investors were excluded from registering as investment companies under the Investment Company Act. Such registration can be burdensome, as it requires the regular disclosure of investment positions and limits the use of leverage, among other requirements.

change, we find that the former increased 40% more on average. Importantly, this finding is robust to excluding information technology (IT) funds, which suggests it is not driven by the Internet boom in the late 1990s.

Taken together, our results suggest that the growth in the supply of private capital has allowed late-stage startups to continue financing their growth while remaining privately held. A natural question then follows: Is staying private a second-best response to the lack of IPOs, or is it actually driving the lack of IPOs? In other words, are startups remaining private because they cannot go public and so find themselves resigned to raising money privately? Or, alternatively, is an IPO still an option for these firms, but they choose to remain private instead?

To shed light on this question, it is helpful to consider why startups may choose to remain private. In their survey of CFOs, Brau and Fawcett (2006) find that the main reason leading the managers of successful firms to remain private is their desire to preserve decision-making control and ownership. Boehmer and Ljungqvist (2004), Boot, Gopalan, and Thakor (2006), and Helwege and Packer (2009), among others, also emphasize founders' desire to maintain control as a key benefit of remaining private. However, founders desire to stay private often conflicts with VCs' desire to go public, as IPOs ensure a timely liquidation of their investment and carry considerable reputational benefits (e.g., Gompers (1996); Gompers and Lerner (1996)).[4]

Consistent with founders' desire for control being a key driver of startups' decision to stay private, we find that the founders' bargaining power early in a firm's life has a negative effect on its eventual exit probability. Our instrumental variable identification strategy exploits state-year variation in the supply of venture capital stemming from variation in the assets of state pension funds (Gonzalez-Uribe (2014); Bernstein, Lerner, Sorensen, and Strömberg (2016)). The first stage shows that founders who raise their first VC round in state-years when the assets of the state's pension funds are high have a persistently higher equity stake (after controlling for the capital raised). In the second stage, founders use this higher equity stake – which is positively correlated with measures of control such as board seats – to decrease the likelihood

[4]For a recent example of this conflict, see "Palantir and Investors Spar Over How to Cash In" (Wall Street Journal, Dec. 30, 2015), which describes the "deepening rift in Silicon Valley between private companies that want to stay that way and investors who want to unlock at least some of the profits from their most successful investments."

their firms go public or are acquired seven (or ten) years later.[5]

The reasons driving the documented increase in founders' bargaining power are likely to be multi-faceted, and a full analysis of them falls beyond our paper's scope. That said, we note that technological changes decreasing startups' capital requirements early in their lifecycle–when uncertainty is highest and thus capital is most expensive (Ewens, Nanda, and Rhodes-Kropf (Forthcoming))—as well as the growth of non-traditional startup investors in late-stage financings have likely played a role. Whatever the reasons, our finding that founders with the most control (and so whose startups have the highest valuations) are in fact the most likely to stay private suggests they do so by choice and not as a second-best response to not being able to go public. This conclusion is reinforced by the growing role of mutual funds and other traditional IPO investors in funding late-stage private startups. These investors' willingness to hold private, illiquid securities suggests they would also be willing to invest in these same startups if they went public.

Our paper makes two contributions. First, we show that the much-debated dearth of IPOs in the U.S. does not appear to have impeded late-stage startups' ability to finance their growth. Of course, ruling out the possibility that the IPO decline has negatively affected startups' access to capital would require a comparison of private startups' ability to fund their (unobservable) investment opportunities today to that of similar public startups in the 1990s. Such a comparison is unlikely to be feasible. However, our finding that private investors provide an increasing amount of capital to late-stage startups, allowing them to reach size thresholds that until recently few private firms reached, suggests private markets are filling much–if not all–of the IPO gap.

Private investors funding late-stage startups include traditional actors such as venture capital funds and more recent entrants such as mutual and hedge funds. Mutual funds' role in funding private startups has garnered considerable recent attention, both in the academic literature (Chernenko, Lerner, and Zeng (2017); Kwon, Lowry, and Qian (2017)) and in the press.[6] Our paper confirms the growth of mutual funds' investments in startups and, more importantly, quantifies their (still) relatively modest importance in the entrepreneurial finance market.

[5] As expected, the OLS partial correlation between founder equity and IPO probability is positive, which is consistent with founder equity (and thus startup valuation) being positively correlated with unobserved quality.

[6] For example, see "Mutual Funds Moonlight as Venture Capitalists". (`https://www.wsj.com/articles/mutual-funds-moonlight-as-venture-capitalists-1398033557`).

Second, our paper contributes to our understanding of the causes driving the decline in IPOs. Prior work (Doidge, Karolyi, and Stulz (2013); Gao, Ritter, and Zhu (2013)) has examined whether this decline can be explained by changes in the public-equity markets, such as the Sarbanes-Oxley Act of 2002 or the 2003 Global Settlement, and has concluded it cannot. Instead, we show that changes in the private markets, some of them regulatory, such as the National Securities Markets Improvement Act of 1996, and some technological, such as lower search costs induced by the Internet, have reduced the relative cost of being private. At the same time, these and other changes (e.g., a lower cost of startup experimentation; Ewens, Nanda, and Rhodes-Kropf (Forthcoming)) have increased founders' bargaining power vis-à-vis investors. This increased bargaining power, coupled with the reduction in the cost of being private, has made it possible for founders to realize their preference for control by delaying–or avoiding altogether–an IPO.

1 Data and Sample

Our data builds off the venture capital (VC) and private investment data provided by VentureSource (a division of Dow Jones) and is supplemented with information from Correlation Ventures, a quantitative VC fund. This supplemental information (described in detail in Ewens, Nanda, and Rhodes-Kropf (Forthcoming)) is particularly useful for the analyses of exit valuations, firm failure tracking and founder equity, which would not be possible if relied only on commercial databases. We begin by considering all startups in VentureSource that raised their first private round of funding after 1992.[7] We observe investments through 2016, and the end of our sample period changes depending on the data demands of each analysis. To be in our sample, a startup needs to be headquartered in the U.S. and have raised at least one equity financing round from a traditional VC investor (defined as standard fixed-life fund that raised capital from limited partners). For startups passing these filters, we observe the capital (equity and debt) they raise both from traditional VCs and from other non-VC investors, such as corporations, private equity (PE) funds, or mutual funds (see Section 3 for details).

Our focus on VC-backed startups, while undoubtedly restrictive, offers three key advantages. First, it allows us to observe private firm-level and financing-level outcomes that are

[7] We choose 1992 as the starting point because the coverage of VC financings and investors is poor until then.

not systematically available for non-VC-backed private firms, providing a unique window to study the changes in the private markets that have accompanied the decline in IPOs. Second, although VC-backed firms make up less than 1% of all privately-held firms (Puri and Zarutskie (2012)), they have historically been a key player in the IPO market,[8] and so they are particularly relevant to analyze the consequences of the decline in IPOs. Third, VC-backed firms also play an outsized role in the production of innovation (Kortum and Lerner (2000)). Therefore, understanding the consequences of their response to the weak IPO environment is important, as these consequences are likely to be felt economy-wide.

We obtain sales and employment information for the firms in our sample from three data sources. For private firm-years, we rely on VentureSource and the NETS database. For public-firm years, we rely on Compustat, which we merge to the VC-backed firms in our sample that go public (we also use Compustat to obtain post-IPO capital-raising data). The combination of these three data sources gives us a rich time series of employment and sales data for 68% of the VC-backed firms in our sample.

2 The IPO Decline and the Financing of Late-Stage Startups

In this section, we begin our examination of the changes in the entrepreneurial finance market that have accompanied the decline in IPOs by analyzing how the financing patterns of VC-backed startups have evolved since the early 1990s.

2.1 Are startups relying on mergers to continue having access to public investors?

This study is motivated by the finding in the literature that IPOs have experienced a dramatic decrease since peaking in 1996 (Doidge, Karolyi, and Stulz (2013); Gao, Ritter, and Zhu (2013)). However, such a decrease does not necessarily imply that startups no longer have access to the public-equity markets: If those startups that used to go public were now being acquired by public firms, the startups would still be able to raise capital from public investors–albeit not as independent firms.

[8] Ritter (2017) shows that, over 1980–2016, VC-backed firms accounted for 58% of tech IPOs and 37% of all IPOs.

Figure 1 shows the evolution of the exit rates of VC-backed startups over our sample period. Specifically, for startups that raised their first financing round in 1992-2009, the figure shows the (stacked) fraction of firms that (1) went public, (2) were acquired, (3) failed, or (4) remained private in the seven years following that first round.[9] Consistent with Doidge, Karolyi, and Stulz (2013) and Gao, Ritter, and Zhu (2013), we find that IPO exits have been extremely rare for firms first financed after 2000. Importantly, though, the decline in IPOs has not been replaced by an increase in acquisitions, which have remained mostly flat throughout our sample period.[10] Instead, Figure 1 shows that the IPO decline has been made up by an increase in the fraction of startups that remain private - and active - for at least seven years after their first funding round.

2.2 More private capital is going to late-stage startups

Figure 1 makes it clear that acquisitions have not filled the gap left by the decline in IPOs; rather, VC-backed startups appear to have found ways to remain private longer than they had historically done. We now turn to investigating whether the private markets have adapted to finance these firms' growth.

For each year from 1992 to 2016, Figure 2 plots the (equal-weighted) average age of startups raising private capital that year, where age is measured in years from the first-financing date. After falling during the 1990s from two to just over one year old, the average age of startups raising private capital more than doubled from 2000 to 2005, staying close to three years old since then. The increase during the 2000s is even more pronounced if we weigh firm age by the dollar amount raised (dashed line),[11] which suggests more mature firms tend to raise larger financing rounds.

The evidence in Figure 2 thus suggests that private investors have reacted to the dearth of IPOs since 2000 by shifting their investments toward late-stage startups. This shift has allowed these startups to continue financing their growth without relying on the public markets.

[9] Figure A1 in the Internet Appendix performs a similar analysis measuring exits in the 10 years following the first financing round. The conclusions remain unchanged.

[10] Splitting acquisitions into those made by public and private firms has no material impact on the results (i.e. both types exhibit similar dynamics). Also, if we condition the analysis on firms that exit, then, consistent with Figure 2 in Gao, Ritter, and Zhu (2013), we find that the IPO decline has led to a sharp decline in the fraction of exits that are via IPO and a symmetric increase in the fraction of exits via acquisition. The difference with our Figure 1 is that we do not condition on exits.

[11] All dollar figures in the paper are in real dollars of year 2009 purchasing power.

Moreover, the evidence reinforces the notion that the increasing fraction of private startups shown in Figure 1 are indeed active firms that continue raising capital.

Figure 3 provides complementary evidence consistent with the hypothesis that private markets are increasingly supporting the growth of late-stage private startups. For startups that raised their first round of funding in 1992-2005, the figure shows the average predicted probability of raising at least seven rounds of private capital in the 11 years following that first round (90% of startups that raise seven rounds of funding do so in 11 years or less). We estimate predicted probabilities using a linear probability model that includes first-financing-year, industry, and state fixed effects. Figure 3 shows that for startups first funded in the 1990s, the average predicted probability of raising seven or more rounds of private capital is 8.1%. By contrast, for startups first funded after 2000, the average predicted probability of raising at least seven rounds of funding is 12.4%–53% higher ($p = 0.002$). Figure A2 in the Internet Appendix shows that a similar increase has not occurred if we focus on startups' ability to raise a second funding round, thus highlighting the fact that the changes in the private capital markets have been centered on late-stage startups.

2.3 Are private markets able to fund the growth of large startups?

Section 2.2 shows that the decline in IPOs has been accompanied by a shift in the supply of private capital toward startups that are on average older and raise late funding rounds. However, the average startup has never been an IPO candidate–historically, only large and successful startups have gone public (e.g., Chemmanur, He, and Nandy (2009)). Thus, understanding the extent to which private investors have been able to fill the gap left by the decline of IPOs requires an analysis of whether private markets are able to finance the growth of large startups. We do this next.

2.3.1 Raising large amounts of capital as a private firm

We begin by studying startups' ability to raise large amounts of capital while remaining private. For each startup in our sample, we compute the total net capital (both equity and debt) raised from both public and private sources during the seven years following the firms first financing round. Specifically, for firms that do not go public during these seven years, our measure of

capital includes only capital raised from private investors; for firms that go public, we include both pre-IPO capital raised from private investors as well as net capital raised at the IPO and any subsequent follow-on offerings from public investors.

Figure 4 shows that, among startups whose first funding round was prior to 1997, approximately 80% of those that raised over $150 million in the seven years following that first round went public.[12] There is little doubt that the ability to raise large amounts of public capital was a key driver in these firms' IPO decision: in untabulated results, we find that 83% of the total capital they raised was from public investors at or after the IPO. This finding is consistent with the notion that before the IPO decline, most successful startups that raised large amounts of capital did so by going public.

By contrast, the figure shows that of those startups whose first funding round was after 1998 and that went on to raise over $150 million in the following seven years, fewer than 40% relied on the public markets to do so. Importantly, the total number of firms raising over $150 million in the mid-2000s cohorts was similar to that of one decade earlier—although that number has remained below the heights of the late 1990s. The evidence in Figure 4 thus suggests that private markets have been able to fill at least a substantial part of the gap left by the decline of IPOs in providing large amounts of capital to the most successful startups.

This conclusion is reinforced by Figure 5, which provides a multivariate and continuous version of Figure 4. Specifically, Figure 5 examines whether the relationship between the net amount of capital raised by a firm during the seven years following its first funding round and the likelihood that the firm is public has changed over time. To do so, we plot the annual coefficients β_t (for $t \in [1992, 2009]$) from the following regression:

$$Y_{7it} = \beta_t \times \ln K_{7it} + \gamma_t + \eta_s + \theta_j + \varepsilon_{it}$$

where i indexes firms and t indexes the year the firm raised its first funding round. Y_7 is an indicator equal to one if the firm went public during the seven years following its first funding round; K_7 is the net amount of capital raised by the firm during these seven years; and γ_t, η_s,

[12] Fewer than 6.5% of our sample firms go on to raise $150 million in the seven years following their first round of funding, thus making $150 million a natural (if necessarily arbitrary) threshold to identify "large" amounts of capital. Our conclusions are robust to using other thresholds, or to not using a binary threshold at all (see Figure 5).

and θ_j capture first-funding year, state, and industry fixed effects, respectively.

The figure shows that for firms in the pre-1997 cohorts, there was a strong partial correlation between the (log) amount of capital the firms raised and their likelihood of being public. Simply put, as shown in Figure 4, most firms that raised large amounts of capital did so by going public. Since 1999, this partial correlation has seen a 75% decrease, thus indicating that the fact that a firm raises a large amount of capital is a much weaker predictor of the likelihood that the firm is public than it was prior to the IPO peak in 1996. Thus, the growing ability of private investors to fund large and successful startups with considerable sums of money has made it much less reliable to use a firms fundraising activity to predict its listing status.

2.3.2 Achieving scale as a private firm: employment and sales

In addition to being able to raise large amounts of capital, are those startups that remain private able to reach a large scale as measured by real variables such as employment or sales? To shed light on this question, Figures 6 and 7 present analogous versions of Figures 4 and 5 focusing on employment instead of capital raised; Figures A3 and A4 in the Internet Appendix do the same for sales.

Figure 6 shows that the decline in IPOs has been accompanied by a marked decline in the fraction of startups with over 200 employees that are public–but not in the total number of startups that reach this size, which rebounded strongly after the 2001 recession. Indeed, less than a third of startups with over 200 employees from the cohorts that raised their first funding round after 2001 did so by going public, while in the early and mid-1990s this fraction surpassed 80%. Similarly, Figure 7 shows that the partial correlation between the (log) number of employees a firm has and the likelihood that the firm is public was cut in four for the 2000s cohorts relative to the pre-1997 cohorts. Figures A3 and A4 show similar results when we focus on sales instead of employment.

