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Do Venture Capital Firms Benefit from a Presence on Boards of Directors of Mature Public Companies?

Abstract

This paper examines the benefits to venture capital firms of their officers holding directorships in mature public companies in terms of fundraising and investment performance. Our empirical results show that venture capital firms raise more funds, set higher fund-raising targets, and are more likely to successfully exit their investments post-appointment of their officers to boards of directors of S&P 1500 companies. Directorship status in mature public firms provides venture capital firms with enhanced networks, visibility, and credibility, all of which facilitate their fundraising activities. In addition, the knowledge, expertise, and experience acquired through holding directorships in mature public firms are beneficial for their portfolio companies, as measured by the likelihood of successful exits.

Keywords: venture capital, board, directorships, public companies, exits.
JEL Code: G24, G3

Introduction

Venture capitalists (VCs) have long been recognized as providers of capital, and monitors of small and young businesses. However, VCs' roles in mature public firms have only recently been brought to the attention of academics and professionals. Celikyurt, Sevilir, and Shivdasani (2012) documented the fact that 30.5 percent of Standard & Poor's (S&P) 1500 companies' directors had a VC background prior to their board appointments. They found that the presence of VCs on boards of directors is strongly associated with greater innovation activity by mature firms. In addition, the presence of VCs also increases the likelihood that mature firms will acquire a VC-backed company, will establish strategic alliances with other VC-backed companies, and will undertake corporate venture capital investments in start-up companies. Because the focus of their study was on the benefits to mature firms of having VCs on their boards, the question of whether or not VC firms benefit by having a presence on the boards of mature public companies thus remains unexplored. In this paper, we aim to fill this gap by examining this unanswered question. We investigate the potential (but crucial) benefits to VC firms, which are mainly in the areas of *fundraising* and *investment performance*.

We followed Celikyurt, Sevilir, and Shivdasani (2012) to construct our VC director sample, which covers the period from 1998 to 2011. Our final sample consists of 1,359 unique VC directors working in 700 different VC firms. We collect VC fundraising, investment, firm, and exit data from VentureXpert, which has been used extensively in previous studies (Nahata, 2008; Cumming and Dai, 2010).

The first benefit we examine is VC fundraising, which a number of previous studies have also examined (Gompers and Lerner, 1998; Gompers, 1996; Jeng and Wells, 2000;

Mayer et al., 2004). In general, these studies have found that reputation increases VC firms' ability to raise new capital, and reputation is achieved by quickly taking portfolio companies public (i.e., VC "grandstanding"). In our study, we postulate that holding directorships in mature public companies also increases VC firms' reputation and improves their fundraising performance, because having a presence on the boards of S&P 1500 companies provides these firms with visibility, credibility, and enhanced networks (Celikyurt, Sevilir, and Shivdasani, 2012). Although our analysis indicates that a significant difference exists between VC firms with and those without directorships, such difference could be due either to selection or treatment effects. We address these concerns by comparing fundraising performance during pre- and post-directorship appointment periods, and find that better performance results from holding directorships. In addition, we use the difference-in-difference method to address any concern that the difference could be due to economic effects (i.e., VC firms raise more funds when the economy is booming), and our results remain quantitatively the same. Overall, our results show that directorships in mature public companies benefit VC firms in terms of fundraising performance.

The second benefit we examine is VC investment performance. A number of recent studies have examined VC firms' roles as knowledge intermediaries (González-Uribe, 2013; Dessi and Yin, 2014). These studies have shown that VC investors can communicate valuable knowledge to entrepreneurs, and to other portfolio companies, thus facilitating innovation. Based on these earlier findings, we question whether or not VC firms can also transfer knowledge and experience gained from holding directorships in mature public companies to their small non-public portfolio companies, and thus improve their investment performance, as measured by the likelihood of a successful exit (Cumming and Dai, 2010; Dai et al., 2012; Nahata, 2008). Our empirical results

show that VCs improve their firms' investment performance after their officers become directors of mature public companies, and better investment performance is due to their status as directors and not to their firms' reputation during the pre-appointment period.

Overall, our results show that VCs benefit from their directorships in S&P 1500 companies in terms of both fundraising and investment performance. Specifically, VC firms raise more funds, set higher fundraising targets, and have a higher likelihood of successful exits after having a presence on the boards of directors of mature public companies. These results are consistent when controlling for a matched sample of VC firms with similar reputation, but without directorships in mature public companies.

The rest of this paper is organized as follows. Section 2 highlights related studies and proposes testable hypotheses; Section 3 provides an outline of the study, and discusses data and methodology; Section 4 analyses the empirical results; and Section 5 concludes the paper.

Literature review and hypothesis development

VC characteristics and directorships

Before analyzing the potential benefits that accrue to VC firms, we focus on the characteristics of VC firms that make them more likely to build connections with public companies. As suggested by Celikyurt, Sevilir, and Shivdasani (2012), mature public companies select directors with VC backgrounds based on the anticipated experience and expertise they bring.[1] VCs' experience and reputation within the VC industry are therefore likely to influence public companies' choices and decisions. We use initial public offering (IPO) market share and VC investment share to measure VC firms'

[1] For instance, in an article in the *Silicon Valley Business Journal* (23 June 2014), Intel announced that Aneel Bhusri, CEO of Greylock Partners, had joined the company's board. Intel said: "We are very pleased to have Aneel Bhusri as an Intel director. His more than 20 years' experience in enterprise software innovation and cloud computing will increase our board's depth in areas that are key to Intel's business and crucial in today's connected world."

reputation, in a similar manner to that of Nahata (2008) and Krishnan et al. (2011). We measure IPO market share as the dollar market value of all companies taken public by the VC firm from the beginning of calendar year 1980 up until a given calendar year, normalized by the aggregate market value of all VC-backed companies that went public during those years. The VC investment share is the dollar investment made by a VC firm from the beginning of 1980 up until a given calendar year, normalized by the overall aggregate investment in the VC industry in those years. We postulate that reputable VC firms, which have higher IPO market share and VC investment shares, are more visible and potentially more valuable to mature public companies, and hence their officers are more likely to obtain board seats.

In addition to reputation, we also examine other characteristics of VC firms. Specifically, we examined their age, size, location, and type. We use the total number of years a firm had experience as a VC investor (Cumming et al., 2006) as a measure of VC firms' experience. We posit that because older VC firms are more experienced, knowledgeable, and credible, their officers are more likely to be selected as directors by S&P 1500 companies. We classify all VC firms into two categories: "Independent VCs," i.e., those VC firms that are traditionally not affiliated with any corporations, banks, or governments, and "others," i.e., those with such affiliations. Given that S&P 1500 companies invite VCs to join their boards to add value, it is unlikely that they would invite non-independent VCs to join their boards of directors.[2] Officers of such "captive" VC firms, especially corporate VC firms, are thus far less likely to attain directorships than are independent VCs.

Finally, we examine whether or not the location of VC firms influences the likelihood of their officers' obtaining directorships. VCs based in U.S. venture hotbeds

[2] For instance, it is unlikely that the semiconductor company Qualcomm would consider inviting someone from Intel Capital to join its board of directors.

(California and New York State) are exposed to more entrepreneurial activities than those based in other states (Gompers et al., 2005). These VCs are likely to be more experienced in evaluating and cultivating young firms than other VC firms, an attribute that is potentially extremely valuable to S&P 1500 companies.[3] We therefore posit that VCs based in venture hotbeds are more likely to obtain directorships than others. Based on the above discussion, we develop the following hypothesis:

Hypothesis 1*: More reputable, older, larger, and independent VC firms, and those based in venture hotbeds, are more likely than others to have a presence on boards of directors of S&P 1500 companies.*

Directorships and VC fundraising

Gompers and Lerner (1998) examined the fundraising process within the context of the U.S. VC market and found that economic growth, R&D expenditures, and firm-specific reputation and performance influence fundraising. Further, they found that VC firms tend to hold larger equity stakes in firms that have recently gone public in order to raise greater amounts of money. A related study by Gompers (1996) showed that young VC firms tend to rush to IPOs in order to facilitate their future fundraising. Evidence from outside the United States also shows similar findings. Jeng and Wells (2000) and Mayer et al. (2004) examined the impact of a series of factors such as IPOs, accounting standards, labour markets, and economic growth on the ability of VC firms to raise new capital. They showed that the ability to take companies public determines the ability to raise new capital.

