Board Dynamics over the Startup Lifecycle

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Keywords: venture capital, board of directors, corporate governance, independent directors, mediation

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Abstract

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1 Introduction

The board of directors has ultimate decision-making authority over significant corporate matters. While the literature has extensively explored the composition of public firm boards, we know comparatively little about the boards of private firms. In contrast to the public firm board that is governed by an extensive set of regulations, the flexibility available to the private firm board leaves open the possibility that its composition and dynamics play a relatively larger role in firm outcomes. The goal of this paper is to study the venture capital-backed startup board and its evolution from the first round of financing to exit. We examine the determinants of board composition across firms and over time, the allocation of control over the board, and the roles of independent directors, i.e., directors who are neither representatives of the venture capitalists nor founders.

The venture capital (VC) setting is an intriguing area to investigate the board of directors because investors play an active role in their investments and their board positions are often central to exerting power (e.g., Lerner, 1995; Kaplan and Strömberg, 2003). However, there is little evidence both on the director composition – entrepreneur, VC, and independent – and on how the balance of power on the board changes over the startup's life. Next, the widespread presence of independent directors on startup boards is interesting in two key aspects. First, unlike in public firms, their presence on startup boards is voluntary and guided by the value they can create and the roles they can play. Second, the traditional monitoring role for independent directors of public firms is less important in VC-backed startups because VC investors have both the time and powerful incentives to monitor the managers of their portfolio companies. In fact, we find that the dynamics of board composition over time and across startups is consistent with independent directors playing a previously under-explored "mediation" role, mediating and resolving disputes between venture capitalists and entrepreneurs (Blair, 2014; Broughman, 2010, 2013).

To study these questions, we build a novel dataset of VC-backed startup boards by merging two key data sources. The first is Form D filings on SEC EDGAR, which list individual directors, beneficial owners, and top executives. Form D data post 2008 are available in machine-readable

format, and the pre-2008 data are collected by a combination of pdf processing and manual data analysis. We merge Form D data with VentureSource, which provides information on investor-directors and independent directors but does not have data on directors representing the founders. The resulting sample covers 7,201 startups over 2002–2017. These data represent one of the largest samples in terms of both startups and sample period studied in the literature.[1] For each startup, we observe the evolution of its board from the first VC financing round.

The dynamics of board size and composition reveal the evolution of control over the startup life cycle. At first financing, the average (median) board has 3.6 (3) members, and control over the board is most frequently allocated to the entrepreneurs/executives. As the startup grows and raises capital, the average startup adds both venture capital investors and independent directors. This pattern provides a direct view of the professionalization process led by venture capitalists (Hellmann and Puri, 2002). The average board size across a firm's life is 4.4, with approximately 2 seats held by VCs, 1.7 by executives, and 0.8 by independent directors.

Next, although the presence of independent directors is not required by law, it is widespread: the fraction of firm-year observations with at least one independent director on the board is 49%, and the fraction of startups that had an independent director by their fourth round of financing is 63%. Moreover, in about 33% of observations, neither the VCs nor the entrepreneurs control the majority of seats on the board, so whenever these two parties disagree, independent directors play a tie-breaking role and thus have substantial power over board decisions. In addition, the composition of startup boards and the allocation of board control exhibit interesting dynamics over the last two decades. For example, VC control over startup boards has been steadily declining: the fraction of startups in which VC investors controlled the majority of board seats after the second financing round was about 60% for startups originated in 2002, but fell to about 25% for startups originated in 2013. Not only VC control, but even the presence of VC investors on startup boards has been declining as well. This trend has been accompanied by an increasing fraction of boards controlled by the entrepreneurs and a slight decline in the

[1]Lerner (1995) studies 307 biotechnology firms, Kaplan and Strömberg (2003) investigate 213 VC investments, and Broughman (2010) exploits rich data on 54 VC-backed firms. Amornsiripanitch, Gompers, and Xuan (2019) have the largest sample of VC-backed boards, however, it faces limitations because the data provider (VentureSource) typically lacks entry dates and does not track executive directors.

use of independent directors. Such patterns are observed both based on a broad definition of independent directors (as any directors who are not representing VC investors or entrepreneurs) and based on a more conservative definition, where only directors with no previous professional ties with either the VCs or the entrepreneurs are considered independent.

To understand these trends and the overall dynamics of startup board composition, we investigate which factors determine the allocation of board control and the roles that independent directors play on these boards. First, independent directors could play an advisory and resource provision role, whereby they provide advice and access to valuable resources and networks. However, this role alone cannot explain why such directors are often given substantial voting power over the decisions: if the only role of independent directors were to provide advice and connections, there would be no need to give them a tie-breaking role. Moreover, the firm could establish an advisory board (as is frequently done in private firms) or add these individuals to the board as "board observers."

We therefore investigate the previously under-explored role of independent directors, which has been proposed in the law literature (Blair and Stout, 2001; Broughman, 2010, 2013) – the "mediation" role. The idea of the mediation role is that in an incomplete contracts setting (Grossman and Hart, 1986; Hart and Moore, 1990), independent directors with a tie-breaking role can improve both ex-post efficiency, by picking decisions that maximize the value of the startup, and ex-ante efficiency, by incentivizing both the VC and the entrepreneur to make capital and human capital investments, respectively. This can be more efficient than giving full control to either of the two parties, and even more efficient than state-contingent control (Aghion and Bolton, 1992). Intuitively, suppose that at a certain point, the firm needs to make a decision that causes a disagreement between the VC and the entrepreneur. Such disagreements are likely to arise for decisions involving subsequent rounds of financing, delayed exits, the sale of the firm, or CEO replacement, and particularly after negative shocks that require reorganization. If full control over the board is given to either the VC or the entrepreneur, then the party in control will pick the decision it prefers the most. However, there may be circumstances when it is more efficient to instead take some "middle-ground" action, and this can be achieved by allocating a tie-breaking role to an independent director, who maximizes

the value of the startup as a whole. Moreover, by picking this middle-ground action, rather than an action that favors one party over the other, the independent director gives incentives to each of the parties to make ex-ante investments. Put differently, allocating the tie-breaking role to independent directors offers a commitment to both the VC and the entrepreneur to refrain from opportunistic behavior in the future, and such commitment would be impossible to achieve if one of the parties had full control, even if it were on a state-contingent basis.[2]

Whether giving a tie-breaking role to independent directors is optimal, crucially depends on the stage of the firm's life cycle and the allocation of bargaining power between the entrepreneurs and VCs. When one party's (either VC's or entrepreneur's) participation and effort are much more crucial for the startup compared to the other party (i.e., the relative bargaining power of one of the parties is particularly high) then allocating full board control to that party can be optimal despite potentially inefficient decisions ex-post. However, when investments by both parties are crucial for the startup to succeed (i.e., neither the VC's nor the entrepreneur's relative bargaining power is very high), it is optimal to give independent directors a tie-breaking role. We refer to such allocation of board control as "shared control."

This logic leads to our key predictions. First, within a startup life cycle, as the cumulative amount of capital contributed by the VC investors increases, control over the board will shift from entrepreneur control at early stages of financing, to shared control at intermediate stages of financing, and to VC control at later stages of financing. Second, across firms, for any given point in the startup life cycle, we expect the allocation of control to move from entrepreneur control, to shared control, and then to VC control as the VC's bargaining power relative to the entrepreneur increases.

We show that these predictions are broadly consistent with the observed patterns in the data, within and across firms. First, within a firm's life cycle, the allocation of control over the board shifts from the entrepreneur, to shared control, and then to VC control as the firm goes through financing rounds. In particular, conditional on a change in board control from one year to the next, entrepreneur control is 71% likely to switch to shared control, and shared

[2]Many term sheets have provisions that give preferred shareholders veto rights as a class. We focus on those actions that require a board vote, of which there are many.

control is 85% likely to switch to VC control. For example, after the first round of financing, 48% of firms over our sample period have entrepreneur-controlled boards and only 20% have VC-controlled boards; the average board has 57% of seats controlled by the entrepreneurs, 30% of seats controlled by the VCs, and 13% of seats controlled by independent directors. After the second financing round, shared control and VC control are the two most common arrangements constituting 36% of observations each, while only 28% of firms have entrepreneur control. For example, the median firm has two entrepreneur directors, two VC directors, and one independent director, with an independent director playing a tie-breaking role. Finally, in the fourth round of financing, VC control is the most common arrangement (63% of the sample), with the average firm having 53% of seats controlled by the VCs. These patterns are robust to controlling for industry-by-year fixed effects, location fixed effects, and the capital raised by the startup in the financing round.

We next test our predictions in the cross-section of firms. We proxy for the VC's bargaining power relative to the entrepreneur in two ways. The first measure is constructed at the industry level: we consider the equity stake that VC investors obtain in startups for a given amount of contributed capital (i.e., the ratio of capital invested by the VC to post-money valuation), and take its average across all financings within an industry in the previous year. Assuming that the amount of capital contributed by the VC is determined by the firm's production needs and not by the parties' bargaining power, a higher industry-average VC equity stake during the previous year corresponds to higher industry-level VC bargaining power in negotiations over the firm's valuation. Our second proxy is a measure of dry powder, which is a rough estimate of the amount of available capital in active VC funds. It is constructed at the geographical region level and is calculated as the sum of all capital raised by VC funds in this region in the past, net of the sum of all capital invested by VCs in this region in the past. In years when dry powder is relatively low, VC bargaining power is high (because the supply of funds is scarce), and vice versa.

Consistent with the above predictions, there is a monotonic negative relation between entrepreneur control over the board and both proxies for the VC's bargaining power, controlling for industry and location fixed effects. Likewise, there is a monotonic positive relation between

VC control over the board and both proxies. Both the within-firm and the cross-sectional results are robust to a more conservative definition of independent directors, which treats directors with prior professional ties with the VC or the entrepreneur as being affiliated with that party, and only considers unconnected directors as truly independent.[3]

Finally, the above discussed time-series trends in the allocation of board control are also broadly consistent with our hypotheses. In particular, prior literature has identified two important changes to the supply of private equity capital over the last decades. The first was the deregulation of private equity markets, which made it easier for both startups and the private funds investing in them to raise capital (Ewens and Farre-Mensa, 2020). The second has been the growth in direct private equity investments by non-traditional investors, such as sovereign wealth funds, mutual funds, and hedge funds (e.g., Fang, Ivashina, and Lerner, 2015; Chernenko, Lerner, and Zeng, 2017; Ewens and Farre-Mensa, 2020). These changes have increased the supply of private capital and, as a result, the bargaining power of startup founders vis-à-vis VC investors (e.g., Ewens and Farre-Mensa, 2020; Eldar, Hochberg, and Litov, 2020). In addition, technological advancements, such as the advent of Amazon's Web Services in 2006, decreased the costs of starting new businesses and thereby lowered the capital contributed by VC investors in early stages (Ewens, Nanda, and Rhodes-Kropf, 2018). Both the reduction in VC bargaining power due to greater availability of private capital and the reduction in VC investments predict lower VC control and higher entrepreneur control over the board, which is exactly what we observe in the data. The decrease in the use of independent directors that accompanies higher entrepreneur control over boards is consistent with the mediation role hypothesis.

Overall, our paper presents novel evidence about the composition and evolution of startup boards. Our results are suggestive of the previously unexplored role of independent directors – mediation. This role could be relevant not only for startup boards, but also in other settings that involve multiple large blockholders with potentially conflicting interests.

[3]All these results are also robust to considering only healthcare or IT startups separately.

Related literature

Our paper contributes to the large literature on corporate boards (see Adams, Hermalin, and Weisbach (2010) for a comprehensive survey). Given the data limitations, most of this literature focuses on boards of publicly listed firms. There is a small literature that studies what drives VC board membership and what actions VC board members take.[4] Sahlman (1990) and Gorman and Sahlman (1989) were the first to document that board membership is an important way that investors interact and add value to startups in their portfolios. Lerner (1995) is the first comprehensive study on VC board activity, which focuses on VC directors' role in CEO turnover and on how VC board positions relate to their geographic distance to the firm. Amornsiripanitch, Gompers, and Xuan (2019) investigate which VC investors take a board seat and find that prior investor-founder relationship and lead investor status are important predictors of VC board membership. Venugopal and Yerramilli (2019) combine CrunchBase, AngelList, and BoardEx and study whether non-executive directors' experience, investment in the firm, and ties with its founders and investors are associated with their appointment to the board, as well as how their appointment is associated with subsequent outcomes. Researchers have also studied the role of board seats in contracts and general investor control rights. Kaplan and Strömberg (2003) examine a sample of VC contracts and find that most separately define board seats, cash flow rights, and control rights. Board rights are often allocated in response to bad states, thus shifting power from entrepreneur to VC. The role of independent directors is not a focus of their study. Kaplan and Strömberg (2004) find that two measures of risks faced by startups – internal and external – are highly correlated with board seat provision to investors, and VC board control is predictive of interventions such as CEO replacement. Finally, in the context of public firms, Field, Lowry, and Mkrtchyan (2013) and Iliev and Lowry (2020) document that VC investors continue to play an active role on boards of VC-backed startups after they go public.