One common concern about the drop in IPOs since 1997 was that the lack of capital would not allow private firms to achieve scale and grow. For instance, President Obama noted at the JOBS Act signing (2012): "For business owners who want to take their companies to the next level, this bill will make it easier for you to go public. And that's a big deal because going public is a major step towards expanding and hiring more workers." While we cannot rule out the

possibility that the decline in IPOs has made it harder for some startups to fund their growth, the evidence in this section suggests that private investors have filled much–if not all–of the gap left by the decline in IPOs. By shifting their investments toward late-stage startups, private investors have been able to provide considerable amounts of capital to successful startups, enabling them to hire large numbers of employees and achieve high sales volumes. We now turn to studying the sources of this private capital.

3 Who Are the Private Investors Funding Late-Stage Startups?

Section 2 shows the last two decades have seen a marked increase in the supply of private capital going to late-stage startups, which has helped fill the gap left by the decline in IPOs. In this section, we investigate the sources of this private capital.

3.1 VC investors' role in funding late-stage startups

Traditionally, venture capitalists (VCs) have been a key player in the entrepreneurial finance market, particularly in funding the kind of high-growth startups that tend to become IPO candidates (e.g., Kortum and Lerner (2000); Puri and Zarutskie (2012); Gornall and Strebulaev (2015)). To what extent have VCs driven the growth in the supply of capital going to late-stage startups over the last two decades? For each year from 1992 through 2016, Figure 8 breaks down the funds raised by late-stage startups into funds raised from traditional VC investors and from other non-VC investors. Given our focus on the funders of late-stage startups, the figure and all other analyses in this section include only startups that are at least four years old (as elsewhere in the paper, we measure age since the first financing round).[13]

Consistent with our findings in Section 2, Figure 8 shows a large increase in the amount of private capital going to late-stage startups, raising from an average $1 billion per year in 1992-1996 to around $10 billion in 2005-2009, and then raising again to an average $23 billion in 2014-2016. Through 2009, both traditional VC investors and less traditional startup investors such as private equity (PE) funds contributed to this increase to a similar extent. However, in recent years, non-VC investments in late-stage startups have more than doubled those of

[13]We choose four years as the age threshold because the average IPO firm prior to the 1996 listing peak was four years removed from its first VC financing. Our conclusions are robust to using other thresholds.

traditional VCs, with non-VC investments peaking at $30 billion in 2015.

Before investigating who these non-VC investors are, we seek to better understand VCs' growing tendency to invest in mature startups, reflected both in Figure 8 and in Figures 2 and 3 above. Have VC investors changed their fundraising or investment strategies in order to increase their investments in late-stage startups? We consider two possibilities. First, overall VC fundraising could have increased, and VCs could be funneling this additional funds to late-stage startups. This does not appear to be the case: Figure A5 in the Internet Appendix shows that the total annual capital raised by VC funds has been largely flat since the years of the dot-com boom (see also NVCA (2016)).

If total VC fundraising has not changed significantly, then VCs must have changed how they deploy their capital. The typical VC fund's agreement with its investors (known as limited partners, or LPs) has a 10-year life, although it often allows extensions of up to three years beyond these 10 years. The increase in late-stage investments could then be the result of VCs supporting their portfolio companies longer, effectively extending their investment horizon by shifting their investments toward the second half of their fund's life.

The evidence in Figure 9 is consistent with this explanation. For VC funds raised between 1992 and 2006, the figure shows how old the funds are, on average, when they invest in their portfolio companies (we measure fund age in years since the fund's closing date). Given that our goal is to investigate whether funds from recent vintages make investments later in their lives to continue supporting their still-private portfolio companies, we limit the sample to follow-on investments in existing portfolio companies.

The figure shows that the average age at which VC funds make follow-on investments increased by almost a full year, from 3 to 3.9 years, when comparing funds raised prior to 2000 to those raised after 2000, a 31% increase ($p < 0.001$). We obtain a very similar pattern if we compare the predicted (log) ages at which funds make follow-on investments using a linear regression model that includes fund-vintage-year, industry, and state fixed effects ($p < 0.001$).

VCs have traditionally been reluctant to invest late in the life of their funds, for fear of not being able to liquidate their investments before the end of their fund's life. The results in Figure 9 show that the decline in IPOs has been accompanied by an apparent decrease in this reluctance, which has enabled VCs to support their portfolio firms longer than they traditionally

had. That said, the shift toward more late-stage investments has not been without its tensions: As we discuss in Section 5 below, VCs' liquidity needs have become a growing source of friction between them and their portfolio companies.

3.2 Non-VC investors' role in funding late-stage startups

Figure 8 shows that non-VC investors play an increasingly important role in financing late-stage startups, accounting for over 70% of the capital these startups raised in 2014-2016, the last three years of our sample. But who are these non-VC investors? Figure 10 breaks them down in four categories: diversified private equity (PE) funds, corporations making minority investments in startups, mutual funds, and a fourth category that combines hedge funds and investment banks. See Table A1 in the Internet Appendix for the names of the investors most active in each of these categories. (The figure does not show non-VC investors that VentureSource identifies as "Other," a catch-all category that includes individuals, family offices, and sovereign wealth funds, among others.)

Private equity funds have consistently been the largest non-VC investor in late-stage startups, with the aggregate size of their investments increasing by a factor of 4.4 from 1999-2001 to 2014-2016. PE investors thus appear to have gradually diversified their traditional focus on leveraged buyouts, expanding the amount of capital they allocate to so-called "growth equity" investments in late-stage startups.

PE funds are followed in order of importance by corporations, with mutual funds and the combined hedge fund/investment bank category coming in next. The growth in investments by both mutual funds and hedge funds/investment banks has been particularly stark since the second half of the 2000s, peaking at a combined $3.3 billion in 2015. This rising importance of mutual funds as investors in private startups is the focus of recent studies by Chernenko, Lerner, and Zeng (2017) and Kwon, Lowry, and Qian (2017).

Interestingly, mutual and hedge funds have historically been active IPO investors. The fact that they are increasingly willing to invest in VC-backed startups while the startups are still private suggests that mutual and hedge funds would also be willing to invest in these same firms if the firms were to go public–if anything, to the extent that the firms' securities would be more liquid, they should be *more* willing to do so. The evidence in Figure 10 is thus hard to reconcile

with the notion that the decline of IPOs has been driven by public investors' unwillingness to bear the risks associated with investing in VC-backed IPO firms.

Have the private investments of non-traditional startup investors been concentrated precisely on the mature startups captured in Figures 8 and 10, or are these investors now also investing in younger firms? To shed light on this question, Table 1 investigates the relationship between a startup's age and the likelihood that the startup raises capital from non-VC investors in a given financing round.

The results in column 1 point to a strong relation between the age of a startup when it raises capital and the fraction of the capital that is supplied by non-VC investors, with each additional year of age being associated with a 10% increase in the fraction of non-VC capital ($p < 0.001$). Column 2 shows this finding is robust to including industry $\times$ financing year fixed effects (instead of simply including industry and financing year fixed effects, as in column 1), while column 3 shows it is robust to using the financing round number instead of the startup's age to proxy for its maturity. In addition, columns 4-6 show that our conclusions are also robust to estimating a linear probability model where the dependent variable is an indicator for whether the round includes at least one non-VC investor.

The evidence in Table 1 thus indicates that the increasing role that non-traditional startup investors play in funding late-stage startups is not part of a broader phenomenon whereupon these investors have now become major investors in startups of all ages. Rather, they appear to be concentrating their investments in the kind of late-stage startups that would have been prime candidates to go public before the IPO decline.

4 What Explains the Growth in the Supply of Private Capital to Late-Stage Startups?

Sections 2 and 3 demonstrate that private investors–both traditional investors in startups such as VCs and less traditional investors such as PE funds and mutual funds–have increased their investments in late-stage startups by a factor of 25 since the mid-1990s. In this section, we seek to understand some of the drivers of this increase.

Before delving into the analysis, it is important to properly set expectations. Our goal here

is not to cleanly identify one factor that can explain all the trends we have documented in Sections 2 and 3. We doubt such one factor exists–although of course future researchers may prove as wrong. Instead, we view both the decline in IPOs and the increase in the supply of private capital to late-stage startups as products of a new entrepreneurial finance market equilibrium whereby fewer startups rely on the public investors to finance their growth. The emergence of this new equilibrium has likely been facilitated by a combination of interrelated supply and demand shifts. In this section, we provide evidence of two such private-market supply-side changes – one technological and one regulatory – that have contributed to the growth in the supply of private capital for late-stage startups.

4.1 Technological advances and reduction of search costs

Technological advances such as the Internet have reduced search costs (Kahle and Stulz (2016)) and made it easier for startups and investors to find each other without relying on personal connections or centralized exchanges.[14] This change has decreased the relative advantage of stock markets as centralized marketplaces where firms and investors without a personal relationship can meet. At the same time, technology – primarily the Internet and growth of mobile – has facilitated the communication between firms and investors, helping investors monitor distant firms even when they cannot rely on the governance and disclosure regulations that public firms must follow.

In this section, we ask whether there have been any changes to the geographic distance between investors and their portfolio companies. Lower search costs should make it easier to invest in more distant startups. Measuring the distance between a lead investor (i.e. largest capital supplier in a financing) and startup is straightforward. We compute the distance in miles between the startup's headquarters and that of the lead investor(s), using the closest of the latter to the startup if there are more than one. This calculation is a noisy approximation of true distance as it ignores the role that say direct flights (e.g. see Bernstein, Giroud, and Townsend (2016)) may play in making an otherwise distant destination in fact close in time. Has this distance changed over the roughly 25-year sample period?

[14] According to the Pew Research Center, Internet use among American adults went from 14% in 1995 to 52% in 2000, 68% in 2005, 76% in 2010, and 88% in 2015. Source: `http://www.pewinternet.org/2014/02/27/part-1-how-the-internet-has-woven-itself-into-american-life/andhttp://www.pewinternet.org/fact-sheet/internet-broadband/`.

To address this question, we regress distance between lead investor and startup on a trend variable and a series of startup financing controls (i.e. industry, state, and round number fixed effects). Columns (1) and (2) of Table 2 show that on average, there has been no statistically significant change over time in this distance. However, when we consider the subset of late-stage financings – again proxied by age greater than four years old – a clear increasing trend emerges.[15] The coefficient implies a 3% increase in the distance between investor and startup per year or roughly 500 mile increase over 10 years for the average pair. Consistent with the notion that the rise in the supply of private capital has been accompanied by a reduction in investors' search and arm's length monitoring costs, the mean distance between late-stage startups and their lead investors has been on an increasing trend since 1992. There is some evidence that non-VC investors – which Figure 8 shows have played a key role in driving the increase in the supply of capital to late-stage startups – have exhibited a larger increase in distance, though we lack the power to show a statistical difference. Thus, these private investors appear to be increasingly able and willing to invest in late-stage startups with whom they do not have a close geographical (or personal) connection.

4.2 Regulatory changes affecting private firms

Technological changes that impact the cost of search are not the only change to the private capital markets that could drive patterns observed thus far. The early 2000s saw a number of major regulatory changes in the public-equity marketsmost notably, Regulation Fair Disclosure in 2000, the Sarbanes-Oxley Act of 2002, and the 2003 Global Settlement. Several public commentators have argued that these changes increased the cost of being public, particularly for small- and medium-sized public firms, and were a key driver of the decline in IPOs (see, e.g., Zweig (2010); Weild (2011)). However, both Gao, Ritter, and Zhu (2013) and Doidge, Karolyi, and Stulz (2013) conclude that such regulatory changes cannot explain the IPO decline. In particular, Doidge et al. write that their "results make it possible to reject the hypothesis that the regulatory changes of the early 2000s caused the decrease in small-firm IPO activity because it became abnormally low before these changes took place" (p. 549). One source of change has yet to be explored in the finance literature (to our knowledge) and should have

[15]The results hold with a full sample estimation and interaction of "older than 4 years" and the trend control.

direct implications on the size and cost of private capital.

4.2.1 Deregulating and unifying the private capital markets

A few years before these changes affecting public firms discussed above were adopted, several regulatory changes affecting *private* firms made it easier for firms and their investors to raise capital. The changes followed the October 1996 passage of the National Securities Market Improvement Act (NSMIA) signed by-then President Clinton. The NSMIA emerged in an era of often competing and sometimes conflicting state and federal securities rules. The securities regulations – often called 'blue sky laws' – can cover mutual funds, IPOs, investment advisors and startups. Former SEC Chairman J. Armstrong Sinclair presents one particularly negative view of the securities laws prior to the NSMIA passage (Armstrong (1958)):

> The 'blue sky' laws had come to have a special meaning–a meaning full of complexities, surprises, unsuspected liabilities for transactions normal and usual–in short, a crazy-quilt of state regulations no longer significant or meaningful in purpose, and usually stultifying in effect, or just plain useless.

In 1996, then-SEC chairman Arthur Levitt argued to Congress for change to this patchwork of regulations:[16]

> The current system of dual Federal-State regulation is not the system that Congress–or the [SEC]–would create today if we were designing a new system. While securities markets today are global, issuers and securities firms still must register many securities offerings in 52 separate jurisdictions; satisfy a multitude of separate books and records requirements; and bear the substantial costs of compliance with the overlapping requirements.

The NSMIA was an attempt to create security regulation uniformity at the federal level and improve capital access overall. In this section, we summarize the components of this law change that impacted the cost and availability of private capital.

[16]Securities Investment Promotion Act of 1996: Hearings on S. 1815 Before the Senate Comm. on Banking, Housing and Urban Affairs, 104th Cong. 32 (1996), statement of Arthur Levitt, Chairman U.S. Securities and Exchange Commission

Federal preemption for (small) issuers

Consider a hypothetical startup seeking outside capital for a new investment. Given the riskiness and uncertainty of the opportunity, it has to raise outside equity financing. Several existing regulations apply in this setting. Passed in 1982, Regulation D amended the Securities Act of 1933 to lower barriers for this company's private capital offerings and remove burdensome registration requirements faced by public firms. Registration requires both extensive financial disclosures and rules on firm governance. States' blue-sky laws often added an additional layer of regulation because many did not allow the same exemptions as the SEC, thus negating their value. If a startup sought capital across many state lines, then additional regulatory complexity emerged because each state could have different disclosure and registration rules. States attempted to create some uniformity in their securities regulation through the Uniform Securities Act (1958, 1985) and the Uniform Limited Offering Exemption (ULOE, 1983). The ULOE in particular sought to coordinate state laws with Regulation D and was eventually adopted in some form by 27 states. However, several legal scholars (e.g. Maynard (1987), Denos (1997) and Campbell Jr. (1998)) argue that this law did little to create uniformity. These features of the regulatory regimes at the state and federal-level introduced a relatively larger burden on small, private issuers.[17]

The passage of the NSMIA allowed some federal provisions for private security and fund registration exemptions to preempt any related regulation in each state where they raised capital.[18] Specifically, the Act "preempts state securities law in certain areas long burdened by duplicative regulation by both federal and state governments" (Denos (1997), pp 101). In particular, the Act made it easier for firms to raise capital from investors in different states. If investors or startups raised capital with "covered securities" from "qualified purchasers" (e.g. institutions or accredited investors), then the NSMIA exempted those sales from state regulations, registration or review of the offerings merits. Covered securities are those sold under rule 506 of Reg. D; a rule that allows unlimited capital raises so long as all the purchasers are accredited investors. Rule 506 is the most popular exemption used by issuers (Ivanov and Bauguess (2013)) and used by most private equity funds raising capital. Insofar as this Act

[17]Even large, registered securities struggled to deal with multiple state blue sky rules. For example, Apple could not sell securities from its 1980 IPO to buyers in 20 US states (Denos (1997)).