Our analysis extends prior studies by incorporating another potentially important determinant of VC fundraising: reputation. Previous studies have found that a good VC

[3] For example, generally speaking, a VC firm based in California would be more appealing to S&P 1500 companies than would a VC firm based in Nebraska.

reputation, achieved by bringing portfolio companies to IPOs as early as possible, i.e., by "grandstanding" (Gompers, 1996), increases VC firms' abilities to raise new capital. We postulate, however, that VC firms can gain reputation through directorships in mature public companies. Board seats in S&P 1500 companies provide visibility, credibility, and enhanced networks for VC professionals, which are likely, in turn, to improve VC firms' ability to raise new capital. The measures we use are total amounts raised and target amounts. The total amount equals the sum of all funds raised by a particular VC firm during the sampling period (1980–2013); the target amount is the sum of all target funds of VC firms during the sampling period. The total amount raised objectively measures the results of fundraising, while the target amount captures VC firms' subjective perception. We posit that VC firms, after obtaining directorships, are not only better able to raise new funds, but also become more confident in their ability to raise funds. Therefore, we hypothesise that directorships in S&P 1500 companies will increase the total amount VC firms raise, and the target amounts VC firms set:

Hypothesis 2a*: Directorships in S&P 1500 companies will increase the total amounts VC firms raise.*

Hypothesis 2b*: Directorships in S&P 1500 companies will increase the target amounts that VC firms set.*

Directorships and investment performance

Various studies, including those by Giot and Schwienbacher (2007), and Isaksson (2007), have examined VC exits in different contexts. A large body of literature has concluded that exits are influenced by various factors. These studies have reported that the characteristics of VC firms and investee companies affect the likelihood of exits (Elisabete, Cesaltina, and Mohamed, 2008). Others (Cumming et al., 2006; Cumming

and MacIntosh, 2003) have found that better economic conditions and legal environments increase the likelihood of exits. In addition, VC syndication (Megginson and Weiss, 1991; Lerner, 1994; Giot and Schwienbacher, 2007), geographical distance, and cultural disparity (Cumming and Dai, 2010) also influence VCs firms' exits within the context of cross-border VC investments.

Only recently have VC firms' roles in mature public firms been the subject of attention. Celikyurt, Sevilir, and Shivdasani's (2012) study found that VC directors in mature public companies significantly improve public companies' innovation activities. Following Celikyurt, Sevilir, and Shivdasani (2012) and González-Uribe (2013), Dessi and Yin (2014) further examined the VC directors' role as knowledge intermediaries. For instance, they found that VC directors can communicate valuable knowledge to entrepreneurs, and to other portfolio companies, thus facilitating innovation.

In the current study we measure *investment performance* by the likelihood of a successful exit, a factor that has been used extensively in previous studies (Cumming and Dai, 2010; Dai et al., 2012; Nahata, 2008). We postulate that being on the board of mature public companies provides VC professionals access to better knowledge and experience of the product, market, and the industry, all of which can be transferred to their portfolio companies and consequently improve the latter's performance. In other words, VC firms benefit from holding directorships in mature public companies through their ability to take their portfolio companies to successful exits. We therefore propose our third hypothesis as follows:

Hypothesis 3*: Directorships in S&P 1500 companies will increase the likelihood of a successful exit.*

Data and methodology

Data and sample

We follow the methodology of Celikyurt, Sevilir, and Shivdasani (2012) to construct our initial sample. We collect director data from the RiskMetrics[4] database, which provides information on directors of S&P 1500 firms from 1996 onwards. The RiskMetrics database reports the directors' primary employment, committees they serve on, their board affiliations, shares held, total voting power, and other factors. Our sample covers U.S. companies from 1998 to 2011, and extends the sample studied by Celikyurt, Sevilir, and Shivdasani (2012).[5] To identify VC directors, we adopt a two-step method. In the first step, we search for keywords that might define a VC firm in four different employment-related data items provided by RiskMetrics for each individual director.[6] These employment-related data items are the primary company name, employment category, other employment title, and type of services for each director. If at least one of the keywords we search is available in any of these data items, we consider that individual as a potential VC director. In the second step, we hand-collect information on VC director candidates from the VentureXpert database in the Securities Data Company (SDC) database. We only record candidates as VC directors if they are from VC firms in the VentureXpert database; this procedure avoids including directors that may have self-described themselves as a venture capitalist based on their experience as a private investor, but who lack the skills and networks associated with working at a VC firm. After these two steps, we identify 1,359 unique VC directors working in 700 different VC firms. In addition, we collect information on VC directors'

[4] Formerly known as the Investor Responsibility Research Center (IRRC).
[5] Our sample starts in 1998 because this is the first year that the IRRC database collected primary employment data on directors, which is one of the main data items needed for our analysis.
[6] The keywords are: venture, capital, partner, fund, investor, angel, finance, financial, and management.

year of joining their respective boards in order to measure the starting point of potential benefits more accurately.[7] For instance, if a VC became a director of Company A in 2006 but joined VC firm B in 2009, we consider 2009 as the benefit starting point, rather than 2006. We collect this information primarily from VC firms' websites, with supplementary sources such as Bloomberg and Forbes. We collect fundraising, VC investments, VC firms, and exits data from VentureXpert (SDC Platinum), which is the official database used by the National Venture Capital Association (NVCA), and has been used extensively in previous studies.

Table 2 presents a summary of the statistics of our sample. Panel A shows VC firms' directorships in S&P 1500 companies. As shown, during the sample period, each VC firm was associated, on average, with two S&P 1500 companies, while the maximum number ranged up to 25. This suggests that there are significant differences among VC firms in terms of their affiliations with public companies. The majority of firms were associated with one S&P 1500 company, while only a small number of VC firms had multiple affiliations. In addition, as shown in the table, it is common for VC firms to send multiple officers to sit on boards, as suggested by the number of directors per VC firm on the boards of S&P 1500 companies. Similarly, S&P 1500 companies usually invite more than one VC director to sit on their boards. Again, these numbers vary significantly among different VC firms. Panel B presents the descriptive statistics of VC directors' experience.

As shown in the table, most VC directors joined S&P 1500 boards around 1999, and most VCs joined/started the VC firm around the same time. As discussed above, there are two types of VC directors in our sample: 1) those who directors joined the S&P 1500 board first, then joined/started the VC firm (15 percent); and 2) those who

[7] We also collect the job title of each VC director in the VC firm, although we only recorded the title of the VC director if he or she was a founder of the VC firm, because other titles are time-varying.

started their careers as venture capitalists, then became directors of S&P 1500 companies (85 percent). In the first case, these individuals stayed on the boards for approximately six years before they joined/started their VC firm. In the second instance, the individuals spent an average of seven years in a VC firm before starting their directorships in S&P 1500 companies. Panel C describes VC directors' roles within the VC firm and the S&P 1500 company. We find that 37 percent of our VC directors were the founder/co-founder of the VC firms with which they were associated, suggesting that S&P 1500 companies tend to favor the most experienced and reputable VCs in the industry. In terms of VC directors' roles within the S&P 1500 companies, 7 percent held chair/vice-chair positions; 8 percent held CEO, CFO, and/or COO positions; and 9 percent held president/vice-president positions. The majority (82 percent), however, did not hold the above positions. This is also shown by the classification of "directorship": 77 percent of VC directors were independent, while only 22 percent were employees or otherwise linked to the S&P 1500 companies. These results suggest that large public companies invite VC directors mostly for their experience and expertise in the field, rather than for their management skills.

In summary, our results show that VC firms tend to send multiple officers to sit on the boards of S&P 1500 companies; the majority of VC directors started their careers as venture capitalists, and only later joined S&P 1500 boards; and only a small proportion of VC directors hold positions such as chair, CEO, or CFO within the S&P 1500 companies, while the majority are independent.

[INSERT TABLE 2 HERE]

Dependent variables

The dependent variable across all models in Table 4 is a dummy variable, which takes the value of one if a specific VC firm obtained at least one directorship in an S&P 1500 company in that particular year, and zero otherwise. The dependent variables in Table 6 are either the natural logarithm of the total amount raised or the target amount. The dependent variable in Models 1–3 of Table 8 is a dummy that takes the value of one if the investee company was exited through IPO and/or mergers and acquisitions (M&As) by the end of 2012, and zero otherwise. We consider both IPOs and M&As to be successful exits (Cumming and Dai, 2010; Dai et al., 2012; Nahata, 2008). In Models 4–6 of Table 8, the dependent variable is the time to exit, calculated by taking the difference between the year in which the portfolio company received its initial funding and the observation year, or the end of 2012.