Our contribution to these papers is twofold. First, our data uniquely cover board composition for a comprehensive sample of VC-backed firms from 2002 to 2017 and how it evolves from

[4]Cornelli and Karakaş (2015) study the role of boards in LBOs backed by private equity funds.

first financing to exit. Standard datasets, such as VentureSource and CrunchBase, do not have data on executive directors, often have limited data on independent directors, and cannot fully document board dynamics due to missing start and end dates of directorships. To our knowledge, Form D filings are the only public source of information on startup board composition and evolution. We analyze both post-2008 and non-machine-readable pre-2008 Form D filings, which allows us to identify board members beyond the VC investors, capture board control as well as directors' start and end dates, and more directly test the unique roles of each type of board member. Second, we study very different questions. While most of the above papers examine what factors lead a VC investor to take a board seat and analyze how this impacts outcomes, our focus, in contrast, is on the determinants of board composition, the allocation of board control, and on the roles of independent directors, especially, their mediation role.

In the context of public firms, the literature emphasizes two key roles of the board and independent directors in particular. One is monitoring: independent directors are supposed to monitor the manager on behalf of the shareholders, evaluate and incentivize managerial performance, and replace the manager when needed (Hermalin and Weisbach, 1998). Consistent with the monitoring role, Weisbach (1988) shows that CEO turnover is more sensitive to firm performance when boards are dominated by outside directors than when they are insider-dominated. Byrd and Hickman (1992) and Cotter, Shivdasani, and Zenner (1997) find that outsider-dominated boards perform better in tender offers, both as bidders and as targets. Nguyen and Nielsen (2010) and Fracassi and Tate (2012) study the value effects of outside directors using sudden director deaths and show that the value contribution of directors is higher when they are more independent of the CEO. The second role of directors on public firm boards is advisory: the board draws on its members' knowledge and experience to advise management on key corporate decisions and strategic directions (Adams and Ferreira, 2007). For example, Coles, Daniel, and Naveen (2008) argue that board advice is especially important in complex firms; Field, Lowry, and Mkrtchyan (2013) emphasize the advisory role of busy directors for recent IPO firms; and Harford and Schonlau (2013) show that directors' acquisition experience is valued in the labor market for directors. Differently from this literature, we emphasize the mediation role of independent directors.

The idea of the mediation role goes back to Blair and Stout (2001), who emphasize that "directors ought to be viewed not as "agents" who serve only the shareholders, but as "mediating hierarchs" who ... are charged with the task of balancing the sometimes-conflicting claims and interests of the many different groups... ." Similarly, Blair (2014) contrasts directors' monitoring role, which is supposed to alleviate "vertical" conflicts of interest (between managers and shareholders) with their mediation role, which focuses on "horizontal" conflicts of interest (between different stakeholders). She points out that such horizontal conflicts of interest are quite likely in VC-backed firms, where disagreements can arise between the holders of preferred and common shares or between the holders of different classes of preferred shares, e.g., for decisions involving the sale of the firm or its merger with another firm. Broughman (2010, 2013) presents a theory showing how independent directors can mediate conflicts between VC investors and entrepreneurs and why this can be preferred to both unilateral control of one party and to board deadlock (Donaldson, Malenko, and Piacentino, 2020), and presents descriptive statistics on a sample of 54 VC-backed firms sold in 2003 or 2004. While the mediation role has received attention in the legal literature, we are aware of only one paper in the finance literature that explicitly discusses this role, albeit in a very different setting. Burkart, Miglietta, and Ostergaard (2017) analyze Norwegian public firms at the turn of the 20th century, when firms were not required to have a board. They show that a firm was more likely to set up a board when its ownership structure included many small shareholders, and hypothesize that boards both monitored the management and mediated among shareholders.

2 The startup board

Through surveys and small sample data collection, we have a broad understanding of what venture capital-backed boards do. First, a recent survey of venture capitalists in Gompers, Gornall, Kaplan, and Strebulaev (2020) shows that a typical VC considers board control an important part of deal negotiation. The board itself has many responsibilities, summarized well by Kaplan and Strömberg (2003):

"The board is generally responsible for (1) hiring, evaluating, and firing top man-

agement; and (2) advising and ratifying general corporate strategies and decisions." (p.287)

Likewise, the 2007 white paper by a group of VC industry experts summarizes the general duties of startup directors as "serving as fiduciaries for all shareholders; hiring, evaluating, and firing the CEO and approving officer selection; ... reviewing and confirming basic company objectives and business strategy; ... approving equity incentives and establishing executive compensation; [and] overseeing regulatory and legal compliance" (p.12).[5]

Moreover, Fried and Ganor (2006) emphasize that "startup boards—unlike public company boards—are frequently and intimately involved in strategic decision-making and personnel issues" and note that board control gives the controlling party the ability to "initiate fundamental transactions such as mergers, IPOs, and liquidations" (p.987).

3 Data

We seek to create a database of board composition and dynamics of U.S.-based VC-backed startups financed from 2002 to 2017. The source of startups is the data provider VentureSource, supplemented with regulatory Form D filings. Form D filings are exemption requests made by startups raising private capital. Identifying the full board of directors, specifically executives, demands that we impose several sample filters to minimize measurement error. First, we require the startup to raise equity financing (e.g., not convertible notes or straight debt) at least once during the 2002–2017 sample period, in order to ensure that there are some shareholders who could have board rights. Second, for at least one equity financing during the sample period, equity capital has to be provided by at least one traditional U.S.-headquartered venture capital investor.[6] Third, we require that the startup's first VC financing in VentureSource

[5]See "A Simple Guide to the Basic Responsibilities of VC-backed Company Directors," issued by the Working Group on Directory Accountability and Board Effectiveness.

[6]Most major commercial data providers define a traditional VC investor as a firm that manages limited life funds that raise capital from institutional investors. Those funds have a fee and carry compensation scheme for general partners and have a stated objective of investing in high-growth private firms. Investors that are thus excluded include corporate venture capitalists, angel investors, individuals, and large private equity investors (e.g., buyout or growth equity investors). Startups in VentureSource that *only* raised capital from any of these

is accompanied by the filing of a Form D (to ensure that we see the board over the entire life of the startup, starting at first VC financing). A lack of a filing may be because the startup raised capital in only one state or simply failed to comply with the regulation.[7] Fourth, the startup's Form Ds must report at least one executive director by the end of the sample period. This condition is important because VentureSource does not track executive directors. Finally, we start tracking startups after they raise their first VC equity financing (as reported in VentureSource) or when they file their first Form D (whichever comes first). With the VentureSource sample defined above, we search for these startups on the SEC EDGAR site, i.e., find their CIK identifiers.

Form D filings list the individual directors, beneficial owners, and top executives. For 2002–2009, these filings are available in pdf form. Individual names and titles, such as executive or director, were extracted with a combination of pdf processing and manual data collection. The Internet Appendix has more details on the disclosure regulations and our data collection steps. Filings posted after 2008 are in machine-readable format (XML). The resulting list of directors and their association with the firms – executive or non-executive – is next merged with the board of directors and executive listing (first and last names) in VentureSource. VentureSource provides information on investor-directors and independent directors; it also has information on partners at the investing VC firms and the startup's executives. However, VentureSource does not indicate whether executives have board positions, so Form D data are crucial for identifying executive directors. The combination of the two databases thus provides a new view on executive directors unavailable in VentureSource and also flags individuals in Form Ds as one of three types: executive, investor, or independent director.[8] The Form D

excluded investors are thus not in our sample. To avoid capturing startups that are mis-classified as VC-backed or that are relatively developed by the time they are tracked by VentureSource, we also exclude any startups whose first observed financing is a public investment in private equity, a restart round, a secondary transaction, a later-stage financing, or a grant from a private organization.

[7]See the Internet Appendix for the analysis of regulatory regimes and ways to avoid Form D filing.

[8]In particular, an executive director has two boxes checked on the Form D ("Director" and "Executive Officer"). For other directors, we rely on VentureSource to identify their type: We used the list of investors and VC partners (that had invested in the startup) from VentureSource to identify the non-executive directors on the Form D as investor-directors. The remainder of directors in Form D were identified as independent directors (part of them merged with the VentureSource independent directors, called "Outsiders"). The reason we could not rely solely on Form D to identify investor-directors is that only some years have a "Beneficial Owner" tick box that could potentially identify investors separate from independent directors; we also found many instances

data are themselves an imperfect source of board data. There are cases where VentureSource reports investor-directors or independent directors not found in a contemporaneous Form D.[9] We believe that these are cases where the election of the director happened *after* the Form D filing deadline, so we add directors only available in VentureSource to our sample. Overall, we believe the combination of requiring a Form D with at least one executive director over the firm's life and using all directors from both Form Ds and VentureSource addresses limitations of both data sources.

The Form D data also provide a crucial piece of information often missing in commercial data providers: director start dates and end dates. Regulations require that Form Ds must be filed within 15 days of the first sale of securities, so we can accurately assign start dates with the information on directors from the filing. Thus, for investor-directors or independent directors in both VentureSource and the Form D, the latter allows us to fill in missing start dates.[10] After all these data are combined, we still may lack the start dates of some directors. For these, PitchBook provided additional board member start dates. As for director end dates, they are set either to six months prior to the first Form D filing in which a given director is no longer listed,[11] or prior to the exit of the firm (e.g., IPO, failure, or acquisition). Startups without exits by the end of the sample period are tracked for two years after their last VC financing event.[12] The final data set provides the composition and dynamics of the full board of directors for our sample of startups. The current sample includes 7,201 startups.

The last step before the analysis is a transformation of the data. The merge of VentureSource

where a director did not have "Beneficial Owner" checked but was known to be a major investor.

[9]About 85% of the investor-directors listed in VentureSource are found in the Form D. Each individual in the Form D who does not match to a known investor in VentureSource is treated as an independent director. Approximately 19% of independent directors are only found in the Form D filings. We ignore startups where VentureSource lists the startup as having at least one unknown investor (or "undisclosed") and we cannot confirm the ID's identity in VentureSource.

[10]To get start dates from VentureSource for directors only available in VentureSource, we used a combination of reported start dates in VentureSource and dates when the VentureSource research team updated the board data. During most of our sample period, VentureSource contacted a startup or its investors twice a year. If a start date was missing, but the "last update date" field was known and varied across board members (if they are all the same, VentureSource said it was most likely late backfill), then we used this update date.

[11]If the previous Form D filing is less than 6 months from this filing, then the end date is set to the halfway point between the two filings.

[12]This assumption ensures that we do not impose stale board data from still-private startups. Effectively, this assumption treats the startup as "failed" as of two years post-last VC financing (or end of sample if sooner).

and the Form D results in a unit of observation at the financing event. Using the date of first financing and either the eventual exit (e.g., IPO or acquisition) or the end of the sample period, we create a startup-year panel. The board characteristics for years with more than one financing are set to the last financing of that year, while board characteristics in years without financings are imputed from the previous year.

Table 1 reports the cross-sectional characteristics of the firms in our sample and compares them to firms in VentureSource that satisfied the main sample rules (raised equity financing by at least one traditional U.S.-based VC during our sample period), but either never filed a Form D (58% of that sample) or filed it at some point but did not satisfy other sample rules (e.g., because there was a VC financing before the first Form D filing). Firms in our sample are more likely to have a first round Series A because seed financings are often raised from smaller, non-traditional VCs and non-VC investors, who are less likely to comply with Form D regulations. Sample firms are also more likely to be headquartered outside CA: startups outside CA often need to raise capital out of state and as a result, as we discuss in the Internet Appendix, cannot satisfy the exemptions to avoid form D filing. Next, driven by some backfill in Form D filings by firms going public,[13] sample firms are more likely to go public and in turn, have more financings. The differences in total capital raised are due to a combination of two effects. The first is that Form D filers tend to raise more capital than non-form D filers, as is apparent from Section 3.1 of the Internet Appendix. The second effect, which dominates the first, is that out-of-sample firms include not only non-form D filers, but also startups that filed form D at a certain point but had VC financings before that, leading to some survivorship bias and resulting in them raising more capital than in-sample form D filers.[14] Despite these differences, we believe that our sample of startups is generally representative of the VC universe during the sample period.

[13]Based on conversations with practitioners, firms doing an IPO tend to retroactively file Form Ds for their prior financings, because going public requires compliance with disclosure regulations.

[14]Given that out-of-sample firms consist of both non-form D filers and form-D filers not satisfying out filters, the same competing effects are also present for other characteristics.

Form D filers and data accuracy. In Section 3 of the Internet Appendix, we discuss several potential concerns about our use of Form D data both for sample inclusion and the board data itself. First, we ask whether startups with at least one Form D filing are different from the average VC-backed startups. The analysis suggests that Form D filers are a bit older, are less likely to be based in California, and raise more capital over their lives. We explore the sources of these differences based on the existing disclosure regulations. Next, we investigate whether these differences manifest themselves in board characteristics. Using a small, nearly-comprehensive sample of board data for non-Form D filers in one state, we find that boards of Form D filers are larger on average but exhibit no major differences in dynamics or composition. Finally, we address whether Form Ds provide accurate data on board seats using a small sample of boards from the single state and certificates of incorporation. In the vast majority of cases where we have information on boards from both a Form D and other sources, there is agreement between the two, and any disagreements are often driven by idiosyncratic features of the startup. We conclude that board data collected from a combination of Form D filings and commercial databases has no major bias in the cross-section or time series in terms of board composition and dynamics.