[18]See NSMIA section 102(a), 15 U.S.C - section 77r(a) (West Supp. 1997) (amending Securities Act of 1933 section 18).

simplified or eliminated a patchwork of regulations faced by issuers, then it should lower issuers' cost of capital. Investors – particularly those who seek to invest in securities in multiple states – should in turn, experience more investment opportunities due to the lower regulatory and transaction costs.

Investment Company Act of 1940 (3(c)(1) and 3(c)(7))

NSMIA also changed some regulations faced by private equity funds through changes to the Investment Company Act of 1940. The Act regulates companies that "engage primarily in business of investing and reinvesting in securities of other companies" (Loss, Seligman, and Paredes (2017), pp 47-8). Open-end (mutual funds) and closed-end funds are common examples of entities regulated by this Act. As with the securities regulations discussed above, this Act sets out registration exemption rules, here applied to investment companies. Registration involves disclosure about investment positions and policies concerning borrowing, lending, new issuances, etc. It also triggers possible changes in board of director structure, rules on affiliated transactions and limitations of the use of leverage. Upon registration, these companies are further required to file financial statements at least semi-annually. Registration rules and exemptions to it were a major component of the Act.

In 1996, section 3(c)(7) and 3(c)(1) of Investment Company Act were added and amended, respectively. The former amendment removed the registration requirement for funds that privately sold stakes to only qualified purchasers.[19] The amendments to 3(c)(1) clarified and reduced the scope of "beneficial owners" that could trigger registration for funds who do not sell publicly.[20] Private equity and venture capital firms use these new exemptions when managing funds. For example, they must file a Form ADV to request either exemption type above and provide details supporting their claim.[21] In fact, 38% of the 3900 VC funds with Form ADVs request a 3(c)(7) exemption, while the use of this exemption is also strongly and positively

[19]It is still the case that (pre-2012) these companies would have to register their shares if they had more than 499 investors of any type.

[20]Prior to the NSMIA, funds with 100 or fewer investors were excluded from registering as investment companies under the Investment Company Act. However, the rules for what counted as an investor was "overly broad and extremely confusing" according to a report from SEC's Division of Investment Management (Securities, Commission, et al. (1992) report, pp 108). This amendment narrowed the set of entities that counted as investors and thus could lead to fewer funds exceeding the limit.

[21]Using the Form ADV filings of VC funds from the SEC website, we find that all funds use either the 3(c)(1) or 3(c)(7) exemption. The bulk of the 3900 funds (72%) use the latter. Some 5% of funds report having more than 100 investors. These funds have an average size of $450m compared to $62m for VC funds with fewer than 100 investors.

correlated with fund size. These facts are central to our identification strategy below. Combined with the private placement preemption from NSMIA, these amendments to the Investment Company Act should have had real impacts on the number and size of private equity funds.[22]

4.2.2 Connection to the private equity and IPO markets

The federal preemption of blue sky laws following the passage of NSMIA removed a large set of regulatory requirements on small issuers, which include both operation companies (i.e. our startup example) and funds. Both types could now rely on federal exemptions if they sold securities or stakes in their funds to qualified purchasers. Thus, NSMIA should increase the availability of capital for all private issuers, particularly those that sought capital across state lines. Notwithstanding the blue-sky provisions, the regulatory changes in the Investment Company Act impacted investment firm fund-raising capabilities both on the intensive and extensive margin. The smaller set of investors that count against beneficial owner cap that trigger registration should have lowered the barrier to raising a new fund. For existing funds that sought increase their size, the qualified purchaser exemption – effectively allowing an unlimited number of such investors – would make it much easier for funds to raise larger and larger funds.

While the NSMIA appears to have received little attention among finance scholars, several legal scholars and practitioner-oriented publications have argued that it played a first-order role in facilitating private firms' access to capital (e.g., Denos (1997); Campbell Jr. (1998); Cox (2013); Badway, Horn, McCoy, Reid, and Romaszewski (2016)). For instance, writing of NSMIA and other regulatory changes affecting the private-equity markets, de Fontenay (2017) notes that "the liberalization of the rules for selling and trading private securities is arguably the most significant development in securities regulation of the last thirty years, but the empirical literature on the decline of public equity has largely overlooked it. This is a critical and surprising omission, because the changes to the private side of securities regulation bear directly on a company's decision to go public" (p. 466).

Importantly, unlike the early 2000s regulatory changes affecting public firms which took

[22]Legal scholars (e.g. Greupner (2003)) argue that the main beneficiary of these changes to the Investment Company Act were hedge funds. These funds relied on the 3(c)(1) exemption prior to 1996 and often faced the 100 shareholder constraint. They could now rely on 3(c)(7).

place after the IPO decline began, the NSMIA was signed into law in late 1996, coinciding with the U.S. listing peak as measured by Doidge, Karolyi, and Stulz (2017). While this fact in no way proves that the NSMIA was the one cause of the IPO decline – and we do not claim (or believe) it was – it does indicate that the timing of the NSMIA adoption makes it at least possible that it was one of the factors contributing to this decline.

4.3 The Impact of NSMIA on VC and PE funds

Did this regulatory change and increased uniformity of securities laws impact VC and PE fundraising and thus provide an explanation for the growth in late-stage capital? To address this question, we study the real fund size of newly raised funds closed around October 1996. The less stringent investor cap for forced registration and the lowering of barriers to raising capital across state lines implied that new funds should – all else equal – be larger after the law change. However, this increase in size should not hold uniformly across fund types. Investing firms that manage smaller funds that say invest in early-stage IT firms, likely never hit the one hundred investor mark and could presumably find sufficient capital in one or two U.S. states. On the other hand, investing firms that seek out larger, late-stage investments are the most likely to benefit from this change for the opposite reason. Such funds were more likely to be near (or above) the pre-1996 cap or had a demand to seek a wider set of investors to achieve the desired scale of the fund. This intuition leads us to estimate a difference-in-difference estimator.

We consider VC and PE funds raised in the years surrounding the NSMIA passage: 1994–1998. The first difference is motivated by the discussion above and compares large vs. small funds identified by the fund type in VentureSource, Preqin and Pitchbook or by characterizing their investments. Using either the fund classification in each database (e.g. "Early stage VC", "Mezzanine", "Growth Equity" or "Later stage VC") or the fraction of observed investments in later-stage financings, we separate funds into early and late stage. The latter will be considered the set of treated funds. Of course, comparing fund size changes around the law change is limited by the fact that all U.S. funds regardless of size were impacted by the passage of NSMIA. Therefore, we introduce a sample of non-U.S.-headquartered VC and PE funds from Pitchbook, each classified at early or late-stage funds as discussed above. Changes in these funds' size provide an alternative counter-factual for the U.S. market. This additional data

results in 142 non-US funds.

A treated fund is either one headquartered in the U.S. or in our main specification, a U.S. fund that primarily makes late-stage investments. For VC funds, late stage funds typically make first-time investments in a startup on or after its Series C, while most PE funds such as buyout or mezzanine are all late-stage investors.[23] Late-stage funds are indeed larger than their early-stage peers. In the sample of U.S. funds over the 1994–1998 sample period, the average size of the late stage fund is $173m versus $81m for non-late-stage funds. The post period are all funds raised in the two years after October 1996. Table 3 presents the results.

The analysis begins with a difference-in-difference comparing the log of real fund size of U.S.-based and non-U.S. based funds. Here we ignore fund type and focus on the immediate effect of the deregulation. Controls include quarter fixed effects (many funds closed in Q4), industry fixed effects[24] and fund sequence (i.e. number) fixed effects. Column 1 shows that US-based funds – of all sizes – grew at a relatively faster rate after the passage of NSMIA compared to those outside the US. Column 2 of Table 3 presents the within-U.S. difference-in-difference results where we compare late-stage funds to other fund types. The interaction term - "Post X Late stage" – has the expected positive sign and implies a 45% relative increase in fund size for U.S.-based late-stage funds in the post period. The dummy "Late stage" has the expected sign as well.

The era under study here includes years close in time to the IT boom era of 1998–2000 (we end in 1998), so a reasonable concern is that the results are somehow driven by this growth. So long as the IT boom was a global phenomenon, then the inclusion of non-US late-stage funds is an adequate counter-factual (column (1)). Moreover, there is a priori no reason why the Internet boom would have differentially affected late-stage funds, particularly once we control for fund industry fixed effects. Nonetheless, column 3 excludes all funds with an IT focus with little change in results. Similarly, we repeat the analysis of column (2) using the non-U.S. fund sample in column (4) and find no economic or statistically significant change in fund size. The final column of Table 3 presents results using the underlying fraction of investments that

[23] When using investment histories to identify stage-preferences, it is crucial that we consider only first-time investments. Follow-on investments in late-stage financings are made by early-stage investors.

[24] Industry is identified either by the fund's classification in the original data source or by characterizing the most popular industry in which it invested. Industries are "Business/Consumer/Retail", "Healthcare", "Information Technology" and "Other."

are late-stage (i.e. post Series B). The results are unchanged, suggesting that the proxy for late-stage is robust. Overall, the passage of the NSMIA appears to have allowed VC and PE funds investing in late-stage startups – startups at stages typically considering an IPO – to raise larger amounts of capital.

5 Is Staying Private a Second-Best Response to or Driving the Lack of IPOs?

The evidence in the prior sections points to the emergence of a new equilibrium in the entrepreneurial finance market in which the gap left by the decline of IPOs has been filled – at least in part – by an increase in the supply of private capital to late-stage startups. In this section, our goal is to investigate whether the emergence of this equilibrium follows from lack of demand from the public markets for late-stage startup offerings, or whether these firms could still go public but are instead choosing to stay private.

To shed light on this question, we present two complementary types of analysis. We begin by analyzing the cross-sectional characteristics of those firms that are more likely to stay private, with a focus on understanding the role that founders' bargaining power plays on the exit decision. Having found that, in the cross-section, an increase in founder equity increases a startup's likelihood of staying private, we go on to show that the IPO decline over the last twenty years has been accompanied by a time-series increase in founder bargaining power.

5.1 Lower demand for IPOs?

Can a lack of public equity investor demand for IPOs be to blame for the fall in IPOs? In the case of the VC-backed startup, the evidence presented here suggests not. Some of the most important players in IPO offering – mutual funds, hedge funds and large institutional investors – have increased their participation in late-stage VC investments. Such investments are at least as risky and certainly less liquid than comparable investments in public equities. Thus, it does not appear that a lack of public equity investor demand is a first-order explanation for the lack of IPOs.

5.2 The effect of founder equity on the exit decision

For startups' decision to stay private to drive the dearth of IPOs rather than being a response to public markets becoming less welcoming to them, it needs to be the case that startups decision-makers prefer to stay private. The literature has long recognized that staying private allows founders to retain control of their firms (e.g., Boehmer and Ljungqvist (2004); Boot, Gopalan, and Thakor (2006); Helwege and Packer (2009)), which leads many founders to have a preference for delaying, or avoiding altogether, an IPO. Consistent with this view, Brau and Fawcett (2006) survey of CFOs shows that the main reason why firms stay private is their managers desire to preserve control.[25] If the private markets can better fund their firms' growth, then founders will face less pressure to go public.

By contrast, investors' preferences, particularly in the case of early investors such as VCs, are often quite different. VC funds have a fixed lifecycle (typically, 10 years) at the end of which the funds must be liquidated and the proceeds paid back to investors–ideally in cash or liquid securities. In addition, VCs derive considerable reputational benefits from taking their portfolio firms public (e.g., Gompers (1996); Gompers and Lerner (1996), which can help them attract new investors–and fees–to their next fund. For these reasons, VC investors often have a preference for taking their successful portfolio companies public. Indeed, many of the features in convertible preferred stock purchased by VCs are structured explicitly to align the exit type and investment horizon of the founder and investor (e.g. see Hellmann (2006) and Kaplan and Strömberg (2004)). Such contract features include redemption rights (i.e. puts) and forced conversion to common equity in the case of an IPO. Overall, the decision whether and when to go public is a central conflict between VCs and founders.

These differing exit preferences often give rise to conflicts between the founders and investors of successful startups, which will ultimately be resolved in favor of the party that has decision-making control when an IPO becomes a possibility. In order to test this prediction, Table 4 examines how a founder's equity stake early in her startup's life affects the startup's eventual exit probability. By measuring founder equity early in the startup's life, we avoid capturing a mechanical correlation between the startup's financing and exit decisions and the equity owned

[25]Snap's recent March 2017 IPO saw an extreme version of this demand for control, with the firm offering only non-voting shares in its IPO. Of course, it remains to be seen whether this will be a one-off occurrence or the beginning of a new trend.

by the founders later in the firm's life. Of course, founder equity still remains endogenous even when measured years before an IPO becomes a possibility; we will address this endogeneity using an instrumental variable (IV) approach.

Before discussing our findings in Table 4, it is important to ensure that a founder's equity stake is positively correlated with the degree of control of the startup's major decisions–such as exit decisions–the founder has, as this assumption is implicit in our Table 4 analysis. To do so, we use data from VentureSource and VC Experts. We find that a founder's equity stake is negatively correlated with standard measures of investor control, such as the likelihood that the investor has any board voting rights early in the startups life ($p = -.11$) and the number of non-executive board members 2 to 3 years later ($p = -.22$ and $-.23$, respectively). Moreover, higher equity stakes of founders in the early years is negatively correlated with redemption rights (i.e. puts for the investor) and participation rights for VCs. Both contract terms are important levers of control for investors.

Table 4 (Panel A) presents the OLS estimation of a regression where the dependent variable is equal to one if the startup had an IPO within 7 years of its first financing. "Founder's equity stake" is one minus the total as-if-common equity sold to investors in the first financing event. Controls include the log of total capital raised in seven years along with fixed effects for state, year founded and industry. Column 1 in Table 4 begins by showing that the OLS partial correlation between founder equity and a startup's probability of exit is positive. The coefficient suggests a one standard deviation increase in first-year founder equity (19%) results in an 8% increase in the probability of an IPO. This finding is not surprising, as founder equity is likely to be positively correlated with unobserved startup quality, while higher quality startups are more likely to be able to have a successful exit, all else equal. Column 2 introduces the instrument variable.

Our instrumental variable identification strategy exploits state-year variation in the supply of venture capital stemming from variation in the assets of state pension funds (Gonzalez-Uribe (2014); Bernstein, Lerner, Sorensen, and Strömberg (2016)). The instrument relies on the fact that state pensions are an important source of capital for VC investors, these investors prefer to invest in local VCs and finally, that their allocation choices are not driven by individual startup investment opportunities. Satisfying the exclusion restriction requires

that the level of state-year pension assets impact a startup's IPO probability only through founder equity. First, research shows that major LPs such as these pension funds tend to overweight their portfolios to local investments, which suggests they are not responding to investment opportunities (Hochberg and Rauh (2012)). Second, there is a large distance in time between the pension funds allocation decision and the VC's investment in the startup. On the one hand, this attenuates the first stage, but more importantly, it suggests any pension fund manager's allocation choice is quite removed from predictions about future exit markets.

Column 2 of Table 4 shows the reduced form relationship between the instrument and our dependent variable. The negative sign goes in the direction of our hypothesis: more capital available to startups increases founder bargaining power and leads to fewer, slower exits. Next, column 3 presents the first stage results. It shows startup founders that raise their first VC round in state-years when the assets of the state's pension funds are high, have a higher equity stake (after controlling for the capital raised). As predicted, more capital invested by major LPs has a "money chasing deals" impact on entrepreneurial bargaining power (e.g. Gompers and Lerner (2000)). The F-statistic is reassuringly high at 17.

