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Change gears before speeding up: The roles of Chief Executive Officer human capital and venture capitalist monitoring in Chief Executive Officer change before initial public offering

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Abstract

Research Summary: With data on 1,156 venture capitalist (VC)-backed U.S. initial public offerings (IPOs), we find that the initial level of Chief Executive Officer (CEO) human capital (HC) when a firm receives its first VC investment is negatively related to the likelihood of changing CEO before IPO. The distance between a firm and its lead VC has a positive effect on the likelihood and this effect is stronger when the initial CEO HC is lower. These results suggest that as a larger distance amounts to greater cost of VC direct monitoring, VC is more compelled to change CEO, especially when initial CEO HC is lower. Controlling for the endogeneity of CEO change, we find that CEO change before IPO has a positive relationship with the firm's IPO valuation and changes in operating performance.

Managerial Summary: Changing CEO prior to IPO is common in startups, especially in those backed by VCs. We argue that VC can monitor a portfolio firm in two ways (which are not mutually exclusive): *directly monitoring* onsite the firm and *indirectly monitoring* relying upon the firm's top management especially CEO. We propose and find empirical evidence to support that as

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a larger distance between a firm and its lead VC amounts to greater cost of direct monitoring and thus making direct monitoring less feasible, the VC is more compelled to change CEO, especially when the CEO is deemed less capable (i.e., having a lower level of human capital). We also find that CEO change before IPO increases a firm's IPO valuation and changes in operating performance.

KEYWORDS

CEO change, CEO human capital, initial public offering, IPO performance, venture capital

1 | INTRODUCTION

On June 20, 2017, Uber, a unicorn startup, ousted its co-founder Chief Executive Officer (CEO) Travis Kalanick. After a high profile search that included candidates such as Meg Whitman, CEO and board chair of Hewlett-Packard, and Jeff Immelt, then CEO and board chair of General Electric, Uber hired Dara Khosrowshahi as CEO on August 30, 2017. This change in the CEO position represented an important step moving toward Uber's planned initial public offering (IPO) in 2019. While what happened in Uber was controversial and unusual, consisting of scandals including accused sexual harassments, changing CEO prior to IPO is quite common in startups, especially in those backed by venture capitalists (VCs). As documented by Wasserman (2012, p. 299), among the 1,542 startups in the technology and life science sectors that he surveyed, 61% of these firms replaced CEO, sometimes multiple times, after receiving VC funding.

Changing CEO prior to IPO is necessary to many startups because the environment of a public-listed company is different from and more complex than that of a startup. Firms preparing for IPO need to assemble a broad range of managerial capabilities to deal with the more complex environment after IPO. As professional investors, VCs typically understand such needs and pay special attention to the leadership and governance of their portfolio firms (Pollock, Fund, & Baker, 2009; Sahlman, 1990). If necessary, they can use their power in the boardroom and/or through their investment contracts to replace the incumbent CEO (Levin, 2002). However, changing CEO is not cost- or risk-free, even if VCs have the power to do it in their portfolio firms. The literature on CEO succession has demonstrated that changing CEO can be disruptive, even in large and mature corporations (for a review, see Finkelstein, Hambrick, & Cannella, 2009). Compared to large and mature corporations, startups typically do not have well-established organizational structures, procedures or policies, and rely heavily upon the specific individuals at key positions. Thus, replacing CEO can present a great challenge to startups and the VCs that back the startups.

Therefore, it is important to examine how VCs make decisions on CEO change in their portfolio firms. Recent studies on this topic have found that firm size, firm growth, founder ownership (Boeker & Karichalil, 2002), and industry uncertainty (Pollock et al., 2009) may affect such decisions. These studies suggest that task environments of startups, as indicated by their size, growth and industry uncertainty can affect such decisions and power, as indicated by founder ownership, matters too.

