

# Executive Turnover in Venture-backed Entrepreneurial Firms

Michael Ewens and Matt Marx\*

November 25, 2013

Preliminary and incomplete, please do not cite.

## Abstract

Myriad studies of public companies have tied CEO replacement to various factors including firm performance. We know much less about the dynamics of executive turnover in smaller, privately-held ventures. We provide the first such large-scale analysis, augmenting VentureSource with hand-coding of arrival and departure dates for tens of thousands of executives at thousands of VC-backed companies. The resulting data includes 7,242 executive transitions in 13,298 firms. In contrast to prior work, we find that executive turnover is not limited to “professionalization” but is driven specifically by corrective action surrounding poor firm performance as well as taking advantage of “hot” liquidity markets. The importance of these signals in turnover decisions depends on the strength of the VC board and investor composition. These results describe when and how investors exercise the control rights contractually afforded them.

---

\*Ewens: Carnegie Mellon University - Tepper School of Business (mewens@cmu.edu). Marx: MIT – Sloan School of Business (mmarx@mit.edu). Both authors recognize the support of the Kauffman Junior Faculty Fellowship. We thank David Denis and the participants at the Duke Strategy Conference for their comments. The VentureSource data is provided by Correlation Ventures, to which Ewens is an advisor and investor

# 1 Introduction

One of the key roles played by venture capital investors is monitoring the progress of portfolio companies. Monitoring may involve several activities including staged infusions of capital (Gompers (1995)), collaborating on business strategy (Hsu (2006)), and replacing key executives. The Kaplan and Strömberg (2004) study of VC contracts documents this power to replace executives and finds that asymmetric provisions grant VCs strong control rights when startups do not develop as expected. Thus entrepreneurial founders and early executives may pay the price for access to the capital and expertise that VCs bring.

The desire for such rights is understandable given the dim prospects for liquidity events coupled with the frequent attribution of such failures to problems with the executive team of the startup (Gorman and Sahlman (1989); Kaplan and Strömberg (2004)). Although this control right is believed to be a crucial way to solve agency problems in financing entrepreneurial firms, very little is known about whether, when, and how such rights are actually exercised. Thus, we have only limited insight into patterns of executive turnover in startup companies.

By comparison, an extensive literature chronicles several strong patterns regarding CEO and executive turnover in public firms. CEOs are forcibly removed after poor firm performance (e.g. Parrino (1997)), changes in market outcomes (Kaplan and Minton (2012)) or even after industry peers improve (e.g. Jenter and Kanaan (Forthcoming)). These responses are often tempered or amplified by the strength of outsiders on the corporate board (e.g. Weisbach (1988)). With a few exceptions, this rich understanding of corporate governance in public firms is missing in the study of high-growth entrepreneurial firms.

Documenting differences in executive turnover between public and private firms is fruitful given unique features of the venture capital market. Extant evidence on executive turnover shows patterns not found in public firms, including that firm success breeds turnover. Either the path to IPO (e.g. Kaplan, Sensoy and Strömberg (2009) or meeting milestones Wasserman (2003)), can increase turnover rates even for well-performing executives. This perhaps counter-intuitive relationship is a by-product of the “professionalization” role of VCs that often follows from success (Hellmann and Puri (2002)). Moreover, the separation of ownership and control in public firms – mitigated

through board of directors – is less pronounced in the high-growth entrepreneurial firm. Ownership by VCs as shareholder representatives is substantial compared to firms in the public sphere. Finally, whereas public boards may be focused on generally growing the stock price, the VC-backed firm aims for a particular liquidity event. Thus, the relationship between firm, industry and market performance and turnover could be substantially different.

This paper documents when and how VCs exert their control rights to replace executives in portfolio companies. Motivated by the themes of public firm corporate governance, we then ask how turnover is related to firm performance. The performance relationship extends to address whether industry trends such as capital availability can explain executive turnover. Finally, we investigate how and when VC board members incorporate these firm and market signals. Using variation in board investor characteristics, we ask whether either tempers or amplifies responses to performance signals.

We shine light on the involvement of investors in imperiled portfolio companies by tracking executive replacement among the population of VC-backed ventures from 1992 through 2012 as identified by VentureSource and augmented by additional collection of individual biographies. Many join dates of executives – and thus transition dates – are missing, so several web sources, Capital IQ and online resumes supplemented over 6000 executive biographies. The database is combined with the NETS data on employment and sales figures to produce measures of firm-level time-varying characteristics. We consider all executives at the CEO, “CXO” and VP level for firms with at least two financing events. The final sample includes 13,298 with 51,393 covering firms founded between 1992 and 2008. There are a total of 7,242 in 3,905 firms. The annual rate of CEO turnover is approximately 5%, while 14% of entrepreneurial firms exhibit at least one turnover. Some 15% of executives in the sample are ever replaced. The resulting data and transitions exceeds even the samples of public firms studied in the literature.

We answer the questions posed above in two ways. The first is a executive-level cross-sectional analysis that seeks to isolate the determinants of turnover. Covariates of interest include title, VC characteristics, board characteristics at join and capital raised. The second strategy considers a general hazard model of executive turnover, where a unit of observation is the entrepreneurial

firm financing. An executive turnover can occur on or after a financing, provided a set of dates at which we can measure time-varying firm and industry characteristics is available. Here we ask how changes to firm prospects or the industry capital availability impact the turnover risk for entrepreneurial executives.

The first analysis asks how executive turnover at the firm level correlates with firm success. Extant studies of entrepreneurial firm turnover events use samples of successful firms, so one might predict a positive correlation. In fact, an analysis of over 9,200 entrepreneurial firms show that any turnover implies a 19% (22%) lower probability of an IPO (IPO or acquisition). Interestingly, the characteristics of the turnover have differential correlations. CEO turnover has a negative relationship with IPO success and switches sign for IPOs. Further, other C-level executive turnovers predict positive changes to successful exits. The replacement of founders only negatively correlates with the IPO or acquisition outcome. These raw relationships suggest that the type and timing of transitions have significant and interesting heterogeneity.

Our first exploration of this heterogeneity is the cross-sectional executive characteristics that predict turnover. In a sample of 51,393 executives, several correlations stand out. Founders are at the lowest risk of turnover in the set of all top executives. This result is surprising as the benchmark from earlier studies with higher turnover rates focused solely on CEOs. Next, cross-sectional differences in an executive's first VC syndicate, syndicate size or whether they join with a new investor have little predictive power. In contrast, an executive's past connection to a syndicate member and board size at join has some positive predictive power. The former result is surprising given the VCs has better knowledge about the familiar executive. Finally, we find a strong pecking order by executive title with CEOs at the most risk and VPs at the least. Capital raised at the executive's join date attenuates the rate of turnover. Larger capital raises typically imply higher valuations and possibly more equity held by non-investors. These facts are new, but do not yet reveal how boards, VCs and executives interact.

We next investigate whether executive replacement is connected to poor performance of the startup. Given that the population is private firms, we cannot rely on stock prices but instead create a proxy in terms of whether the firms' next round of financing arrives unusually late as

compared to others in the same industry and of the same vintage. A large literature on public firm governance (e.g. Parrino (1997), Denis and Denis (1995), Jenter and Lewellen (2010) and Taylor (2010)) asks when turnover occurs and its ramifications. The variable captures how an entrepreneurial firm behaved in between its financing events when either capital was difficult to raise or the firm struggled to meet internal targets. Firms that enter the state we call “living dead” are 25% less likely to IPO, raise more capital and exit at lower valuations. For turnover, firms that enter living dead see an increase in turnover rate of 60%. We also construct a metric for good news at the firm called “Improved prospects.” The variable captures time-variation in employment growth, capital raising and revenue production. Changes in good news also positively predict turnover, but on a much smaller scale than “living dead.” As these turnovers are more likely tied to the “professionalization” studied in the literature, we believe these more common bad news transitions are an important area for study.<sup>1</sup>

The analysis of firm performance and turnover for left tail outcomes mirrors results in the corporate governance literature, while the right tail responses are likely unique to the high-growth entrepreneurial firm. An additional turnover response variable studied for public firms are market and industry signals. Historically, it was difficult to find evidence that public boards respond to market news outside the control of the executives with turnover. More recent work on Jenter and Kanaan (Forthcoming) suggests that boards do in fact use industry and peer performance in their turnover decisions. We next ask similar questions for VC-backed firms with measures of industry exits and industry inflows. Changes in the exit environment of the firm’s industry signal improved prospects for investors or changes in the competitive landscape, while increase in capital inflows show a “hot” market with inflating values and new entrants. Repeating the empirical strategy for firm performance, we find that both contemporaneous industry exits and inflows predict significantly higher turnover rates. Insofar as such transitions are board-driven, it appears that investors respond to good and bad industry news with changes at the executive-level.

Finally, we ask how the sensitivity of turnover to firm and industry performance changes with investor and board characteristics. For example, stronger boards for investors could be more

---

<sup>1</sup>Our focus is of course on observable bad news, so what we find may be an underestimate of the true relationships.

responsive to bad firm performance, while less investor control could give executives more freedom when competitive pressures increase. Using several proxies for board composition, a variable for a new investor and new board member, we show that performance sensitivity depends on board strength. Larger boards are more responsive to both good and bad news at the firm-level. Larger VC boards and more experienced VCs are less likely to respond to dramatic shifts in industry inflows. Also, when an executive and investor concurrently join a firm, the subsequent response of turnover to improved firm prospects is almost completely dampened. The differential impact of good and bad news implies a important information processing role of VC boards that has thus far been unexplored.

This paper contributes to two strands of literature. The first studies the financing and governance of the high-growth entrepreneurial firm financing by venture capital. The second strand studies corporate governance in general, with a typical application to public firms, their boards of directors and CEOs. Ours is the first paper to deliver large-sample analysis of executive turnover in privately-held companies. While many have studied this phenomenon in the context of large, publicly-held companies, the only prior articles on private firms use smaller samples focused just on the CEO. We find sharp contrasts with public-company turnover, pointing to a more activist role of venture boards as they attempt to guide the startup toward a liquidity event. They do so by replacing executives when the firm is doing poorly, which extends a nascent literature on failing venture-backed firms. Beyond work using Census data in Puri and Zarutskie (2012), our study is one of the first in the venture capital literature to measure and study entrepreneurial firms performing poorly.

More generally, we contribute to a perennial debate in the venture capital literature regarding the value of the VC firm and partner (e.g. Ewens and Rhodes-Kropf (2013) and Hellmann and Puri (2002)). To date, value added by investors has primarily been found at the point of investment selection or the monitoring of firms as they grow. Given that the majority of entrepreneurial firms fail, establishing that investors (attempt to) add value by replacing executives in imperiled ventures is an important perspective of this aspect of financial intermediation.