The final column of Table 4 shows the second stage estimates with the instrumented founder equity stake. In contrast to the estimates in column 1, the instrumented equity predicts a negative casual effect on IPO probabilities. The magnitudes imply that a 1% increase in founding equity leads to an economically meaningful 1.8 percentage points fall in the probability of an IPO in seven years. Overall, this cross-sectional evidence demonstrates a real conflict between investor exit preferences and those of founders. Panel B of the same table repeats the analysis for a more general dependent variable that is one if the startup had an IPO or successful acquisition in seven years. A successful acquisition is one that has a reported price that is at least two times total capital invested into the startup. The results are unchanged.

5.3 Has the decline in IPOs coincided with an increase in founder control?

The evidence in Section 5.2 opens the door to the possibility that the decline in IPOs over the last 20 years may have been driven – at least in part – by a concurrent increase in founder control. Indeed, if more founders are in a position to influence their firms' exit decisions, we should see fewer firms going public as they use their control to stay private. The patterns

of first-time financing founder equity stakes shown in Figure 11 suggests that this proxy for founder bargaining power has indeed changed over the sample period.

The figure reports the average fraction of equity held by founders as of the first round of financing (or end of first year if there is more than one financing event) across all startups with data available. The average was between 50-55% until 1999 and dropped significantly in the post-dot com era. By 2007 the average equity position had returned to the 2000 peak and since has reached over 65%.[26] Figures A6 and A7 in the Internet Appendix show similar patterns for founder equity 3 and 5 years after first financing, demonstrating real persistence in this proxy. Figure 12 further reinforces the notion that founders' control over exit decisions has increased over time. Specifically, the figure shows that the presence of redemption features in VC contracts, which can be used by investors to force an exit – or, at least, force startups to buy them out – has experienced a sharp decline since the early 2000s. Figure 12 also shows that participation – often coupled with forced conversion to equity for large IPO events – has also become less popular over the last 15 years. In sum, the collection of time trends in founder bargaining power combined with the IV results in Table 4 help reinforce a demand-driven explanation for fewer IPOs.

The reasons driving the documented increase in founders' bargaining power are again likely to be multi-faceted, and a full analysis of these reasons falls beyond the scope of our paper. We have provided some evidence that alternative investors in the late-stage capital market are playing an increasingly active role in venture capital. Their increased activity and additional changes to the investment choices of VCs by supporting older startups was preceded by the deregulation of private markets through the passage of NSMIA. As most VC financing is staged over multiple rounds, lower cost of late-stage capital should increase early-stage founder bargaining power through either a positive capital supply shock or through lower financing risk (e.g. Nanda and Rhodes-Kropf (2016)). Other changes are also likely at play. The decreasing search costs – driven by technological change and the freeing of information – makes these non-traditional investors more likely to invest in startups. The technological change has also decreased startups' capital requirements early in their life-cycle – when uncertainty is highest

[26]For the more recent years of our sample period, these equity first round equity stakes are almost certainly a lower bound. The rapid growth in the use of convertible notes and other convertible debt instruments, which result in zero founder dilution at first financing, would increase these equity positions.

and thus capital is most expensive (Ewens, Nanda, and Rhodes-Kropf (Forthcoming)) – which has been found to increase founder equity stakes in the early stages. Although we cannot isolate one dominant mechanism, the evidence presented does show that startups are most likely staying private by choice of both founders and their investors, rather than because of a lack of access to public markets.

6 Conclusion

We provide the first rigorous evidence that the lack of IPOs has not hindered U.S. startups' ability to finance their growth, as some scholars and policymakers had feared. President Obama at JOBS Act signing (2012):

> For business owners who want to take their companies to the next level, this bill will make it easier for you to go public. And that's a big deal because going public is a major step towards expanding and hiring more workers. It's a big deal for investors as well, because public companies operate with greater oversight and greater transparency.[27]

We show that the first "big deal" (going public is a major startup towards expanding and hiring) is perhaps not such a big deal any more as firms appear to be able to raise plenty of capital while private. Since 1999, private firms are able to raise large sums of capital and reach scale in terms of sales or employment at rates that were historically only available to their public counterparts. These changes coincide with increased activity of non-traditional investors in venture capital such mutual funds, hedge funds and private equity investors.

The collection of evidence about private capital markets provided here is not the smoking gun that the literature has sought to explain the decline of the US IPO markets. However, we do show strong evidence that several mostly contemporaneous changes – regulatory and technological – have led to a new equilibrium where fewer firms are going public. The role of changes to the private capital markets (rather than direct costs of being a public firm) highlighted here can help explain some of the conflicting results about the impact of the JOBs Act on IPOs (e.g. Dambra, Field, and Gustafson (2015) and Chaplinsky, Hanley, and Moon

[27] Remarks by the President at JOBS Act Bill Signing, April 5th, 2012.

(2017)). Importantly, our results strongly point to the fact that this new equilibrium is not an inferior equilibrium that has come about by some unfortunate freeze of the IPO market. Rather, many firms appear to be choosing to stay private longer and thriving in this new equilibrium.

Staying private longer or avoiding the IPO has some possible negative consequences for investors. For example, the lack of IPOs has implied a substantial change in the degree of oversight and transparency under which some of the most 'successful' firms in our economy now operate. Recent managerial issues in companies such as Uber[28] and Theranos[29] demonstrate that managerial entrenchment or weak governance is one potential downside to the increased founder bargaining power.

[28] See https://www.nytimes.com/2017/08/10/technology/travis-kalanick-uber-lawsuit-benchmark-capital.html.

[29] See https://www.wsj.com/articles/theranos-has-struggled-with-blood-tests-1444881901.

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7 Figures and Tables

Figure 1: Exit status by year of first VC financing

For startups that raised their first financing round in 1992-2009, the figure shows the (stacked) fraction of startups that (1) went public, (2) were acquired, (3) failed, or (4) remained private during the seven years after their first financing. (E.g., for firms that raised their first financing round in 2000, we measure exits as of 2007. We observe exits through 2016, so ending the sample of first financing rounds in 2009 allows us to observe seven full years of exits for all firms.) We ensure those startups we identify as "Still Private" have not failed by using VentureSource's failure information, complemented with manual searches; in addition, we conservatively code as failed any startup that has not raised capital in five years. The sample includes all VC-backed startups described in Section 1.

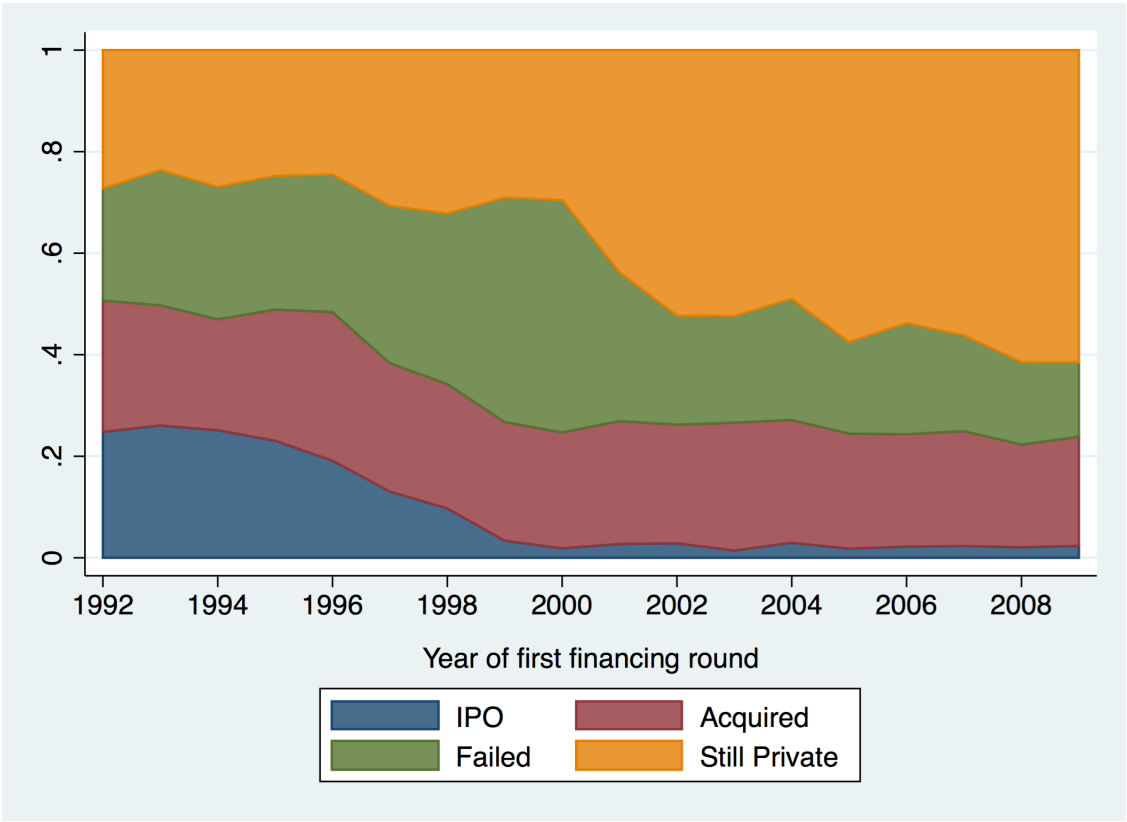

Figure 2: Age of startups raising private capital

For each year from 1992 to 2016, this figure reports the average age of startups raising private capital that year, where age is measured in years from the first-financing date. We show both an "equal-weighted" average, which averages the age of all startups that raise funding each year, and a "dollar-weighted" average, where we weigh firm age by the dollar amount raised (in real 2009 USD). Our definition of private capital includes both traditional VC investors and non-VC investors such as corporations, PE funds, or mutual funds investing in private firms; see Section 3 for further details.

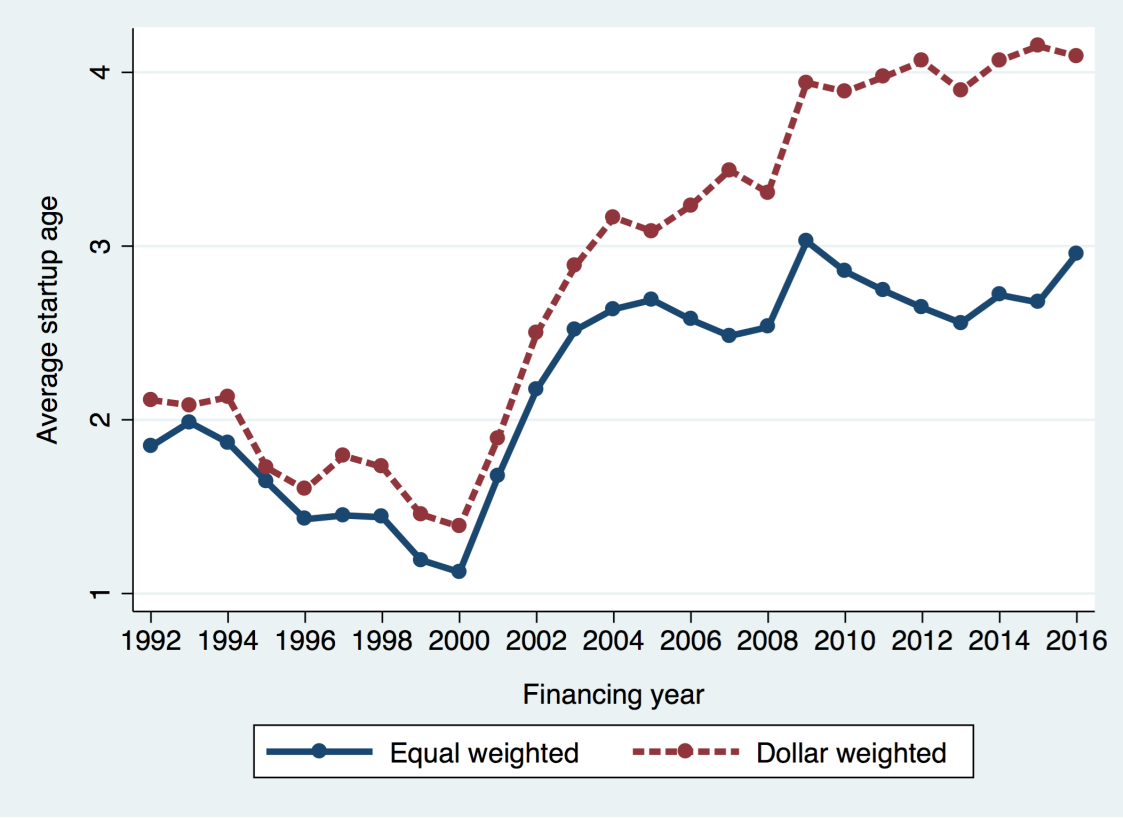

Figure 3: Probability of raising at least seven financing rounds

For startups that raised their first round of financing in 1992-2005, the figure shows the average predicted probability of raising at least seven rounds of private capital in the 11 years following the startup's first financing round, alongside the 95% confidence interval of these averages (90% of startups that raise seven rounds of funding do so in 11 years or less). We estimate predicted probabilities using a linear probability model that includes first-financing-year, industry, and headquarter state fixed effects.

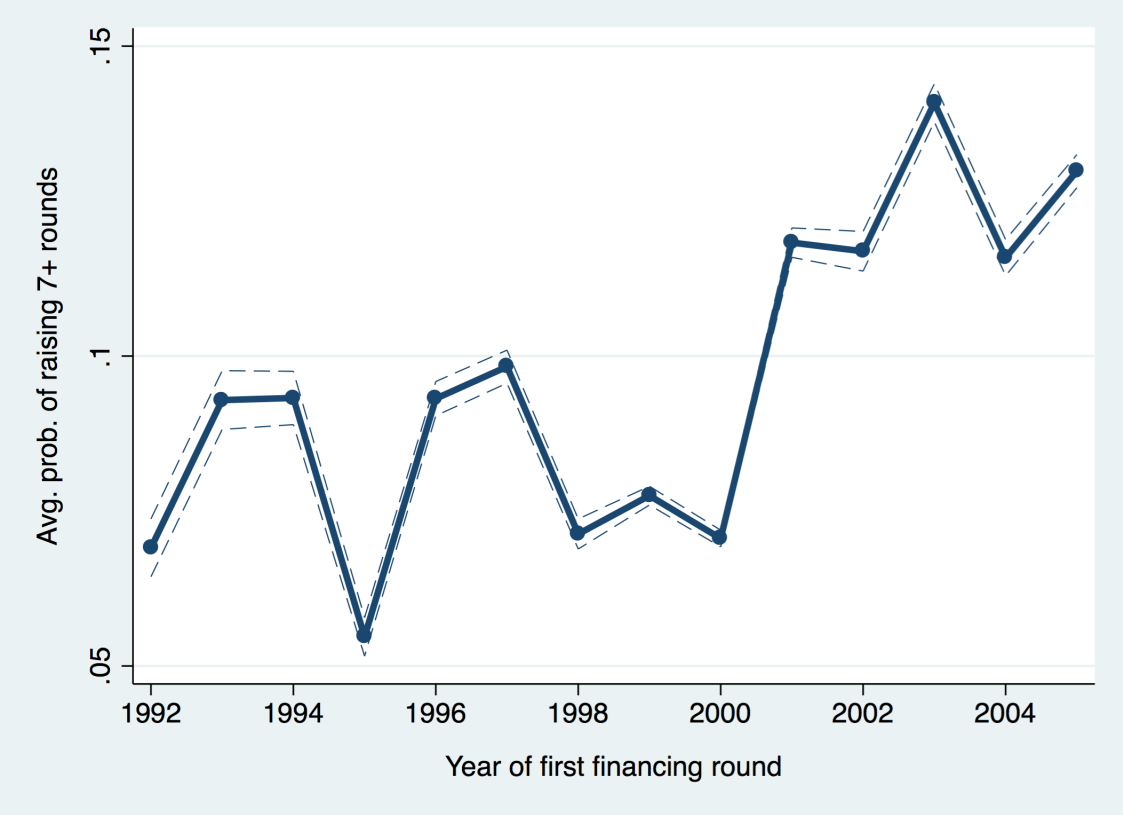

Figure 4: Raising large amounts of capital as a private firm

The figure reports the number of startups that raised at least $150m (in real 2009 USD) seven years after their first round of financing, split into two groups. "Private" is the count of firms that satisfy this criteria that were still private (i.e. no IPO, failure or acquisition) seven years after their first financing. "Public" are the set of firms that went public within seven years of their first financing event. The capital is a cumulation of both that raised as a private firm (here, from private equity investors) and post-IPO offerings for those firms that went public. Data from VentureSource and Compustat are used to aggregate the capital raised.