In this study, drawing upon a human capital perspective and an agency view, we develop and empirically test a theoretical model on how VC monitoring affects VCs' decisions on CEO change in their portfolio firms. Since we are interested in the role of VCs in CEO change in their portfolio firms, initial CEO refers to the person in the CEO position when a firm receives its first round VC funding, who may and may be not the founder CEO of the firm.[1] We propose that VCs can monitor a portfolio firm in two ways (which are not mutually exclusive): *directly monitoring* onsite the firm and *indirectly monitoring* relying upon the firm's top management especially CEO (i.e., agent). Since CEO human capital (i.e., the agent's ability) is crucial in VC indirect monitoring, a CEO with a low level of human capital is more likely to be replaced after the firm receives VC investment. Moreover, the extent to which VC direct monitoring is feasible in their portfolio firms varies. As a larger geographic distance between a firm and its lead VC amounts to more costly direct monitoring, direct monitoring is less feasible for a remote lead VC, increasing the need for the VC to change CEO, particularly when the firm's initial CEO HC is low. In essence, we treat VCs' direct monitoring and indirect monitoring in portfolio firms as substitutes.

With data on 1,156 VC-backed IPOs debuted in the U.S. markets in 1995–2013, we find empirical support to these predictions. Moreover, as suggested in the arguments above, VCs' decisions on CEO change in portfolio firms are endogenous. Without controlling for such endogeneity, empirical evidence on the performance consequences of CEO change in startups are speculative at best. Using the distance between a firm and its lead VC as an instrument variable, we find that CEO change before IPO has a positive relationship with the firm's IPO valuation (i.e., Tobin's Q) and changes in its operating performance around IPO and after IPO.

Our study can make important contributions to the entrepreneurship literature. First, by integrating a human capital perspective and an agency view, we develop a coherent theoretical framework that focuses on the role of VC monitoring in VC decisions on CEO change in their portfolio firms. Our framework explains how VCs achieve the delicate balance between pros and cons of replacing CEOs in their portfolio firms. Second, by controlling for the endogeneity of VCs' decisions on CEO change in their portfolio firms, we provide strong empirical evidence on the benefits of CEO change in VC-backed firms before their IPO.

2 | RESEARCH HYPOTHESES

2.1 | Initial level of CEO human capital and CEO change before IPO

As the most influential member of the executive leadership team, CEO plays a central role in the decision-making process, which affects the firm's development path and performance (Offstein & Gnyawali, 2005). In particular, given the small size of an entrepreneurial firm and the high uncertainties to which it is usually exposed, CEO plays a crucial role in shaping the firm's vision and direction (Bruton, Fried, & Hisrich, 1997), and in influencing its performance (Finkelstein & Hambrick, 1990; Zimmerman, 2008).

Given the importance of CEO, VCs give a significant weight in their investment decisions to the ability of the CEO in providing strategic leadership to the firm as it evolves from a startup stage to a public company (De Clercq, Fried, Lehtonen, & Sapienza, 2006; Fried & Hisrich, 1995). The firm life cycle theory suggests that the required managerial capabilities

[1]Empirically we control for the founder status of the initial CEOs.

change as firms evolve from entrepreneurial endeavors concerned with their survival to established entities facing complex organizational systems (Rubenson & Gupta, 1992). CEOs whose capabilities do not catch up with their firms' growth can adversely affect the productivity, and may result in a failure in adapting their firms and developing products and required processes for the success of the firms (Bartel & Lichtenberg, 1987). As a result, new ventures may outgrow managerial capabilities of their incumbent CEOs, raising the need to change the incumbent CEOs (Wasserman, 2003).

Of course, not all CEOs will be outgrown in managerial capabilities as their firms mature and move toward IPO. Incorporating a human capital perspective, we propose that CEOs with a high level of human capital can continuously provide the required managerial capabilities to their firms and that it is CEOs with a low level of human capital that are more likely to be replaced prior to IPO. Human capital includes both formal education and off-the-job training, and on-the-job training (Becker, 1964, 1993). Accordingly, in this study, a CEO's human capital refers to his/her managerial skills gained from both education and experience. Degrees and education credentials indicate individuals' differences in abilities, persistence and other valuable traits (Becker, 1993, pp. 19–20). Since we are interested in whether CEOs have the required managerial capabilities to lead their firms toward IPO, for education, we focus on education in business. Formal business education allows CEOs to have a good understanding of the complexity of managing a modern corporation and the various and even conflicting demands of its internal and external constituents. In their work on human capital theory, Murphy and Zabojnik (2004) argued that over the past 30 years, general managerial skills have become more important for the CEO job than firm-specific knowledge. As business and management and other related disciplines make steady progresses, once an individual has mastered knowledge and skills in these disciplines, his/her knowledge and skills are transferable across firms and even industries, which can substantially improve his/her ability to manage any company. They used MBA degrees as a proxy for general human capital and found that an increase in the share of CEOs with MBA degrees in an industry is associated with a decrease in the average job tenure of executives before they are appointed as CEO (a typical proxy for firm-specific human capital).