## 2 Predictions and literature

Two literatures inform our analysis of executive turnover in entrepreneurial firms: corporate governance of public firms and financial intermediation with venture capital. The corporate governance literature asks whether firm performance, market outcomes and governance differences can explain the variation of executive turnover in public firms. A vast literature documents a connection between firm performance and forced turnover, suggesting the both that boards play an important monitoring goal and that studies of the impacts of turnover need must be cautious of mean reversion. Parrino (1997) shows that performance can explain forced turnover and also helps understand who replaces the exiting CEO. Hermalin and Weisbach (1988) show that poor firm performance leads to CEO replacement, while a newer study by Jenter and Lewellen (2010) finds similar patterns. Relatively unexplored is whether these same variables can help us understand similar patterns in VC-backed high-growth entrepreneurial firms.

Consider first a signal of poor firm performance. Research on VC contracts (e.g. Kaplan and Strömberg (2003)) tells us that these are states of the world where investors have disproportionate power relative to their equity stakes. We would expect to see significantly more turnover in these states. Despite these clear predictions, the empirical evidence on turnover in VC-backed firms is predominantly focused in good states of the world. Both Kaplan, Sensoy and Strömberg (2009) and Wasserman (2003) have a major focus on successful outcomes and both find high rates of turnover. Yet studies of venture capital investment returns (e.g. Korteweg and Sorensen (2010)) show that failure is the norm for these entrepreneurial firms. Our first goal is to estimate the relative rates of turnover in bad times compared to all other states of the world. We would expect to see turnover increase in both the right and left tails of firm performance, the former having a higher risk of turnover.

Following the literature on the relationship between market performance and turnover, we next ask how time-varying characteristics can explain turnover. How, if at all, should changes in the firm's industry impact turnover? The compensation contracts of top management in VC-backed firms typically include a collection of vested and un-vested common equity, which are rarely tied to complex relative performance metrics. A large literature on public firms provides guidance. Jenter

and Kanaan (Forthcoming) find a strong relationship between market and industry shocks to CEO turnover, which counters predictions of many governance models. One prediction of nearly all models of optimal compensation contracts is their insensitivity to market-level shocks. Holmstrom (1982) shows that optimal compensation contracts should include benchmarks for relative performance when firms are in more competitive industries, however, market level changes do not factor into the contract. Of course, the entrepreneurial firm backed by VC operates in a unique environment compared to the public firm, so one may predict results would change. Other studies find mixed evidence for a relationship between the market and turnover. Aggarwal and Samwick (1999) find little evidence in the cross-section of relative performance pay, however, it does exist in less competitive industries. Kaplan and Minton (2012) find evidence of a relationship between overall stock market performance and turnovers driven by insiders (rather than mergers or acquisitions).

How do these empirical patterns and theories guide predictions about similar issues for VC-backed firms? The typical entrepreneurial firm operates in a new, highly competitive industry where it sits at a disadvantage to well-resourced incumbent firms, and chances of failure are high. It is likely then that industry changes – exit markets or capital availability – could have dramatic consequences on the firm. Further, an executive’s human capital can be closely tied to a narrow segment of an industry or business model. If market changes provide information about future value of these markets, they can in turn inform understanding of executive value. Of course, one can also argue that boards should not punish executives for changes that are plausibly out of their control. These alternatives provide interesting competing predictions that we take to the data below.

Next, we perform a basic analysis on the role of the venture capital board. As Lerner (1995) shows, there is a strong connection between outside board membership and the need for monitoring, suggesting that VC board members actively monitor. Kaplan and Strömberg (2004) show that board rights are an important control mechanism and are often state-contingent, particular in the left-tail of firm performance. We follow Weisbach (1988) and ask whether the sensitivity to firm performance or industry characteristics varies with proxies of outside (VC) board control and composition.<sup>2</sup> Our empirical approach also mimics Yermack (1996) who looks at overall board size

---

<sup>2</sup>Also see Guo and Masulis (2012) who use a change in board governing laws to show a relationship between board independence and turnover sensitivity.

and performance sensitivity. We discuss below how data limitations result in a hybrid of these two strategies.

To summarize, our analysis comprises three parts. The first documents the cross-sectional characteristics of executive turnover to provide a benchmark comparison to the large set of fact for public firms. Second, we look at the dynamics of turnover and its relation to two performance metrics: the firm and the “market.” The market will include measures of industry exit opportunities and capital availability. Third, we ask how response to changes in performance and board structure interact to address questions of how the VC board realizes its control rights.

### 3 Data and variables

The data comes from three sources. We begin with the management and executive team data available from Venture Source. Venture Source is a database of venture capital transactions, entrepreneurial firms, investments and outcomes provided by Dow Jones.<sup>3</sup> The data includes the full set of top-level managers, executives and investor board members. Important for this study, we observe an individual executive’s title and whether there are multiple individuals with the same title. Such an instance forms the basis of our measurement of transitions. Unfortunately, the dates an individual exits or joins the firm is missing in approximately 70% of the observations.

The large fraction missing join dates in VentureSource hinders our ability to match observables to executives and identify the timing of turnovers. Thus, we supplement the management data with outside data collection via several of online resources to date exit and entry to the management team. Sources include company websites, Capital IQ, Zoominfo and public LinkedIn resumes. These sources typically include an online biography or resume which can date the beginning of tenure and if there is a transition, the end. From this collection, we are able to add the join date for more than 6200 additional executives (1063 are executives who are never replaced).<sup>4</sup> Not all executives are simply replaced and exit the firm. Instead, an executive can be promoted or demoted and remain with the firm. VentureSource does not track the individual’s title history, however, we

---

<sup>3</sup>The data is graciously provided by Correlation Ventures, a quantitative VC fund.

<sup>4</sup>The data collection and cleaning continues as of 11/2013, so the sample size will only increase in future drafts.

are able to determine 768 individual changes in title with biography strings. These demotions and promotions identify the first position at the firm, which we use to re-assign the individual’s title for the turnover search. The data from which we sample includes 51,393 executives with a known join date in 13,298 entrepreneurial firms.

Several corporate governance questions relate turnover to time-varying firm performance. Firms in our sample lack rich financials or traded stock, however we do have some employment and sales data provided by NETS. NETS collects the annual Dun and Bradstreet firm characteristics, creating a panel dataset of a large set of U.S. firms. The NETS data was merged with VentureSource startups using a combination of company name, location and industry classification. From this, we are able to calculate employment and sales growth for a large fraction of the startups in the sample. Table 2 presents summary statistics on the firms for which we could and could not identify the dates of transition. Firms that lack transition dates are different in several dimensions: they are younger, raise less initial capital and have fewer financing rounds. Similarly, they fail at a 80% higher rate. It appears that the missing dates could be a consequence of short-lived firms that either VentureSource could not fully survey or who executives did not report online. Simply, many firms may chose to shut down rather than change executives.

### **3.1 Executive turnover**

Executive transitions are identified as follows. The first step is to identify groups of people who held the same title within the same firm. We normalize job titles both by level (e.g., “VP” and “Vice President”) and by function (e.g., “Software Development” vs. “Software Engineering”) while being careful not to lump together titles at the same level and in the same function that are nonetheless distinct (e.g., “VP North American Sales” and “VP International Sales”). Fortunately, since we aim to identify within-firm transitions, most of the within-firm variation in title naming is due to typography. We then discard “joint” titles that can be held simultaneously by multiple people (e.g., “Founder”, “Co-CEO”). Normalized non-joint titles (i.e., roles) held by more than one person at the same company represent transitions, but these only enter into our analysis if we can

determine the date of the transition(s) by knowing the join dates of all occupants of that role.<sup>5</sup>

### 3.2 Variables

We observe the dynamics of the entrepreneurial executive team, investors and board of directors. The variables described in this section attempt to measure the characteristics of these changes.

The variables used in the first part of the analysis are measured at the entrepreneurial firm financing event. The major dependent variable “Had Transition” is a dummy variable equal to one if a financing had a transition at the time of the financing or after the financing and prior to any subsequent financing. In the second analysis, we construct a person-financing database that tracks entry and exit of executives at each entrepreneurial financing event. Here, “Had transition” is a dummy if an executive was replaced at the current financing or some time prior to the subsequent financing.

The VC-backed entrepreneurial firm has a board of directors comprised of three different agents: independent observers, investors and executives (see Kaplan and Strömberg (2003) for details). Independent directors and investors have been shown to play an important role in turnover.<sup>6</sup> For example Lerner (1995) shows that CEO turnover is strongly correlated with an increase in the role of investors on the board of directors. This fact motivates the first of our governance variables: “Outside board size.” For each entrepreneurial firm investment in the data, we observe whether an investor in the syndicate is a lead and whether the investor ever took a board seat. This information combined with some join dates available in VentureSource provide a picture of the investor board dynamics. In particular, we can characterize whether a financing has a new board member (“New board”) and the overall board size at each financing.<sup>7</sup>

Figure 1 shows that the average number of VC board members after three rounds of financing is two.<sup>8</sup> Similarly, we can observe both the existence and count of the number of new investors in a financing syndicate (“New investor”). These board characteristics reveal the relative strength of

---

<sup>5</sup>An exception to this is if the role is CEO, and one of those holding the role is missing a join date, which we assume to be the founding of the company. We assume that all other executive roles might not have been established at founding.

<sup>6</sup>Observers are typically jointly appointed by VC and executives and hold a vote.

<sup>7</sup>See the appendix for more details on properly measuring the dynamics of the board and some data limitations.

<sup>8</sup>The outside member data is fairly static, so we cannot exploit much variation.

the investors and thus their ability to replace managers. Baker and Gompers (2003) show that VCs on a board signal a higher likelihood of independent outsiders, thus we believe this VC-only count is an excellent approximation for non-executive board strength. The new investor information can signal changes in the pool of active investors, management team and strategy. A final picture of the investor set is a quality measure “VC experience” and a dummy variable for syndicates in the top quartile, as measured by summing the total investment made by each syndicate member as of each quarter.

Next, we characterize how the firm performs over time. The first measure is “living dead.” The goal of the living dead measure is to capture an entrepreneurial firm’s inability to raise capital, reach milestones or grow at a high rate. A strong measure of success for VC-backed entrepreneurial firms is the rate of capital raises over time and the growth in the capital level (e.g. see Korteweg and Sorensen (2010)). The time from a firm’s previous financing to the next forms the basis of our proxy. A firm is in a living dead state if the time between these financings exceeds the 90th percentile of the same time for firms in the previous five years that are in the same industry, development stage and capital stock size. Thus, the variable is forward-looking from the perspective of the financing date, but reveals whether the firm appeared living dead during the post-financing period. The Appendix has additional details on variable construction.