Allocation of board control. One of our main goals is to understand how control over the board is allocated among investors, entrepreneurs (who we refer to interchangeably as executives), and independent directors. We therefore introduce the following definitions of board control. We call a board "*VC-controlled*" if VC directors hold strictly more than 50% of board seats, or if VC directors hold exactly 50% of the seats and entrepreneurs hold strictly less than 50% of seats (suggesting that they jointly control the remaining half of seats together with independent directors).[15] Similarly, we call a board "*entrepreneur-controlled*" if entrepreneurs hold strictly more than 50% of board seats, or if they hold exactly 50% of the seats while VCs hold strictly less than 50%. In addition, our sample includes some startups whose boards are initially empty but add directors in subsequent rounds of financing. We define such boards at

[15]In this second type of a board, the most unfavorable situation for the VC investor is the one in which the independent directors always side with the entrepreneur, resulting in deadlock. In all other scenarios, the VC would be able to implement its preferred decision.

their initial, empty, stage as entrepreneur-controlled because the absence of a board is likely to mean that the entrepreneur has full control over the decisions. Finally, the remaining category corresponds to *"shared control."* In a typical board in this category, both VCs and entrepreneurs hold strictly less than 50% of seats, while the remaining seats are held by independent directors, who are thus playing a tie-breaking role whenever the two parties disagree.

4 Descriptive statistics

This section describes the basic patterns in the board data for the firms in our sample. Table 2 presents summary statistics for the panel data of board composition. Because Form Ds are only filed during new financing rounds, we observe board composition only in years when new financings are raised. For each year without a financing event, we impute board data from the previous financing event. Accordingly, Panel A reports all firm-year observations, while Panel B only reports the subset of firm-years in which the firm raised at least one equity financing.

According to Panel B, the average board size across a firm's life is 4.4. About 2 of the directors are VCs, while 1.7 and 0.8 of the seats are held by executives and independent directors, respectively. This composition corresponds to an average of 39%, 46%, and 15% of seats controlled by VCs, executives, and independent directors, respectively. The use of independent directors is very common: they are present in 49% of firm-year observations.

Figure 1 reports board seat counts by firm age, where age 0 corresponds to the year when the startup first raises VC equity financing. On average, startup boards start with fewer VC investors than executives. By three years after their first VC financing, startup boards have more directors who are investors than executives. The figure also reveals that the number of independent directors also grows over time (from zero to one for a median firm) but, importantly for our results, it grows more slowly than VC seats.

Figure 2 reports the fraction of the board composed by each type of director by firm age. Consistent with the patterns in Figure 1, the fraction of executives on the board decreases (from 0.55 in early years to 0.30 in later years), and the fraction of investor-directors increases with age. The median fraction of seats occupied by independent directors first increases but

stabilizes at about 0.15 after the first two years.

There is also an interesting distinction between the evolution of startup boards depending on the type of exit. In particular, Figure 3 considers two subsamples: firms that exited via an IPO in the left panel, and firms that exited via being acquired in the right panel. The x-axis captures the number of years prior to exit. For each year prior to exit, we only consider the subsample of startups that were active and still private at that time (i.e., the set of firms for $t = -s$ are those that exited in s or greater years since first VC financing). The comparison of the two figures reveals that firms doing an IPO significantly increase their board size approaching the IPO compared to acquired firms: the average board size right before exit is 7 for IPO exits and approximately 5 for exits via an acquisition.[16] In addition, IPO firms add more independent directors: prior to going public, an average startup has two independent directors, compared to only less than one independent director prior to being acquired. A potential explanation for this difference is the regulatory requirement of at least 50% independent directors for publicly listed firms: adding such directors in advance, in anticipation of going public, allows them to learn about the startup and thereby be more effective after the IPO. This evidence is consistent with the professionalization and standardization of startups by VC investors (Hellmann and Puri, 2002; Rajan, 2012).

We next ask whether the composition of boards has changed over our sample period in terms of board control. The left panel of Figure 4 presents the time series summary of VC board control for age cohorts. The x-axis is the year a startup raises its first round of VC equity, and each time series presents the fraction of that cohort that had a VC-controlled board by round one, two, and three. First, the figure reveals a significant decline in the probability that a startup has VC majority control over the board. The youngest firms have experienced the largest decline: first- and second-round boards have roughly half the probability of VC control since 2012 than those in the early 2000s. The right panel of Figure 4 presents the same time series cohort analysis, but for the fraction of firms with entrepreneur board control in each of the rounds. Together, these figures show a shift in board control from VC investors to

[16] This board size is comparable to that found in Baker and Gompers (2003) for a set of newly-public firms from 1978–1987.

entrepreneurs.

Figure 5 explores some of the sources of these changes in VC and entrepreneur majority by breaking down other components of the board at the time of the first VC equity financing. Consider first the solid line, which reports the fraction of startups at age zero that have a board with at least one VC director. This fraction has decreased significantly and consistently over the sample period. The declined representation of VC investors on the board has also been accompanied by smaller board size (dashed line). Finally, the blue dotted line shows that the role of independent directors on startup boards has declined as well, albeit not as strongly: the fraction of age-zero boards with at least one independent director has declined since the early 2000s, falling from 40% to 35%.

In the next sections, we explore the roles of independent directors in startup boards, which allows us to explain both these descriptive statistics of board composition over the firm's life cycle (Section 6.1) and these time-series trends (Section 6.3).

5 Mediation role of independent directors

In this section, we discuss the mediation role of independent directors and derive our key empirical predictions. Although we are unaware of research in finance considering this role on startup boards, statements by industry practitioners show that they believe that independent directors act as mediators in some cases. For example, the NVCA (the lobbying group for the VC industry) provides popular "model documents" such as investor rights agreements, certificates of incorporation, and voting agreements.[17] In the latter, they discuss that in the eyes of the court, independent directors can lessen the need for alternative contractual terms that deal with exit decision conflicts. To introduce the mediation role of independent directors, we present a very simple model, which is based on Aghion and Bolton (1992) and Broughman (2010, 2013). Intuitively, the mediation role can arise in the setting of Aghion and Bolton (1992) if we consider three (or more) actions that the firm could take, as opposed to two.

[17] See `https://nvca.org/model-legal-documents/` and `https://nvca.org/wp-content/uploads/2019/06/NVCA-Model-Document-Voting-Agreement.docx`.

5.1 Model

Consider a risk-neutral entrepreneur (E) and a risk-neutral venture capitalist (VC). The entrepreneur is cash-constrained. At time 0, the VC investor decides whether to finance the firm, and the entrepreneur decides whether to contribute his human capital. Both parties have their outside options, I^{VC} and I^{E}, if they choose to not contribute their capital and human capital, respectively. If one of the parties does not make the investment, the payoffs of both parties are zero.

If the parties invest, then at time 1, the firm can take one of three possible actions 1, 2, and 3. These actions can correspond to any important decisions that are likely to give rise to conflicts of interest between the VC and the entrepreneur: raising a subsequent round of financing, the sale of the firm, CEO replacement, or the timing of the exit such as an IPO.

The present value of the payoff for the entrepreneur from action i is given by V_i^E, and the payoff for the VC is V_i^{VC}. For simplicity, we assume there is no discounting. We also make the following assumptions:

1. $V_1^{VC} > \max\{V_2^{VC}, V_3^{VC}\}$
2. $V_3^E > \max\{V_1^E, V_2^E\}$
3. $V_2^E + V_2^{VC} > \max\{V_1^E + V_1^{VC}, V_3^E + V_3^{VC}\}$.

These assumptions imply that the VC investor prefers action 1 the most, the entrepreneur prefers action 3 the most, and action 2 is efficient in that it maximizes the combined payoff.

Contracts are incomplete, and the parties cannot contract on actions. Instead, the choice between the actions is made by the board. The board can be controlled in three different ways. In an entrepreneur-controlled (VC-controlled) board, the entrepreneur (VC investor) has full decision-making authority to choose the action. In a board with "shared control," neither the VC nor the entrepreneur have the majority of the seats, and there is an independent director, who maximizes the joint payoff of the two parties, i.e., the total value of the startup. Under shared control, the decision-making protocol is as follows: the VC and the entrepreneur each suggest an action, and the independent director chooses between the two proposed actions.

We next compare the three allocations of control over the board from the perspective of ex-ante and ex-post efficiency.

Entrepreneur control. Under E-control, the entrepreneur would like to choose action 3. However, there is a possibility of renegotiation. We assume that the VC investor makes a take-it-or-leave it offer to the entrepreneur to induce him to take a different action. Then, the ex-post efficient action 2 is implemented, and the VC gives the entrepreneur just enough cash to make him indifferent between actions 2 and 3, i.e., the amount of $V_3^E - V_2^E$. Therefore, the payoffs of the entrepreneur and the VC are, respectively, V_3^E and $V_2^{VC} - \left(V_3^E - V_2^E\right)$. For this allocation of control to be ex-ante efficient (in the sense that both investments are made), the following constraints need to be satisfied:

$$\begin{aligned} V_3^E &\geq I^E, \\ V_2^{VC} - \left(V_3^E - V_2^E\right) &\geq I^{VC}. \end{aligned} \tag{1}$$

VC control. Under VC control, the VC would like to choose action 1. Because the entrepreneur is cash constrained, there is no renegotiation, so action 1 is chosen. This allocation of control is ex-ante efficient if and only if

$$\begin{aligned} V_1^E &\geq I^E, \\ V_1^{VC} &\geq I^{VC}. \end{aligned} \tag{2}$$

Note that if $V_1^E < I^E$, it is technically possible for the VC to offer cash to the entrepreneur at stage 0. For simplicity, we shut down this option, motivating it by the lack of commitment power by the entrepreneur: if the entrepreneur's human capital investment is non-verifiable, he could take cash at stage 0 and then still not invest his human capital and instead exercise his outside option to get I^E, so such transfers would not occur.

Shared control with independent director as the mediator. Suppose that $V_1^E + V_1^{VC} \neq V_3^E + V_3^{VC}$, so that the independent director is never indifferent between the two proposed

actions. Then, in equilibrium, at least one of the parties will propose action 2, and it will be chosen by the independent director.[18] Hence, the action is ex-post efficient, and there is no need for renegotiation. For this allocation of control to be ex-ante efficient, we need

$$\begin{aligned} V_2^E &\geq I^E, \\ V_2^{VC} &\geq I^{VC}. \end{aligned} \tag{3}$$

Which allocation of control is optimal?

As the above arguments imply, VC control is not ex-post efficient, while both entrepreneur control and shared control achieve ex-post efficiency. However, these allocations of control may not be ex-ante efficient. In particular, it follows from (1)-(3) that it is easiest to satisfy the VC's participation constraint under VC control because in this case, the payoff of the VC is the highest. As a result, if I^{VC} is sufficiently high, i.e., $I^{VC} \in (V_2^{VC}, V_1^{VC}]$, then giving control to the VC is necessary to ensure that the firm is financed. Therefore, VC control can be optimal despite the potential ex-post inefficiency.

Similarly, if I^E is sufficiently high, then giving control to the entrepreneur is necessary to ensure that the entrepreneur invests his human capital in the project — both VC control and shared control may not promise the entrepreneur enough rents to motivate him to make the investment.

Finally, for intermediate levels of I^{VC} and I^E, shared control ensures both ex-ante and ex-post efficiency, and hence is optimal.

5.2 Predictions

A key conclusion from the above analysis is that as I^{VC} increases relative to I^E, control should shift from (1) entrepreneur control, to (2) shared control, and then to (3) VC control. This conclusion gives rise to two sets of predictions: within the firm's life cycle and across firms.

[18] For example, it cannot be that the independent director chooses action 1 in equilibrium. In this case, the entrepreneur can benefit from deviating and proposing action 2, because it will be chosen by the independent director over any other action and because $V_2^E > V_1^E$ (the inequality $V_2^E > V_1^E$ follows from combining assumptions 1 and 3 above).

First, within the firm's life cycle, as the amount of capital contributed by the VC and, accordingly, the value of its stake in the firm increases with financing rounds, I^{VC} increases relative to I^{E}. Intuitively, the outside option of the VC investor is to sell its stake in the firm, and this outside option increases with the amount of contributed capital. Hence, our first prediction is the following:

Prediction 1. *Within the firm's life cycle, control over the board will shift from (1) entrepreneur control in early financing rounds; (2) to shared control in subsequent financing rounds; and (3) to VC control in late financing rounds.*

Second, across firms, the bargaining power of the VC relative to the entrepreneur (in the sense of their outside opportunities from investing capital and human capital, respectively) corresponds to a higher I^{VC} relative to I^{E}. Hence, our second prediction is as follows:

Prediction 2. *Across firms, as the VC's bargaining power relative to the entrepreneur increases, control over the board will shift from (1) entrepreneur control for low VC bargaining power; (2) to shared control for intermediate levels of VC bargaining power; and then (3) to VC control for high VC bargaining power.*

The VC's relative bargaining power is likely to be higher if private equity capital is scarce relative to the supply of startups, which we exploit in some of our proxies for bargaining power in Section 6.2.

6 Main analysis

In this section, we test the main predictions of the mediation role hypothesis, summarized in Section 5.2. Section 6.1 examines Prediction 1 within the firm's life cycle, Section 6.2 examines Prediction 2 in the cross-section, and Section 6.3 discusses how the above discussed trends in the allocation of board control over the sample period can be viewed from the perspective of the mediation role.

6.1 Allocation of control within the firm's life cycle

The first prediction of the mediation role is that over the startup life cycle, control over the board will shift from entrepreneurs, to shared control with independent directors playing a tie-breaking role, and then to VC control. We first note that the patterns in Figure 2 are broadly consistent with this prediction: at age zero, entrepreneurs on average control more than 50% of the seats, but they quickly lose full control and start sharing it with independent directors and VCs, whereas the fraction of VC directors gradually increases over the firm's life cycle.