Whereas formal education certainly represents a process of learning, people can also learn from their prior experience, resulting in increased performance in their current jobs (Eesley & Roberts, 2012). The most studied experience in the entrepreneurship literature arguably is founders' prior startup experience (Eesley & Roberts, 2012; Hsu, 2007). Other experiences also matter. For example, Beckman and Burton (2008) found that the founding team's prior functional experiences predict subsequent senior managers' backgrounds. They also found that firms started with a broadly experienced team receives VC investments faster and achieve other milestones faster.

In this study, since we are interested in whether CEOs have the required managerial capabilities to move their firms from entrepreneurial endeavors to public-listed companies, we include a broad range of experience—that is, prior IPO experience, prior CEO experience, and prior experience as an executive in a large listed company, all of which have direct relevance to this transition. More specifically, CEOs with prior IPO experience have personally experienced an IPO process as an executive or a director. They not only understand the roles and demands of key players such as regulators, institutional investors, underwriters and auditors, they also have connections with these key players that can help the CEOs' future IPOs. Moreover, CEOs with prior CEO experience and/or prior large listed company executive experience tend to have a good understanding of the complicated environment of a modern corporation including

greater public and regulatory scrutiny, and thus can better recognize and address challenges as their firms prepare for IPO. For example, Yang, Zimmerman, and Jiang (2011) found that CEO's prior executive experience—that is, a C-level executive or a vice president of another firm—significantly reduces a new venture's time to IPO. Similarly, Gimmon and Levie (2010) found that founders with business management experience—that is, having profit and loss responsibility exercised by being CEO, self-employed, or project manager, have a higher likelihood of receiving external funding and venture survival. These empirical evidences support the value of CEOs' prior executive experience in IPO firms. Based upon these arguments and empirical evidence, we propose that,

Hypothesis (H1) *The initial level of CEO human capital at the time when a firm receives its first VC funding is negatively related to the likelihood that the firm changes CEO before its IPO.*

2.2 | Lead VC-firm distance, VC monitoring, and CEO change before IPO

The above prediction is based upon the argument that CEOs with a low level of human capital cannot catch up with the managerial needs of firms that prepare for IPO, and thus, need to and will be replaced. However, VCs' decisions on replacing CEO after investing in a portfolio firm are certainly more complicated than that. First, as noted earlier, startups typically do not have well-established organizational structures, procedures or policies, and rely heavily upon the specific individuals at key positions. Thus, replacing CEO can be disruptive to a venture. Second and related, replacing CEO after a VC joins a portfolio firm breaks the implicit "social contract" within the firm, which can hurt morale and commitment of other managers/employees and prompt them to looking for alternative opportunities (Friedman & Saul, 1991). Third, there is value in keeping the top management team stable, especially the founders, in IPO firms. For example, Nelson (2003) found that investor reactions to founder-led firms' IPOs are higher than to the comparison group, relative to accounting value.

We argue that whether VCs change CEO after investing in portfolio firms also depends upon whether they have alternative ways to monitor the firms. We propose that VCs can monitor their portfolio firms in two ways that are not mutually exclusive: *directly monitoring* and *indirectly monitoring*. *Indirect monitoring* refers to that VCs rely upon their agents, that is, portfolio firms' top management teams especially the CEOs, to monitor the firms. Standard agency theory is based upon the assumption of goal incongruence between principals and agents, and argues that agents, if not monitored, may purse their own interests that may differ from the principals' interests (Eisenhardt, 1989). In an extension of the agency theory, Hendry (2002) pointed out that principals face another problem—the problem of honest incompetence. He argued that agents' incompetence can lead to essentially the same predictions as in standard agency theory, even when agents are assumed to be honest and dutiful.