Determinants of VC directorship

Directorship

Directorship is a dummy variable that takes the value of one if the VC firm had at least one partner sitting on the board of an S&P 1500 company, and zero if the VC firm obtained no directorships during the sampling period.

Post-directorship

The *post-directorship* variable is only observable for VC firms that obtained directorships during the sampling period, and is a dummy variable that takes the value of one if the VC firm had existing directorships in S&P 1500 companies, and zero if the VC firm had not yet obtained a directorship.

Directorship length

The *directorship length* variable is only observable for VC firms that obtained

directorships during the sampling period. We measure this as the number of years between the year in which a VC firm obtained a directorship and the observation year.

Control variables

In our analysis of directorship and VC fundraising, we follow Gompers and Lerner (1998) by including several variables to control for VC firm characteristics. For instance, Gompers and Lerner (1998) found that older and larger VC firms are more likely to raise larger amounts of funds than are younger and smaller ones. A better economic environment, as measured by gross domestic product (GDP) growth in the previous year, also facilitates VC firms' fund-raising abilities. In addition to VC firm age, size, and GDP growth, we also include VC firm type, location, and year dummies to control for other VC firm characteristics and year fixed effects in our models.

In our analysis of investment performance, we follow Nahata (2008) by including variables to control for characteristics of VC firms, portfolio companies, and deal characteristics. We include VC firm age, IPO market share (to control for VC firms' experience), and reputation (Nahata, 2008). We also control for venture-related characteristics. We include seed/start-up stage, early stage, expansion stage, and later stage dummies in our analysis. We include these variables because previous studies have suggested that early-stage ventures are risky and have high odds for failure (Cochrane, 2005), and also because the level of information asymmetry and uncertainty are higher at the early than at the later stage (Dai et al., 2012). VC syndication is also important and can systematically reduce the level of uncertainty. Megginson and Weiss (1991) and Lerner (1994) found that VC syndication is positively related to the likelihood of IPO exits. Giot and Schwienbacher (2007) found that the larger the size of VC syndication, the shorter the time to exit a portfolio company. Therefore, we include *syndicate size*, which is the total number of VC firms invested in a particular portfolio

company. To control for other characteristics of VC firms, we include *VC type* dummies to indicate different types of VC firms. In addition, we account for venture industry and year-specific fixed effects by including *industry* dummies and *year* dummies in our estimations; we also include *total funding received* to control for investment size.

Estimation models

a. Logit model

We use a logit model to estimate the likelihood of becoming directors and investment performance (at the company level). Since the dependent variables in both analyses are binary in nature, we apply a logit model. The basic function of the non-linear model is described as:

$$\hat{Y}_i = e^u/(1+e^u) \qquad (1)$$

In Table 4, $\hat{Y}_i$ is the probability of having at least one partner sitting on the board of an S&P 1500 company for the *i*th year; $\hat{Y}_i$ equals 1 if the VC firm had at least one directorship in an S&P 1500 company, and 0 otherwise. Equation (1) is as follows:

$$u = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_t X_t \qquad (2)$$

Where α is the constant, and β_1 to β_t are coefficients of independent variables X_1 to X_t. The analytical form of the logit model in Table 4 is as follows:

$$\begin{aligned} Likelihood\ of\ becoming\ a\ director \\ = \beta_1 VC\ firm\ reputation + \beta_2 VC\ firm\ age + \beta_3 VC\ firm\ size \\ + \beta_4 VC\ firm\ type + \beta_5 VC\ firm\ location + \beta_6 Year\ dummies \end{aligned} \qquad (3)$$

Where *VC firm reputation* is measured by two proxies: the first, *IPO market share*, is the dollar market value of all companies taken public by the VC firm from the beginning of calendar year 1980 up until a given calendar year, normalized by the aggregate market value of all VC-backed companies that went public from the beginning of 1980 up until the same calendar year. The second, *VC investment share*, is the dollar investment from the beginning of 1980 up until a given calendar year, normalized by the overall aggregate investment in the VC industry in those years. *VC firm age* is measured by the period between VC firms' year of incorporation and the observation year. *VC firm size* is the VC firms' capital under management in a particular year, calculated by taking the sum of all previous funds raised by the VC firm. *VC firm type* is measured by a dummy variable that takes the value of one if the VC firm was not affiliated with any other entities, and zero otherwise. *VC firm location* is a dummy variable that takes the value of one if the VC firm was based in either California or New York State; year dummies are dummy variables that indicate the observation year.

In Table 8, $\hat{Y}_i$ in equation (1) is the estimated probability of a successful exit for the *i*th investment; $\hat{Y}_i$ equals 1 if the company was successfully exited by the end of 2012, and equals 0 otherwise. *u* is the normal linear regression model. The analytical form of the logit model in Table 8 (Models 1–3) is the following:

$$\begin{aligned} Likelihood\ of\ successful\ exit \\ &= \beta_1 VC\ firm's\ directorship + \beta_2 VC\ firm\ age + \beta_3 VC\ firm\ reputation \\ &+ \beta_4 VC\ firm\ location + \beta_5 Venture\ stage + \beta_6 VC\ syndicate\ size \\ &+ \beta_7 VC\ firm\ type + \beta_8 Total\ funding + \beta_9 Year\ dummies \\ &+ \beta_{10} Industry\ dummies \end{aligned} \quad (4)$$

where *VC firm's directorship* is measured by three proxies. *Directorship* is a dummy

variable that takes the value of one if the portfolio company received funding from at least one VC firm with directorships, and zero otherwise. *Post-directorship* is a dummy variable that takes the value of one if the year in which a portfolio company received its initial funding was during the post-directorship period, and zero otherwise. *Directorship length* is the number of years between the year in which a VC firm obtained directorships and the observation year. *VC firm age* is measured by the period between VC firms' year of incorporation and the observation year; *VC firm reputation* is measured by IPO market share, which is the dollar market value of all companies taken public by the VC firm from the beginning of calendar year 1980 up until a given calendar year, normalized by the aggregate market value of all VC-backed companies that went public from the beginning of 1980 up until the same calendar year. *VC firm location* is a dummy variable that takes the value of one if the VC firm was based in either California or New York State (venture hotbeds), and zero otherwise. *Venture stage* is measured by three dummies that indicate the stage of the portfolio company when it received its first funding. *VC syndicate size* is the number of VC firms that invested in the portfolio company. *VC firm type* is measured by two dummy variables that indicate whether the VC firms were affiliated with a corporation or a bank. *Total funding* is the total amount that the portfolio company received across all rounds. *Year dummies* and *industry dummies* are dummy variables that indicate the observation year and the portfolio company's industry, respectively.

The log transformation of the logistic model is given by:

$$ln\left[\hat{Y}_i/(1-\hat{Y}_i)\right] = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_t X_t \qquad (5)$$

We estimate the parameters through the maximum likelihood method. To test the statistical significance of the predictor variable, we use the Wald test. Pseudo R^2 is

used to measure the goodness fit of the model. Pseudo R^2 is similar to R^2 in the ordinary least squares (OLS): the larger the pseudo R^2, the better the goodness of fit.

b. Heckman two-stage model

In our analysis of directorship and VC fund-raising, we use a Heckman two-stage model, which estimates two equations. The first stage is the probability of raising a fund in a particular year:

Stage 1:

$$Likelihood\ of\ raising\ a\ fund = \beta_1 VC\ firm\ age + \beta_2 VC\ firm\ size + \beta_3 VC\ firm\ location + \beta_4 GDP\ growth + \beta_5 Year\ dummies \quad (6)$$

The second stage is the estimation of the amount raised (or target size), given that the funds were raised in that year:

$$Stage\ 2:$$

$$Size\ of\ the\ funds\ raised = \beta_1 VC\ firm's\ directorship + \beta_2 VC\ firm\ age + \beta_3 VC\ firm\ size + \beta_4 VC\ firm\ type + \beta_5 VC\ firm\ location + \beta_6 Year\ dummies \quad (7)$$

c. Cox proportional hazard model

We examine the "time-to-exit"/exit rate using a Cox proportional hazard model in Table 8 (Models 4–6). This model is used in our company-level analysis. The dependent variable is the hazard rate, which is the probability of exiting an investment, given that the exits have not occurred. The following is the hazard model:

$$h_j(t|X_j) = h_0(t)\ exp\ (\beta_0 + X_j\beta_x) \quad (8)$$

Where $h_j(t|X_j)$ is the proportional hazard rate, and $h_0(t)$ is the baseline hazard rate at time t. j is the index for an individual firm, and X_j is a vector of independent variables,

which includes VC firm–related factors, portfolio company–related factors, and other control variables. β_x are coefficients to be estimated through the maximum likelihood method. The Cox model makes no assumptions about the distribution of the hazard rate, and can take any shape (i.e. they could be increasing or decreasing functions).