To capture the right tail of firm performance, we create variable called “improved prospects.” This dummy variable is one if one of three conditions occurs. First, a firm can switch from non-revenue to either “Producing revenues” or “Profitable.” Second, the firm can exhibit positive annual employment growth as measured through our merge of NETS and VentureSource. Last, we measure the change in capital raised between financings with the “Capital ramp up” variable that is the ratio of current capital to previous capital raised (1 for first financings). If this ratio is in the top quartile of the full sample, the dummy is set to one. The “Improved prospects” variable is one if any of these events occur in a given financing event (each is relative to the previous, so first financings are zero).

We then characterize the performance of the entrepreneurial firm’s industry during an executive’s tenure. Our approach follows a long literature on corporate governance that asks if and how

boards of directors respond to non-firm performance. For example, Jenter and Kanaan (Forthcoming) find that peer and industry performance impacts the turnover of CEOs who are also underperforming. Market and industry performance are measured in three ways. First, the variable “Industry exits” is the log of total IPOs and acquisitions in the firm’s industry in the previous six months. A relatively larger set of recent exits suggests an improved exit environment. Next, the variable “Lagged acquisitions” sums the just total acquisition exits in the firm’s industry in the previous six months.<sup>9</sup> These two variables should capture the exit environment quality or the opening of the “exit window.” The third variable sums the total capital invested by VCs in the firm’s industry in the previous six months (logged).<sup>10</sup> Rather than reflecting exit opportunities, this variable should capture the competitive intensity of an industry over time for current investors. Overall, we predict that changes in these three variables map to the state of the firm’s industry and overall venture capital market.

Additional variables control for person, firm and investor characteristics. We have the title of each executive, which includes “CEO,” a catch-all for other C-level executives “CXO” and Vice President “VP.” Each executive’s past founding experience and current tenure length is also available. An executive or set of executives are labeled as a founder as described in Ewens and Fons-Rosen (2013). Financing-level variables include the size of the investment syndicate, round number, total capital raised, firm industry and firm founding year. Unless otherwise noted, all regressions include fixed effects for the financing year, join year for the executive, firm industry, financing stage (four categories) and entrepreneurial firm state of location.

### 3.3 Sample and turnover rates

We begin the analysis with the set of entrepreneurial firms founded between 1992 - 2008.<sup>11</sup> The early cutoff gives time for both exits and transitions to occur. Additionally, we require that the

---

<sup>9</sup>IPOs are relatively rare and industry-specific, so breaking them out how leaves little explanatory power.

<sup>10</sup>The industry classifications are Biopharmaceuticals, Business Support Services Communications and Networking Construction and Civil Engineering Consumer Information Services Electronics and Computer Hardware Financial Institutions and Services Food and Beverage, Healthcare Services, Household and Office Goods, Media and Content, Medical Devices and Equipment, Medical Software and Information Serv., Personal Goods, Retailers, Semiconductors, Software, Travel and Leisure, Vehicles and Parts, Wholesale Trade and Shipping.

<sup>11</sup>We have financing data available for pre-1992 companies, however, the coverage of management teams and transitions is relatively worse.

entrepreneurial firm have at least two financing so there is time for transitions and new hires. All executives with the title “CEO,” “Vice President” or with “Chief” in their title are included. If an executive joined the firm prior to the first financing, then they are included if they remain at least one day after the first outside capital infusion. The resulting dataset includes 49,032 executives in 12,679 entrepreneurial firms.<sup>12</sup> Of these executives, we identify 11,329 founder or co-founders. With a join date and replacement date (if there is a turnover event) available, a dataset is made that has an observation for each quarter that an executive is listed as active at the firm. A given quarter can have a financing event or be in between financings. These interim periods will provide time-variation in firm and market performance, however, most analyses below collapse the data to each financing in which an executive was active.

Several features of the final turnover database are worth highlighting. There are 3,905 firms that have at least one transition in 53,240 financing events. Thus, over 30% of the firms in the sample have at least one turnover in their lifetime at the CEO/CXO or VP level. Although this might seem low given the results of Kaplan, Sensoy and Strömberg (2009) and Hellmann and Puri (2002), note that over 50% of firms fail within four years and may have little time for management changes. Approximately 15% of all executives were ever replaced over the sample period (7,242 ).<sup>13</sup> Figure 2 shows the annual rate of top management turnover, where the denominator is all executives in firms active in the year. Per year, four percent of CEOs are replaced. CEOs are the most at risk, followed by CXOs.

How do these rates compare to turnover studied in public firms? Several studies point to forced turnover rates of CEOs to be approximately 2% a year (e.g., Taylor (2010)). Thus, VC-backed management is at a significantly higher risk of turnover than public firm executives. Similarly Kaplan and Minton (2012) and Huson, Parrino and Starks (2001) show an average of 12% of firms have a turnover in a given year, which compares to the 30% of firms in the VC-backed sample. Finally, the mean (median) tenure of a CEO ending in turnover is 3 (2.27 ) years and 4.43 (3.8 ) through firm exit without turnover. These compare to 4 and 6 years in the Taylor (2010). As we

---

<sup>12</sup>The sample shrinks slightly in some specifications due to missing data.

<sup>13</sup>Though we lack the details available for public firms, this sample of executives and firms is much larger than previously studied in public firms (e.g. 1,627 turnovers in Jenter and Kanaan (Forthcoming) or 981 CEOs and 7,325 firm-years in Taylor (2010)).

have yet to separate forced versus voluntary turnovers, it is not possible to match exact comparisons. However, these relatively lower tenure lengths and the results below suggest that the bulk of the changes are forced turnovers.

## 4 Data summary

We begin with a simple breakdown of when turnover occurs in the entrepreneurial firm lifecycle. Figure 3 shows the distribution of time from first VC financing to first transition for all firms with at least one transition. The first three years of a startup’s life after VC have the highest risk of turnover. Figure 4 presents the distribution of transition events by firm financing round. The transition rates peak in a firm’s second financing, but remain relatively high six financings after the first VC raise.

How does turnover at the firm-level predict liquidity events? On the one hand, previous results from the literature (e.g. Kaplan, Sensoy and Strömberg (2009) ) that find significant turnover rates for successful firms predict a strong positive correlation. Alternatively, if the average turnover event in VC-backed entrepreneurial firms mirror that of public firms, then we would expect a strong negative relationship between turnover and performance (insofar as there is not full recovery). Table 3 considers the status of all exited entrepreneurial firms and how it relates to the firm’s turnover experience. Column (1) shows that turnover correlates with eventual IPO and column (2) shows that the same holds for exits via an acquisition or IPO. The remaining last two columns break out turnovers by title. For IPO outcomes, CEOs changes are negatively correlated while positively for CXO. Only when acquisitions are included as success does a change in CEOs correlate with success. CEO turnover could on average be a signal that the firm as a whole is struggling, while changes to other executive levels are associated with strategy change or professionalization. Analysis below will clarify these results.

Table 4 details the financing-level relationship between financings that left either the “living dead” and “improved prospects” states as described in Section 3.2. A financing observation is “living dead” if it leaves such a state. Similarly, a financing has “Improved prospects” if it follows a change in improved prospects (i.e. good news). Several differences across financings are clear

and consistent with the goals of each variable. Living dead financings are more likely followed by new investors, who are less experienced and investing in smaller syndicates. The last two facts are consistent with a struggle to raise outside money, very likely at a reduced valuation. The higher probability of being profitable is likely driven by living dead being a later stage event. Last, employment growth is statistically lower after a living dead financing. The improved prospects panel similarly shows economic differences. Financings following good news have more experienced investors, are more likely to be profitable, having larger syndicates and more employment growth. Overall, the t-test evidence across financings suggests that the two proxies for firm performance capture real phenomenon.

Table 5 asks how firms that ever enter these two state differ in ex-ante and ex-post characteristics. If “living dead” proxies for a negative shock and firms do not fully recover, then we would expect these firms to appear worse at exit or end of sample. Similarly, the “improved prospects” firms should look better in possible both ex-ante and ex-post characteristics. The panel “Living dead” first illustrates that firms that enter this state have 40% lower probabilities of IPO, higher probabilities of acquisitions and less likely to fail. Furthermore, these firms raise slightly more capital yet produce exit valuations that are \$54m less on average. Firms with good prospects in their history are less likely to be private, raise more capital in more financings and produce higher average exit valuations. Overall, the evidence suggests that these two financing-level proxies reflect real differences in firm prospects.

## 5 Results

### 5.1 Executive cross section and turnover

We first ask what executive, firm and market characteristics predict turnover. Table 6 documents these cross-sectional relationships where time-varying controls are measured at the time the executive joins the firm. A unit of observation is a entrepreneurial firm and executive at her first VC financing. For the roughly 50% of the sample that were part of the management team pre-VC, we

measure the characteristics at the firm’s first financing. We estimate the following specification:

$$\text{Turnover}_{ij} = \beta_0 + \beta_1 X_i + \beta_2 Z_{ij} + \gamma_{ijt} + \epsilon_{ij} \quad (1)$$

where  $i$  is executive and  $j$  is entrepreneurial firm. The vector  $X_i$  includes person characteristics at the time of join such as title and past experience. The vector  $Z_{ij}$  includes entrepreneurial firm, investor and board characteristics measured at the time executive  $i$  joins firm  $j$ . Year of join fixed effects are included in  $\gamma_{ijt}$ . The results are reported from a linear probability model for easier coefficient interpretation, however, all conclusions are robust to a probit or logit specification.

The controls are defined in Table 1, of which several are worth highlighting. The variable “# VCs on board at join” is the board size of VC investors and should capture the relative strength of VCs in governance. In most specifications, this control has little correlation with eventual replacement. Several non-title controls have predictive power. The first is “Previous exec. experience” which is one if the executive has any previous instance as a founder or executive. The large positive coefficient suggests these individuals are 16% more likely to be replaced. Both being part of the management team prior to VC financing and having a connection to one of the investors increases the likelihood of a transition. This result is surprising as one would expect VCs with voting rights to prefer those executives that they know best. The final column of Table 6 considers executives with at least one year of tenure with no change in results.