Changing CEO in portfolio firms helps VCs to address the agency problem in the firms and improves the effectiveness of their indirect monitoring in the firms. First, a CEO hired by the VC owes his/her job to the VC and thus tends to feel beholden to the VC. In comparison, a CEO who founded the firm or took office before the VC's joining has already established his/her power in the firm and is harder to be controlled by the VC. In simple words, a CEO appointed by a VC is more like the VC's agent than a CEO who was already in the CEO office when the firm received VC funding. Thus changing CEO helps solve the agency problem as

stated in traditional agency theory. Moreover, the VC can select a new CEO whose knowledge and skills fit the firm's task requirements, helping solve the problem of agents' honest incompetence.

Meanwhile, *directly monitoring* refers to VCs' onsite involvement with their portfolio firms. Different from large public-traded companies, which typically have dispersed ownership structures that reduce both the incentive and ability for owners to monitor management (Jensen & Meckling, 1976), ownership in VC-backed firms is relatively concentrated before their IPOs. A lead VC, by definition, owns a significant proportion of ownership of the firm. The existing literature on VCs has shown that VCs can be closely involved in their portfolio firms and such involvements increase the firms' innovation and the likelihood of a successful exit (Bernstein, Giroud, & Townsend, 2016). In particular, lead VCs are actively involved in the management of portfolio firms while syndicate members generally play a passive role (Gompers & Lerner, 1996; Gorman & Sahlman, 1989). For example, in Bernstein et al.'s (2016) survey of 306 alumni of Stanford, MIT and Dartmouth that had VC experiences, the survey participants reported that they spent 48% of their time monitoring and assisting portfolio firms. In other words, onsite direct monitoring is a feasible option for lead VCs in their portfolio firms.

As noted above, although changing CEO allows a lead VC to have an agent of its choice in a portfolio firm, changing CEO can cause disruption and other problems in the firm. We propose that whether a VC changes CEO depends upon the extent to which its direct monitoring in the firm is feasible. More specifically, we propose that a VC is more likely to change CEO in a portfolio firm if its direct monitoring of the firm is less feasible.

One important factor affecting the cost and thus the feasibility of VC's direct monitoring in a portfolio firm is the geographic distance between the VC and the firm. Previous studies have argued that a VC's ability to provide monitoring, coaching, and networking to a portfolio firm depends on how frequently it interacts with the firm and its top management team, which is further dependent upon the geographic distance between the VC and the firm (Chen, Gompers, Kovner, & Lerner, 2010; Lerner, 1995). For example, Lutz, Bender, Achleitner, and Kaserer (2013) found that spatial proximity increases the likelihood of forming a financing relationship between a VC and a firm even in a dense economy like Germany, and this is particularly important for a lead VC. Lerner (1995) found that VCs are more likely to sit on the boards of geographically proximate portfolio firms. Bernstein et al. (2016) found that 71% of their survey respondents reported that they tended to visit local portfolio firms—those located within 50 miles of the VCs, more than nonlocal firms. Proximity reduces the time cost of monitoring, and increases mentoring and knowledge flow as a result of more frequent planned interactions and more serendipitous interactions (Bernstein et al., 2016; Sapienza & Gupta, 1994; Sorenson & Stuart, 2001). Moreover, social networks tend to be regional (Blau, 1977). Thus, both monitoring cost and information cost decreases as VC-portfolio firm distance decreases (Lutz et al., 2013).

Geographic proximity is particularly important for lead VCs because they tend to be actively involved in the management of portfolio firms whereas syndicate members tend to take a passive role (Bernstein et al., 2016; Wright & Lockett, 2003). When a lead VC is geographically proximate to a portfolio firm, the VC can have more frequent interactions with the firm' top management team and provide oversight to the firm, therefore there is a lower need to change the CEO. On the contrary, since direct monitoring is less feasible for a remote lead VC, it is more crucial for the VC to replace CEO in a portfolio firm. In examining investment contracts between VCs and portfolio firms, Bengtsson and Ravid (2009) found that when the geographical distance between a VC and a portfolio firm is greater, the investment contract tends to include

more investor-friendly cash flow contingencies, which give high-powered incentives to the firm's managers. Their findings are consistent with our argument that when a larger distance makes VC direct monitoring less feasible, indirect monitoring through agents becomes more important—by providing high-powered incentives to agents in their study or by changing agents in our study. Based upon these discussions, we propose that,