Table 3 offers more detailed statistics about the composition of an average and median board at each round of financing. In the first round, entrepreneurs control about 57% of seats in an average board, and the median board has two entrepreneurs and one VC investor. By the second financing round, the most common arrangement is shared control: the median board has two entrepreneurs, two VC investors, and one independent director to break the tie in case of disagreement, and the average percentages of entrepreneur and VC board seats are 44% and 41% respectively, i.e., none of them controls the majority. Over subsequent rounds of financing, the number and fraction of VC directors gradually increase, and by the fourth financing round, the average firm has 53% of board seats controlled by VC investors.

Table 4 and Figure 6 use the definitions of board control introduced in Section 3 to show the evolution of board control within the life cycle. Consistent with Prediction 1, entrepreneur control is the most common arrangement during the first financing round: 48% of startups are controlled by entrepreneurs, as opposed to 20% by VC investors and 32% with shared control. As the firm raises additional financing, entrepreneur control becomes much less common; in contrast, the most common arrangements in the second round are shared control and VC control, each comprising 36% of the sample. Finally, VC control is the most common arrangement among startups that have progressed to the next rounds: it is observed in 52% and 63% of startups in the third and fourth round, respectively. These patterns are clearly seen in the left panel of Figure 6. The right panel of Figure 6 shows similar, although a bit noisier, dynamics as a function of firm age.

To test the life cycle hypothesis directly, we calculate the transition probabilities between the three types of board control. In particular, we ask: conditional on the board having a given allocation of control in one year, what is the likelihood it will have a different allocation of control in the next year? This analysis is presented in Table 5. The results in Panel A, which considers all financing years, are consistent with the life cycle hypothesis: conditional on a change in board control from one year to the next, entrepreneur control is 71% likely to switch to shared control (30.47/(30.47+12.31)), whereas shared control is 85% likely to switch to VC control (30.98/(30.98+5.55)). Conditional on the board being controlled by the VCs, VCs are 89% likely to retain control in the next year. The results in Panel B, which only considers financing years in which there was a change in board size, are very similar.

Finally, Table 6 and Figure 7 test the life cycle hypothesis controlling for industry by year fixed effects, the capital raised by the startup in the financing round, and location fixed effects, where location is defined as one of the nine Census divisions.[19] Table 6 presents the regression results, and Figure 7 plots the corresponding estimated coefficients from this regression. Consistent with prior results, entrepreneur control becomes exceedingly less likely as firm age increases (column 1) or as the firm goes through financing rounds (column 5), whereas VC control becomes exceedingly more likely (columns 3 and 7). The fraction of startups with shared control reflects the net of these two effects: on the one hand, as firm age/financing round increases, part of the firms switch from entrepreneur control to shared control, and on the other hand, part of the firms switch from shared control to VC control.[20]

Columns 4 and 8 of Table 6 show that the presence of independent directors on the board monotonically increases with startup age and financing round. This pattern is consistent with the predictions of the mediation role, according to which independent directors are added to the board once full entrepreneur control is no longer optimal. In addition, under the premise that advice from the board becomes more important at later stages of the startup life cycle,

[19]See, e.g., https://www.ncdc.noaa.gov/monitoring-references/maps/us-census-divisions.php for the list of nine Census divisions.

[20]Whether the relation between the stage of the life cycle and shared control is positive or negative depends on whether, as the startup matures, the first effect happens at a higher or lower speed than the second. In our sample, entrepreneur control is replaced by shared control at a higher speed than shared control is replaced by VC control in earlier years, but at a lower speed in later years, leading to the non-monotonic pattern in columns 2 and 6.

this pattern is also consistent with independent directors' advisory role. However, the advisory role alone cannot explain why independent directors are not only added to the board, but are also given critical voting power through their tie-breaking role.

6.2 Allocation of control and VC bargaining power

Proxies for VC bargaining power. To test the second prediction in Section 5.2, we use two proxies to capture VC bargaining power relative to the entrepreneur. The first proxy is based on valuations that VC investors pay for firms in a given industry, while the second is based on the supply of VC capital in the region.

To construct the first proxy, we consider each of the seven industry groups separately.[21] Within each industry group, we calculate the average equity stake of the VCs (i.e., the ratio of capital invested by the VCs to post-money valuation) in early financing rounds across all firms during the previous year. For columns 1-4 of Table 7, we then split the observations within each industry group into three groups: (1) the top quartile of average VC equity in the previous year; (2) the bottom quartile of average VC equity in the previous year; and (3) the middle 50% of observations. The top (bottom) quartile corresponds to the group with the highest (lowest) VC bargaining power within industry. Similarly, columns 5-8 of Table 7 correspond to the split of the sample period into quintiles within each industry. The idea of this measure is that if the amount of capital contributed by the VC is determined by the firm's production needs and not by the parties' bargaining power, then a higher average VC equity stake corresponds to higher VC bargaining power in negotiations over the firm's valuation.

To construct the second proxy, we use a measure of "dry powder," i.e., the supply of VC capital available for investment, at the geographical location level. We use geographical location, rather than industry as in the previous measure, because it is difficult to classify VC firms by industry. Specifically, we consider nine Census divisions (which we refer to as "regions") and allocate each startup and each VC to a given region based on the location of the startup and the location of the VC firm's headquarters, respectively. Within each region, we measure dry

[21] The four most represented industry groups are information technology, healthcare, consumer services, and business and financial services.

powder in a given year as the total capital raised by all VC funds in this region since 1990 and up to this year, minus the total capital invested into startups located in this region from 1996 up to this year. We then split all observations within each region into three groups: (1) the top quartile of division-level dry powder in the previous year, which corresponds to the highest supply of VC capital and hence the lowest level of VC bargaining power; (2) the bottom quartile of division-level dry powder in the previous year, i.e., the highest VC bargaining power; and (3) the middle 50%. This definition corresponds to columns 1-4, and in columns 5-8, we similarly split the sample period into quintiles within region. Our preferred measure of bargaining power is the equity-based proxy as the dry powder measure is noisier.[22]

Results. The main outcomes of interest are the allocation of board control (the dummies for entrepreneur, VC, and shared control) and the presence of independent directors on the board. We only consider the first equity financing round because for any subsequent round, the allocation of control depends on the allocation of control during the previous financing rounds, which makes the results harder to interpret. In Table 7, we regress each outcome variable on dummies for high/highest and low/lowest VC bargaining power, as well as industry and region fixed effects. In all regressions, the excluded category is the middle of the distribution. We do not include year fixed effects because by construction, the variation in our bargaining power measures is mostly coming from the time-series variation within an industry/division.

The results based on the first proxy (average VC equity stakes in the industry-year) are presented in Panel A of Table 7. Consistent with Prediction 2, column 1 and 5 show that entrepreneur control is most likely when VC bargaining power is the lowest and becomes increasingly less likely as VC bargaining power increases. For example, the fraction of startups with entrepreneur control in the lowest (highest) quartile of VC bargaining power is higher (lower) than in the middle of the distribution by 0.07 (0.16). These effects are economically

[22]There are two major reasons why the dry power proxy is noisier than the equity-based measure. First, in order to have more than annual variation, we assigned VC funds to geographic regions based on their headquarters location. Most VCs are able to invest nationally and may have multiple offices making investments. Second, because it is challenging to observe the exact VC fund that invests in a startup, the sum of capital raised by startups is an imperfect measure of funds deployed by previously closed VC funds. For example, some investors in equity financings are corporate VCs or individuals that do not invest out of traditional funds.

significant, given that the average fraction of entrepreneur-controlled boards in the first financing round is 0.48. In contrast, and also consistent with the prediction, the fraction of VC-controlled boards increases with VC bargaining power proxy: it is by 0.05 lower (0.12 higher) in the bottom (top) quartile than in the middle of the distribution, with the sample average of 0.20.

The relation between VC bargaining power and shared control reflects the net of these two effects: whether it is positive or negative depends on whether, as VC bargaining power increases, entrepreneur control is replaced by shared control at a higher or lower speed than shared control is replaced by VC control. In our sample, entrepreneur control is replaced by shared control at a slightly higher speed than shared control is replaced by VC control, leading the likelihood of shared control to slightly increase with VC bargaining power. Finally, the dummy variable for the presence of independent directors on the board has the same pattern as the dummy for shared control, which is consistent with the idea that independent directors are added to the board to mediate conflicts between investors and entrepreneurs.

The corresponding results for the second proxy (dry powder) are presented in Panel B. Although these results are noisier, they are all broadly consistent with those in Panel A.

6.3 Trends in board composition and control

We now return to the discussion of trends in board composition and board control, presented in Figures 4 and 5. According to Prediction 2, the declining fraction of startups with VC-controlled boards and the contemporaneous increase in the fraction of startups with entrepreneur-controlled boards would be consistent with a decline in VC bargaining power over time. Are there reasons to believe that there has been such a shift in bargaining power? The findings in the prior literature suggest that this could indeed be the case, due to several technological and regulatory developments in private equity markets.

First, the literature documents that there has been a substantial increase in the supply of private equity capital, which increased the outside opportunities of entrepreneurs relative to VCs and thereby increased entrepreneurs' bargaining power. This happened due to a combination of two effects. The first was the 1996 deregulation of private equity markets (the National

Securities Markets Improvement Act, or NSMIA), which made it easier for startups to raise capital from out-of-state investors and, at the same time, made it easier for VC funds to raise larger amounts of capital. Ewens and Farre-Mensa (2020) show that NSMIA increased the supply of private capital and helped strengthen founders' bargaining power vis-a-vis investors. The second, related, effect has been the entry of non-traditional investors, such as mutual funds, hedge funds, and sovereign wealth funds, which have become increasingly active in making direct private equity investments in startups (e.g., Fang, Ivashina, and Lerner, 2015; Chernenko, Lerner, and Zeng, 2017; Ewens and Farre-Mensa, 2020).

In addition to these changes on the financing side, there have been important changes on the technological side. Specifically, the 2006 introduction of cloud computing services by Amazon significantly lowered the cost of forming new internet-based startups by removing the need for large upfront investments in hardware. Ewens, Nanda, and Rhodes-Kropf (2018) show that this decrease in the cost of starting new businesses increased the prevalence of a "spray and pray" investment approach, whereby VC investors provide lower amounts of funding to a larger number of startups. Similarly, Eldar, Hochberg, and Litov (2020) show that this technological change coincided with a shift towards founder-friendly dual-class structures.

Both the reduction in VC bargaining power and the lower amount contributed by VCs in early stages correspond to lower I^{VC} in the model of Section 5. Section 5.2 therefore predicts a greater likelihood of entrepreneur control and a lower likelihood of VC control over time, which is exactly what we observe in Figure 4. Not only VC investors are less likely to control the board during the first financing round, they are also less likely to join the board all together (solid line in Figure 5). Figure 4 also reveals that the growth in entrepreneur-controlled boards during the first financing round has been especially pronounced (from 0.3 in 2002 to 0.55 in 2013), even more so than the decline in VC-controlled boards (from 0.35 in 2002 to 0.15 in 2013). The net effect of these two trends has been a slight decrease in the fraction of startups with shared control and, correspondingly, a slight decrease in the presence of independent directors on the board (dotted line in Figure 5) and board size (dashed line in Figure 5).

Overall, the time-series dynamics of board composition and board control are broadly consistent with the mediation role of the board and bargaining story hypothesis.

6.4 Director connections

The mediation role of independent directors requires that they do not represent the sole interests of either entrepreneurs or VC investors, and instead maximize the joint welfare of both parties. Our baseline analysis defines an independent director as any director who is not affiliated with either entrepreneurs or VCs. Because such directors are jointly appointed to the board by mutual consent of entrepreneurs and VCs, it is reasonable to assume that they have incentives to preserve their reputation with both parties and thus would not favor one over the other. In addition, the fiduciary duty of the board is to maximize the interests of common stockholders, which would counteract the potential bias that independent directors may have towards VCs. Nevertheless, a potential concern is that due to their extensive networks and influence, VC investors may exercise undue influence over director appointments, which would tilt such mutually appointed directors towards favoring VCs despite their fiduciary duties.

Therefore, in this section, we use a more conservative definition of independent directors by analyzing the data on past connections between independent directors on the one hand, and VCs and/or entrepreneurs on the other. We only classify an independent director as truly independent, or "unconnected," if the director has not had prior interactions with either VC investors or entrepreneurs in any of his prior positions.

An interaction between an independent director and one of his co-directors on the board can occur one of three main ways. First, the independent director (ID) could have a past interaction via a board seat. In this interaction type, the ID's past board positions could be in the role of an ID or an investor as found in VentureSource.[23] Second, an independent director could have had a past executive or founding position at a previous startup as recorded in VentureSource and, through these past positions, could be connected to that previous startup's investors or board members. In particular, a connection or interaction with a past investor can happen because (i) the investor was a director in the past startup or (ii) was a partner at a firm of any of the investors in the past startup (e.g., a general partner at an investor that did not take a board seat). Third, the ID could have previously had an investor role such as lead

[23]Recall that we cannot observe executive directors in VentureSource outside of our data that incorporates Form Ds.

investor, investor-director, or partner at a VC firm. These past experiences introduce a wealth of possible connections through syndication and/or board seats. In sum, each pair of "investor and independent director" and "executive and independent director" on the current board can have a connection via any past investment activity, board activity, or employment within the VC industry. We then classify the independent director in such a pair to be "connected" (to the investor or executive, respectively). This connection definition is agnostic about the past roles that the ID or the other co-director played in the past (e.g., the ID could be a founder in the past, while the entrepreneur on the current board could have been a VC). Finally, if the ID is connected to *both* the entrepreneur and VC, then we effectively ignore the connections and treat this director as truly independent.