As we saw in the firm cross-section in Table 3, turnover and firm outcomes are highly correlated. Table 7 separates the sample of entrepreneurial firms by industry and exit outcome to isolate differences by firm type and success. There are some intuitive differences between biotech and information technology firms. In the latter, there is relatively less turnover in “CXO” and executives with previous founder experience. The former result is likely driven by the dominant title in the “CXO” category of CTO. It appears that those titles are relatively more protected in IT firms, perhaps because they are more difficult to replace or more pivotal. Next, it is interesting to compare the IPO and alternative exit samples. The IPO sample represents an almost full generalization of the Kaplan, Sensoy and Strömberg (2009) sample of 90 IPO’d firms to almost 1000. The average turnover rate in these eventually successful firms is 7.7%, significantly lower than the 12% average

in the full sample. This rate compares to the 43% of Kaplan, Sensoy and Strömberg (2009) for founder-CEOs. The large difference may be attributable to the sample’s coverage of multiple industries, investors and a longer time series.

Finally, Table 8 considers sub-samples of the executives and firm to check the robustness of the results. Column (2) shows that executives who were with the firm prior to the first VC financing exhibit similar turnover risks. The column “Exited” asks whether firms that have yet to exit the sample are driving the results and they are effectively unchanged. Column (4) repeats an important sampling restriction in the VC literature by ignoring executives who joined in the boom years of 1998 - 2000. Only the coefficient on industry inflows exhibits some difference with the full sample. The final column excludes executives who are also founders. The order of replacement by title – CEO vs. CXO – and other major controls remain unchanged.

## 5.2 Dynamics of turnover

The previous analysis considered the first financing of an executive’s tenure as the unit of observation. We now ask how time-varying firm, investor and market characteristics can predict turnover. Here, a unit of observation is each financing that an executive is employed by the firm. These events are when we consider executives “at risk.”<sup>14</sup> Again, we consider a simple linear form now with a  $t$  subscript:

$$\text{Turnover}_{ijt} = \beta_0 + \beta_1 X_i + \beta_2 Z_{ijt} + \beta_3 M_{jt_{i0}} + \gamma_{ijt} + \nu_{ij} \quad (2)$$

where  $\text{Turnover}_{ijt}$  is one if executive  $i$  was replaced in firm  $j$  at or after financing  $t$  (but prior to financing  $t + 1$ ). The new variables are the controls  $M_{jt_i}$  which capture investor and board characteristics at firm  $j$  when executive  $i$  joins ( $t_{i0}$ ).

Table 9 begins the analysis of how market and firm performance relate to turnover. The first three columns introduce the industry variables measured at each of the firm’s financing event while the executive is employed. “Industry exits” counts the number of exits – IPOs and acquisitions

---

<sup>14</sup>A full hazard specification produces similar results, however, the vast majority of executives do not have turnover. Thus, standard hazard models will treat them as censored.

– in the firm’s industry in the previous six months, while “Lagged acquisitions” considers just acquisitions. Both of these variables should incorporate the exit opportunities or “IPO window” that is available to the firm. On the other hand, “Lagged industry inflows” sum the total dollars invested over the previous six months in the firm’s industry. A relatively higher (lower) number suggests that the firm’s industry is hot (cold). Increases in exit opportunities or inflows correlate positively with turnover rates. Economically, a one-standard deviation increase in recent exits implies a 13% increase in the probability of a turnover. That is, hot exit markets and increased attention through new capital put executives at higher risk for replacement. Note that the same implication – with a different sign – holds for cold markets. Alternatively, increased inflows make outside options at other firms more valuable, increasing exit of executives. The remaining columns of Table 9 reveal how firm-performance and turnover relate.

Two facts stand out from the coefficients on “Living dead” and “Improved prospects.” First, both tails of the firm performance distribution predict higher turnover rates. Entering the living dead state increases the probability of a turnover by 60%. This result is consistent with the findings of Kaplan, Sensoy and Strömberg (2009), Wasserman (2003) and Hellmann and Puri (2002) who find that transitions occur at high rates in good times. Only Hellmann and Puri (2002) show that some turnovers are involuntary and presumably preceding by poor performance. Thus, column (4) provides the first large-scale evidence that poor firm performance predicts turnover. The positive relationship between improved prospects and turnover is likely the professionalization turnover previously studied in the literature. Here, comparing the coefficient estimates in columns (4) and (5) reveals that turnover rates are orders of magnitude larger in bad states than after improved prospects. The existing literature painted a picture of high turnover in the latter states of the world, thus the literature may have underestimated the risk of executive turnover.

### **5.3 Turnover and governance**

We next address whether and how the composition of the board and VC strength changes sensitivity to market performance. Table 10 regresses the turnover dummy by financing event on a set of controls and several interactions (Equation (2) with interactions). The interactions include recent

exits and the four metrics of investors and governance (see Section 3.2). If for example, boards with relatively more VCs as directors is more sensitive to market performance, then we would expect the interaction of “Industry exits X Board size” to be non-zero. Across each metric, there appears to be no difference in sensitivity to recent industry exits. In contrast, we see some differential sensitivity to industry inflows in columns (5) and (6). The negative coefficient on the experienced VC and board size measures suggests that such syndicates and boards are less sensitive to changes in the availability of capital. Why would more experienced investors and more VC representation lower the sensitivity? Larger industry inflows correlate with higher valuations (e.g. Gompers and Lerner (2000)) or a hot market (e.g. Nanda and Rhodes-Kropf (Forthcoming)). Under standard models of board governance, market signals that are not controlled by the management team should not factor into a turnover decision. It is possible that more experienced VCs and boards with more VC control are better suited to filter out market signals in their assessment of executives or retain management with improved outside options. Similarly, stronger VC boards may correlate with more aggressive professionalization which coincides with hot markets.

Table 11 repeats the analysis of Table 10 now with interactions for firm-level performance. Columns (1)-(4) interact the investor and board characteristics with a dummy for whether a financing is “living dead.” Only the coefficient on the interaction term “Living dead X Board size” is statistically significant. The positive relationship implies that boards with relatively more VC representation are more sensitive to firm performance than smaller boards. Economically, an increase in board size of one – .8 standard deviations – predicts a 9% increase in sensitivity to a poor performance of the startup. The other side of firm performance – “improved prospects” – also exhibits differential sensitivity by governance and investor. First, column (6) shows that the average sensitivity to good news predominantly comes from relatively larger boards. Also, column (8) and the negative coefficient on the interaction “Good news X New investor?” reveals that executives who join the firm with a new investor are relatively safer when prospects improve. This relationship suggests that concurrent management and boards remain linked during what otherwise would be professionalization turnover. Such board connections are the manifestation of the changing board around turnover in VC-backed firms (Lerner (1995)) and public firms (Denis and Sarin (1999))

Overall, the results mirror those of Weisbach (1988) who finds that independent boards respond more strongly to firm performance.

## 6 Discussion

We interpret these results cautiously, for several reasons. We do not (yet) have precise join and departure dates for all executives at every VC-backed venture, and although we anticipate substantial progress in this area, we will likely not achieve a full census of such transitions. Moreover, in such a large sample it is impractical to collect person-specific data regarding whether the particular transition was (in)voluntary. Finally, given that these data are constrained to venture-backed companies, one must be careful in generalizing to the full population of privately-held firms. Despite these limitations, we believe that this study offers several contributions.

First, this is the first paper to our knowledge that provides large-sample examination of executive turnover in privately-held companies. While many scholars have drawn connections between the replacement of public-company officers—although often restricted just to the CEO—similar studies among private companies are at once infrequent and tend to rely on smaller-sample data from retrospective surveys or interviews.

Second, and more substantively, the results draw sharp distinctions with work on public-company executive replacement. Top management turnover rates exceed those observed in all samples of public firms of which we are aware, pointing to a potentially more activist role of private-company directors (who in venture-backed companies tend to be investors). This point is reinforced by our finding that the likelihood of turnover is increasing in the number of director-investors. Moreover, the active role played by director-investors is evidenced by the contrast between public and private company turnover with regarding to market/sector trends. While several studies have found that public-company executives are not replaced in the face industry or macro trends not specific to the firm, private boards appear to react sharply to “hot” liquidity markets by replacing executives. These results suggest a dynamic where public-company executives appear to be evaluated according to their circumstances-adjusted performance whereas director-investors place great(er) weight on the executives’ ability to facilitate a liquidity event.

Third, the results at once deepen and question existing impressions of executive turnover in private companies. As noted above, prior work has largely been conducted using samples that are either smaller-scale, success-biased, or CEO-focused. Extant analyses largely see the replacement of founder-CEOs as part of a “professionalization” process inherent in the adolescent stage of the entrepreneurial process. While our findings are not necessarily inconsistent with this view, we take more of a contingent view in which turnover is not simply inevitable but rather dependent on both the performance of the firm and the influence of external conditions. Startup executives are more likely to be replaced when the firm is underperforming (i.e., “living dead”), which indicates that investors indeed exercise the control rights present in VC contracts and underscores the importance of governance mechanisms. This work contributes to a nascent literature on failure in the venture capital industry, which has been virtually ignored in previous work although the vast majority of VC-backed ventures do not produce highly attractive returns. Understanding how management and investors interact in these situations highlights the role of financial intermediaries and another view of the riskiness of high-growth entrepreneurship

Fourth, we find counterintuitive features of executive turnover in startup companies. Whereas one might expect that startup executives with experience in venture-backed ventures would be at lower risk of turnover, the opposite turns out to be the case. We also find that founders are considerably less likely to be replaced as CEO than suggested by prior research, which is likely attributable to the greater completeness of our dataset. The last point is particularly salient for would-be entrepreneurs who might have been unnecessarily worried that they could be fired or demoted.

## 7 Conclusion

This paper documents patterns in the turnover of executives in high-growth entrepreneurial firms backed by VCs. In a large sample of 51,393, some 15% have a turnover event. Turnovers at the firm-level are on average associated with success, however, the type and timing of the events matters. An executives risk of turnover is highest as a CEO who has strong connections to the current investors, while founders and the ability to raise large amounts of capital dampens turnover rates.

Turnover responds strongly to lower firm prospects and to a lesser extent, good news about firm performance. In contrast to many studies of public firms, we find a positive relationship between industry characteristics such as exit opportunities and capital inflows. The fact that external forces predict firm-level turnover challenges simple governance models that incorporate only managerial output.

The evidence points to a relatively higher risk of turnover for these executives compared to public CEOs. It also shows for the first time how good and bad signals are incorporated into control right decisions of investors. In particular, we provide the first large-scale evidence of the information-processing role of investors and boards. That information comes from two sources: firm-level changes and the evolution of the firm's industry.