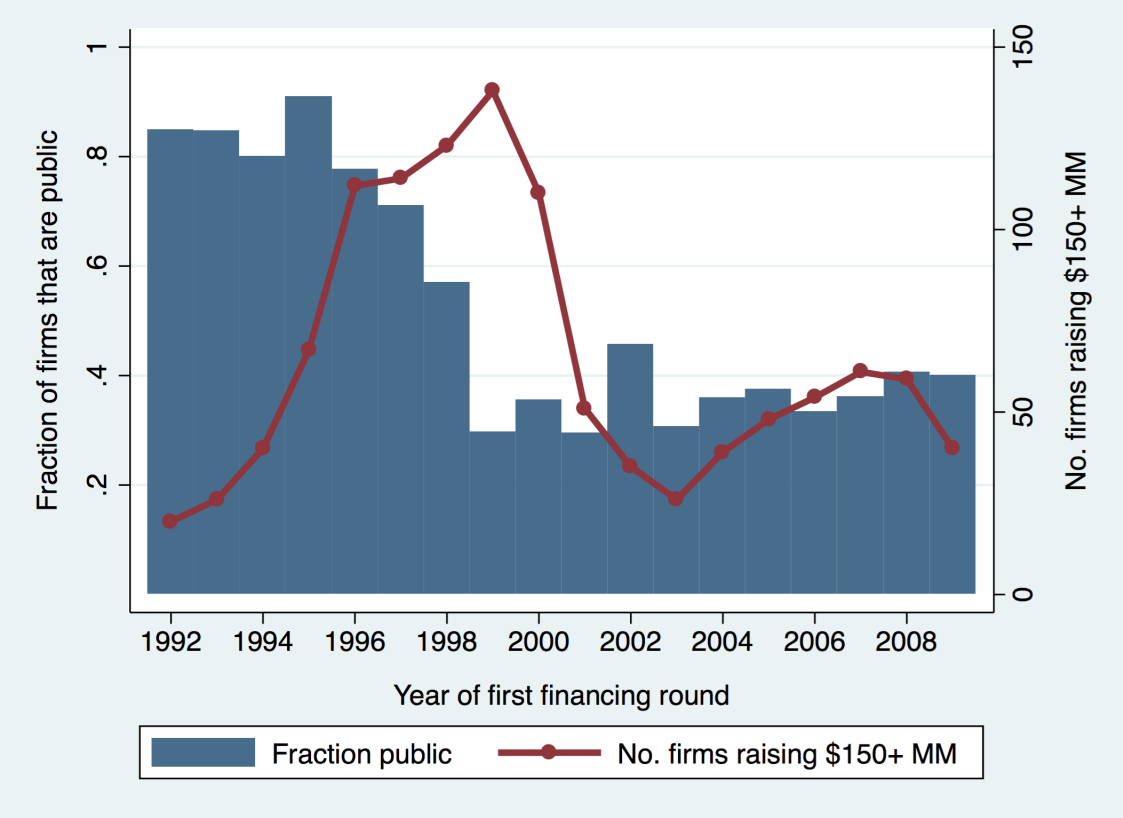

Figure 5: Year fixed effect estimates for relationship between capital raised in seven years and IPO probability

The figure plots the coefficient estimates (and their 95% confidence intervals) from the follow regression:

$$Y_{7it} = \beta_t \times \ln K_{7it} + \gamma_t + \eta_s + \theta_j + \varepsilon_{it}$$

where i indexes firms and t indexes the year the firm raised its first funding round. Y_7 is an indicator equal to one if the firm went public during the seven years following its first funding round; K_7 is the net amount of capital raised by the firm during these seven years; and γ_t, η_s, and θ_j capture first-funding year, state, and industry fixed effects, respectively. The dependent variable is one if the startup had an IPO within 7 years of its first financing event. Robust standard errors are used to construct the 95% confidence intervals.

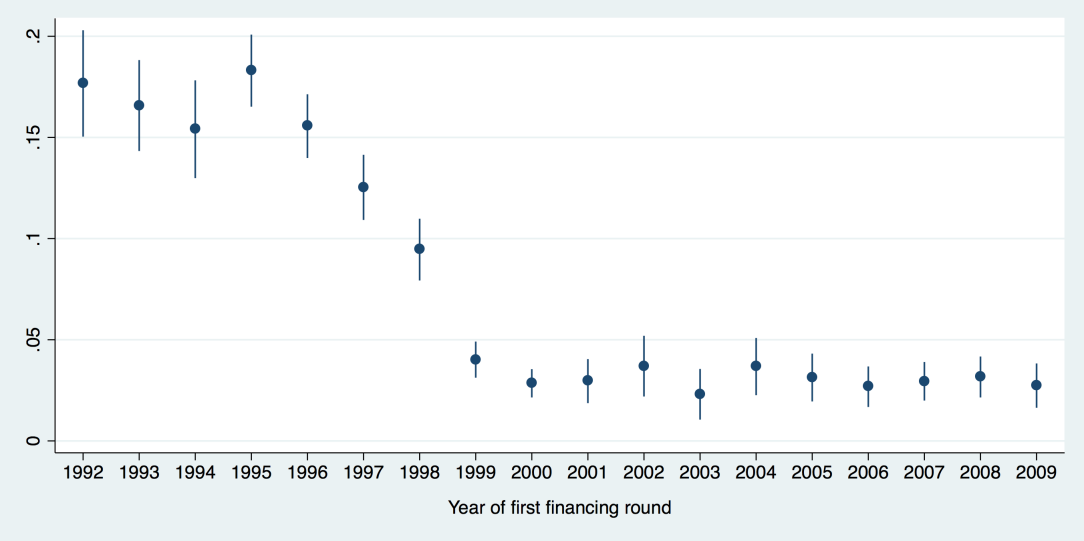

Figure 6: Number of firms raising with at least 200 employees seven years after first financing: public vs. private

The figure reports the number of startups that had at least 200 employees seven years after their first round of financing (measured using VentureSource, NETs and Compustat), split into two groups. "Private" is the count of firms that satisfy this criteria that were still private (i.e. no IPO, failure or acquisition) seven years after their first financing. "Public" are the set of firms that went public within seven years of their first financing event. The employee count is measured either as a private firm or public firm, seven years after first financing.

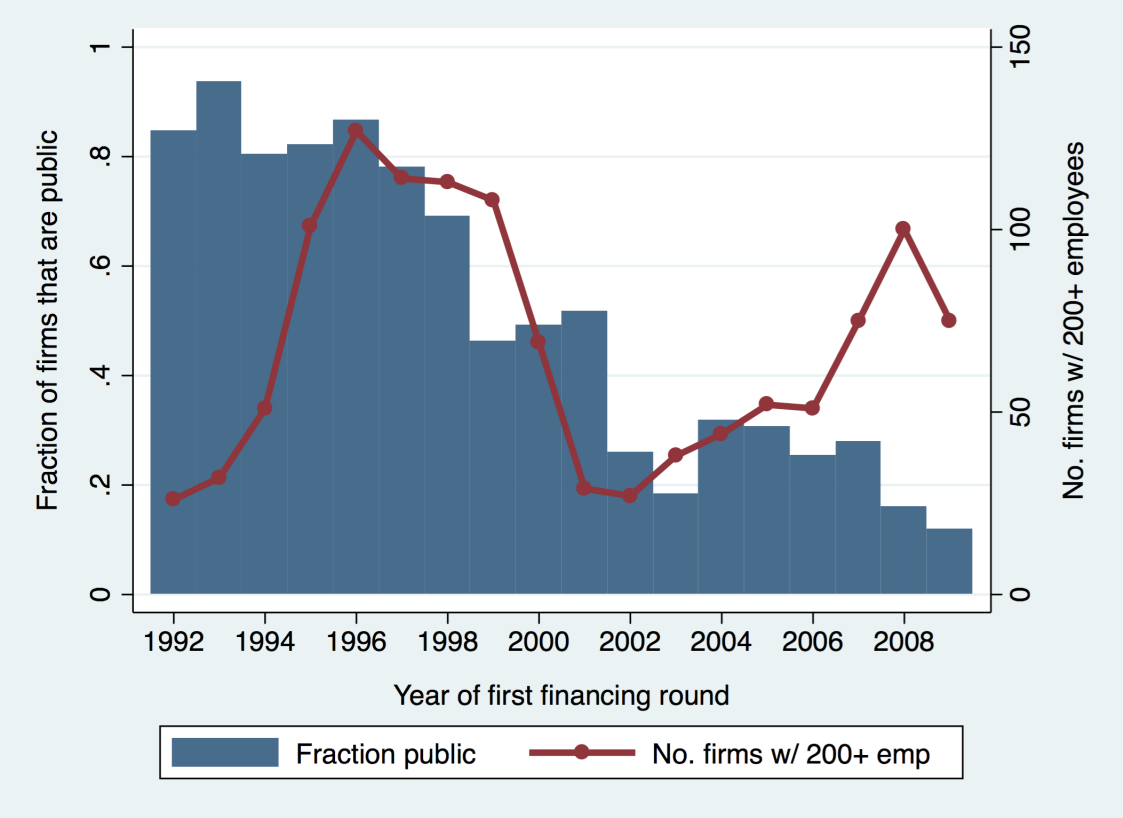

Figure 7: Year fixed effect estimates for number of firms with at least 200 employees seven years after first financing: public vs. private

The figure plots the coefficient estimates (and their 95% confidence intervals) from the follow regression:

$$Y_{7it} = \beta_t \times \ln K_{7it} + \gamma_t + \eta_s + \theta_j + \varepsilon_{it}$$

Here, the dependent variable is one if the startup had an IPO within 7 years of its first financing event. The coefficients of interest are the γ_s on the interaction of year first financing and the $\ln E_{7i}$ log of total employees as of seven years since first capital raised. s_i and I_i are state and industry fixed effects respectively and the ρ_t are fixed effects for the year of first financing. Robust standard errors.

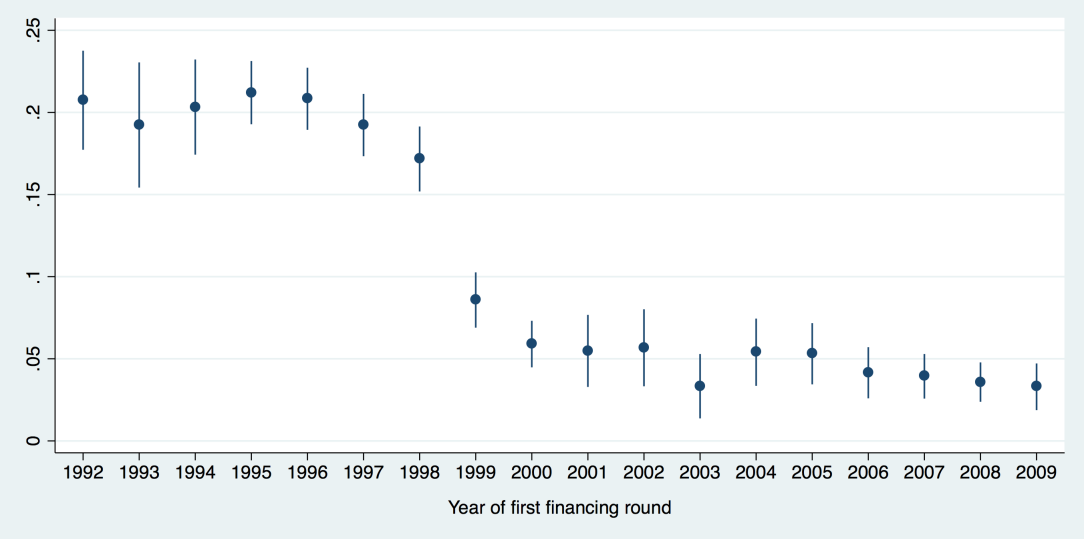

Figure 8: Capital provided by venture capital and non-venture capital investors to startups four years and older

The figure presents the sum of total capital raised in each financing year (in 2009 dollars) for startups at least four years old, measured since their first financing. The dashed line aggregates the capital invested by traditional VC investors. The green bars present the difference between the VC contributions and total capital invested, which is capital contributed by non-traditional investors. Capital in a financing is split as describe in Section 1.

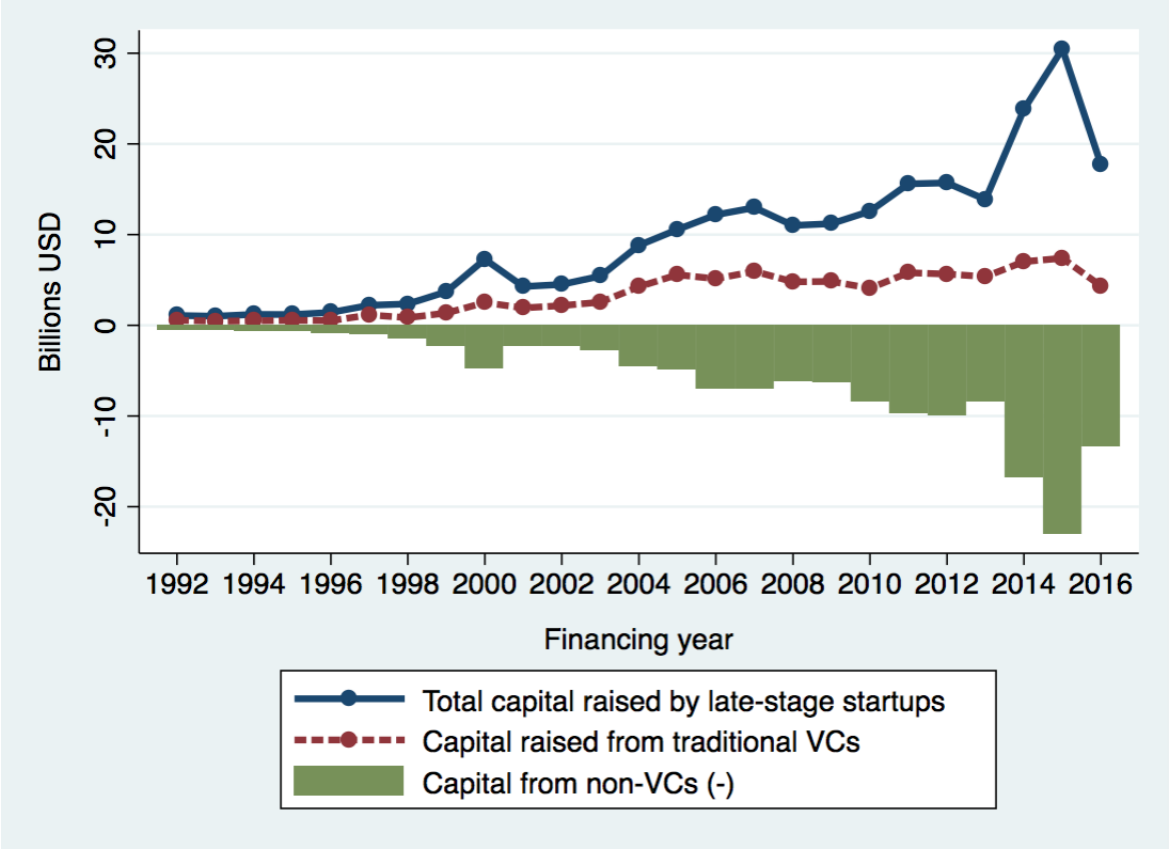

Figure 9: Venture capital fund age at financings

The figure presents the average age of funds when they make follow-on investments. Funds are pooled into their vintage years. That is, for each follow-on investment made by a VC funds, we take the mean of the age of the fund at the time of each investment. We then average this number across all funds in the vintage year. The sample stops in 2006 to allow funds time to make 10 years of investments.