In our analysis of investment performance, we use the computed time to exit as the dependent variable. The "survival" time in years is either the time between the first investment date, the exit date, or the difference between the investment date and 31 March 2012. We do not consider the not-yet-exited deals as being unsuccessful, but rather treat them as being "right-censored."

Analysis

Directorship and VC firm characteristics

Univariate analysis

Before moving on to the analysis of the potential benefits of directorship in S&P 1500 companies that accrue to VC firms, we are interested in the initiation of the process, i.e., what characteristics of VC firms make them more likely to build such connections with large public companies? We first examine whether or not there is a difference between VC firms with and those without directorships in terms of their characteristics. Table 3 shows a comparison between these two groups. As shown in the table, VC firms with directorships were in general more reputable and larger than those without, as measured by IPO market share, VC investment share, and firm size. In terms of firm type, VC firms with directorships were mainly independent, while VC firms without directorships had higher proportions of "captive" VC firms (CVCs; i.e. those affiliated with

corporations, banks, or governments). This is not surprising, because having directors from independent VC firms sitting on the board will lead to fewer conflicts of interest than having directors from CVC firms, especially corporate firms, which are likely subsidiaries of their competitors. This explains why only three percent of directors on the boards of S&P 1500 companies in our sample were found to be from CVCs. Nearly 50 percent of the sample VC firms with directorships were headquartered in the venture hotbeds of California and New York State. VC firms without directorships, on the other hand, were relatively more geographically scattered.

Overall, thus, our results suggest that VC firms with directorships are larger and more reputable; mostly not affiliated with corporations, banks, or governments; and are based mainly in California or New York. The results so far, however, do not necessarily imply that such VC characteristics lead to directorships in S&P 1500 companies. Therefore, in the next section we test whether or not these characteristics cause VC firms to obtain directorships, while controlling for other determinants.

[INSERT TABLE 3 HERE]

Multivariate analysis

In this section, we test whether certain characteristics of VC firms lead to directorships in S&P 1500 companies, controlling for the variables shown in Table 3. The dependent variable in these models is a dummy variable that takes the value of one if a specific VC firm obtained at least one directorship in an S&P 1500 company, and zero otherwise. These regressions control for size effect, firm location, firm types, and year-fixed effects. The main explanatory variable we are interested in is VC firm reputation (Nahata, 2008). We use IPO market share and VC investment share as two measures of VC firm

reputation. IPO market share is the dollar market value of all companies taken public by the VC firm from the beginning of calendar year 1980 until a given calendar year, normalized by the aggregate market value of all VC-backed companies that went public from the beginning of 1980 up until the same calendar year. VC investment share is the dollar investment from the beginning of 1980 up until a given calendar year, normalized by the overall aggregate investment in the VC industry in those years. We also examine whether older, larger, and independent VC firms, and those based in venture hubs, are more likely to obtain directorships.

Model 1 presents regression estimates with VC reputation as measured by IPO market share. The coefficient of IPO market share is positive and significant at 1 percent, indicating that more reputable VC firms are more likely to obtain directorships in S&P 1500 companies. Model 2 examines an alternative measure of VC reputation. The coefficient of the VC investment share is positive and significant at 1 percent, which is consistent with the results of Model 1. In Model 3, we include both measures of reputation, and the results are consistent with our Hypothesis 1. In all three models we include VC firms' age, size, type, and location to examine whether or not these characteristics also influence the likelihood of becoming directors in S&P 1500 companies. The results indicate that larger, independent VC firms, and those based in venture hubs, are more likely to obtain directorships, which is consistent with Hypothesis 1. The results also indicate, however, that younger VC firms are more likely to obtain directorships in S&P 1500 companies, which is inconsistent with our hypothesis. Our explanation is that younger VC firms are more motivated to build up their reputations through holding directorships in large public companies, while older and more established VC firms have less incentive to do so. This explanation is similar

to Gompers's (1996) "grandstanding" theory, which suggests that young VC firms take companies public earlier than older VC firms do in order to establish their reputation.

Overall, our results show that more reputable and larger VC firms are more likely to obtain board seats in S&P 1500 companies, and that independent VC firms, based in venture capital hubs, are more likely to obtain directorships than are CVC firms and those based in other U.S. states.

[INSERT TABLE 3 HERE]

Directorships and fundraising

In the previous section, we examined the characteristics that determine the likelihood of becoming directors in S&P 1500 companies. Now we move on to the potential benefits that accrue to VC firms with directorships in S&P 1500 companies. We conduct our analysis in two steps. First, we compare VC firms with directorships with those without them to see if any significant difference exists between these two groups. The differences we found in the first step, however, may be due to a treatment effect, a selection effect, or both. Under the treatment effect, VC firms do benefit from their directorships in large public companies in terms of knowledge, experience, credibility, and visibility, which may lead to better fundraising and investment performance. Under the selection effect, S&P 1500 companies only recruit people to sit on their boards from reputable, experienced VC firms with good track records, in order to add value to the corporation. In other words, VC firms with directorships are essentially good VC firms in the first place, and the difference is not due to their holding directorships in S&P 1500 companies. It is also possible that both effects exist, since they are not mutually exclusive. That is to say, high-quality VC firms are more likely to obtain directorships

in large public companies and such directorships, in return, are beneficial to them, and thus make these VC firms even better. In order to test for a treatment effect, in the second step we focus only on VC firms with directorships and test if there is a significant difference between pre- and post-directorship periods in terms of fundraising and investment performance. Overall, our first step attempted to identify a potential treatment effect; step two aims to confirm its existence.

Celikyurt, Sevilir, and Shivdasani's study (2012) suggested a few potential benefits of holding directorships in large public companies that may accrue to VC firms, such as enhanced networks and reputation, greater visibility, and access to detailed knowledge of R&D efforts. In this study, we focus on two primary functions of VC firms: fundraising and funding portfolio companies. In the following sections, we examine whether or not holding directorships the boards of S&P 1500 companies facilitates VC firms to raise more funds and thus improve their investment performance.

Univariate analysis

Table 5 provides a univariate analysis of directorships and VC firms' fundraising abilities. The measures we use are fund size and target size. *Fund size* is equal to the average size of all funds a VC firm raised during the sampling period (1980- 2013). The *target amount* is the average of all target amounts set by a VC firm during the sampling period. While fund size measures the objective results of fundraising, target size captures VC firms' subjective perception. Panel A provides a comparison between VC firms with and those without directorships to test whether a difference exists between them in terms of fund and target sizes. The results show that the funds raised by VC firms with directorships was triple that of VC firms without directorships. Similarly, the

target size of VC firms with directorships was double the target amount of VC firms without directorships. The t-tests for these three measures are all significant, at 1 percent. The results indicate that not only are VC firms with directorships more confident (i.e., they set higher targets), but they are also better able to achieve their targets (i.e., they have larger fund sizes) compared to VC firms without directorships. The difference between VC firms with directorships and those without directorships does not suggest, however, that there is a treatment effect. This difference may occur because VC firms with directorships are essentially of high quality and thus are able to raise more funds, even without directorships.

Panel B aims to test if a treatment effect exists by comparing pre- and post-directorship fundraising. The results show that VC firms are able to raise more funds after obtaining a presence on the boards of directors of S&P 1500 companies. Similarly, the post-directorship target size is also higher. Panel C uses the difference-in-difference method to account for a potential industry effect. The results show that, on average, VC firms raised $205 million more than the industry average in the post-directorship period, but raised only $23 million above the industry average prior to obtaining directorships; this difference is significant at 1 percent. The results are similar for target size. Our results suggest that VC firms set higher targets and are able to raise more funds in the post-directorship period, even after controlling for the industry effect.