## References

- Aggarwal, Rajesh K, and Andrew A Samwick.** 1999. “Executive compensation, strategic competition, and relative performance evaluation: Theory and evidence.” *The Journal of Finance*, 54(6).
- Baker, Malcolm, and Paul Gompers.** 2003. *Journal of Law and Economics*.
- Denis, David J, and Atulya Sarin.** 1999. “Ownership and board structures in publicly traded corporations.” *Journal of Financial Economics*, 52(2): 187–223.
- Denis, David J, and Diane K Denis.** 1995. “Performance changes following top management dismissals.” *The Journal of Finance*, 50(4): 1029–1057.
- Ewens, Michael, and Christian Fons-Rosen.** 2013. “The Consequences of Entrepreneurial Firm Founding on Innovation.” *Working Paper*.
- Ewens, Michael, and Matthew Rhodes-Kropf.** 2013. “Is a VC Partnership Greater than the Sum of Its Partners?” *Working paper*.
- Gompers, Paul A.** 1995. “Optimal investment, monitoring, and the staging of venture capital.” *The Journal of Finance*, 50(5): 1461–1489.
- Gompers, Paul, and Josh Lerner.** 2000. “Money chasing deals? The impact of fund inflows on private equity valuation.” *Journal of Financial Economics*, 55(2): 281–325.
- Gorman, Michael, and William A Sahlman.** 1989. “What do venture capitalists do?” *Journal of Business Venturing*, 4(4): 231–248.
- Guo, Lixiong, and Ronald Masulis.** 2012. “Board structure and monitoring: New evidence from CEO turnover.” *Working paper*.
- Hellmann, Thomas, and Manju Puri.** 2002. “Venture Capital and the Professionalization of Start-Up Firms: Empirical Evidence.” *The Journal of Finance*, 57(1): 169–197.

- Hermalin, Benjamin E, and Michael S Weisbach.** 1988. “The determinants of board composition.” *The RAND Journal of Economics*, 589–606.
- Holmstrom, Bengt.** 1982. “Moral hazard in teams.” *The Bell Journal of Economics*, 324–340.
- Hsu, David H.** 2006. “Venture capitalists and cooperative start-up commercialization strategy.” *Management Science*, 52(2): 204–219.
- Huson, Mark R, Robert Parrino, and Laura T Starks.** 2001. “Internal monitoring mechanisms and CEO turnover: A long-term perspective.” *The Journal of Finance*, 56(6): 2265–2297.
- Jenter, Dirk, and Fadi Kanaan.** Forthcoming. “CEO Turnover and Relative Performance Evaluation.” *The Journal of Finance*.
- Jenter, Dirk, and Katharina Lewellen.** 2010. “Performance-induced CEO turnover.” *Working Paper*.
- Kaplan, Steven N, and Bernadette A Minton.** 2012. “How has CEO turnover changed?” *International Review of Finance*, 12(1): 57–87.
- Kaplan, Steven N, and Per Strömberg.** 2003. “Financial contracting theory meets the real world: An empirical analysis of venture capital contracts.” *The Review of Economic Studies*, 70(2): 281–315.
- Kaplan, Steven N, and Per Strömberg.** 2004. “Characteristics, contracts, and actions: Evidence from venture capitalist analyses.” *The Journal of Finance*, 59(5): 2177–2210.
- Kaplan, Steven N, Berk A Sensoy, and Per Strömberg.** 2009. “Should investors bet on the jockey or the horse? Evidence from the evolution of firms from early business plans to public companies.” *The Journal of Finance*, 64(1): 75–115.
- Korteweg, Arthur, and Morten Sorensen.** 2010. “Risk and return characteristics of venture capital-backed entrepreneurial companies.” *Review of Financial Studies*, 23(10): 3738–3772.
- Lerner, Josh.** 1995. “Venture capitalists and the oversight of private firms.” *The Journal of Finance*, 50(1): 301–318.

- Nanda, Ramana, and Matthew Rhodes-Kropf.** Forthcoming. “Investment cycles and startup innovation.” *Journal of Financial Economics*.
- Parrino, Robert.** 1997. “CEO turnover and outside succession a cross-sectional analysis.” *Journal of Financial Economics*, 46(2): 165–197.
- Puri, Manju, and Rebecca Zarutskie.** 2012. “On the Life Cycle Dynamics of Venture-Capital- and Non-Venture-Capital-Financed Firms.” *The Journal of Finance*, 67(6): 2247–2293.
- Taylor, Lucian A.** 2010. “Why are CEOs Rarely Fired? Evidence from Structural Estimation.” *The Journal of Finance*, 65(6): 2051–2087.
- Wasserman, Noam.** 2003. “Founder-CEO succession and the paradox of entrepreneurial success.” *Organization Science*, 14(2): 149–172.
- Weisbach, Michael S.** 1988. “Outside directors and CEO turnover.” *Journal of Financial Economics*, 20: 431–460.
- Yermack, David.** 1996. “Higher market valuation of companies with a small board of directors.” *Journal of Financial Economics*, 40(2): 185–211.

# Tables and figures

Figure 1: Board dynamics across entrepreneurial firm lifecycle

Notes: Graph presents the average size of VC board of directors by entrepreneurial firm financing round. “Mean fraction of outsiders” uses the total count of independent directors as of the end of the sample (an upper bound) as the denominator. The sample includes all entrepreneurial firms with at least two financings and founded between 1992 and the present.

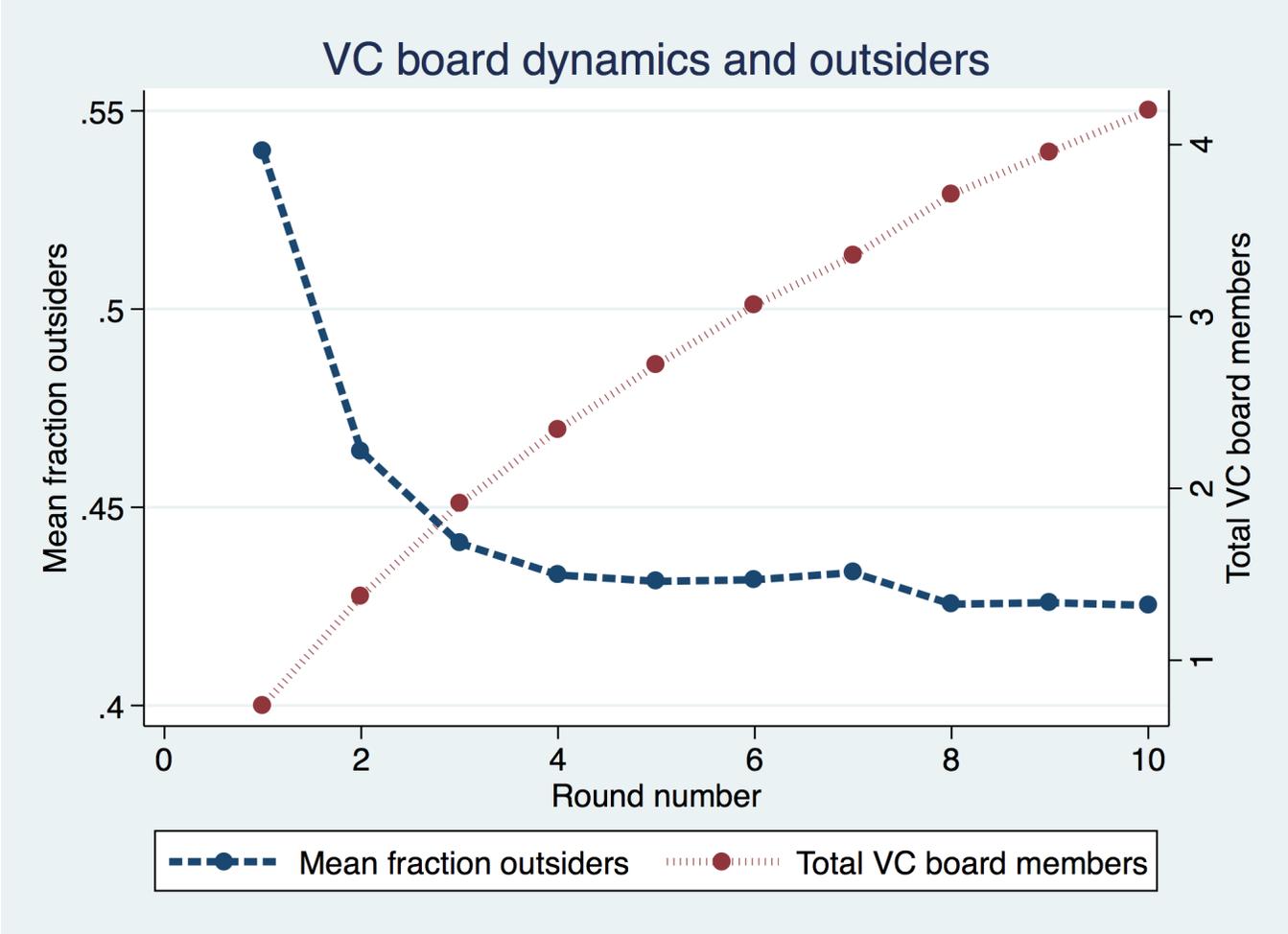


Figure 2: Rate of executive turnover by year and title

Notes: Graph presents the fraction of active executives that are replaced in a given year by title. The denominator is the set of all executives in non-exited entrepreneurial firms and the denominator is the count with the given title that are replaced. “Founder” can include any of the titles “CEO,” “CXO” or “VP.”



Figure 3: Hazard function of time to transition: from first VC

Note: Figure reports empirical distribution of time to an entrepreneurial firm's first management transition first infusion of VC to the first management transition.