Hypothesis (H2) *The distance between a firm and its lead VC is positively related to the likelihood that the firm changes CEO before its IPO.*

Moreover, we propose that the relationship above is stronger when a portfolio firm's initial CEO HC level is low than when it is high. As discussed earlier, changing CEO in a portfolio firm not only allows a lead VC to have an agent of its own choice, but also provides an opportunity for the VC to choose a new CEO whose knowledge and skills fit the firm's task requirements, helping solve the problem of agents' honest incompetence (Hendry, 2002). Clearly, the problem of honest incompetence is particularly salient when the initial CEO has a low level of HC, thus providing strong incentive for a remote lead VC to replace the low-HC initial CEO. Therefore,

Hypothesis (H3) *The positive relationship between the lead VC-firm distance and the likelihood of changing CEO before IPO is stronger when the firm's initial level of CEO HC is low than when it is high.*

2.3 | CEO change and IPO valuation

Above, we argued that CEO change in portfolio firms is VCs' endogenous decision. We propose that VCs tend to change CEO when the initial CEO has a low HC, when a large distance makes it less feasible to directly monitor the firm, and especially when both conditions exist. In essence, we argue that VCs' onsite direct monitoring and indirect monitoring, which relies upon agents, are substitutes. The co-existence of direct monitoring and indirect monitoring provides opportunities for lead VCs to balance pros and cons of CEO change in portfolio firms. That is, since a proximate lead VC can have direct monitoring in a portfolio firm, it does not need to change CEO in the firm (even if s/he has a low level of HC), so that the VC can avoid the disruption of CEO change. In contrast, since direct monitoring is less feasible for a remote lead VC, it tends to replace CEO in a portfolio firm, especially if the CEO has a low level of HC. In this scenario, the benefit of CEO change (or the potential damage of not changing CEO) outweighs the potential cost and risk of CEO change. Put together, we propose that CEO change can improve the quality of a portfolio firm, which can be translated into a higher IPO valuation.

Here, we would like to crystalize two underlying assumptions of this prediction, which have been more or less implied in our earlier arguments. The first assumption is that the initial CEO is not chosen endogenously by VCs or others to ensure high firm performance and as a result, there is greater variation in the initial CEO human capital than later. This assumption very likely holds in our research context because we focus on entrepreneurial firms before they receive first VC investment. While it is possible that people with a high level of human capital choose to start their businesses after a successful career in established organizations, it is equally possible that people with a low level of human capital are forced to take an entrepreneurial path because they have limited career options in established organizations. Therefore,

while the population that starts a new venture is clearly selected, conditional on starting a new venture, some firms will have CEOs with higher or lower human capital. However, this would change after these firms receive VC investments. As professional investors, VCs understand the importance of having a high-profile CEO for the venture to go to IPO and to succeed after it. Therefore, VCs tend to make decisions on CEO change in order to have a high level of CEO human capital at the IPO time and such decisions can improve the portfolio firms' performance.

The second assumption is that lead VC-firm distance is not correlated with IPO firms' performance other than through VC's decision on CEO change. As argued earlier, distance reduces VC's chance to directly monitor a portfolio firm (which is in turn important for the firm's performance), one may argue that distance can directly affect the firm's performance. The key point here is that, as we argued, direct monitoring is not the only monitoring option that VCs have, instead they also have the option of indirect monitoring that relies upon having a loyal and capable agent (i.e., CEO) in the firm. Indeed, as professional investors, lead VCs would not jump into an investment opportunity without knowing some possible ways that would allow them to engage in the firm. As we have noted, we view VCs' onsite direct monitoring and indirect monitoring as substitutes. Considering the potential disruption of CEO change, we argue that VCs tend to make decisions on CEO change based upon the feasibility of direct monitoring, which is a function of distance. Therefore, while we cannot definitely rule out the possibility that distance can directly affect a portfolio firm's performance, we expect that the leftover effect of distance on performance, on top of CEO change, is small.[2] It is under these two assumptions, which are not implausible in our research context, that we propose the following hypothesis.

Hypothesis (H4) *CEO change before IPO is positively related to a firm's IPO valuation*.