We next redefine board control given these connection classifications: we consider a director connected to VCs (entrepreneurs) through his past professional experience as a representative of VCs (entrepreneurs). Under this new definition, some startup boards that were previously classified as having shared control are now reclassified as having VC (entrepreneur) control.

Table 8 presents the descriptive statistics on director connections and the reclassification of board control. Overall, the fraction of startups that had at least one unconnected independent director gradually increases over the startup life cycle, from 31% in the first round to 50% in the fourth round, which exhibits a similar start but less steep increase than patterns observed in Table 4. Across financing rounds, between 70% and 80% of independent directors are not connected to either VCs or entrepreneurs. Directors connected to entrepreneurs are rather rare (about 1% of all independent directors), so the remaining 20%-30% of independent directors are connected to VCs. This leads to a slight reclassification of certain startups' board control: around 10% (3%) of startups with at least one independent director that were previously classified as having shared control are now classified as having VC (entrepreneur) control.

Tables 9 and 10 repeat the analysis in Tables 6 and 7, respectively, but using the new definitions of board control. This analysis reveals very similar results to those obtained without the director connections data. There is a pronounced monotonic positive (negative) relation between startup age/financing round and VC (entrepreneur) control over the board, and, similarly, there is a monotonic positive (negative) relation between proxies for VC bargaining

power and VC (entrepreneur) control over the board. Thus, our main conclusions are robust to the more conservative definition of independent directors.

7 Robustness

Our results are robust to two assumptions in the Form D data creation. First, recall that when a non-executive director listed on the Form D does not merge with a VC investor or partner at a VC investing firm, then we assign that individual as an independent director. Some of these directors were found in VentureSource or Pitchbook as independent directors, thus verifying their type. However, we could not find corroborating evidence of the independent director status in many cases. The first robustness tests reruns the full set of results after excluding any startup that has at least one such independent director assignment that did not have verification in Pitchbook or VentureSource. Implementing this rule results in a sample of 6,249 startups (14% sample loss) and no meaningful change to the main results (see Section 4.3 of the Internet Appendix).

Second, a major rule for our sample creation is the filing of at least one Form D filing over the startup's life. Some startups fail to file a Form D with every financing event, so it is possible that this rule leaves us with stale boards due to a lack of new disclosures. It effectively means that for startups that stopped filing Form D at a certain point, we rely on VentureSource to identify any changes to the board after that point. The second robustness test drops a startup from the sample if they have a known VC financing, but no Form D was filed in the previous two years. The resulting sample has 6,881 (4.5% sample loss) startups and the results are quantitatively unchanged, as shown in Section 4.3 of the Internet Appendix.

8 Conclusion

We study the determinants of board composition at VC-backed startups and its evolution from the first financing round to exit. We are particularly interested in the following questions. What are the roles of independent directors on boards of VC-backed firms? How is control over the

board allocated between VC investors, entrepreneurs, and independent directors? And how do independent directors' roles and the allocation of control over the board depend on factors such as the stage of the startup life cycle, the amount of financing provided by VC investors, and the bargaining power of the two parties?

We examine these questions using a novel dataset, which covers more than 7,200 startups from 2002 to 2017. We show that independent directors are widespread, even though their presence is not required by regulation. Moreover, they often have substantial voting power: in many cases, neither the VC-affiliated directors nor the entrepreneurs control the majority of board seats, so independent directors play a tie-breaking role, effectively making the decision whenever the two parties disagree. Such disagreements are likely to arise for issues related to the sale of the firm or its merger with another firm, subsequent financing rounds, or CEO replacement.

Our key hypothesis is that unlike in public firms, where the main roles of independent directors are monitoring and advising, an important role of independent directors in VC-backed firms is mediation. Specifically, independent directors can help mediate conflicts between VC investors and entrepreneurs on the board, which can increase both the ex-post efficiency of decisions taken by the firm and the ex-ante likelihood that the firm is financed. As the amount of financing contributed by VC investors increases or as VC bargaining power relative to the entrepreneur increases, the mediation role of independent directors becomes more important. As a result, the allocation of control over the board is likely to change from entrepreneur control, to shared control with independent directors serving as tie-breakers, and then to VC control. We show that the patterns of board composition and board control are broadly consistent with the predictions of the mediation role. We also show that over time, control over boards has shifted from VC control to greater shared and entrepreneur control, consistent with the general trend towards lower VC bargaining power that has been documented in other studies.

Overall, our results provide suggestive evidence for a previously under-explored role of independent directors. The mediation role could be relevant for other types of companies with two or more large blockholders that have conflicting interests. Thus, exploring this role further, beyond the setting of VC-backed startups, could be an interesting direction for future research.

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9 Tables and Figures

9.1 Figures

Figure 1: Board composition: counts

The figure reports the average and median number of board seats held by executives, independent directors, and venture capitalists. The x-axis is the years since first VC equity financing (i.e. when we start tracking startup boards).

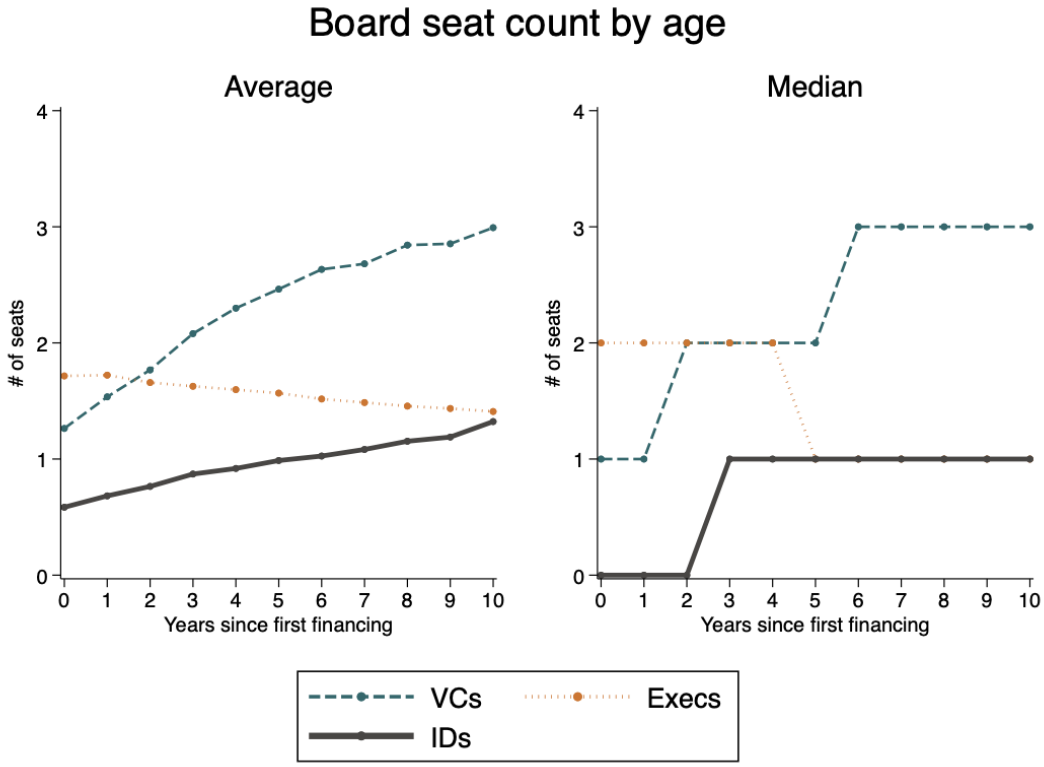


Figure 2: Board composition: percentage

The figure reports the average and median fraction of board seats held by executives, independent directors, and venture capitalists. The x-axis is the years since first VC equity financing (i.e. when we start tracking startup boards).

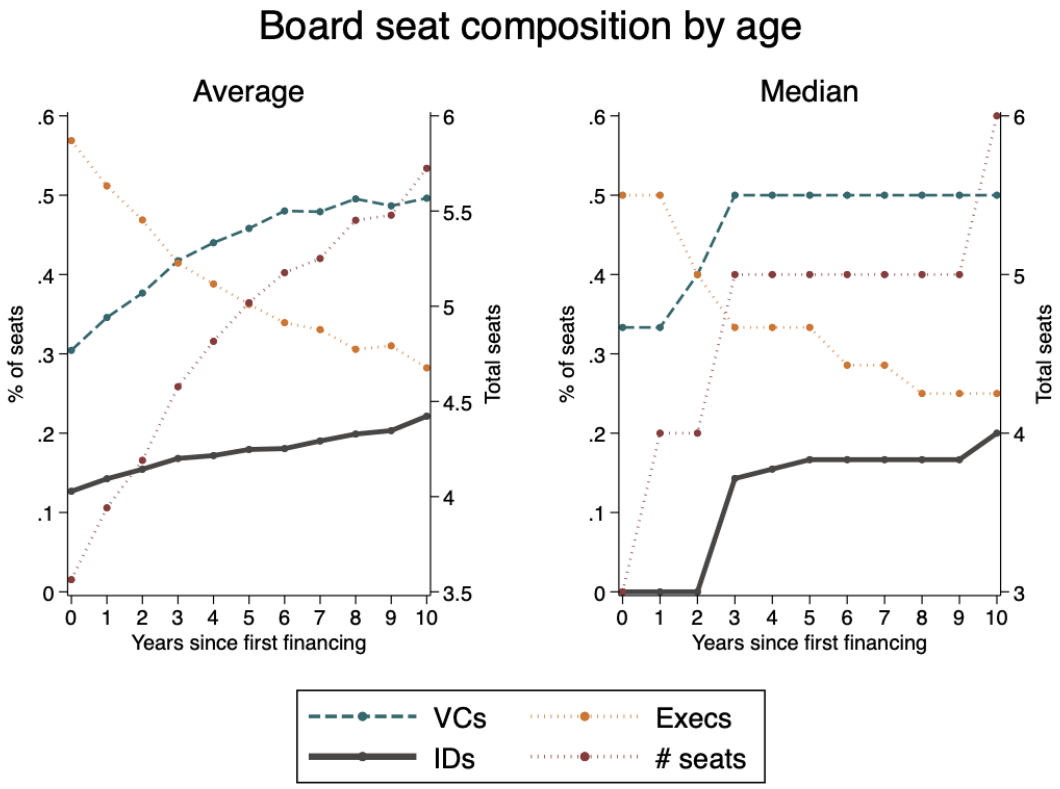


Figure 3: Board composition by exit type

The figure reports the composition of an average startup board for the years prior to either an initial public offering (IPO) or acquisition. The x-axis reports the years prior to either exit event and only considers the set of startups with some activity in those years (e.g., if a startup went public in 5 years, then their board data are only in the years [-5, 0]).

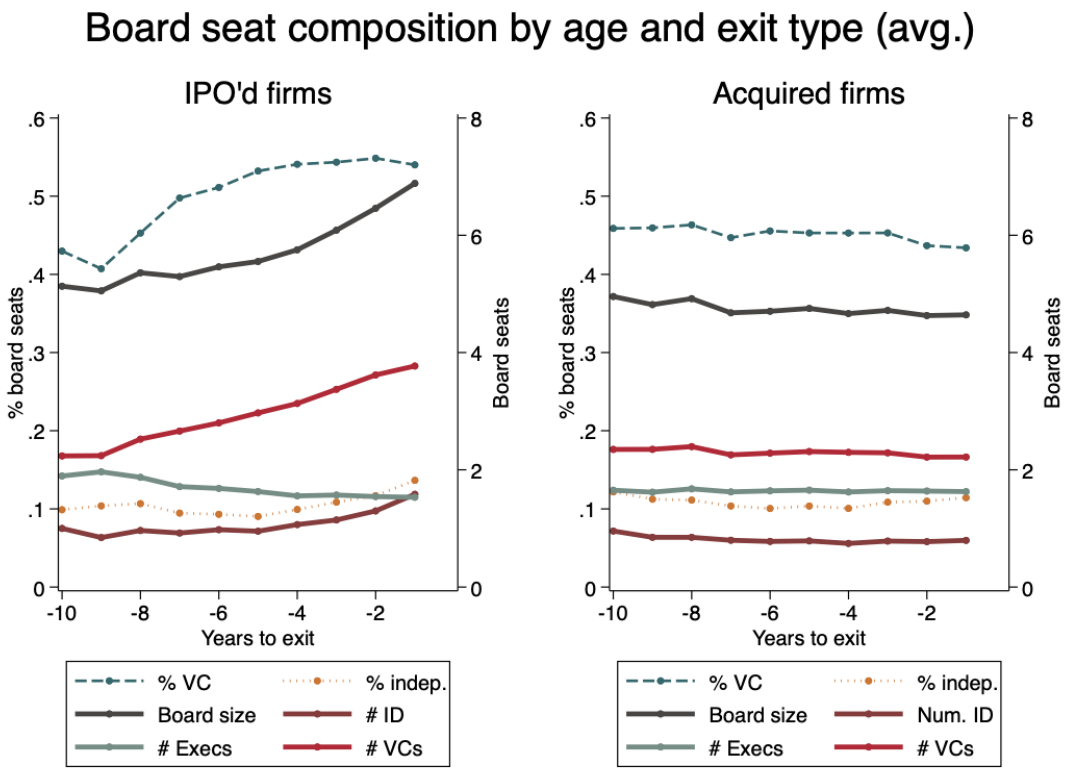


Figure 4: Percent of firms with VC and entrepreneur control over time

The figure reports the percentage of startups by year and financing round (sequence of equity financings) where the venture capitalists (investors) control more than 50% of board seats (left) and the same percentage controlled by the executives (right). What remains are startups where neither party controls the board, i.e., startups with shared control. The x-axis is the year that the startup first raised venture capital financing and thus compares cohorts of startups over their first three financing rounds. For example, the Round 3 statistics in 2002 include the set of startups first financed in 2002 that also had at least a third financing round by the end of the sample period.