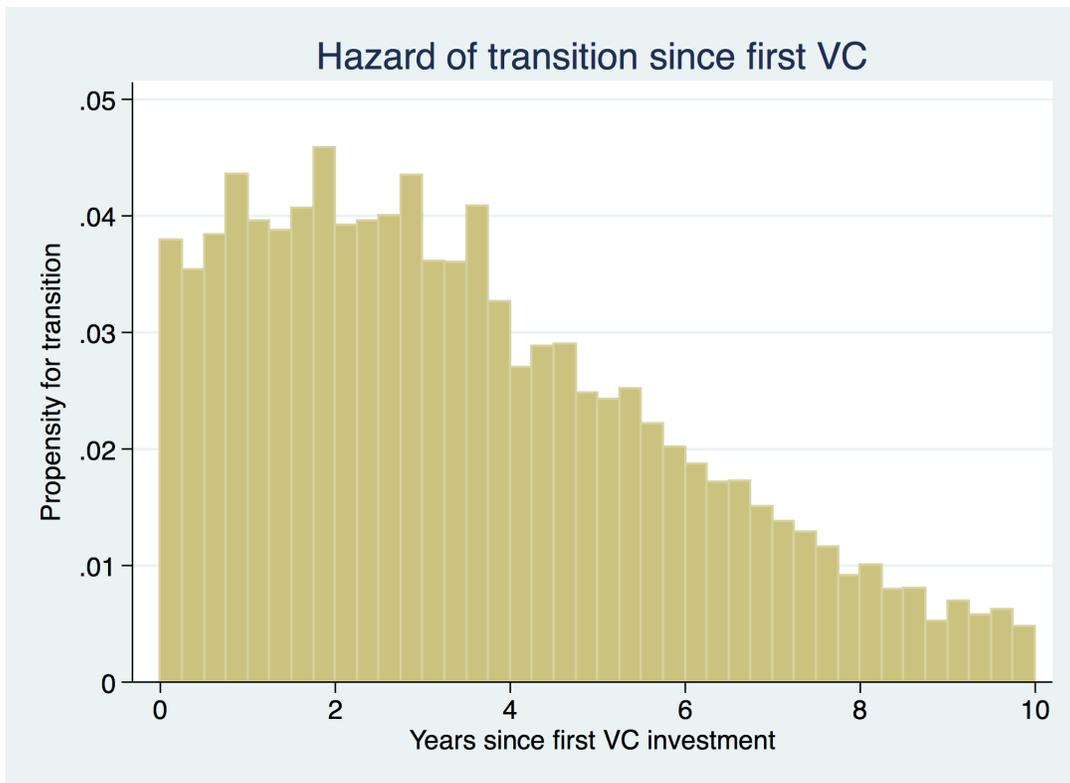


Figure 4: Hazard function of time to transition: round number

Note: Figure reports the distribution of round numbers for all transitions. A transition is assigned to the closest previous financing event of the entrepreneurial firm. Smaller round numbers are for early stage financings.

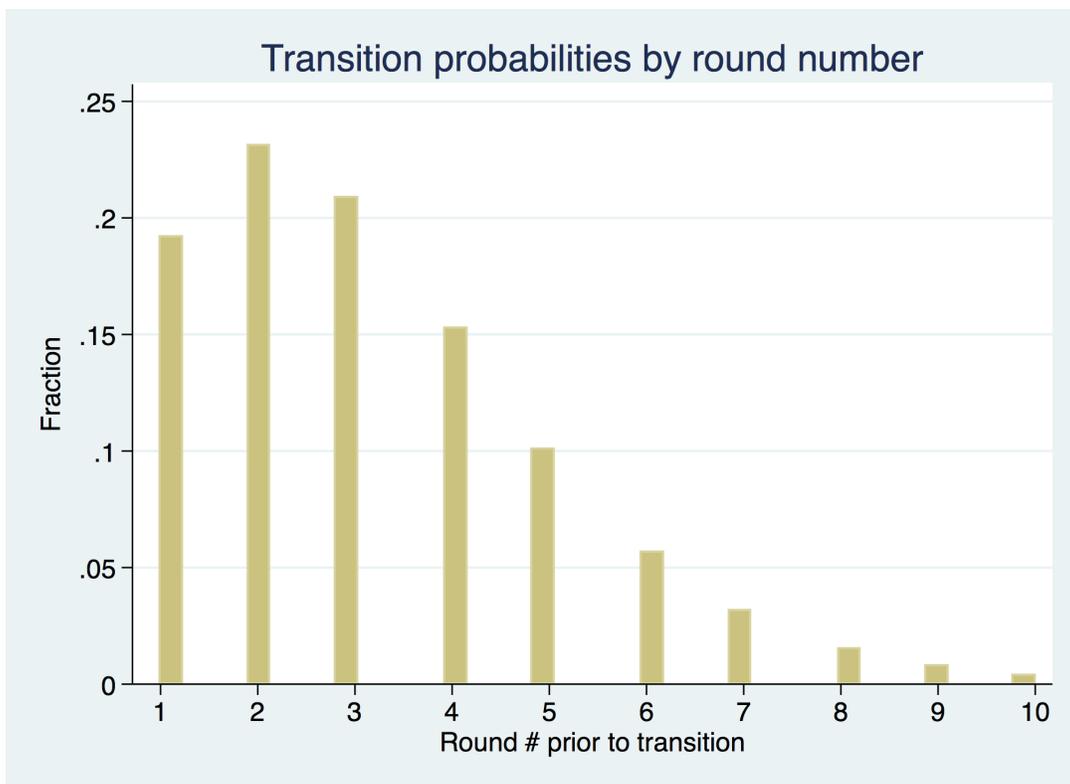


Table 1: Variable description

Note: Description of the variables used in the summary statistics and regression analysis.

IPO	A dummy variable equal to one if the entrepreneurial firm exited via an initial public offering by the end of the sample period (6/2013).
Acq.	A dummy variable equal to one if the entrepreneurial firm exited via an acquisition or merger by the end of the sample period (6/2013).
Private	A dummy variable equal to one if the entrepreneurial firm remains private as of the end of the sample (2012).
Failed	A dummy variable equal to one if the entrepreneurial firm failed by the end of the sample (6/2013).
Founding year	The founding year of the entrepreneurial firm, set to the year of first VC financing if unknown.
Biotech	A dummy variable equal to one if the entrepreneurial firm's industry is health-care or biotechnology.
IT	A dummy variable equal to one if the entrepreneurial firm's industry is information technology.
First capital raised	The total capital raised in the first first VC financing.
Total raised	Total capital raised by an entrepreneurial firm across all its financing events.
Total rounds	Total financing rounds with VC for the entrepreneurial firm.
Is living dead	A dummy variable equal to one if the entrepreneurial firm's financing event took longer than similar financings in the same industry, stage and capital amount over the previous five years (top 10%).
Formerly living dead	A dummy variable indicating whether a VC financing follows a previously living dead financing (and exits).
Positive growth	A dummy for positive growth in employment over year after the financing event.
Negative growth	A dummy for negative growth in employment over year after the financing event.
VC total investments (log)	The average number of investments made by all syndicate members as of financing event (logged). This is an experience measure.
Age of firm	Age of entrepreneurial firm at a financing event in years since firm founding .
Total VC invested previous year	Total capital raised in VC in the prior year in all entrepreneurial firms.
Total IPOs in previous year	Total IPO events of VC-backed firms over the previous year.
Return on S&P 500	Annual return for a buy-and-hold strategy of the S&P 500 over the year prior to the VC financing.
Founder	Dummy for whether the individual is a firm founder
Previous VC experience	Dummy for whether the executive previously worked at another VC-backed firm.
Worked with VC	Dummy for whether the executive with past experience also worked with one of the VCs invested in the current firm.
# active investors	Count of total investors in all current and past syndicates.
Revenues or profits?	Dummy for whether the firm has revenues or profits in the current financing.
Previous founder	Dummy for whether the executive has previously been a founder.

Table 2: Comparison of firms with transitions: known and unknown dates

Note: Table report means, differences and two-sided t-statistic p-values for two sub-samples. “Unknown date” are management transitions where we observe two unique individuals with the same title, but we cannot determine when each joined the firm. The column “Known date” includes the set of firms for which we can date at least one of the individuals, and thus the transition itself. Table reports entrepreneurial firm characteristics as defined in Table 1.

	Unknown date	Known date	Diff/s.e.
IPO	0.0823	0.114	-0.0315*** 0.00833
Acq.	0.350	0.388	-0.0376** 0.0131
Private	0.234	0.293	-0.0591*** 0.0121
Failed	0.307	0.172	0.136*** 0.0107
CA	0.372	0.416	-0.0431** 0.0132
MA	0.0933	0.121	-0.0276** 0.00860
TX	0.0524	0.0578	-0.00537 0.00623
NY	0.0662	0.0503	0.0160** 0.00606
Founding year	1996.9	1997.9	-0.944*** 0.173
Biotech	0.206	0.191	0.0144 0.0107
IT	0.503	0.573	-0.0699*** 0.0134
First capital	6.273	7.079	-0.806 0.466
Total Raised	24.58	49.90	-25.31*** 3.838
Total rounds	3.272	4.504	-1.232*** 0.0642
Exit valuation	\$93.2m	\$234.3m	-\$141.1 60.8
Unique firms	1,814	6,851	8,665

Table 3: Differences in firm outcomes by turnover

Notes: Table reports the relationship between whether a firm had a particular type of turnover and eventual outcome. All regressions are probit, where the unit of observation is an entrepreneurial firm. A firm is included in the sample if it has exited as of the end of the sample period (June 2013). “IPO” has dummy dependent variable that is one if the firm eventually has an IPO. “IPO/Acq.” includes in this dependent variable whether the firm also exited via an acquisition. “Had turnover” is one if the firm had at least one turnover in its lifetime. “Had CEO turnover” is one if that turnover was a CEO. “Had CXO turnover” is one if any of the C-level executives not including the CEO were replaced during the firm’s life. “Had founder turnover” is one if one of the founder’s was ever replaced in any top executive position. The excluded group of executives are vice presidents. “First VC experience” is the log of the first VC syndicate’s experience for the entrepreneurial firm. “First capital raised” is the log of the first capital infusion. “State FE” are dummies for the firms state of location, “Year founded FE” are dummies for the year of firm founding and “Industry FE” are dummies for one of the five industry categories. Standard errors are clustered at the year of founding. significance: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

	IPO (1)	IPO/Acq. (2)	IPO (3)	IPO/Acq. (4)
Had turnover	0.227*** (0.0752)	0.320*** (0.0885)		
Had CEO turnover			-0.298*** (0.0912)	0.166** (0.0826)
Had CXO turnover			0.359*** (0.108)	0.361*** (0.0609)
Had VP turnover			0.184*** (0.0303)	0.352*** (0.0599)
Had founder turnover			-0.0821 (0.0774)	-0.240*** (0.0775)
First VC experience	0.0495*** (0.0174)	-0.0000172 (0.0141)	0.0478** (0.0187)	-0.00223 (0.0147)
First capital raised	0.00402*** (0.00154)	0.000763 (0.000551)	0.00399*** (0.00155)	0.000727 (0.000522)
Observations	9268	9268	9268	9381
Pseudo $R^2$	0.114	0.039	0.122	0.045
Mean dep. var.	0.107	0.690	0.107	0.106
State FE?	Y	Y	Y	Y
Year founded FE?	Y	Y	Y	Y
Industry FE?	Y	Y	Y	Y