3 | METHODS

3.1 | Sample

In this study, we followed a multistage procedure to filter the list of all 6,116 IPOs in the U.S. markets obtained from the Securities Data Company (SDC) database from 1995 to 2013. In line with prior research, we first excluded real estate investment trusts, joint ventures, closed-end funds, foreign IPOs, unit offerings, corporate spinoffs and carve-outs, financial IPOs, and those with an offer price below five dollars as their institutional characteristics are different from those of typical IPO firms (Jain & Kini, 1994; Jain & Tabak, 2008). This resulted in a sample of 3,896 IPOs. We then focused on the sample of 1,875 IPOs that were backed by VCs. We eliminated IPOs with missing data on their VC firms in the VentureXpert database, which resulted in 1,394 IPOs. In this study, we focus on CEO change *following* VC investments. This gives a great assurance on the role played by VC firms in CEO changes in these firms and is consistent with prior research stating that CEO replacement is usually initiated by VCs (e.g., Boeker & Karichalil, 2002). From the IPO prospectuses, we hand-collected data on CEO and IPO company characteristics, and got a final sample of 1,156 companies with complete data. This dataset has information on initial CEOs' and IPO-stage CEOs' ownership, education, and experience. It also includes data on lead VC age, nature, and ownership, as well as a set of IPO firm characteristics such as size, industry, age and firm value at IPO.

[2]Our empirical investigations show that distance is a plausible instrument, which is consistent with the causal effect.

3.2 | Modeling methodology and measurements of variables

3.2.1 | Models testing H1–H3

Our H1–H3 examine the impact of initial CEO HC and VC-portfolio firm distance on the likelihood of CEO change. *CEO Change* is set to "1" if a firm changed CEO between receiving the first round of VC investment and IPO, and "0" otherwise. Since the dependent variable is a dummy, probit models are used to test these hypotheses. In our sample of 1,156 IPO companies, 472 firms changed their CEOs between the first round VC financing and IPO, and others did not.

The main predictors in these models are the initial level of CEO human capital (*Initial CEO HC Index*) and the distance between the lead VC and a IPO firm (*Lead VC-Firm Distance*). In line with Pollock et al.'s (2009) recent calling for a greater use of indices in research on strategy and governance, we construct a CEO human capital (HC) index, which is an index comprised of five dimensions of CEO human capital. Three dimensions are associated with CEO Experience: whether or not a CEO had a prior IPO experience as an executive or a director, a prior experience as CEO, and a prior experience in a public-listed company on the S&P 500 list, the Fortune 500 list or a similar foreign stock market index. Two dimensions are associated with CEO Education: whether or not a CEO possesses an MBA or another graduate-level management degree, and whether or not a CEO has an undergraduate degree in finance and/or accounting.[3] Thus, the CEO HC index ranges from zero to five. The use of a single index avoids the collinearity problem associated with potential high correlations between individual components (Pollock et al., 2009), and allows a parsimonious way to test hypotheses.

Lead VC-Firm Distance is calculated using the natural logarithm of the shortest travel time in minutes between the headquarters of the IPO firm and the lead VC (Bernstein et al., 2016). To test H3, we further divide the variable of *Lead VC-Firm Distance* into two variables: *Distance in Low CEO HC* and *Distance in High CEO HC*. *Distance in Low CEO HC* is equal to the *Lead VC-Firm Distance* variable if a firm's initial level of CEO HC is lower than the sample median, and 0 otherwise. *Distance in High CEO HC* refers to the *Lead VC-Firm Distance* variable if a firm's initial level of CEO HC is equal or higher than the sample median and 0 otherwise.

The models also control for a set of variables related to initial CEOs (i.e., CEOs at the time when the firms received the first round of VC investment), lead VCs, and firms. In terms of CEO characteristics, we control for *CEO Founder dummy*, *CEO Age*, and *CEO Share Ownership*. Founder CEOs as well as CEOs with a greater share ownership tend to have greater power, thus making it more difficult for VCs to replace them (Boeker & Karichalil, 2002). CEO age is included because it may affect the likelihood of CEO turnover.