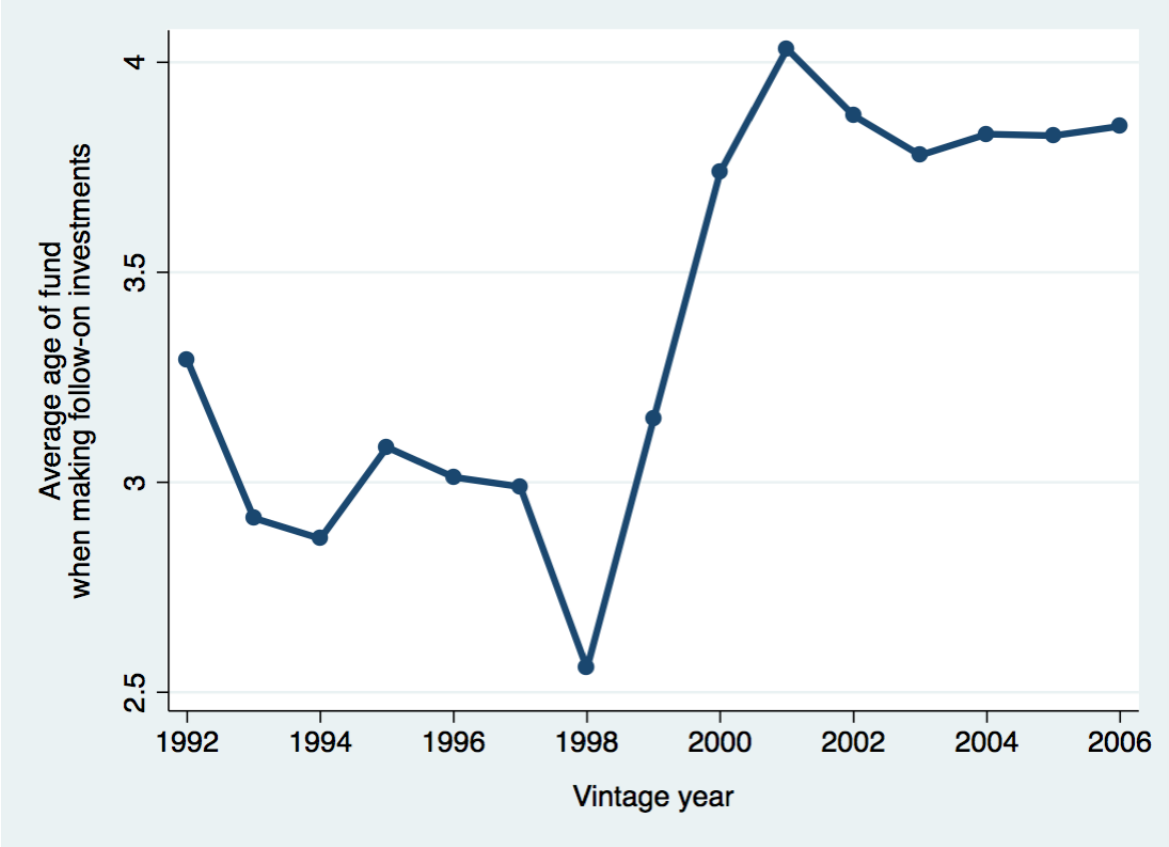

Figure 10: Breaking down non-VC investors in late-stage startups

Notes: The figure breaks down the capital numbers provided in Figure 8 by each category of non-VC investor. "Corp." are either corporations making direct investors or their venture capital arms. "Div. PE" include a wide assortment of growth equity funds, mezzanine and traditional private equity investors. "Hedge/Inv. bank" include hedge funds and investment banks. The excluded group here is "Other," which is a catchall from VentureSource that include LPs, family offices, soverign wealth funds and individuals. All dollars in 2010 dollars.

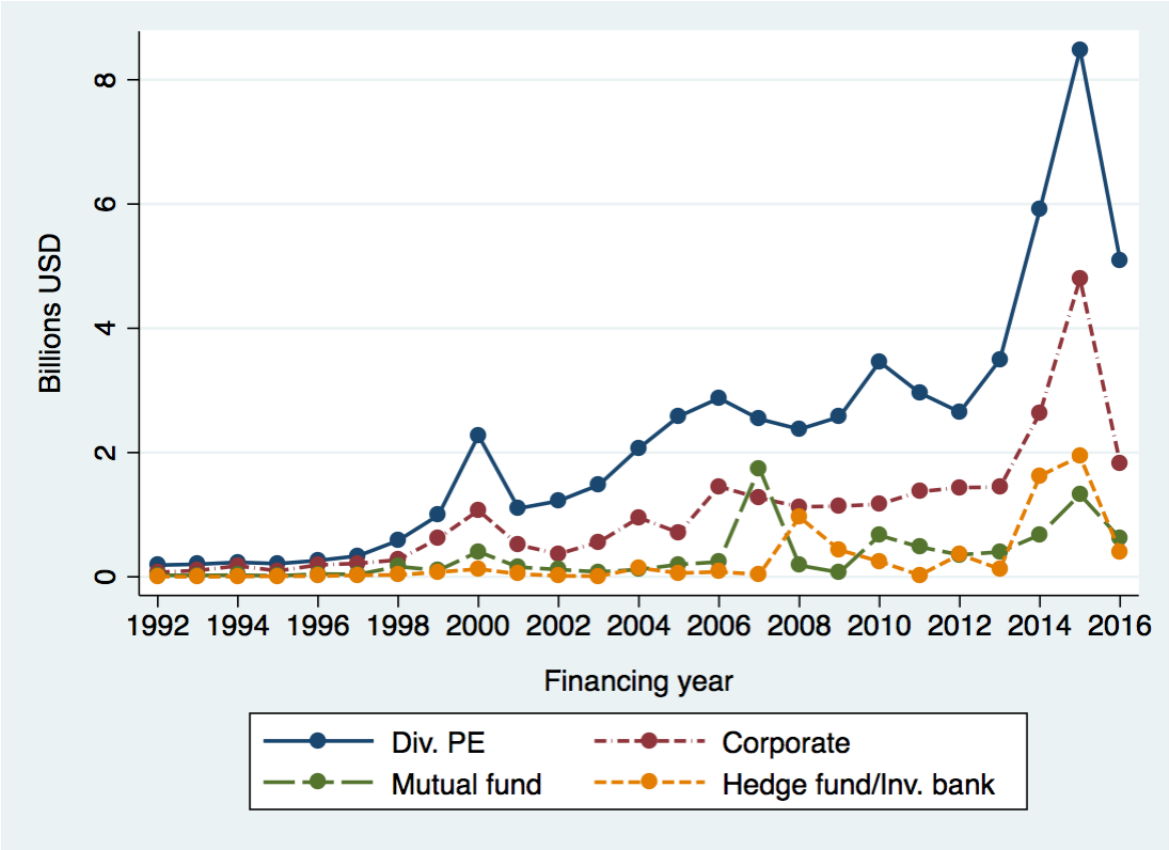

Figure 11: Founder equity in first financing

Figure reports the average equity stakes held by non-investors – founders and holders of options – after the first round of VC financing. To compute this equity stake, we require the premoney valuation V and capital raised K in the financing. The founders are assumed to have $1 - \frac{K}{K+V}$ after the financing. As is typical in these calculations, we assume common equity so this is an upper bound on the founders' equity position.

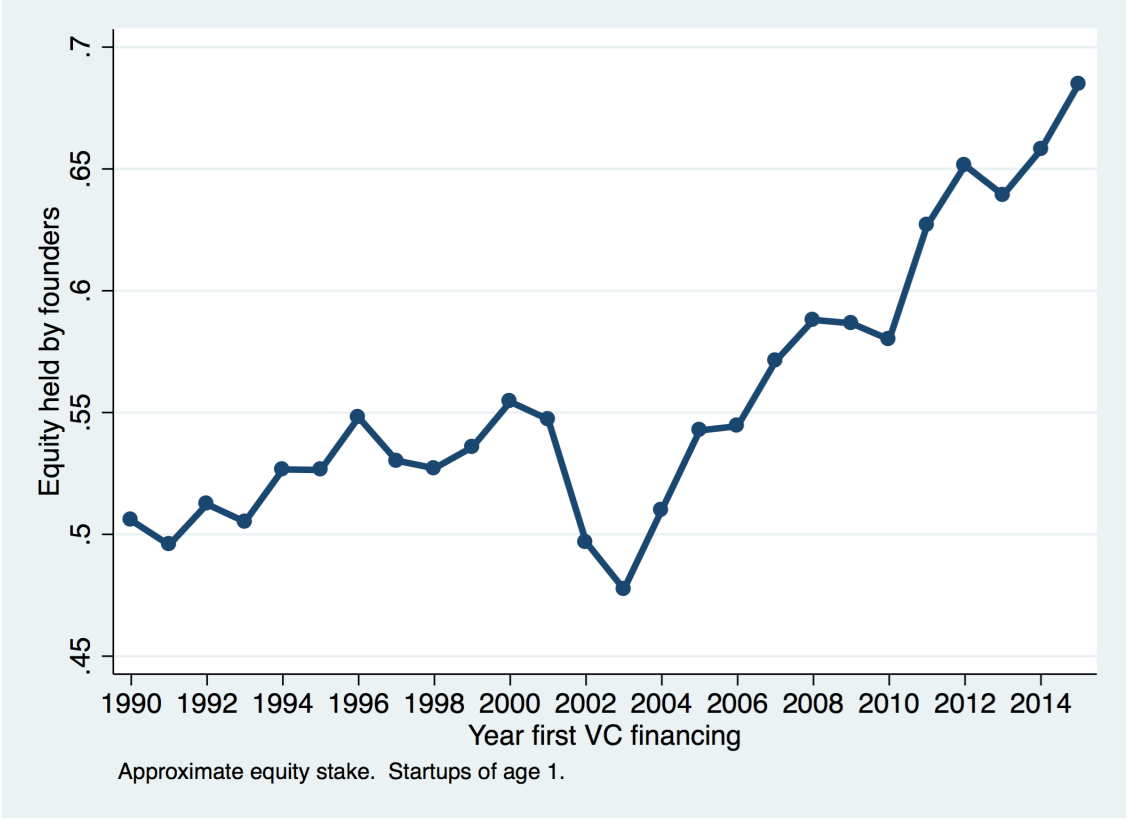

Figure 12: First round contract features over time: redemption and participation rights

Figure reports the fraction of first round financings that have one of two contract features. The first is redemption, which provides the purchasing preferred shareholders a time-dependent put option (effectively) on the startup. The second is "Participation" which provides the preferred shareholder a combination of downside protection and upside potential along with a provision for forced conversion to common equity if a large enough liquidation value is reached.

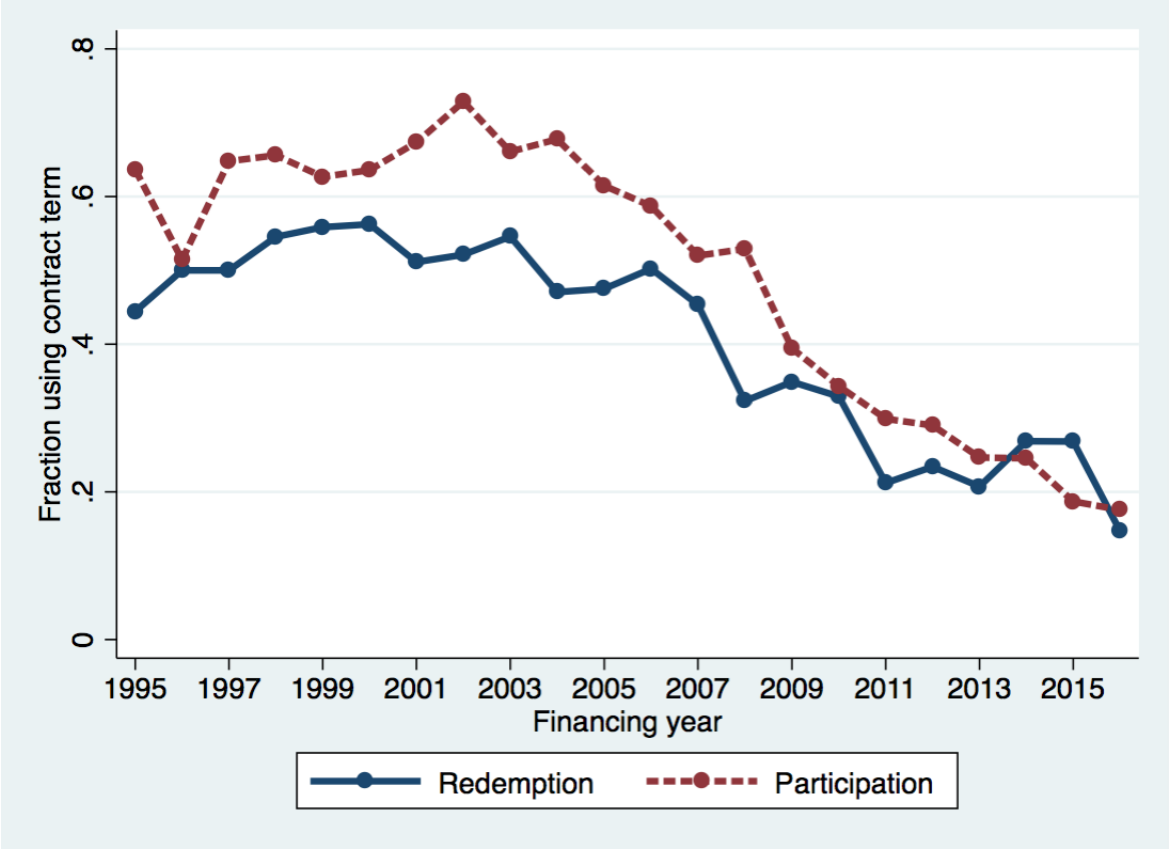

Table 1: Capital raised from non-VCs over startup's lifecycle

The table presents financing-level OLS regressions where the dependent variable is the fraction of capital provided in a financing round (columns 1-3) or a dummy variable that is one if a financing has at least one non-VC investor. The variable "Log firm age (yrs.)" is the log of the number of years since the startup's first VC financing event at the time of the current financing. "Log round #" is the log of the financing number. "Log raised ($m)" is the log of total capital raised in the financing (in 2009 dollars) and "Log syndicate size" is the log of the number of investors in the financing. "Year FE" are fixed effects for the financing year, "Industry FE" are fixed effects for the startup's industry and "State FE" are fixed effects for the startup's headquarter state (US only). Robust standard errors clustered at the startup in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	(1)	(2)	(3)	(4)	(5)	(6)
	% non-VC	% non-VC	% non-VC	Had non-VC?	Had non-VC?	Had non-VC?
Log firm age (yrs)	0.103***	0.105***		0.091***	0.093***	
	(0.002)	(0.002)		(0.003)	(0.003)	
Log round #			0.117***			0.101***
			(0.003)			(0.003)
Log raised ($)	0.034***	0.033***	0.032***	0.030***	0.029***	0.029***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Log syndicate size	-0.112***	-0.109***	-0.111***	0.136***	0.138***	0.137***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Constant	0.646***	0.470***	0.474***	0.765***	0.606***	0.611***
	(0.044)	(0.043)	(0.043)	(0.045)	(0.044)	(0.044)
Financings	75410	75410	75410	75410	75410	75410
R^2	0.092	0.099	0.097	0.113	0.118	0.116
Year FE	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y
Industry X Year FE	N	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y