Table 4: Predictability of living dead and improved prospects: within-firm

Notes: Table reports the financing-level predictability of a “living dead” or “improved prospects” within an entrepreneurial firm’s financing. “Living dead” is equal to one if the previous financing ever entered “living dead” (same for “improved prospects”). Thus, the sample of financings only includes non-final financings. “No change” is the sample of financings that did not have a change in either status. “New board member” is equal to one if the financing has a new investor board member (same with “New investor”). “Capital ramp up” measures the ratio of current capital over previous capital raised. “VC experience” is the experience (log # of investments) of the current syndicate. “Revenues or profits” is equal to one if the financing has a firm with revenues or profits. “Syndicate size” is the syndicate size of the current financing. “Employment growth” is the growth in annual employment level. Significance: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

	Living dead		
	After living dead	No change	Diff/s.e.
New board member	0.347	0.334	0.0128 0.00897
New investor	0.712	0.631	0.0803*** 0.00913
Capital ramp up	3.199	3.144	0.0546 0.274
VC experience	3.480	3.666	-0.186*** 0.0244
Revenues or profits	0.872	0.719	0.152*** 0.00840
Syndicate size	0.556	0.636	-0.0803*** 0.00832
Employment growth	0.218	0.267	-0.0488*** 0.00837
Observations	2,989	36,953	39,942
	Improved prospects		
	Improved prospects	No change	Diff/s.e.
New board member	0.337	0.333	0.00363 0.00473
New investor	0.642	0.633	0.00822 0.00481
Capital ramp up	2.967	3.317	-0.350* 0.144
VC experience	3.717	3.591	0.126*** 0.0128
Revenues or profits	0.766	0.697	0.0694*** 0.00443
Syndicate size	0.703	0.562	0.141*** 0.00433
Employment growth	0.488	0.0535	0.435*** 0.00383
Observations	19,244	20,697	39,942

Table 5: Predictability of living dead and improved prospects: cross-section

Note: Table report means, differences and two-sided t-statistic p-values for two sub-samples. “Ever living dead” are firms that had at least one instance of a “living dead” scenario as discussed in Section X (relatively long time between financing events). The column “Never living dead” includes firms with at least two rounds of funding never entered the living dead state. “Improved prospects” includes all firms that had employment growth, above median capital raise or became profitable. We only consider firms founded prior to 2009. Table reports entrepreneurial firm characteristics as defined in Table 1.

	Living dead		
	Never living dead	Ever living dead	Diff/s.e.
IPO	0.0806	0.0512	0.0294*** 0.00568
Acquired	0.388	0.507	-0.118*** 0.0106
Private	0.285	0.327	-0.0420*** 0.00984
Failed	0.218	0.0784	0.139*** 0.00839
CA	0.422	0.353	0.0692*** 0.0106
MA	0.108	0.111	-0.00318 0.00673
Founding year	2000.3	1999.1	1.226*** 0.0915
Biotech	0.194	0.243	-0.0498*** 0.00870
First capital	6.072	6.173	-0.101 0.328
Total Raised	2.608	2.705	-0.0968* 0.0417
Total rounds	3.913	4.362	-0.449*** 0.0444
Exit value (\$m)	\$196m	\$141m	\$54.92m 50.02
Observations	10608	2674	13282
	Improved prospects		
	No change	Improved prospects	Diff/s.e.
IPO	0.0714	0.0836	-0.0122* 0.00515
Acquired	0.410	0.417	-0.00675 0.00964
Private	0.302	0.270	0.0328*** 0.00891
Failed	0.186	0.198	-0.0119 0.00767
CA	0.404	0.418	-0.0140 0.00962
MA	0.107	0.113	-0.00550 0.00609
Founding year	2000.2	1999.6	0.658*** 0.0832
Biotech	0.200	0.213	-0.0122 0.00788
First capital	6.140	5.962	0.178 0.297
Total Raised	2.568	2.790	-0.223*** 0.0377
Total rounds	3.983	4.061	-0.0782 0.0403
Exit value (\$m)	\$177m	\$214m	-\$37.1m 41.4
Observations	9722	3560	13282

Table 6: Executive-level analysis of management transitions

Notes: Table reports the entrepreneurial executive-level analysis of firm, investor and market characteristics that correlate with turnover. The dependent variable is equal to one if the executive was ever replaced. All variables are measured at the time of the executives first financing when their tenure begins. All regressions are linear probability models. The column “> 1 tenure” includes all executives with at least one year of tenure. “CEO” is one if the executive is the CEO title, “CXO” is one for all other “Chief” level titles and the excluded category is “VP.” “Firm founder?” is equal to one if the individual is the firm founder and “Serial founder?” is one if that founder has previous founding experience. “VC experience at join” is the log of the VC syndicate at the executive’s join date. “# VCs on board at join” counts the number of VC investors on the board at join. “Syndicate size at join” is the size of the VC syndicate at time of join and “New investor at join?” is equal to one if a new investor joined the syndicate. “Industry inflows at join” is the log of capital invested in the entrepreneurial firm’s industry in the previous six months. “Previous exec. experience?” is one if the executive worked previously at another entrepreneurial firm. “Worked with VCs” is one if the executive raised capital from the entrepreneurial firm’s investors prior to this position. “Joined before VC” is one if the executive was with the firm prior to the first investment by VCs. “Capital raised as of join” is the total capital raised by the time the executive joined. “Industry FE?” are five industry dummies, “Year join FE?” are dummies for the join year, “Stage join FE” are fixed effects for the stage of the firm when the executive joined (e.g. early vs. late) and “State FE” are entrepreneurial firm state dummies. Standard errors are clustered at the join year of the executive. Significance: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

	All (1)	All (2)	All (3)	> 1 tenure (4)
CEO	0.0490*** (0.00723)	0.0525*** (0.00697)	0.0606*** (0.00590)	0.0593*** (0.00586)
CXO	0.0208*** (0.00428)	0.0181*** (0.00379)	0.0245*** (0.00346)	0.0263*** (0.00349)
Firm founder?	-0.0832*** (0.00934)	-0.148*** (0.0103)	-0.151*** (0.00890)	-0.130*** (0.00792)
Previous founder?	-0.0150* (0.00809)	-0.0323*** (0.00793)	-0.0332*** (0.00694)	-0.0280*** (0.00763)
VC experience at join		0.000345 (0.00116)	0.000977 (0.00100)	0.00146 (0.000981)
# VCs on board at join		0.00225* (0.00132)	0.00241* (0.00138)	0.000950 (0.00141)
Syndicate size at join		0.00744** (0.00343)	0.00243 (0.00324)	0.00362 (0.00363)
New investor at join?		0.00883* (0.00517)	0.00472 (0.00453)	0.00275 (0.00368)
Industry inflows at join		0.00779*** (0.00224)	-0.00218 (0.00305)	-0.00193 (0.00262)
Previous exec. experience?		0.0151** (0.00644)	0.0210*** (0.00418)	0.0214*** (0.00402)
Worked with VCs		0.0281*** (0.00303)	0.0239*** (0.00311)	0.0229*** (0.00344)
Joined before VC		0.0461*** (0.00391)	0.0451*** (0.00425)	0.0432*** (0.00433)
Capital raised as of join		-0.00119 (0.000954)	-0.00157* (0.000861)	-0.000969 (0.000805)
Observations	57184	57182	57182	50487
$R^2$	0.013	0.032	0.043	0.038
Unique executives	50810	50809	50809	45747
# firms	13296	13295	13295	12944
% transition	0.117 36	0.117	0.117	0.0993
Industry FE?	N	N	Y	Y
Year join FE?	N	N	Y	Y
Stage join FE?	N	Y	Y	Y
State FE?	N	Y	Y	Y

Table 7: Executive-level analysis of management transitions by firm characteristics

Notes: Table reports the entrepreneurial executive-level analysis of firm, investor and market characteristics that correlate with turnover. The dependent variable is equal to one if the executive was ever replaced. All variables are measured at the time of the executives first financing when their tenure begins. All regressions are linear probability models. “Biotech” is the set of healthcare-focused entrepreneurial firms. “IT” is the set of information technology firms. “IPO” includes entrepreneurial firms that eventually go public, while “Failed” includes only failed firms. “Acquired” includes all firms that were acquired or merged. Variables are as defined in Table 6. Standard errors clustered at the executive’s join year. Significance: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

	Biotech (1)	IT (2)	IPO (3)	Failed (4)	Acquired (5)
CEO	0.104*** (0.0108)	0.0484*** (0.00817)	0.0283** (0.0107)	0.0382*** (0.00681)	0.0504*** (0.00602)
CXO	0.0555*** (0.00522)	0.00128 (0.00373)	0.0423*** (0.00923)	0.00225 (0.00588)	0.0153*** (0.00442)
Firm founder?	-0.110*** (0.00972)	-0.173*** (0.0119)	-0.0594*** (0.0126)	-0.112*** (0.0153)	-0.182*** (0.0120)
Previous founder?	-0.0179 (0.0208)	-0.0443*** (0.0111)	-0.0840*** (0.0285)	-0.0214 (0.0238)	-0.0251** (0.0115)
VC experience at join	-0.00489** (0.00237)	0.000901 (0.00201)	-0.000238 (0.00242)	0.00187 (0.00309)	0.00122 (0.00127)
# VCs on board at join	0.00161 (0.00165)	0.00339* (0.00175)	0.00310 (0.00197)	0.00877** (0.00401)	0.000986 (0.00205)
Syndicate size at join	0.00145 (0.00658)	0.00773* (0.00390)	-0.00484 (0.0112)	0.00355 (0.00406)	0.00599 (0.00477)
New investor at join?	0.0140 (0.0116)	0.000458 (0.00396)	-0.000904 (0.00999)	0.0324*** (0.0100)	0.00106 (0.00511)
Industry inflows at join	-0.0128** (0.00494)	0.000442 (0.00583)	0.00497 (0.00420)	-0.00383 (0.00511)	-0.000582 (0.00387)
Previous exec. experience?	0.0297*** (0.00569)	0.0199*** (0.00644)	0.0454*** (0.0133)	-0.00528 (0.00911)	0.0166** (0.00721)
Worked with VCs	0.0167 (0.0128)	0.0186** (0.00755)	0.0227* (0.0121)	0.0209 (0.0128)	0.0260*** (0.00520)
Joined before VC	0.0325*** (0.0116)	0.0622*** (0.00843)	0.0317** (0.0138)	0.0453*** (0.0151)	0.0405*** (0.00495)
Capital raised as of join	-0.00144 (0.00197)	-0.00226 (0.00138)	-0.0142*** (0.00165)	-0.000360 (0.00228)	-0.00225* (0.00121)
Observations	10736	29072	7955	8487	24599
$R^2$	0.045	0.047	0.047	0.046	0.052
Unique executives	9830	25912	7690	8337	22916
# firms	2709	5941	993	2521	5480
% transition	0.101	0.133	0.0774	0.0857	0.133
Industry FE?	N	N	Y	Y	Y
Year join FE?	Y	Y	Y	Y	Y
Stage join FE?	Y	Y	Y	Y	
State FE?	Y	Y	Y	Y	Y