Overall, our results indicate that VC firms with directorships perform better than their counterparts without directorships in terms of fundraising, and that this ability results from their involvement in large public companies. We suggest that the main reason for this finding is that having a presence on the boards of large public companies provides networks, visibility, and creditability to VC professionals, which in turn

improves their ability to raise funds.

[INSERT TABLE 5 HERE]

3.4.2.2 Multivariate analysis

We now use a multivariate analysis to confirm the results of the univariate analysis above that having a presence on the boards of S&P 1500 companies leads to better fundraising performance for a VC firm. We use the Heckman two-stage model to estimate two equations. The first equation is the probability of raising a certain amount of funds in a given year; the second is the amount raised, assuming that the funds were raised in that particular year. Models 1 and 3 include all VC firms, i.e., those with and without directorships. The main independent variable we are interested in is *directorship*, a dummy variable that takes the value of one if a specific VC firm had directors on S&P 1500 company boards, and zero otherwise. We also control for other VC firm characteristics such as age, size, type, and location, and year fixed effects. The results indicate that having directors sitting on the board of mature public companies leads to more funds being raised, as well as higher targets. These results from the multivariate analysis are consistent with those of the univariate analysis. In terms of other VC characteristics, we find that older and larger VC firms are more likely to raise more funds and to set higher targets. Although the results indicate that a significant difference exists between VC firms with and those without directorships in terms of fundraising, as discussed above, the difference may be attributable to a selection effect. We run additional tests to address this concern.

Models 2 and 4 focus only on VC firms with directorships to test whether or not having a presence on the boards of large public companies improved these firms' fundraising

performance. The main independent variable we are interested in is *post-directorship*, a dummy variable that takes the value of one if a particular firm-year was during the post-directorship period, and zero otherwise. As shown in the table, *post-directorship* is positively and significantly related to both fund size and target size, suggesting that VC firms do perform better in terms of fundraising after their officers become directors of S&P 1500 companies. The results for other VC characteristics are similar to those of Models 1 and 3, i.e., larger and older VC firms are more likely to raise more funds and to set higher targets.

Overall, the multivariate results show that holding a directorship in an S&P 1500 company leads to better performance in terms of fundraising: VC firms are able to raise more funds and set higher targets after they have obtained directorships on the boards of S&P 1500 companies. The network and visibility provided by the directorships add significant value to VC firms' follow-up fundraising abilities.

[INSERT TABLE 6 HERE]

Directorships and investment performance

As discussed, our goal is to examine whether or not having a presence on the boards of mature public companies benefits VC firms in terms of their two main functions, raising funds and making investments. In this section, we test whether or not holding directorships leads to better investment performance, as measured by the likelihood of successful exits, either via IPOs or M&As (Nahata, 2008; Cumming and Dai, 2010; Zarutskie, 2010; Dai et al., 2012).

Univariate analysis

Table 7 presents the univariate analysis of *directorship* and VC *investment performance*. Panel A provides a comparison between the investment performance of VC firms with and those without directorships. As shown in the table, 11 percent of the firms in which investments were made by VC firms with directorships went public, as opposed to only 7 percent of firms in which investments were made by VC firms without directorships. In terms of M&As, 27.7 percent of the investments made by VC firms with directorships were exited through M&As, while only 19.7 percent were made by VC firms without directorships. The percentage of all successful exits of VC firms with directorships thus was nearly 12 percent higher than that of VC firms without directorships. This result alone, however, does not suggest that directorships improve VC firms' investment performance. It might also be the case that VC firms with directorships would be able, even without directorships, to take portfolio companies to successful exits. Therefore, in Panel B, we compare the pre-directorship with the post-directorship period by focussing only on VC firms with directorships. These results indicate that 40 percent of investments made during the post-directorship period were exited successfully, compared to 37 percent of investments made during the pre-directorship periods. The difference is significant, at 5 percent.

Overall, our results suggest that investments made by VC firms with directorships in S&P 1500 companies have higher success rates than those without such directorships. This better investment performance is due (at least in part) to their holding directorships, because the detailed knowledge of products and markets of large public companies that they gain is of considerable value in assessing and coaching their portfolio companies, which consequently improves their investment performance.

[INSERT TABLE 7 HERE]

3.4.3.2 Multivariate analysis

In this section, we test whether having a presence on the boards of S&P 1500 companies leads to better VC firm investment performance. Our analysis is carried out at the company level, with only one observation for each portfolio company. We use two measures to estimate investment performance, i.e., the likelihood of a successful exit, and the length of time to exit. The dependent variable in Models 1–3 is a dummy that takes the value of one if the portfolio company ultimately went public or was acquired by the end of 2012, and zero if otherwise; the dependent variable in Models 4–6 is the length of time to exit, calculated by taking the difference between the year in which the portfolio company received its initial funding and the observation year, or the end of 2012. Models 1 and 4 include all VC firms, while Models 2, 3, 5, and 6 only include VC firms with directorships. The main independent variables we are interested in are *directorship*, *post-directorship*, and *directorship length*. *Directorship* is a dummy variable that takes the value of one if a particular portfolio company was backed by at least one VC firm with a directorship in an S&P 1500 company, and zero otherwise. *Post-directorship* is a dummy variable that takes the value of one if the year in which the portfolio company received its initial funding was during the post-directorship period, and zero otherwise. *Directorship length* is the number of years of directorships in S&P 1500 companies at the time of investment. In the case of multiple investors, we take the average of their directorship length. Since the issue of VC exits has been studied extensively by previous studies, we include most of the control variables used in previous studies, such as characteristics of VC firms and investee companies, venture

stages,)and VC syndication. [8] We also include year fixed effects and industry fixed effects.

As shown in Table 8, in Models 1 and 4, *directorship* is positively related to the likelihood of successful exits and times to exit, and is significant, at 1 percent. The results indicate that having a presence on the board of large public companies leads to improved VC firm investment performance. The control variables are mostly consistent with results of previous studies. For instance, early-stage and seed-stage ventures are less likely to be exited; a large syndicate size leads to better performance; and a larger investment size contributes positively to the likelihood of a successful exit. This difference, however, may be attributable to a selection effect: VC firms with directorships are of high quality, and thus would be able to bring portfolio companies to successful exits, even without directorships. We therefore conduct an additional analysis to test if there is a treatment effect. In Models 2, 3, 5, and 6, we focus only on VC firms with directorships. As shown in the table, both *post-directorship* and *directorship length* are positively related to the likelihood of successful exits and times to exit, and both are significant, at 5 percent. These results indicate that VC firms do benefit from holding directorships in large public companies, and that their investment performance is improved (at least in part) as a result thereof.

Overall, our results show that not only do VC firms with directorships tend to perform better than do VC firms without directorships in terms of successful exits, but also that holding directorships in a large public company improves VC firms' abilities to take portfolio companies to successful exits.

[INSERT TABLE 8 HERE]

[8] For relevant use of these variables, see. Elisabete et al (2008), Megginson and Weiss (1991), Lerner (1994), Giot and Schwienbacher (2007).

Conclusion

In this paper, we examine whether or not having a presence on the boards of mature public companies benefits VC firms. We investigate potential benefits from the perspective of fundraising and investment performance. First, we posit that holding directorships in mature public companies provides enhanced networks, visibility, and credibility to VC firms, and therefore increases their ability to raise more funds. The second issue we examine is investment performance. We postulate that having a presence on the boards of mature public companies provides VC professionals access to better knowledge and experience of the product, market, and the industry, which can be transferred to their portfolio companies and thereby improve their investment performance.

Our empirical results show that VCs from reputable, high-quality VC firms are more likely to become directors in S&P 1500 companies, and that having a presence on the boards of such mature public companies brings considerable benefit to these VC firms in terms of fundraising and investment performance, while controlling for a matched sample of VC firms without directorships. We found that VC firms not only raise more funds, but also set higher targets after their officers become directors, suggesting that directorships provide visibility, networks, and credibility to VC firms. We also find that holding directorships increases the likelihood of successful exits of VC firms' portfolio companies, thus indicating that directorships provide VC firms access to knowledge and increased learning opportunities.

Our study extends Celikyurt, Sevilir, and Shivdasani's (2012) work by examining another side of the VC firm/S&P 1500 company relationship, and raises a few interesting questions for future research. For instance, how are these VC directors

selected? Are they invited or sent by VC firms?[9] Do these VC directors gain personal benefits, such as compensation or other non-cash rewards? Could sitting on boards be detrimental to VC firms if they have too many directors in large public companies, and thus are distracted from their primary responsibilities? How do they balance their roles in large public companies with those in small private companies? Future studies that examine these questions would improve our understanding of VC firms' roles in mature companies.