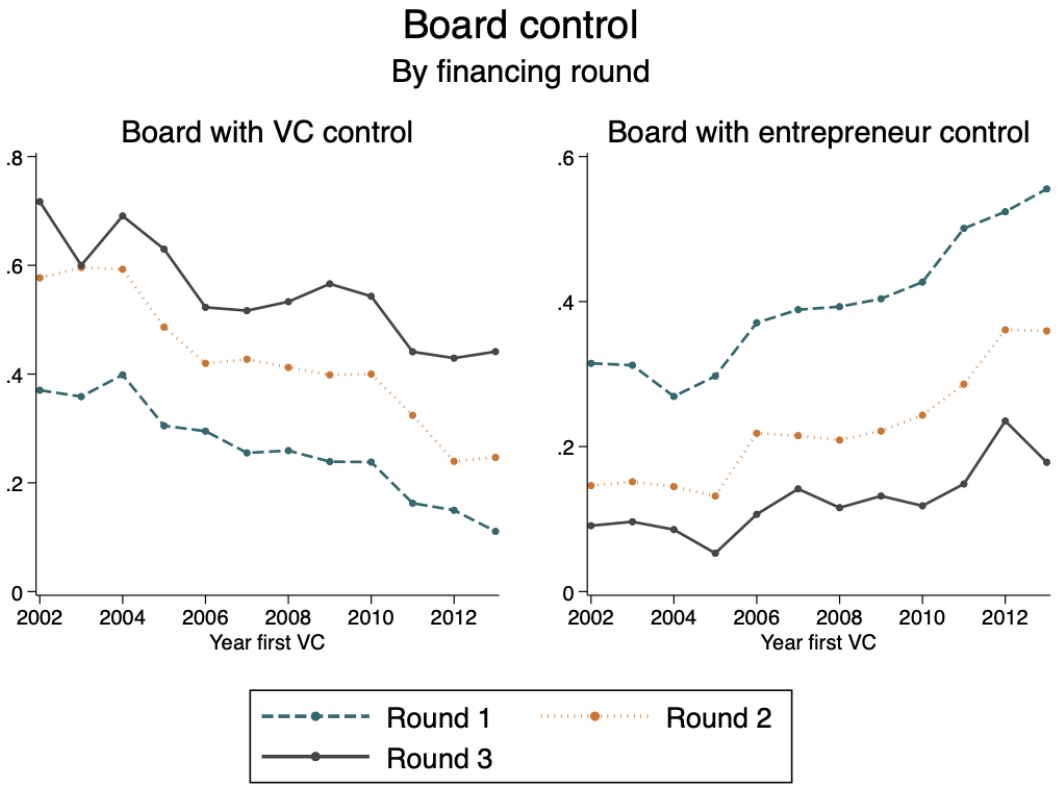


Figure 5: Boards at first financing

The left y-axis reports the percentage of startup boards (with at least one director) that have at least one independent director (dotted line) and at least one VC-director (solid line) in the year of the first VC equity financing. The right y-axis reports the average board size in the year of the first VC equity financing. The x-axis is the year of the first VC equity financing.

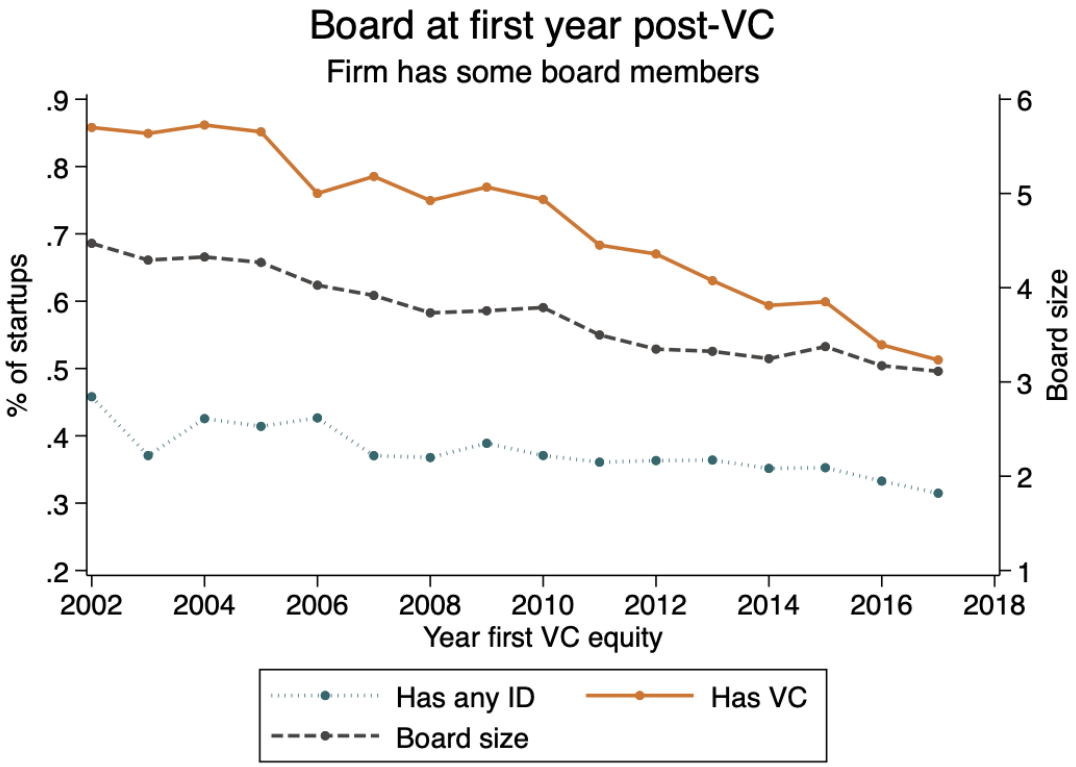


Figure 6: Board control by firm stage: Financing round number and years since first VC

The figure reports the percentage of startups by financing round. "Entrepreneur" is the percentage of startups where executives/entrepreneurs control the board, "VC" is the percentage of startups where investors control the board, and "Shared" is the percentage of startups in which neither VCs nor entrepreneurs control the board.

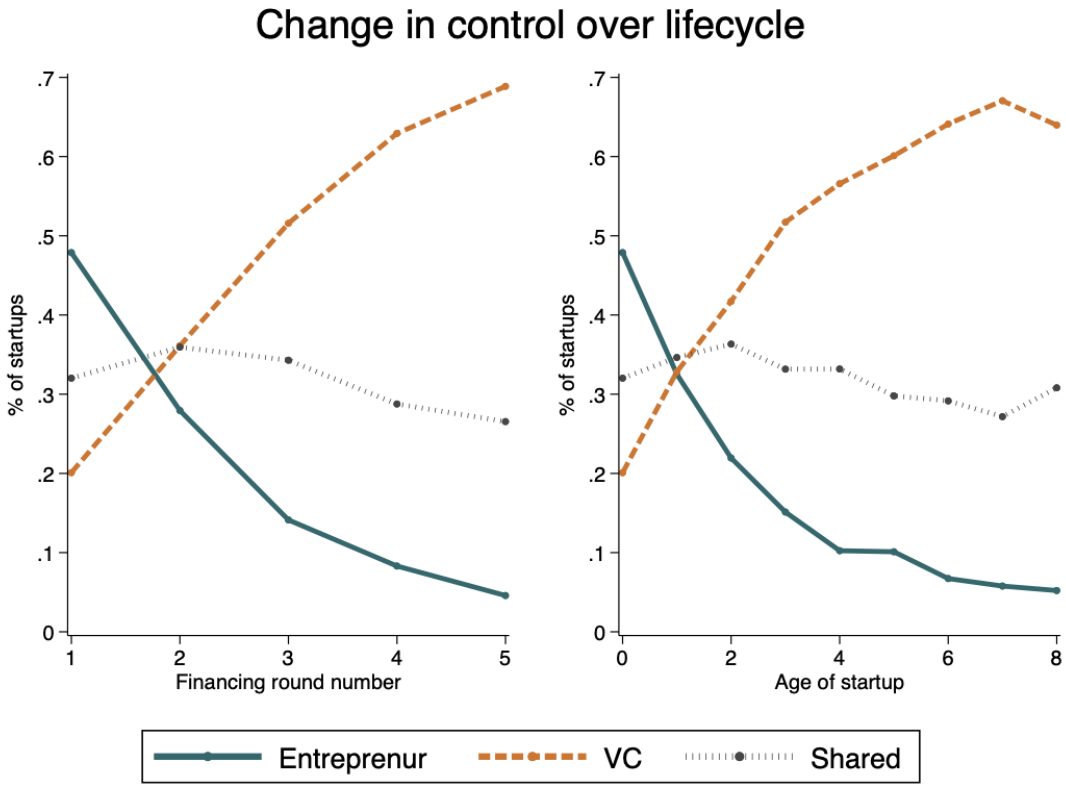
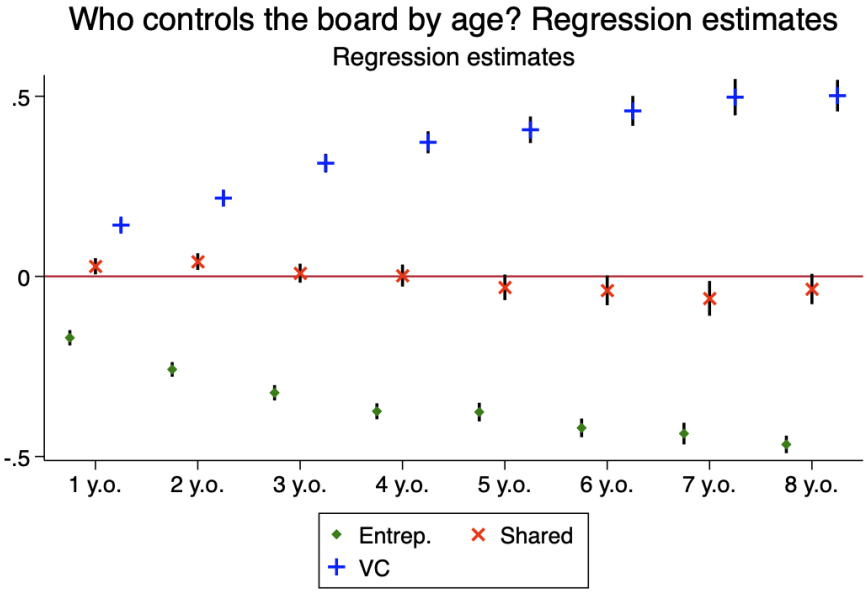
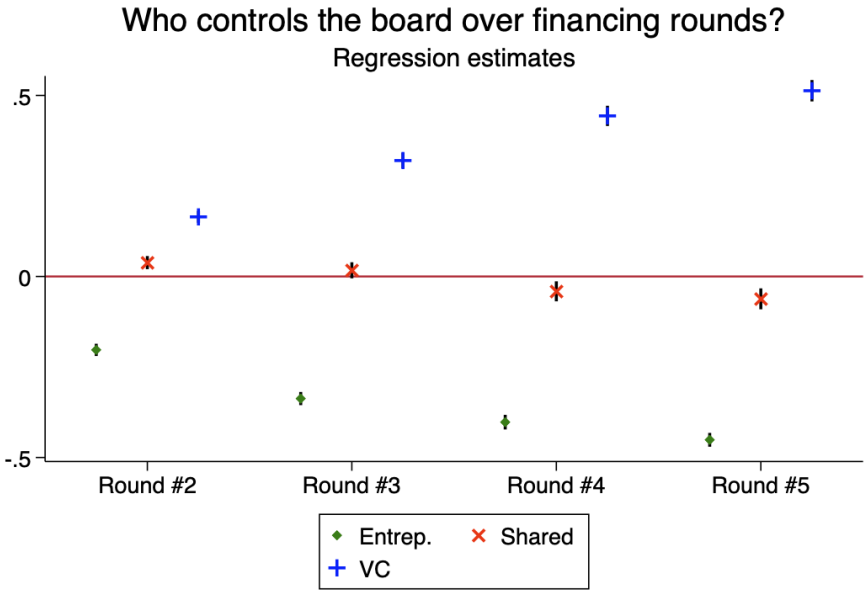


Figure 7: Board control by firm stage: Regression estimates

The figure reports the coefficient estimates (and 95% confidence intervals with robust standard errors) from the regressions reported in Table 6. The top figure reports coefficients from columns (1)-(3) for firm age, and the bottom figure reports coefficients from columns (5)-(7) for financing round. Controls in the regression include log capital raised, fixed effects for year-industry, and location fixed effects.



Age 0 is baseline. Positive values imply relatively higher probability of control by party.



Round 1 is baseline. Positive values imply relatively higher probability of control by party.

9.2 Tables

Table 1: Summary statistics: firms in and out of sample (2002–2017).