Further, we include *Lead VC's IPO Experience at Round 1*—calculated as the number of previous IPOs that the lead VC had been involved in at Round 1, and *Lead VC Share Ownership*, which is equal to the lead VC's share ownership as a percentage of a firm's shares outstanding prior to IPO. We expect more powerful and more experienced lead VCs to be more involved in the management of their portfolio firms. We also control for whether the Lead VC firm is based in the United States or not (*U.S. Lead VC dummy*). Relative to overseas VCs, it is less costly and more convenient for U.S.-based VCs to be involved in the management of their portfolio firms.

[3]There are seven cases where the CEO has both a BBA in Accounting or Finance and a Master degree in Accounting or Finance. In order to avoid double counting, we coded "1" rather than "2," for "CEO education" for these cases. However, coding "2" for "CEO education" for these cases would not materially change our results.

We take into account the nature of the lead VC firm (*Private*, *Corporate*, *Financial*, and *Other*), which provides different support to portfolio firms (Andrieu & Groh, 2012).

Finally, in terms of firm characteristics, we control for the presence of asymmetric information using a *Hi-Tech dummy*, which is equal to "1" if the firm is a hi-tech firm, and "0" otherwise.[4] In line with Pollock et al. (2009), we also create three dummy variables related to the focal industry of the firms, which are *B2C*, *B2B*, and *Infrastructure* dummies in the internet industry. We expect VC firms to be more likely to replace CEOs in firms in more uncertain industries (i.e., B2B and B2C) than in infrastructure. We further include a dummy variable for firms located in California (*CAL Dummy*), which are likely to benefit from a geographically closer relationship with many VCs.[5] We also control for Industry dummies using the 2-digit SIC.

3.2.2 | Models testing H4

H4 examines the performance consequences of CEO change before IPO. As proposed in H1–H3, the decision to change a CEO is endogenous. The Hausman (1978) specification test further confirms the endogeneity of the decision on CEO change (at the 1% significance level). In order to address the bias caused by endogeneity, we use a two-stage least squares (2SLS) regression to test H4. This procedure includes the following Equations (1)[6] and (2) at the level of each IPO firm (represented by index *i*).

$$\begin{aligned} \textit{CEO Change dummy}_i = {} & \alpha_0 + \alpha_1 \times \textit{Initial CEO HC Index}_i + \alpha_2 \times \textit{Distance in Low Initial CEO HC}_i \\ & + \alpha_3 \times \textit{Distance in High Initial CEO HC}_i + \alpha_4 \times \textit{control variables}_i + \varepsilon_i \end{aligned} \tag{1}$$

$$\begin{aligned} \textit{IPO Valuation}_i = {} & \beta_0 + \beta_1 \times \textit{CEO Change dummy} + \beta_2 \times \textit{Initial CEO HC Index}_i \\ & + \beta_3 \times \textit{control variables}_i + \eta_i \end{aligned} \tag{2}$$

Equation (2) represents the second-stage model of the 2SLS procedure and tests H4 on the effect of *CEO change* on *IPO Valuation*. This equation controls for the endogenous decision to change CEO using the regression model in Equation (1). In line with prior research, we measure *IPO Valuation* by Tobin's Q, which is equal to the market value of the assets over its book value, and captures investors' perception of the IPO firm's current and expected profitability (Arend, Patel, & Park, 2014; Hasan, Kobeissi, & Wang, 2011). To account for the entire pricing discovery process, the market value of the assets is calculated at the closing price of the first day

[4]In line with Loughran and Ritter (2004), hi-tech stocks are defined as those with SIC codes 3571, 3572, 3575, 3577, 3578 (computer hardware), 3661, 3663, 3669 (communications equipment), 3671, 3672, 3674, 3675, 3677, 3678, 3679 (electronics), 3812 (navigation equipment), 3823, 3825, 3826, 3827, 3829 (measuring and controlling devices), 3841, 3845 (medical instruments), 4812, 4813 (telephone equipment), 4899 (communication services), and 7371, 7372, 7373, 7374, 7375, 7378, 7379 (software).

[5]In further robustness tests, we control for the geographic presence of the IPO firm in other VC clusters including Massachusetts, and New York, and the results remain consistent and available upon request.