Our study also provides several practical implications for market practitioners. For instance, VC firms should view gaining directorships (in addition to grandstanding) as a means of reputation-building and as an opportunity to gain access to better knowledge and expertise. By sending officers of VC firms to large public companies, or hiring partners who already hold board seats, VC firms could gain credibility and enhanced networks, as well as better knowledge and expertise, which would then improve both their fundraising abilities and investment performance.

[9] Although we provide some evidence of VC firm level in our analysis, we do not examine the characteristics of individual VC directors, such as their work experience, education, and networks.

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Table 1: Definition of variables

Variable name	Definition of variable
Directorship	A dummy variable that takes the value of one if the VC firm had partners sitting on the boards of S&P 1500 companies, and zero if the VC firm had never obtained any directorships during the sampling period.
Post-directorship	A dummy variable that takes the value of one if the VC firm had existing directorships in S&P 1500 companies, and zero if the VC firm had not yet obtained directorships. This is only applied to VC firms that had obtained directorships during their lifetimes.
Directorship length	The number of years between the year in which the VC firm obtained its directorships and the observation year. This is applied only for VC firms that had directorships during their lifetimes.
IPO market share	This is measured as the dollar market value of all companies taken public by the VC firm from the beginning of calendar year 1980 up until a given calendar year, normalized by the aggregate market value of all VC-backed companies that went public during those years.
VC investment share	The dollar investment made by a VC firm from the beginning of 1980 up until a given calendar year, normalized by the overall aggregate investment in the VC industry in those years.
VC firm age	This is measured by the period between VC firms' year of incorporation and the observation year.
VC firm size	This is a VC firm's capital under management in a particular year, calculated by taking the sum of all previous funds raised by the VC firm.
Independent VC	A dummy variable that takes the value of one if the VC firm was not affiliated with any other entities, and zero otherwise.
VC based in venture hotbeds	A dummy variable that takes the value of one if the VC firm was based in either California or New York.

Table 1. Continued

Seed/Start-up venture	A dummy variable that takes the value of 1 if the venture was in the seed/start-up stage when it received its initial funding, and 0 otherwise.
Early-stage venture	A dummy variable that takes the value of 1 if the venture was in the early stage when it received its initial funding, and 0 otherwise.
Expansion-stage venture	A dummy variable that takes the value of 1 if the venture was in the expansion stage when it received its initial funding, and 0 otherwise.
Syndicate size	The total number of VC firms invested in the portfolio company.
Total funding received	The total amount of funding received by a portfolio company across all rounds.
GDP growth in the previous year	The GDP growth of the United States in the previous year.

Table 2: Summary statistics

This table presents the descriptive statistics of VC firms' directorships in S&P 1500 companies. Panel A describes VC firms' and VC directors' association with S&P 1500 companies. Panel B describes VC directors' experience in VC firms and S&P 1500 companies. Panel C describes VC directors' roles within VC firms or S&P 1500 companies. † VC directors who started as directors and then joined/started the VC firms constituted less than 15 percent of our sample, and therefore our main focus is VC directors who started with a VC firm before becoming a director in one or more S&P 1500 companies.

Panel A: VC firms and S&P 1500			
	Mean	Median	Max
No. of S&P 1500 companies per VC firm is associated with	2.539	1.000	25.000
No. of S&P1500 companies per director is associated with	0.893	1.000	6.000
No. of directors per VC firm has that sit on the board of S&P 1500	1.941	1.000	18.000
No. of directors per S&P 1500 company has on board	1.329	1.000	5.000
Panel B: VC directors' experience			
	Mean	Median	Max
Year in which the VC became a director in S&P 1500	1999	1999	2011
Year in which the VC joined/started the VC firm	1997	1998	2012
No. of years of experience in S&P 1500 before joining the VC firm†	5.988	4.500	30.000
No. of years of experience in VC firm before joining the S&P 1500	7.396	5.000	36.000
Panel C: VC directors' role			
	N	%	
VC directors' role in the VC firm			
Founder, Co-Founder	491	37.20%	
Other job titles	829	62.80%	
VC directors' role in S&P 1500			
Chairman, Vice Chairman	94	7.12%	
Chief officers (CEO,CFO,COO)	110	8.33%	
President, Vice President	127	9.62%	
Other job titles	1083	82.05%	
Directorship classification			
Employee	74	5.66%	
Linked	215	16.45%	
Independent	1017	77.81%	

Table 3: Directorships and VC firms' characteristics

This table presents an analysis of VC firms' characteristics based on two groups: VC firms with directorships and VC firms without directorships. Column 1 is on VC firms with directorships; Column 2 is on VC firms without directorships; Column 3 is the difference between Columns 1 and 2; Column 4 is t-statistics; and Column 5 is the p-value. *IPO market share* is the dollar market value of all companies taken public by the VC firm from the beginning of calendar year 1980 up until a given calendar year, normalized by the aggregate market value of all VC-backed companies that went public from the beginning of 1980 up until the same calendar year. *VC investment share* is the dollar investment from the beginning of 1980 up until a given calendar year, normalized by the overall aggregate investment in the VC industry in those years. *VC firm age* was measured by the period between VC firms' year of incorporation and the observation year. *VC firm size* is the VC firm's capital under management in a particular year, calculated by taking the sum of all previous funds raised by the VC firm. *Independent VC firm* is a dummy variable that takes the value of one if the VC firm was not affiliated with any other entities, and zero otherwise. *VC based in venture hubs* is a dummy variable that takes the value of one if the VC firm was based in either California or New York State. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	VC firms with directorships (1)	VC firms without directorships (2)	Difference (3) = (2)-(1)	t-statistics	p-Value
VC reputation					
IPO market share	0.062%	0.010%	-0.052%	-41.127	0.000***
VC investment share	0.328%	0.052%	-0.275%	-92.435	0.000***
VC characteristics					
VC firm age (no. of years)	12.511	15.694	3.182	6.724	0.000***
VC firm size ($ millions)	1,566.662	233.051	-1,333.611	-53.600	0.000***
Firm type					
Independent VC firm (Indicator)	99.129%	52.582%	-46.548%	-120.000	0.000***
Other types of VC firm (Indicator)	0.871%	47.418%	146.548%	120.000	0.000***
Firm location					
VC firms based in venture hubs (Indicator)	48.046%	36.224%	-11.821%	-29.785	0.000***
VC firms based in other states (Indicator)	51.954%	63.776%	111.821%	29.785	0.000***

Table 4: Likelihood of becoming directors

This table presents the regression analysis of the likelihood of VC firms obtaining directorships in S&P 1500 companies. All models were estimated using logistic regression. The dependent variable in all models is a dummy variable that takes the value of one if the VC firm obtained directorship in that particular year, and zero otherwise. Models 1 and 2 examine each reputation measure separately, and Model 3 aggregates two measures in one model. *IPO market share* is the dollar market value of all companies taken public by the VC firm from the beginning of calendar year 1980 up until a given calendar year, normalized by the aggregate market value of all VC-backed companies that went public from the beginning of 1980 up until the same calendar year. *VC investment share* is the dollar investment from the beginning of year 1980 up until a given calendar year, normalized by the overall aggregate investment in the VC industry in those years. *VC firm age* was measured by the period between VC firms' year of incorporation and the observation year. *VC firm size* is the VC firm's capital under management in a particular year, calculated by taking the sum of all previous funds raised by the VC firm. *Independent VC firm* is a dummy variable that takes the value of one if the VC firm was not affiliated with any other entities, and zero otherwise. *VC based in venture hubs* is a dummy variable that takes the value of one if the VC firm was based in either California or New York State, and zero otherwise. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Likelihood of becoming directors					
	Model 1		Model 2		Model 3	
VC reputation						
IPO market share	47.310***	(0.000)	-	-	25.320*	(0.069)
VC investment share	-	-	30.000***	(0.000)	28.850***	(0.000)
VC characteristics						
VC firm age (years)	-0.073***	(0.000)	-0.077***	(0.000)	-0.082***	(0.000)
VC firm size ($ millions)	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)
Independent VC firm (Indicator)	5.398***	(0.000)	5.399***	(0.000)	5.333***	(0.000)
VC based in venture hubs (Indicator)	0.431***	(0.000)	0.398***	(0.000)	0.387***	(0.000)
Year fixed effects	Present		Present		Present	
Log likelihood	-2369.6		-2401.1		-2357.8	
Pseudo R squared	0.128		0.131		0.133	
Number of observations	63,949		63,949		63,949	