The table reports the firm-level statistics for those in and out of our sample. "In sample" startups are those that ever filed a Form D and satisfied all the conditions listed in Section 3. "Out-of-sample" startups are those that raised equity financing by at least one traditional U.S.-based VC during 2002-2017 and first round was not one of the rounds listed in footnote 4, but either (1) never filed a Form D; or (2) filed a Form D at some point but do not satisfy the conditions in Section 3, i.e., did not list any executive director over the firm's life or raised a VC financing before the first Form D. "Year first VC" is the year the startup first raised a VC equity financing. "First round Series A" is a dummy for whether that financing round was a Series A (the alternatives: Seed, Later, Growth, PE). "CA" and "MA" are dummy variables for whether the startup is headquartered in California or Massachusetts. "Total capital raised" is the sum of equity capital raised by the startup as of 2019Q3. "# equity financings" is the total number of equity financings as of the end of 2019Q3. "Had Angel or Accel. round" is a dummy variable equal to one if the startup ever had an angel financing or accelerator event. "Has Form D" is a dummy variable if the startup ever filed a Form D.

	In sample				Out-of-sample			
	Obs	Mean	Median	Std dev	Obs	Mean	Median	Std dev
Year first VC	7,201	2010.738	2011.000	4.303	7,467	2011.783	2013.000	4.179
First round Series A	7,201	0.722	1.000	0.448	7,467	0.635	1.000	0.481
CA	7,201	0.400	0.000	0.490	7,467	0.491	0.000	0.500
MA	7,201	0.099	0.000	0.299	7,467	0.068	0.000	0.252
Went public (as of 2019Q2)	7,201	0.036	0.000	0.187	7,467	0.025	0.000	0.157
Acquired (as of 2019Q2)	7,201	0.339	0.000	0.474	7,467	0.273	0.000	0.446
Total capital raised	7,125	36.999	12.640	97.073	7,033	42.313	11.000	244.870
# equity financings	7,201	2.929	3.000	1.746	7,467	2.740	2.000	1.735
Year founded	7,201	2008.631	2009.000	4.664	7,467	2010.156	2011.000	4.804
First round syndicate size	7,201	2.627	2.000	1.692	7,467	2.542	2.000	1.724
Had Angel or Accel. round	7,201	0.118	0.000	0.323	7,467	0.118	0.000	0.323
Has Form D	7,201	1.000	1.000	0.000	7,467	0.417	0.000	0.493

Table 2: Summary statistics: firm-year observations

The table reports the summary statistics for startups in our sample. Panel A summarizes the set of firm-year observations where we include all years from first VC financing to exit date. That is, the unit of observation is firm-year regardless of whether the startup raised capital in this year. For each year without a financing event, the board data are imputed from the last financing event. Panel B reports the same summary statistics for the subset of years when the startup raised at least one equity financing.

	Panel A: Firm-year; all boards					
	Obs	Mean	25th	Median	75th	Std dev
Board size	35,134	4.365	3.000	4.000	6.000	1.982
# VC directors	35,134	1.918	1.000	2.000	3.000	1.550
# executive directors	35,134	1.637	1.000	2.000	2.000	0.769
# independent directors	35,134	0.810	0.000	0.000	1.000	1.059
% VC directors	35,134	0.390	0.200	0.400	0.600	0.253
% executive directors	35,134	0.452	0.250	0.400	0.600	0.268
% independent directors	35,134	0.158	0.000	0.000	0.273	0.194
Has ID	35,134	0.492	0.000	0.000	1.000	0.500
Year	35,134	2011.822	2009.000	2012.000	2015.000	3.762
	Panel B: Firm-financing years; all boards					
	Obs	Mean	25th	Median	75th	Std dev
Board size	16,642	4.430	3.000	4.000	6.000	2.016
# VC directors	16,642	1.957	1.000	2.000	3.000	1.554
# executive directors	16,642	1.681	1.000	2.000	2.000	0.788
# independent directors	16,642	0.792	0.000	0.000	1.000	1.063
% VC directors	16,642	0.393	0.250	0.429	0.571	0.248
% executive directors	16,642	0.457	0.250	0.400	0.600	0.265
% independent directors	16,642	0.150	0.000	0.000	0.250	0.188
Has ID	16,642	0.479	0.000	0.000	1.000	0.500
Year	16,642	2011.408	2008.000	2012.000	2015.000	3.995

Table 3: Summary statistics: financing-level.

The table reports summary statistics of boards of directors for financing rounds. A financing is an equity raise by the startup.

	Boards at financing # 1					
	Obs	Mean	25th	Median	75th	Std dev
Board size	7,201	3.564	2.000	3.000	5.000	1.749
# VC directors	7,201	1.264	0.000	1.000	2.000	1.207
# executive directors	7,201	1.716	1.000	2.000	2.000	0.816
# independent directors	7,201	0.585	0.000	0.000	1.000	0.953
% VC directors	7,201	0.304	0.000	0.333	0.500	0.251
% executive directors	7,201	0.569	0.333	0.500	0.750	0.282
% independent directors	7,201	0.127	0.000	0.000	0.250	0.193
No VC directors	7,201	0.322	0.000	0.000	1.000	0.467
	Boards at financing # 2					
	Obs	Mean	25th	Median	75th	Std dev
Board size	4,502	4.515	3.000	4.000	6.000	1.817
# VC directors	4,502	1.979	1.000	2.000	3.000	1.393
# executive directors	4,502	1.724	1.000	2.000	2.000	0.782
# independent directors	4,502	0.811	0.000	1.000	1.000	1.044
% VC directors	4,502	0.407	0.250	0.429	0.571	0.230
% executive directors	4,502	0.436	0.250	0.400	0.500	0.235
% independent directors	4,502	0.156	0.000	0.118	0.250	0.187
No VC directors	4,502	0.148	0.000	0.000	0.000	0.355
	Boards at financing # 3					
	Obs	Mean	25th	Median	75th	Std dev
Board size	2,505	5.220	4.000	5.000	6.000	1.837
# VC directors	2,505	2.600	2.000	2.000	3.000	1.482
# executive directors	2,505	1.645	1.000	2.000	2.000	0.769
# independent directors	2,505	0.976	0.000	1.000	2.000	1.108
% VC directors	2,505	0.482	0.333	0.500	0.625	0.213
% executive directors	2,505	0.347	0.200	0.333	0.429	0.193
% independent directors	2,505	0.170	0.000	0.167	0.286	0.182
No VC directors	2,505	0.070	0.000	0.000	0.000	0.256
	Boards at financing # 4					
	Obs	Mean	25th	Median	75th	Std dev
Board size	1,300	5.758	5.000	6.000	7.000	1.829
# VC directors	1,300	3.100	2.000	3.000	4.000	1.571
# executive directors	1,300	1.585	1.000	1.000	2.000	0.739
# independent directors	1,300	1.074	0.000	1.000	2.000	1.131
% VC directors	1,300	0.528	0.400	0.500	0.667	0.195
% executive directors	1,300	0.297	0.167	0.250	0.400	0.160
% independent directors	1,300	0.174	0.000	0.167	0.286	0.173
No VC directors	1,300	0.033	0.000	0.000	0.000	0.179

Table 4: Summary statistics: financing-level control.

The table reports the financing-level statistics on board control.

	Boards at financing # 1					
	Obs	Mean	25th	Median	75th	Std dev
Entrepreneur control	7,201	0.479	0.000	0.000	1.000	0.500
VC control	7,201	0.201	0.000	0.000	0.000	0.401
Shared control	7,201	0.320	0.000	0.000	1.000	0.467
Has ID	7,201	0.364	0.000	0.000	1.000	0.481
	Boards at financing # 2					
	Obs	Mean	25th	Median	75th	Std dev
Entrepreneur control	4,502	0.279	0.000	0.000	1.000	0.449
VC control	4,502	0.361	0.000	0.000	1.000	0.480
Shared control	4,502	0.359	0.000	0.000	1.000	0.480
Has ID	4,502	0.505	0.000	1.000	1.000	0.500
	Boards at financing # 3					
	Obs	Mean	25th	Median	75th	Std dev
Entrepreneur control	2,505	0.141	0.000	0.000	0.000	0.348
VC control	2,505	0.516	0.000	1.000	1.000	0.500
Shared control	2,505	0.343	0.000	0.000	1.000	0.475
Has ID	2,505	0.583	0.000	1.000	1.000	0.493
	Boards at financing # 4					
	Obs	Mean	25th	Median	75th	Std dev
Entrepreneur control	1,300	0.083	0.000	0.000	0.000	0.276
VC control	1,300	0.629	0.000	1.000	1.000	0.483
Shared control	1,300	0.288	0.000	0.000	1.000	0.453
Has ID	1,300	0.632	0.000	1.000	1.000	0.482

Table 5: Control over the startup life cycle: transition probabilities

Panel A reports the percentage of switches in board control across all startup financing-years regardless of the change in board size. Panel B reports the percentage of switches in board control within the subset of financing-years where there is some change in the size of the board.

		Panel A: All financing years Board control at t		
		E	Shared	VC
Board control at $t-1$	E	57.22%	30.47%	12.31%
	Shared	5.55%	63.47%	30.98%
	VC	1.19%	9.83%	88.98%
		Panel B: Year w/ board size change Board control at t		
		E	Shared	VC
Board control at $t-1$	E	35.60%	46.61%	17.80%
	Shared	8.31%	44.34%	47.35%
	VC	1.76%	15.05%	83.19%

Table 6: Regressions of board control indicators over the startup life cycle

The table reports the OLS regression estimates for four related dependent variables. Columns (1), (2), and (3) have a dependent variable that is equal to one if the startup's board has entrepreneur control, shared control, and VC control, respectively, as defined in Section 3. Column (4) has a dependent variable that is equal to one if the board has at least one independent director. The unit of observation is a startup financing-year (i.e., a year with at least one equity financing event). The regression specification in columns 1-4 is

$$Y_{it} = \beta_0 + \sum_{s=1}^{8} \rho_s 1_{age_{it}=s} + \beta_1 K_{it} + IndustryYearFE_{it} + LocationFE_i + \varepsilon_{it},$$

where $1_{age_{it}=s}$ is the dummy for whether the startup is of age s relative to the year when the startup first raised VC equity financing. The excluded category is the year of first financing. All financings for startups greater than 8 years old are winsorized to 8 years old. K_{it} is the log of the total capital raised by the startup in financing year t. "IndustryYearFE" are fixed effects for the interactions of year and industry. "Location FE" are fixed effects for the Census division of the startup's headquarters. The regression specification in columns 5-8 is similar, but uses $1_{round_{it}=s}$ as the dummy for whether the startup is in its financing round s relative to the first VC equity financing. Robust standard errors reported in parentheses. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	E control	Shared	VC control	Has ID	E control	Shared	VC control	Has ID
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1 y.o.	-0.17***	0.028**	0.14***	0.12***				
	(0.011)	(0.011)	(0.010)	(0.012)				
2 y.o.	-0.26***	0.041***	0.22***	0.17***				
	(0.010)	(0.012)	(0.011)	(0.012)				
3 y.o.	-0.32***	0.0089	0.31***	0.21***				
	(0.011)	(0.013)	(0.013)	(0.014)				
4 y.o.	-0.37***	0.0022	0.37***	0.23***				
	(0.011)	(0.016)	(0.016)	(0.016)				
5 y.o.	-0.38***	-0.030*	0.41***	0.26***				
	(0.013)	(0.018)	(0.019)	(0.019)				
6 y.o.	-0.42***	-0.039*	0.46***	0.29***				
	(0.013)	(0.021)	(0.021)	(0.022)				
7 y.o.	-0.44***	-0.061**	0.50***	0.30***				
	(0.015)	(0.025)	(0.026)	(0.026)				
8 y.o.	-0.47***	-0.035	0.50***	0.32***				
	(0.012)	(0.022)	(0.022)	(0.022)				
Round # 2					-0.20***	0.038***	0.16***	0.14***
					(0.0086)	(0.0093)	(0.0083)	(0.0094)
Round # 3					-0.34***	0.017	0.32***	0.21***
					(0.0093)	(0.011)	(0.011)	(0.012)
Round # 4					-0.40***	-0.041***	0.44***	0.26***
					(0.010)	(0.014)	(0.014)	(0.015)
Round # 5+					-0.45***	-0.062***	0.51***	0.32***
					(0.0097)	(0.015)	(0.015)	(0.015)
Log capital raised	-0.077***	0.0035	0.073***	0.034***	-0.079***	0.0031	0.076***	0.035***
	(0.0028)	(0.0031)	(0.0029)	(0.0032)	(0.0028)	(0.0031)	(0.0029)	(0.0032)
Observations	16257	16257	16257	16257	16257	16257	16257	16257
R^2	0.21	0.014	0.20	0.092	0.21	0.015	0.20	0.093
Ind. X Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Location FE	Y	Y	Y	Y	Y	Y	Y	Y