Table 2: Distance between investors and startups over time

The table reports OLS regressions where the dependent variable is the log of the number of miles between a startup and its lead investors in a financing round. The distance is measured from the startup's US headquarters to the investor's headquarter (or nearest headquarter if more than one listed). The unit of observation is a startup-investor pair. Columns (1) includes all financings where we can measure distance. Column (2) includes only financings where startups are less than years years since their first financing. Column (3) consider those that are more than 4 years since their first financing. The last two columns consider the sample of column (3), split by rounds with and without VC-investors. The variable "Year trend" is trend from 1992 - 2014. The fixed effects are as defined in Table 1. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	(1)	(2)	(3)	(4)	(5)
	All	Age < 4	Age ≥ 4	Age ≥ 4	
				Non-VCs	VCs
Year trend	0.001	-0.005	0.029***	0.029***	0.012
	(0.005)	(0.006)	(0.008)	(0.011)	(0.012)
Constant	4.889***	5.114***	6.547***	4.759***	3.878***
	(0.385)	(0.418)	(0.886)	(1.030)	(0.481)
Observations	34092	28032	6060	2975	3085
Startups	16795	16017	3488	2133	2096
R^2	0.054	0.045	0.048	0.069	0.054
Industry FE	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y
Round # FE	Y	Y	Y	Y	Y

Table 3: Changes in VC fund size after NSMIA passage

The table reports OLS regressions of fund size on a series of controls. The dependent variable is the log of VC fund size in 2009 dollars. The date of fund close is identified using the first official close date of the fund. Includes all funds with vintage years 1994 - 1998 (two years on each side of the law change). "Late stage fund" is a dummy variable equal to one if the fund has an above sample median fraction of first time investments after the Series B round or is explicitly listed as a late stage or buyout fund. That is, we take the fraction of a funds first investments in each startup and create a variable that is one if that first financing is a Series C or above. If a large fraction of the fund's investments – compared to the average fund – are in these later round financing, then we assume it is a late-stage investor. "U.S. fund" is one of the fund is headquartered in the US. Column (1) compares all U.S. funds to non-U.S. funds. Column (2) considers the sample of U.S. early and late-stage funds, while Column (3) considers the same sample excluding funds investing in information technology. Column (4) repeats the estimation of Column (2) for the non-U.S. sample (i.e. a placebo). The last column replaces the dummy variable for late stage with its underlying continuous counterpart. "Vintage Year FE" are fixed effects for the fund's vintage year (thus we exclude the "Post" variable). "Fund seq. FE" are fixed effects for the fund sequence (e.g. 1st or 4th fund). Robust standard errors reported in parentheses. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	(1)	(2)	(3)	(4)	(5)
		Late vs. early	Non-IT		
	All	U.S.	U.S.	Non-US	U.S.
Post X U.S. fund	0.426*				
	(0.239)				
Post X late stage fund		0.373**	0.466*	-0.025	
		(0.178)	(0.257)	(0.423)	
Late stage fund		0.493***	0.635***	0.815**	
		(0.137)	(0.185)	(0.360)	
Post X % Post Series B					0.700***
					(0.162)
% late stage					0.539***
					(0.202)
US fund	-0.072				
	(0.204)				
Constant	3.863***	3.569***	3.709***	3.135***	3.770***
	(0.161)	(0.190)	(0.184)	(0.368)	(0.151)
Observations	918	714	390	152	714
R^2	0.08	0.17	0.16	0.11	0.15
Avg. late-stage fund size		173.14	195.10	145.69	
Avg. non-late fund size		81.69	85.91	60.84	
Vintage Year FE	Y	Y	Y	Y	
Fund industry FE	Y	Y	Y	Y	
Fund seq. FE	Y	Y	Y	Y	

Table 4: Effect of founder equity on exit outcomes: instrumental variables

The table reports OLS and 2SLS regression estimates of the relationship between startup exits and early-stage founder equity. Panel A considers the dependent variable that is equal to one if the startup had an IPO within seven years of its first VC financing event. "Founder's equity stake" is the first round equity stake (defined in Figure 11). "Total pension assets (t)" are the startup's state pension assets in the year of the firm's first financing event (in trillions USD, 2009 dollars). "Total capital raised (log, m)" is the total capital raised by the startup within seven years of first financing. Column (1) and (2) present OLS regression estimates, while column (3) presents the first stage estimates of a regression of founder equity on the pension assets instrument. The final column presents the IV estimates or second stage. Panel B considers the alternative dependent variable that is one if the startup had either an IPO or a successful acquisition (sold for at least $2X$ capital invested) within seven years of its first VC financing. "Firm founding year FE" are fixed effects for the startup's founding year and all other fixed effects as defined in Table 1. Standard errors clustered at the state. Significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

	Panel A:IPO in 7 years			
	(1)	(2)	(3)	(4)
	IPO in 7	IPO in 7	Founder %	IPO in 7
	OLS	OLS	First stage	2SLS
Founder's equity stake	0.038*			-1.823***
	(0.021)			(0.678)
Total pension assets (t)		-0.218***	0.120***	
		(0.051)	(0.028)	
Total capital raised (log, m)	0.056***	0.053***	-0.096***	-0.123*
	(0.006)	(0.004)	(0.004)	(0.069)
Constant	-0.132***	-0.012	0.887***	2.046**
	(0.018)	(0.020)	(0.025)	(0.805)
Observations	10440	10440	10440	10440
R^2	0.203	0.205	0.329	.
1st stage F-stat				17.73
	(1)	(2)	(3)	(4)
	Panel B:IPO or quality Acq. in 7 years			
	IPO/Acq. in 7	IPO/Acq. in 7	Founder %	IPO/Acq. in 7
	OLS	OLS	First stage	2SLS
Founder's equity stake	0.049**			-1.478**
	(0.020)			(0.717)
Total pension assets (t)		-0.177***	0.120***	
		(0.062)	(0.028)	
Total capital raised (log, m)	0.055***	0.050***	-0.096***	-0.092
	(0.006)	(0.005)	(0.004)	(0.072)
Constant	-0.144***	-0.029	0.887***	1.613*
	(0.020)	(0.021)	(0.025)	(0.848)
Observations	10440	10440	10440	10440
R^2	0.173	0.174	0.329	.
1st stage F-stat				17.73
State FE?	Y	Y	Y	Y
Firm founding year FE?	Y	Y	Y	Y
Financing year FE?	Y	Y	Y	Y
Industry FE?	Y	Y	Y	Y

8 Internet Appendix

Figure A1: Exit status by first VC financing year, 10 years after first financing: IPO, acquisitions, failures and still private

The figure reports the fraction of firms that have exited or remain private for each first financing year cohort. Startups that fail to raise a new round of capital five years after their last observed financing (as of 2016Q4) are set to failures. The exit state is measured here ten years after the firm's first financing event for each cohort (e.g. for 1998 firms, we ask what fraction exited in what way in 2008). Sample includes all startups described in Section 1.

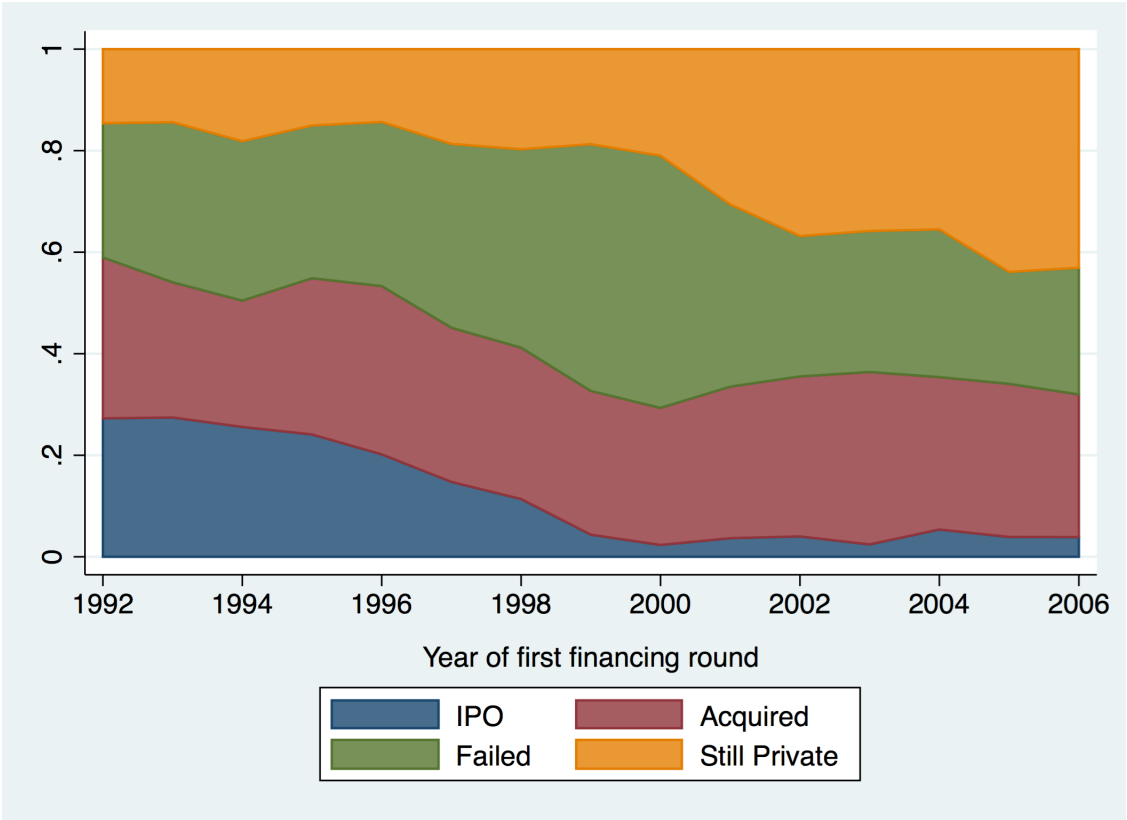

Figure A2: Probability a startup raised at least 2 financings by year of first financing

The figure plots the first financing year fixed effects from the following cross-sectional regression where a unit of observation is a startup:

$$Y_i = \beta_0 + s_i + I_i + \sum_{t=1992}^{2005} \rho_t$$

The dependent variable is a dummy that is equal to one if the startup had a second round of financing as of the end 2016. The figure plots the coefficients ρ_t – the year first financing variable – and the 95% confidence interval (robust standard errors). Controls include industry and state fixed effects.

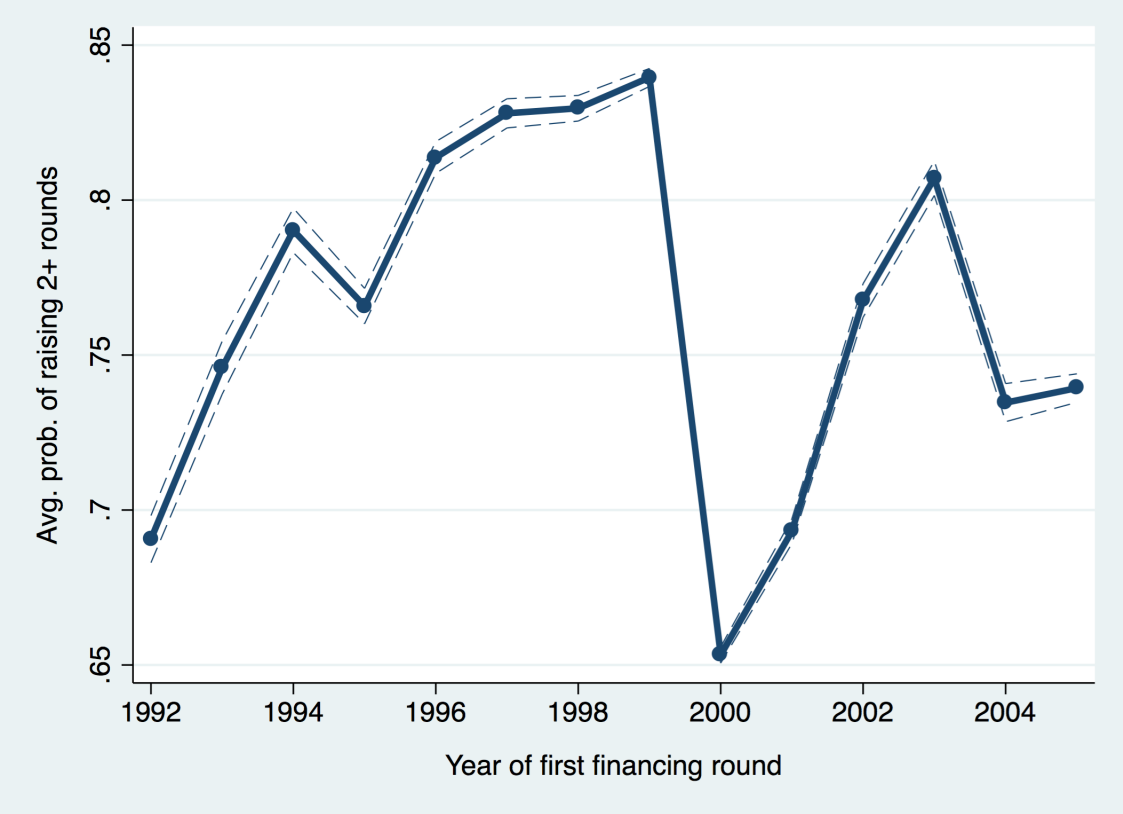

Figure A3: Number of firms raising with at least $100m in sales seven years after first financing: public vs. private

The figure reports the number of startups that had at least $100m in sales seven years after their first round of financing (measured using VentureSource, NETs and Compustat), split into two groups. "Private" is the count of firms that satisfy this criteria that were still private (i.e. no IPO, failure or acquisition) seven years after their first financing. "Public" are the set of firms that went public within seven years of their first financing event. Sales are measured either as a private firm or public firm, seven years after first financing.