Table 5: Directorship and VC fundraising—Univariate analysis

This table presents a univariate analysis of directorships and VC fundraising. Panel A compares VC firms with directorships with those VC firms without directorships. Panel B focusses only on VC firms with directorships and compares pre-directorship fundraising with post-directorship fundraising. Panel C addresses the industry effect concern by using the difference-in-difference method. *Fund size* is the average size of all funds a VC firm raised during the sampling period (1980 to 2013). *Target size* is the average of all target amounts set by a VC firm during the sampling period. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: VC firms with directorship vs. VC firms without directorships								
	All VC firms		VC firms with directorships		VC firms without directorships		Comparison between with- and without- directorship VC firms	
	N	Mean	N	Mean	N	Mean	t-statistics	p-value
Fund size	4,693	105.956	527	256.042	4,166	86.970	-14.435	0.000***
Target size	2,691	150.216	446	258.649	2,245	128.674	-9.125	0.000***
Panel B: Pre-directorship vs. Post-directorship								
	VC firms with directorships		Post-directorship		Pre-directorship		Comparison between pre- and post-directorship VC firms	
	N	Mean	N	Mean	N	Mean	t-statistics	p-value
Fund size	527	256.042	527	469.138	527	224.708	-6.757	0.000***
Target size	446	258.649	446	828.765	446	340.101	-5.921	0.000***
Panel C: Pre-directorship vs. Post-directorship (difference in difference)								
	VC firms with directorships		Post-directorship		Pre-directorship		Comparison between pre-and post-directorship VC firms	
	N	Mean	N	Mean	N	Mean	t-statistics	p-value
Fund size	527	14.992	527	205.261	527	22.977	-4.018	0.000***
Target size	446	51.433	446	246.228	446	40.297	-2.417	0.017**

Table 6: Directorship and VC fundraising—Multivariate analysis

This table presents a regression analysis of directorships and VC fundraising. All models were estimated using the Heckman two-stage model, where the first stage is the probability that a fund was raised in a given year, and the second stage is the amount raised/target set, given that the funds were raised in a particular year. All VC firms were included in each model. The dependent variable is either the natural logarithm of the amount of the raised funds (*fund size*) or the natural logarithm of the target size set by the VC firm (*target size*). Models 1 and 3 include all VC firms, while Models 2 and 4 only include VC firms with directorships. *Directorship* is a dummy variable that takes the value of one if the VC firm had at least one partner sitting on the board of an S&P 1500 company, and zero otherwise. *Post-directorship* is a dummy variable that takes the value of one if the observation year was during the post-directorship period. *VC firm age* is measured by the period between VC firms' year of incorporation and the observation year. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Fund size				Target size			
	Model 1		Model 2		Model 3		Model 4	
Second stage: size of funds raised / target size								
VC firms' directorship								
Directorship (Indicator)	0.338***	(0.000)	-	-	0.383***	(0.000)	-	-
Post-directorship (Indicator)	-	-	0.244***	(0.000)	-	-	0.200***	(0.000)
VC characteristics								
VC firm age (years)	0.142***	(0.000)	0.047***	(0.000)	0.087***	(0.000)	0.035***	(0.000)
VC firm size ($ millions)	0.001**	(0.012)	0.001***	(0.000)	0.001	(0.347)	0.001***	(0.000)
Independent VC (Indicator)	0.089**	(0.004)	0.342	(0.198)	-0.142***	(0.000)	0.736***	(0.008)
VC based in venture hubs (Indicator)	-0.075	(0.110)	0.133*	(0.079)	-0.033	(0.460)	0.196***	(0.005)
First stage: likelihood of raising funds								
VC firm age (years)	-0.041***	(0.000)	-0.019***	(0.000)	-0.033***	(0.000)	-0.019***	(0.000)
VC firm size ($ millions)	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)
VC based in venture hubs (Indicator)	0.097***	(0.000)	-0.003	(0.919)	0.112***	(0.000)	0.002	(0.948)
GDP growth in the previous year	0.015***	(0.000)	0.035***	(0.000)	-0.002	(0.546)	0.032***	(0.000)
Year fixed effects	Present		Present		Present		Present	
p-value of Chi-squared test	(0.000)		(0.000)		(0.000)		(0.000)	
Number of observations	70,343		10,121		66,104		9,238	

Table 7: Directorship and VC investment performance—Univariate analysis

This table presents a univariate analysis of directorship and VC investment performance. Panel A compares VC firms with directorships with those VC firms without directorships. Panel B focusses only on VC firms with directorships, and compares pre-directorship investment performance with post-directorship investment performance. All investments were made during 1980–2009; we track the outcome of each investment until the end of 2012, allowing at least three years for each investment to be exited. *Successful exits* (%) is the percentage of all investments that were exited through either IPO or M&A; we consider both IPOs and M&As as successful exits. *Time to successful exits* is calculated by taking the difference between the year a portfolio company received its first funding and the exit year, or the end of 2012. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: VC firms with directorship vs. VC firms without directorships								
	All VC firms		VC firms with directorships		VC firms without directorships		Comparison between with- and without-directorship	
	N	Mean	N	Mean	N	Mean	t-statistics	p-value
All successful exits	23,434	0.321	9,939	0.390	13,495	0.270	-19.482	0.000***
IPO exits	23,434	0.090	9,939	0.113	13,495	0.073	-10.508	0.000***
M&A exits	23,434	0.231	9,939	0.277	13,495	0.197	-14.352	0.000***
Panel B: Pre-directorship vs. Post-directorship								
	All VC firms with directorships		Post-directorship		Pre-directorship		Comparison between pre- and post-directorship	
	N	Mean	N	Mean	N	Mean	t-statistics	p-value
All successful exits	9,939	0.390	7,336	0.396	2,603	0.371	-2.202	0.028**
IPO exits	9,939	0.113	7,336	0.092	2,603	0.172	11.205	0.000***
M&A exits	9,939	0.277	7,336	0.304	2,603	0.199	-10.328	0.000***

Table 8: Directorship and investment performance

This table presents the regression analysis of directorship and investment performance, as measured by the likelihood of successful exits or times to exit. All VC firms were included in Models 1 and 4. Models 2, 3, 5, and 6 only include VC firms with directorships. This is a company-level analysis, with only one observation for each portfolio company. Models 1, 2, and 3 are estimated using logit regression, while Models 3, 4, and 5 were estimated using the Cox hazard model. The dependent variable in Models 1–3 is a dummy variable that takes the value of one if the company was exited through either IPO or M&A by the end of 2012, and zero otherwise. The dependent variable in Models 3–6 is the time to exit, calculated by taking the difference between the year in which the portfolio company received its initial funding and the observation year, or the end of 2012. Companies that had not yet exited were treated as "right-censored." *Directorship* is a dummy variable that takes the value of one if the portfolio company received funding from at least one VC firm with directorships, and zero otherwise. *Post-directorship* is a dummy variable that takes the value of one if the year in which a portfolio company received its initial funding was during the post-directorship period, and zero otherwise. *Directorship length* is the number of years between the year in which a VC firm obtained directorships and the observation year. The definitions of control variables are provided in Table 1. Year and industry dummies are included to control for year and industry fixed effects, respectively. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

	Likelihood of successful exits						Times to exit					
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
VC firm's directorship												
Directorship	0.158***	(0.000)					0.163***	(0.000)				
Post-directorship			0.132**	(0.034)					0.088*	(0.057)		
Directorship length					0.011**	(0.019)					0.008**	(0.020)
VC firm characteristics												
VC firm age	0.012	(0.530)	0.003	(0.938)	-0.015	(0.666)	0.019	(0.206)	0.015	(0.549)	0.003	(0.925)
VC firm reputation	4.669	(0.154)	8.037	(0.114)	8.641*	(0.088)	4.028*	(0.077)	7.290*	(0.059)	7.760**	(0.042)
Based in venture hotbeds	0.136***	(0.000)	0.111**	(0.028)	0.104**	(0.039)	0.139***	(0.000)	0.104***	(0.006)	0.098***	(0.010)
Venture stage												
Seed/start-up stage	-0.385***	(0.000)	-0.304***	(0.005)	-0.308***	(0.005)	-0.371***	(0.000)	-0.307***	(0.000)	-0.310***	(0.000)
Early stage	-0.247***	(0.000)	-0.178*	(0.092)	-0.183*	(0.084)	-0.244***	(0.000)	-0.186**	(0.027)	-0.190**	(0.024)
Expansion stage	-0.239**	(0.001)	-0.197*	(0.077)	-0.201*	(0.071)	-0.241***	(0.000)	-0.197**	(0.026)	-0.200**	(0.025)