Table 7: Regressions of board characteristics on bargaining power

The table reports regression analysis of startup boards at their first equity financing event. We ask whether the startup board is controlled by the entrepreneur (columns (1) and (5)), whether board control is shared (columns (2) and (6)), whether the board is controlled by the VC (columns (3) and (7)), and whether the board has at least one independent director (columns (4) and (8)). In Panel A, the main controls are proxies for VC bargaining power measured at the year prior to the financing round using average equity stakes acquired by VCs in the industry-year (e.g., a VC investment resulted in the sale of 30% of the as-if-converted shares). "Low VC b.p" is equal to one if the startup raised capital after a year of bottom quartile VC equity stakes in startups in the same industry across the sample period. "High VC b.p." is a dummy for the top quartile (the excluded category is the middle 50%) of VC equity stakes. Columns (5) - (8) further split the sample periods into quintiles of the bargaining power proxy with the excluded category being the middle quintile. Panel B considers an alternative proxy for bargaining power using the total capital raised by VCs in the region from 1990 up to the previous year net of the total capital invested in startups located in that region from 1996 up to that same previous year. This "dry powder" measure captures the amount of capital available to startups. A region is one of the nine Census divisions of the U.S. Because the measures are within industry or region, the variation within is coming entirely from year of first financing, so the analysis excludes year fixed effects. Robust standard errors are reported in parentheses. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	E control	Shared	VC control	Has ID	E control	Shared	VC control	Has ID
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Equity stake proxy							
Low VC b.p. (equity)	0.074***	-0.025*	-0.049***	-0.020				
	(0.016)	(0.015)	(0.011)	(0.015)				
High VC b.p. (equity)	-0.16***	0.038***	0.12***	0.025**				
	(0.013)	(0.013)	(0.011)	(0.013)				
Lowest VC b.p.					0.067***	-0.045**	-0.022	-0.025
					(0.021)	(0.020)	(0.015)	(0.020)
Low VC b.p.					0.037*	-0.019	-0.019	-0.013
					(0.020)	(0.019)	(0.013)	(0.019)
High VC b.p.					-0.082***	0.011	0.070***	0.0034
					(0.019)	(0.018)	(0.014)	(0.019)
Highest VC b.p.					-0.19***	0.046***	0.14***	0.030*
					(0.017)	(0.016)	(0.013)	(0.016)
Observations	7199	7199	7199	7199	7199	7199	7199	7199
R^2	0.060	0.0074	0.061	0.031	0.069	0.0094	0.065	0.032
Mean dep. var.	0.48	0.32	0.20	0.36	0.48	0.32	0.20	0.36
	Panel B: Dry powder proxy							
Low VC b.p. (dry powder)	0.046***	-0.013	-0.033***	-0.015				
	(0.014)	(0.014)	(0.011)	(0.014)				
High VC b.p. (dry powder)	-0.016	-0.011	0.027**	-0.0050				
	(0.014)	(0.013)	(0.011)	(0.013)				
Lowest VC b.p.					0.041**	-0.016	-0.025	-0.012
					(0.021)	(0.020)	(0.016)	(0.020)
Low VC b.p.					0.069***	-0.0075	-0.062***	0.016
					(0.019)	(0.018)	(0.014)	(0.018)
High VC b.p.					-0.0099	-0.0044	0.014	0.019
					(0.019)	(0.018)	(0.015)	(0.018)
Highest VC b.p.					-0.0066	-0.013	0.019	0.012
					(0.017)	(0.016)	(0.014)	(0.016)
Observations	7199	7199	7199	7199	7199	7199	7199	7199
R^2	0.031	0.0051	0.038	0.030	0.033	0.0051	0.040	0.031
Mean dep. var.	0.48	0.32	0.20	0.36	0.48	0.32	0.20	0.36
Year FE	N	N	N	N	N	N	N	N
Ind. FE	Y	Y	Y	Y	Y	Y	Y	Y
Location FE	Y	Y	Y	Y	Y	Y	Y	Y

Table 8: Summary statistics: financing-level connected IDs.

The table reports the financing-level statistics on connected IDs. "Had unconnected ID" is the fraction of all financing-level observations that had at least one director unconnected to either the VC or the entrepreneur. We then focus on the subsample of financing-level observations that have at least one independent director. Within this sample, "% IDs unconnected" is the fraction of independent directors that are unconnected to either VCs or entrepreneurs, and "% IDs VC-connected" ("% IDs Entrep.-connected") is the fraction of independent directors connected to VCs (entrepreneurs) through their past professional positions. "Change to VC control w/ conn." ("Change to entrep. control w/ conn.") is the percent of observations in this sample that were classified as having shared control without the data on connections, but were reclassified as having VC (entrepreneur) control based on director connections.

	Boards at financing # 1					
	Obs	Mean	25th	Median	75th	Std dev
Had unconnected ID	7,201	0.311	0.000	0.000	1.000	0.463
% IDs unconnected	2,618	0.797	0.667	1.000	1.000	0.364
% IDs VC-connected	2,618	0.192	0.000	0.000	0.250	0.355
% IDs Entrep.-connected	2,618	0.011	0.000	0.000	0.000	0.098
Change to VC control w/ conn.	2,618	0.101	0.000	0.000	0.000	0.302
Change to entrep. control w/ conn.	2,618	0.029	0.000	0.000	0.000	0.167
	Boards at financing # 2					
	Obs	Mean	25th	Median	75th	Std dev
Had unconnected ID	4,502	0.416	0.000	0.000	1.000	0.493
% IDs unconnected	2,272	0.752	0.500	1.000	1.000	0.388
% IDs VC-connected	2,272	0.236	0.000	0.000	0.500	0.381
% IDs Entrep.-connected	2,272	0.012	0.000	0.000	0.000	0.103
Change to VC control w/ conn.	2,272	0.124	0.000	0.000	0.000	0.329
Change to entrep. control w/ conn.	2,272	0.020	0.000	0.000	0.000	0.139
	Boards at financing # 3					
	Obs	Mean	25th	Median	75th	Std dev
Had unconnected ID	2,505	0.475	0.000	0.000	1.000	0.499
% IDs unconnected	1,461	0.725	0.500	1.000	1.000	0.393
% IDs VC-connected	1,461	0.264	0.000	0.000	0.500	0.388
% IDs Entrep.-connected	1,461	0.011	0.000	0.000	0.000	0.093
Change to VC control w/ conn.	1,461	0.136	0.000	0.000	0.000	0.342
Change to entrep. control w/ conn.	1,461	0.011	0.000	0.000	0.000	0.104
	Boards at financing # 4					
	Obs	Mean	25th	Median	75th	Std dev
Had unconnected ID	1,300	0.498	0.000	0.000	1.000	0.500
% IDs unconnected	822	0.697	0.500	1.000	1.000	0.406
% IDs VC-connected	822	0.293	0.000	0.000	0.500	0.402
% IDs Entrep.-connected	822	0.010	0.000	0.000	0.000	0.088
Change to VC control w/ conn.	822	0.127	0.000	0.000	0.000	0.333
Change to entrep. control w/ conn.	822	0.011	0.000	0.000	0.000	0.104

Table 9: Regressions of board control indicators over the startup life cycle (with connections)

This table is the analog of Table 6, but using the data on director connections to define board control. The table reports the OLS regression estimates for four related dependent variables. Columns (1), (2), and (3) have a dependent variable that is equal to one if the startup's board has entrepreneur control, shared control, and VC control, respectively, as defined in Section 3, where a director connected to VCs (entrepreneurs) is considered as a representative of VCs (entrepreneurs) in the definition of board control. Column (4) has a dependent variable that is equal to one if the board has at least one unconnected independent director. The unit of observation is a startup financing-year (i.e., a year with at least one equity financing event). All startup financings for startups greater than 8 years old are winsorized to 8 years old. All variables are as defined in Table 6. Robust standard errors reported in parentheses. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	E control	Shared	VC control	Has unc. ID	E control	Shared	VC control	Has unc. ID
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1 y.o.	-0.17***	0.0065	0.16***	0.083***				
	(0.0090)	(0.010)	(0.0091)	(0.0093)				
2 y.o.	-0.25***	0.0062	0.25***	0.12***				
	(0.0092)	(0.011)	(0.010)	(0.010)				
3 y.o.	-0.32***	-0.033***	0.35***	0.16***				
	(0.010)	(0.012)	(0.012)	(0.013)				
4 y.o.	-0.37***	-0.049***	0.42***	0.16***				
	(0.011)	(0.014)	(0.015)	(0.016)				
5 y.o.	-0.37***	-0.077***	0.45***	0.19***				
	(0.013)	(0.016)	(0.018)	(0.019)				
6 y.o.	-0.42***	-0.096***	0.51***	0.20***				
	(0.013)	(0.019)	(0.020)	(0.023)				
7 y.o.	-0.43***	-0.10***	0.53***	0.21***				
	(0.016)	(0.023)	(0.025)	(0.028)				
8 y.o.	-0.46***	-0.11***	0.56***	0.20***				
	(0.014)	(0.023)	(0.025)	(0.030)				
Round # 2					-0.20***	0.012	0.19***	0.10***
					(0.0086)	(0.0090)	(0.0085)	(0.0093)
Round # 3					-0.33***	-0.028***	0.36***	0.15***
					(0.0092)	(0.011)	(0.011)	(0.012)
Round # 4					-0.40***	-0.089***	0.49***	0.18***
					(0.010)	(0.013)	(0.013)	(0.015)
Round # 5+					-0.45***	-0.13***	0.57***	0.22***
					(0.0096)	(0.013)	(0.014)	(0.016)
Log capital raised	-0.076***	-0.0079**	0.084***	0.027***	-0.079***	-0.0085***	0.087***	0.028***
	(0.0038)	(0.0037)	(0.0042)	(0.0049)	(0.0028)	(0.0029)	(0.0029)	(0.0032)
Observations	16257	16257	16257	16257	16257	16257	16257	16257
R^2	0.20	0.019	0.23	0.064	0.21	0.021	0.24	0.064
Ind. X Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Location FE	Y	Y	Y	Y	Y	Y	Y	Y

Table 10: Regressions of board characteristics on bargaining power (with connections)

This table is the analog of Table 7, but using the data on director connections to define board control. The table reports regression analysis of startup boards at their first equity financing event. We ask whether the startup board is controlled by the entrepreneur (columns (1) and (5)), whether board control is shared (columns (2) and (6)), whether the board is controlled by the VC (columns (3) and (7)), and whether the board has at least one unconnected independent director (columns (4) and (8)). In Panel A, the main controls are proxies for VC bargaining power measured at the year prior to the financing round using average equity stakes acquired by VCs in the industry-year (e.g., a VC investment resulted in the sale of 30% of the as-if-converted shares). "Low VC b.p" is equal to one if the startup raised capital after a year of bottom quartile VC equity stakes in startups in the same industry across the sample period. "High VC b.p." is a dummy for the top quartile (the excluded category is the middle 50%) of VC equity stakes. Columns (5) - (8) further split the sample periods into quintiles of the bargaining power proxy with the excluded category being the middle quintile. Panel B considers an alternative proxy for bargaining power using the total capital raised by VCs in the region from 1990 up to the previous year net of the total capital invested in startups located in that region from 1996 up to that same previous year. This "dry powder" measure captures the amount of capital available to startups. All variables are as defined in Table 7. Robust standard errors reported in parentheses. We use ***, **, and * to denote significance at the 1%, 5%, and 10% level (two-sided), respectively.

	E control	Shared	VC control	Has unc. ID	E control	Shared	VC control	Has unc. ID
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Equity stake proxy							
Low VC b.p. (equity)	0.076***	-0.021	-0.054***	-0.0089				
	(0.016)	(0.014)	(0.012)	(0.015)				
High VC b.p. (equity)	-0.16***	0.029**	0.13***	0.011				
	(0.013)	(0.012)	(0.012)	(0.012)				
Lowest VC b.p.					0.074***	-0.054***	-0.019	-0.020
					(0.021)	(0.019)	(0.016)	(0.020)
Low VC b.p.					0.043**	-0.018	-0.025*	0.0017
					(0.020)	(0.018)	(0.014)	(0.019)
High VC b.p.					-0.075***	-0.0044	0.079***	-0.0054
					(0.019)	(0.018)	(0.015)	(0.018)
Highest VC b.p.					-0.18***	0.021	0.16***	0.013
					(0.017)	(0.016)	(0.014)	(0.016)
Observations	7199	7199	7199	7199	7199	7199	7199	7199
R^2	0.062	0.0057	0.068	0.025	0.070	0.0068	0.074	0.026
Mean dep. var.	0.47	0.29	0.24	0.31	0.47	0.29	0.24	0.31
	Panel B: Dry powder proxy							
Low VC b.p. (dry powder)	0.043***	-0.0082	-0.034***	-0.0083				
	(0.014)	(0.013)	(0.012)	(0.013)				
High VC b.p. (dry powder)	-0.013	-0.023*	0.036***	-0.0044				
	(0.014)	(0.013)	(0.012)	(0.013)				
Lowest VC b.p.					0.037*	-0.020	-0.017	-0.0024
					(0.021)	(0.019)	(0.017)	(0.019)
Low VC b.p.					0.061***	-0.0015	-0.059***	0.012
					(0.019)	(0.017)	(0.015)	(0.017)
High VC b.p.					-0.019	-0.0078	0.027*	0.0082
					(0.018)	(0.017)	(0.016)	(0.017)
Highest VC b.p.					-0.0077	-0.027*	0.034**	0.0068
					(0.017)	(0.016)	(0.015)	(0.016)
Observations	7199	7199	7199	7199	7199	7199	7199	7199
R^2	0.032	0.0045	0.043	0.025	0.034	0.0047	0.046	0.025
Mean dep. var.	0.47	0.29	0.24	0.31	0.47	0.29	0.24	0.31
Year FE	N	N	N	N	N	N	N	N
Ind. FE	Y	Y	Y	Y	Y	Y	Y	Y
Location FE	Y	Y	Y	Y	Y	Y	Y	Y

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