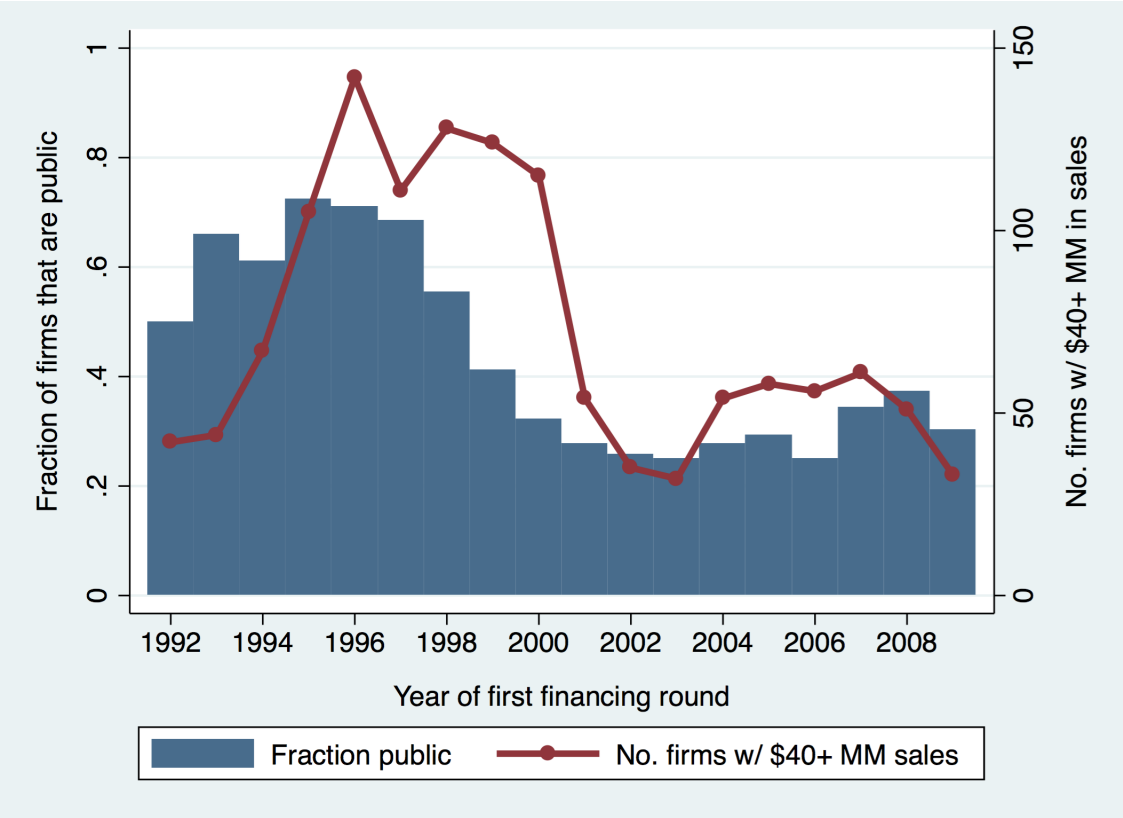

Figure A4: Year fixed effect estimates for relationship between seven year total sales and IPO probability

The figure plots the coefficient estimates (and their 95% confidence intervals) from the follow regression:

$$Y_{7it} = \beta_t \times \ln S_{7it} + \gamma_t + \eta_s + \theta_j + \varepsilon_{it}$$

where i indexes firms and t indexes the year the firm raised its first funding round. Y_7 is an indicator equal to one if the firm went public during the seven years following its first funding round; S_7 is log of total sales for the firm during these seven years; and γ_t, η_s, and θ_j capture first-funding year, state, and industry fixed effects, respectively. The dependent variable is one if the startup had an IPO within 7 years of its first financing event. Robust standard errors are used to construct the 95% confidence intervals.

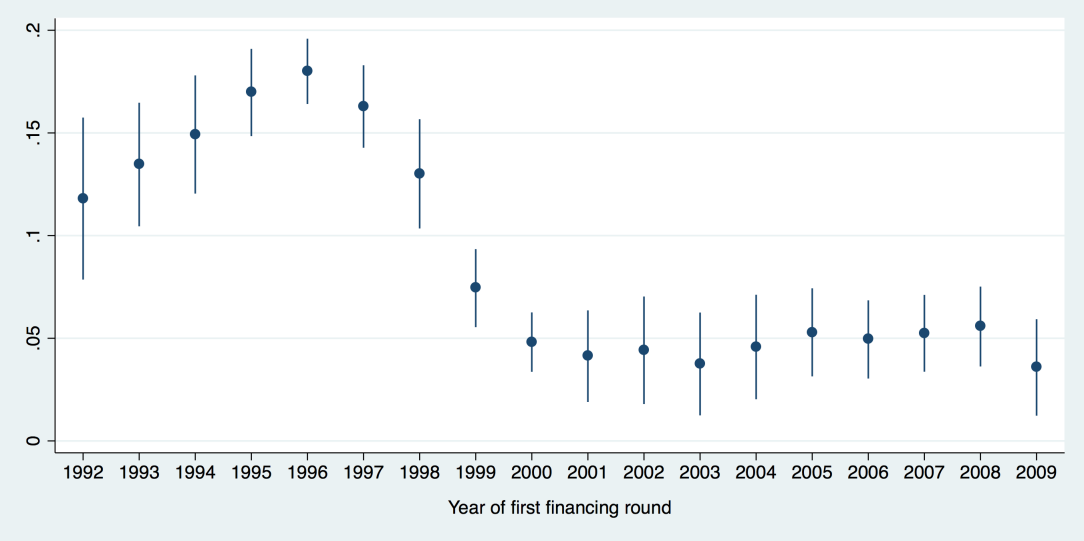

Figure A5: Total capital raised in VC funds: 1990 - 2016

The figure reports the total amount of capital raised in U.S.-based VC funds (in 2009 dollars).

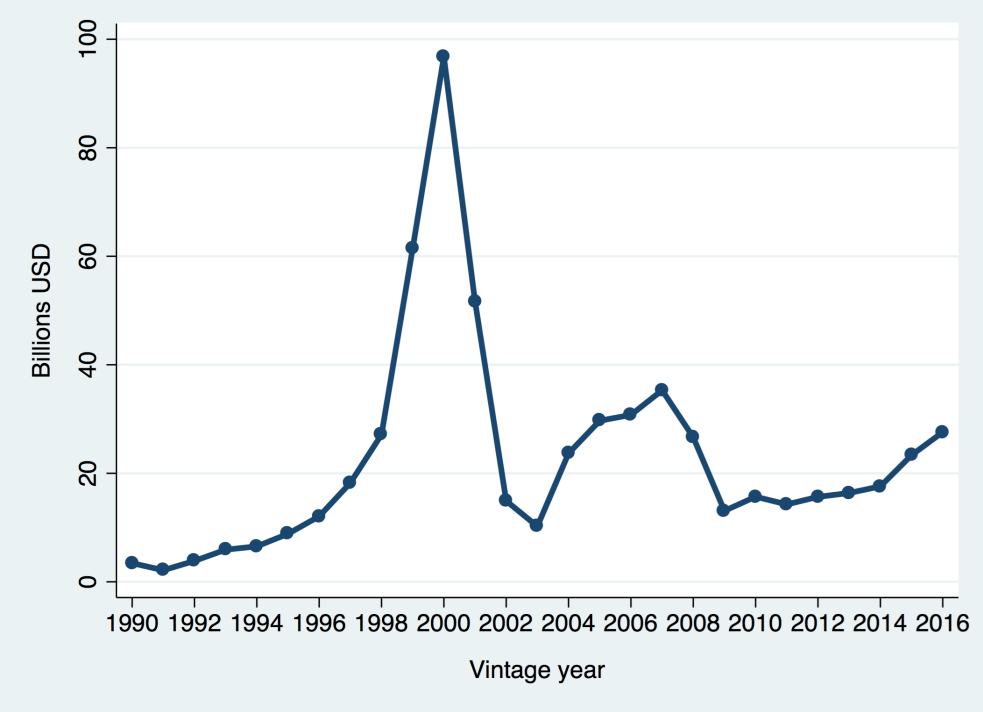

Figure A6: Founder equity three years after first financing

The figure reports the average equity stakes held by non-investors – founders and holders of options – three years safter the first round of VC financing. To compute this equity stake, we require the premoney valuation V and capital raised K in the financing. The founders are assumed to have $1 - \frac{K}{K+V}$ after the financing, where each new financing event dilutes their equity stake. As is typical in these calculations, we assume common equity so this is an upper bound on the founders' equity position.

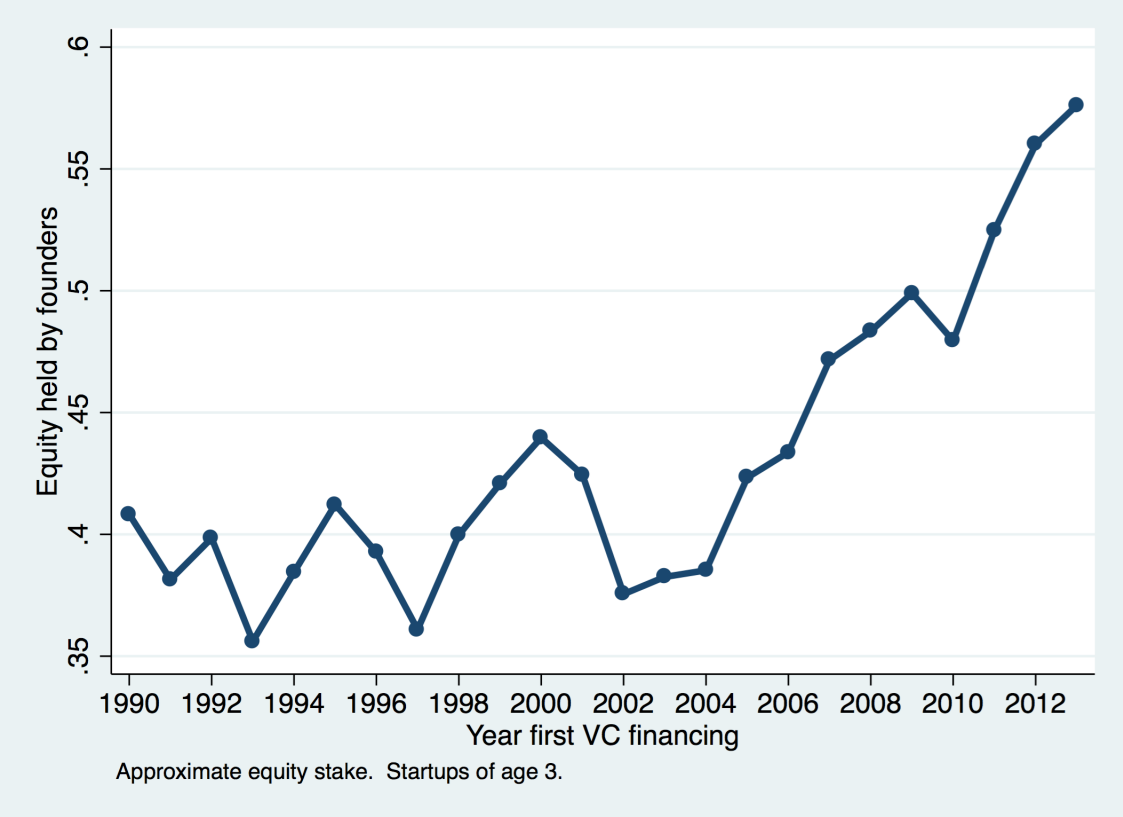

Figure A7: Founder equity five years after first financing

The figure reports the average equity stakes held by non-investors – founders and holders of options – five years safter the first round of VC financing. To compute this equity stake, we require the premoney valuation V and capital raised K in the financing. The founders are assumed to have $1 - \frac{K}{K+V}$ after the financing, where each new financing event dilutes their equity stake. As is typical in these calculations, we assume common equity so this is an upper bound on the founders' equity position.

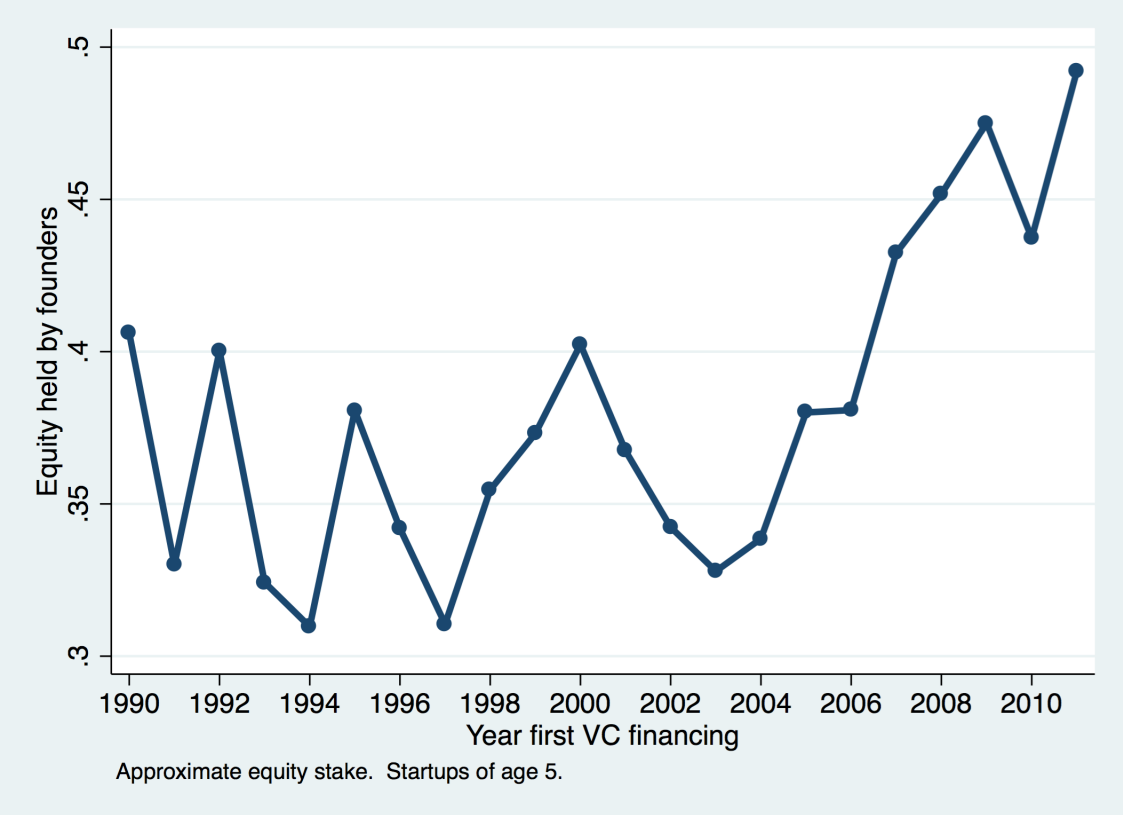

Table A1: Most active non-VC investors

The table reports the top seven investors in each non-VC investor category as proxied by total investments from 1987 - 2015. "Year first inv." is the year the investor first is first observed in VentureSource during this sample period.

Investor	Total deals	Year first inv.
Diversified Private Equity		
Oak Investment Partners	964	1987
Norwest Venture Partners	787	1987
JPMorgan Partners	727	1987
Battery Ventures	672	1987
Highland Capital Partners	629	1988
Morgenthaler Ventures	582	1987
Sprout Group	558	1987
Hedge fund / Investment bank		
Goldman Sachs Group Inc.	357	1988
Allen & Co. LLC	180	1987
RBC Capital Markets Corp.	118	1992
Soros Fund Management LLC	106	1992
Morgan Stanley	102	1998
China Development Industrial Bank	101	1996
Deutsche Banc Alex. Brown	98	1987
Corporations		
Intel Capital	1291	1988
Google Ventures	382	2008
Johnson & Johnson Innovation	331	1988
Shea Ventures	253	1987
SR One Ltd.	249	1987
Cisco Systems	248	1992
Motorola Solutions Venture Capital	219	1988
Public sec./Univ./SBIC		
Stanford University	351	1987
Comdisco Ventures	349	1988
Oxford Finance LLC	316	1992
Affinity Capital Management	170	1995
Novus Ventures	165	1994
AVI Management Partners	147	1987
Two Rivers Associates 111	1987	
Other		
Management	315	1997
Silicon Valley Bank	293	1997
Wilson Sonsini Goodrich & Rosati Corp.	177	1987
Northgate LLC	89	2005
T. Rowe Price Group Inc.	73	1996
Citigroup Inc.	72	1996
MMV Capital Partners	62	2005