Table 8. Continued

Other control variables												
VC syndicate size	0.068***	(0.000)	0.062***	(0.000)	0.062***	(0.000)	0.058***	(0.000)	0.054***	(0.000)	0.054***	(0.000)
Corporate VC	0.065	(0.211)	0.003	(0.970)	-0.001	(0.989)	0.091**	(0.024)	0.032	(0.599)	0.033	(0.586)
Bank VC	-0.177***	(0.001)	-0.113	(0.210)	-0.106	(0.239)	-0.119***	(0.006)	-0.065	(0.350)	-0.059	(0.395)
Total funding	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)
Year fixed effects	Present		Present		Present		Present		Present		Present	
Industry fixed effects	Present		Present		Present		Present		Present		Present	
Log-likelihood	-11985.969		-5882.719		-5882.157		-65055.484		-32358.902		-32358.121	
Pseudo R squared	0.085		0.074		0.074		-		-		-	
Number of observations	20,458		9,450		9,450		20,458		9,450		9,450	

Table 9: Correlation matrix

This table shows the pair-wise correlations matrix of the independent variables used in the logit and Cox models in Tables 4, 6, and 8.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	VC firm age (years)	1.000											
(2)	VC firm size ($ millions)	0.120	1.000										
(3)	Independent VC (I)	0.007	-0.043	1.000									
(4)	VC based in venture hubs (I)	0.145	0.104	-0.044	1.000								
(5)	Seed/start-up venture	-0.028	-0.031	0.016	0.023	1.000							
(6)	Early-stage venture	-0.008	-0.023	0.000	0.064	-0.552	1.000						
(7)	Expansion-stage venture	0.032	0.031	-0.017	-0.065	-0.351	-0.463	1.000					
(8)	Syndicate size	0.004	0.035	-0.409	0.245	0.013	0.035	-0.043	1.000				
(9)	Total funding received	0.131	0.140	-0.156	0.189	-0.275	0.123	0.115	0.351	1.000			
(10)	IPO market conditions	0.010	0.049	0.001	0.031	0.026	-0.027	0.002	0.045	0.021	1.000		
(11)	Directorship (I)	0.289	0.070	0.103	0.232	-0.010	0.083	-0.077	0.188	0.271	0.040	1.000	
(12)	Directorship length (years)	0.357	0.035	0.093	0.236	-0.012	0.081	-0.069	0.161	0.238	-0.008	0.744	1.000

Appendix
Table 1: VC firms' directorship by year

This table presents U.S. VC firms' directorships in S&P 1500 companies from 1985 to 2012. The number of VC firms with directorships, the number of VC firms without directorships, the percentage of VC firms with directorships, the percentage of VC firms without directorships, and the total number of VC firms are presented. Figure 1 is based on this table, and is presented below. The line represents the *percentage* of VC firms with directorships, and the bars represent the *number* of VC firms with directorships.

Year	No. of VC firms with directorships	No. of VC firms without directorships	% of VC firms with directorships	% of VC firms without directorships	Total no. of VC firms
1985	0	2,489	0.000	100.000	2,489
1986	5	2,656	0.188	99.812	2,661
1987	12	2,795	0.428	99.572	2,807
1988	33	2,896	1.127	98.873	2,929
1989	51	3,061	1.639	98.361	3,112
1990	67	3,140	2.089	97.911	3,207
1991	81	3,240	2.439	97.561	3,321
1992	86	3,386	2.477	97.523	3,472
1993	105	3,506	2.908	97.092	3,611
1994	131	3,649	3.466	96.534	3,780
1995	170	3,880	4.198	95.802	4,050
1996	212	4,118	4.896	95.104	4,330
1997	261	4,387	5.615	94.385	4,648
1998	323	4,667	6.473	93.527	4,990
1999	386	5,230	6.873	93.127	5,616
2000	434	5,808	6.953	93.047	6,242
2001	494	6,059	7.539	92.461	6,553
2002	547	6,384	7.892	92.108	6,931
2003	589	6,540	8.262	91.738	7,129
2004	624	6708	8.511	91.489	7,332
2005	676	6913	8.908	91.092	7,589
2006	709	7,124	9.051	90.949	7,833
2007	756	7,316	9.366	90.634	8,072
2008	799	7,492	9.637	90.363	8,291
2009	826	7,674	9.718	90.282	8,500
2010	855	7,812	9.865	90.135	8,667
2011	875	7,940	9.926	90.074	8,815
2012	883	8,056	9.878	90.122	8,939

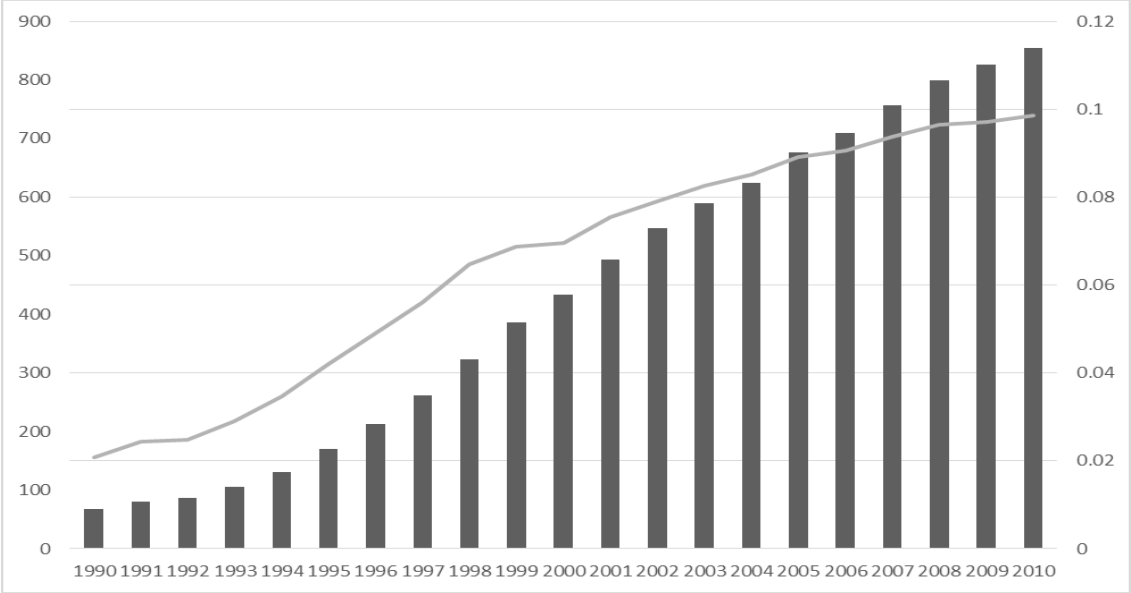

Figure 1. VC firms' directorships by year

Table 2: VC firms and their directorships in S&P 1500 firms—Top 20

This table presents the top 20 VC firms with the largest number of directors on S&P 1500 firms. The number of directors on the boards of S&P 1500 firms, and the number of S&P 1500 firms they are associated with, are both presented.

VC firm name	No. of directors on S&P 1500 firms	No. of S&P firms VC is associated with
Warburg Pincus, LLC	18	25
General Atlantic, LLC	13	24
Bain Capital, Inc.	13	18
The Carlyle Group, LP	11	18
Madison Dearborn Partners, LLC	13	15
Silver Lake Partners, LP	9	15
TPG Capital, LP	15	14
Sequoia Capital	8	14
Thomas H. Lee Partners, LP	10	12
Oak Hill Capital Management	9	12
Kohlberg Kravis Roberts & Co., LP	9	11
Benchmark Capital Management	8	11
Clayton Dubilier & Rice, LLC	8	11
GSC Partners	8	11
AEA Investors, LLC	9	10
Irving Place Capital, LLC	9	10
New Enterprise Associates, Inc.	9	10
Kleiner, Perkins, Caufield & Byers, LLC	8	9
Blum Capital Partners, LP	7	8