Table 8: Executive-level analysis of management transitions by firm characteristics: Robustness

Notes: Table reports the entrepreneurial executive-level analysis of firm, investor and market characteristics that correlate with turnover. The dependent variable is equal to one if the executive was ever replaced. All variables are measured at the time of the executives first financing when their tenure begins. All regressions are linear probability models. “Join before VC” includes only executives that were part of the management team prior to the first VC financing (variables measured at the first financing). “Exited” is the set of firms that exited by the end of the sample (June 2013). “No boom era” excludes all firms founded 1998-2000. “No founders” excludes founders from the sample of executives. Variables are as defined in Table 6. Standard errors clustered at the executive’s join year. Significance: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

	All (1)	Join before VC (2)	Exited (3)	No boom era (4)	No founders (5)
CEO	0.0598*** (0.00584)	0.0468*** (0.00748)	0.0477*** (0.00560)	0.0602*** (0.00826)	0.0573*** (0.00828)
CXO	0.0263*** (0.00352)	-0.00129 (0.00620)	0.0182*** (0.00364)	0.0284*** (0.00451)	0.0323*** (0.00417)
Firm founder?	-0.135*** (0.00800)	-0.164*** (0.00893)	-0.141*** (0.0117)	-0.142*** (0.0125)	
Previous founder?	-0.0336*** (0.00711)	-0.0516*** (0.00896)	-0.0344*** (0.00921)	-0.0316*** (0.00553)	-0.0103 (0.0462)
VC experience at join	0.00117 (0.00102)	0.000114 (0.00129)	0.000118 (0.00117)	-0.000387 (0.00121)	0.000739 (0.00151)
# VCs on board at join	0.00202 (0.00139)	0.00898*** (0.00145)	0.00242 (0.00165)	0.00262* (0.00146)	0.00164 (0.00150)
Syndicate size at join	0.00204 (0.00318)	0.00195 (0.00381)	0.00253 (0.00388)	-0.00124 (0.00397)	0.00637 (0.00582)
New investor at join?	0.00453 (0.00450)	0.0633** (0.0252)	0.00652 (0.00535)	0.00602 (0.00657)	0.00503 (0.00487)
Industry inflows at join	-0.00168 (0.00282)	0.00256 (0.00342)	-0.000405 (0.00355)	0.00493** (0.00232)	-0.00516 (0.00378)
Previous exec. experience?	0.0199*** (0.00415)	0.0397*** (0.0107)	0.0202*** (0.00513)	0.0144*** (0.00444)	0.0194*** (0.00578)
Worked with VCs	0.0226*** (0.00306)	0.0284*** (0.00871)	0.0243*** (0.00276)	0.0289*** (0.00472)	0.0273*** (0.00444)
Joined before VC			0.0455*** (0.00593)	0.0428*** (0.00584)	0.0670*** (0.00675)
Capital raised as of join	-0.00165** (0.000807)	0.000200 (0.00146)	-0.00323*** (0.000923)	-0.00103 (0.00142)	-0.00551*** (0.00138)
Observations	57182	23721	42955	36063	38369
$R^2$	0.041	0.065	0.038	0.043	0.043
Unique executives	50809	22804	38644	33311	34239
# firms	13295	11486	9393	8918	8978
% transition	0.117	0.118	0.114	0.110	0.140
Industry FE?	Y	Y	Y	Y	Y
Year join FE?	Y	Y	Y	Y	Y
State FE?	Y	Y	Y	Y	Y

Table 9: Executive transitions: Market and firm performance

Table reports the executive propensity for replacement where the unit of observation is each financing for which an executive is part of the management team. The dependent variable is equal to one if the executive was ever replaced. Regression models are probit. “Lagged industry exits” is the log of the number of IPOs or acquisitions in the firm’s industry in the previous 6 months. “Lagged total acquisitions” is the number of acquisitions in the firm’s industry in the previous six months. “Lagged industry inflows” is the log of the total capital invested in the firm’s industry in the previous six months. “Living dead” is equal to one if a financing entered the living dead state. “Improved prospects?” is equal to one if the firm’s financing saw a change to profitability, employment growth or above median capital ramp-up. “Time at firm (quarters)” is the time in quarters the executive has been at the firm. “Firm age (log yrs)” is the log of the firm age as of the financing. “VC total investments (log)” is the log of the total investments done by the syndicate. “Addl. controls” include syndicate size, the square of firm age, first capital raised, a dummy for whether the executive has previous experience, log of total capital raised and a dummy for whether the executive worked with the existing syndicate before. FE as defined in Table 6. Notes: Significance: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

	Market/Industry			Firm changes		
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged industry exits (log)	0.0891*** (0.0260)					
Lagged total acquisitions		0.00211*** (0.000513)				
Lagged industry inflows			0.0196* (0.0116)			
Living dead?				0.600*** (0.0269)		0.598*** (0.0270)
Improved prospects?					0.0465** (0.0192)	0.0446** (0.0189)
Time at firm (quarters)	0.0320** (0.0163)	0.0326** (0.0158)	0.0344** (0.0163)	0.0968*** (0.0171)	0.0960*** (0.0179)	0.0967*** (0.0173)
Firm age (log yrs)	0.00826 (0.0128)	0.00894 (0.0124)	0.00913 (0.0124)	-0.00390 (0.0104)	0.0124 (0.0121)	-0.00358 (0.0105)
VC total investments (log)	0.0328*** (0.00489)	0.0375*** (0.00484)	0.0388*** (0.00481)	0.0325*** (0.00503)	0.0315*** (0.00495)	0.0317*** (0.00521)
Observations	179228	182511	182511	182506	182506	182506
Pseudo $R^2$	0.052	0.052	0.050	0.084	0.067	0.084
Unique executives	50296	50584	50584	50582	50582	50582
# transitions	6420	7241	7241	7241	7241	7241
Unique firms	13208	13289	13289	13287	13287	13287
Financing year FE?	N	N	N	Y	Y	Y
Industry FE?	N	N	N	Y	Y	Y
Year join FE?	Y	Y	Y	Y	Y	Y
State FE?	Y	Y	Y	Y	Y	Y
Add'l controls?	Y	Y	Y	Y	Y	Y

Table 10: Executive transitions and governance measures: market performance

Notes: Table reports the executive propensity for replacement where the unit of observation is each financing for which an executive is part of the management team. The dependent variable is equal to one if the executive was ever replaced. Variables are as in Table 9, with the inclusion of several interaction variables. "Industry exits X Exp. VCs" interacts the log of recent exits in the industry and whether a top VC (i.e. top quartile by experience) was in the syndicate at join. "Recent IPOs X Board size" interacts the same with the size of the VC board at join. "Industry exits X New investor?" interacts log of recent exits in the industry with a dummy for a new investor at the time of join. "Industry exits X New board?" interacts the same with a dummy for whether a new VC board members entered at join. The remaining interactions "Industry inflows X" interact the same variables with the log of total inflows in the six months prior to the executives join date. Standard errors clustered at the financing year. Significance: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

	Recent Exits			Industry inflows				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged industry exits (log)	0.113*** (0.0259)	0.114*** (0.0310)	0.115*** (0.0315)	0.119*** (0.0292)				
Industry exits X Exp. VCs	-0.0478 (0.0317)							
Industry exits X Board size		-0.00605 (0.0137)						
Industry exits X New board?			-0.0177 (0.0433)					
Industry exits X New investor?				-0.0255 (0.0271)				
Lagged industry inflows					0.0243* (0.0128)	0.0348*** (0.0111)	0.0263*** (0.0119)	0.0239* (0.0125)
Industry inflows X Exp. VCs					-0.0279*** (0.00803)			
Industry inflows X Board size						-0.0110** (0.00475)		
Industry inflows X New board?							-0.0108 (0.0109)	
Industry inflows X New investor?								-0.00725 (0.00741)
Experienced VCs at join	0.0000548 (0.0423)				0.156** (0.0682)			
# VCs on board at join		-0.00800 (0.0170)				0.0677* (0.0364)		
New board member when join			0.0378 (0.0482)				0.101 (0.0810)	
New investor when join				-0.00233 (0.0327)				0.0246 (0.0570)
Observations	179228	179228	179228	179228	182511	182511	182511	182511
Pseudo $R^2$	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049
Financing year FE?	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE?	Y	Y	Y	Y	Y	Y	Y	Y
Year join FE?	Y	Y	Y	Y	Y	Y	Y	Y
State FE?	Y	Y	Y	Y	Y	Y	Y	Y
Add'l controls?	Y	Y	Y	Y	Y	Y	Y	Y



# 1 Appendix

## 1.1 Living dead variable

The living dead variable derivation considers several firm and financing characteristics. Ultimately, the goal is to assign a month between two of the firm’s financing as “living dead” *as viewed by agents at the time*. Thus, we start by summarizing all historical time to next financing (in years) for financings that occurred and had a follow-on financing prior to the one of interest. The average is narrowed to firms in this group that were of a similar development stage (e.g. early vs. late), capital raised (e.g. above or below median) and industry. For example, for a second round financing in 1998 of a biotech firm that has raised below median capital, we compute the average time to next financing for the same category that were financed and closed between 1993 and 1997. A month is assigned to “living dead” once the time since the current financing is greater than the 90th percentile of this historical distribution.<sup>1</sup> Next, if a financing is identified as “Profitable” or “Has revenues,” it is reassigned to the default state because it is possible that no capital is required to keep the firm alive. Finally, the same process holds for entrepreneurial firms that are still private as of the end of the sample. We create an artificial “next financing” equal to 6/30/2013 (end of the sample) and repeat the process above.

## 1.2 Details on measuring board dynamics

Constructing the board of directors dynamics requires three pieces of information. The first is the current and former investor board members provided by VentureSource. It is rare that join dates and end dates are available, so the next two pieces of information help isolate entry and exit onto the board. Each investor that has a board seat is assigned to that board at their first investment where either they are identified as the “lead” or if they never have a lead position, their first investment in the firm. To isolate exit from the board is more challenging. Most VCs will retain their position, however, it is often possible for early-stage VCs to leave the board as the entrepreneurial firm nears a public offering. We date these exits by tracking the first investment in which a known investor stops participating. Additionally, we require that same financing includes a new investor who also has a board seat. If these two conditions hold, then the board member is removed from the board and the new investor joins. Exit according to this methodology introduces over 150 exits.

---

<sup>1</sup>Results are robust to the 95th and 85th percentile.