[6]Alternatively, we used the following equation as the first-stage model in the 2SLS procedure and the results remained highly consistent: $\textit{CEO Change dummy}_i = \alpha_0 + \alpha_1 \times \textit{Initial CEO HC Index}_i + \alpha_2 \times \textit{Lead VC-Firm Distance}_i + \alpha_3 \times \textit{control variables}_i + \varepsilon_i$.

of trading. For validation purpose, we also use changes in the operating performance of IPO firms around the IPO date (Jain & Kini, 1994). Changes in operating performance are measured by both the return-on-assets (ROA) and the return-on-equity (ROE), from the year prior to IPO to the end of the IPO year, and from the end of the IPO year to the next year ($\Delta ROA_{-1,0}$ and $\Delta ROA_{0,1}$) and ($\Delta ROE_{-1,0}$ and $\Delta ROE_{0,1}$), respectively.

In this 2SLS procedure, the first-stage model (Equation 1) is a linear probability regression. It includes all variables in the second-stage model because the endogenous variable *CEO Change dummy* could be correlated with other independent regressors in the *IPO Valuation* equation (Equation 2), and without including all variables, the IV estimator would be inconsistent (Wooldridge, 2002). However, note that some variables in the *IPO Valuation* equation occur after CEO change (e.g., all the IPO-stage variables) and thus they cannot affect the decision of CEO change. For this consideration, we did not use the first-stage model of the 2SLS procedure to test H1–H3. Nevertheless, as reported later, the results of the first-stage model of the 2SLS procedure offer consistent evidence to support H1–H3.

In this 2SLS procedure, we use *Lead VC-Firm Distance* as an instrumental variable (more precisely, we use *Distance in Low Initial CEO HC* and *Distance in Low Initial CEO HC* as instruments since models including them represent more robust speciation than those including *Lead VC-Firm Distance*). As we proposed in H2 and H3, the lead VC-firm distance is likely to affect VC's decision on CEO change in a portfolio firm. However, there is no obvious theoretical reason to believe that it directly affects the firm's IPO valuation. To test the validity of the choice of our instrument, we have run a number of tests. The p-values of both Durbin and Wu–Hausman statistics are lower than 10%, suggesting that we should reject the null hypothesis that CEO change is exogenous, and treat it as an endogenous variable. Although not reported in the paper, we also find that the Partial R-squared is high at 0.32. This measures the correlation between *CEO Change dummy* and *Lead VC-Firm Distance* after partialling out the effect of other control variables in Equation (1). The *F*-statistic is equal to 37.65, and is higher than the calculated critical values at the 5% level. This rejects the hypothesis that our instrument is weak. We therefore conclude that Lead VC-Firm Distance is a strong instrument.

The second-stage regression model run for IPO valuation (Equation 2) controls for a set of variables at the levels of the IPO-stage CEO, the VC owners, and the IPO firm. In terms of *IPO-Stage CEO Characteristics*, our model controls for *CEO Founder dummy*, *CEO Age*, and *IPO CEO Ownership* (CEO here refers to the IPO-stage CEO). *CEO Founder dummy* is equal to "1" if the CEO is a founder of the IPO firm, and "0" otherwise. Previous studies (Fischer & Pollock, 2004; Nelson, 2003) find that having a founder CEO at the time of IPO may have a positive impact on IPO valuation. *CEO Age* is calculated in years in the year of IPO. Cohen and Dean (2005) find that TMT average age has a negative effect on IPO underpricing, suggesting that an older TMT may enjoy a higher level of legitimacy in eyes of investors. For a similar reason, CEO age may affect the IPO firm's legitimacy in eyes of investors. *IPO CEO ownership* is calculated as the percentage of shares outstanding owned by the CEO prior to the IPO date, as CEOs with higher ownership are less likely to be replaced (Boeker & Karichalil, 2002). We also control for *CEO Tenure* using the number of years between CEO appointment and the IPO date. Prior research suggests that compared to short tenured CEOs who are likely to adopt aggressive strategies to grow their firms, long-tenured CEOs may have lower propensity to seek information to develop and grow (Audia, Locke, & Smith, 2000; Hambrick & Fukutomi, 1991).

In addition to *Lead VC Share Ownership* calculated prior to IPO, we control for *Lead VC's IPO Experience*, measured by the number of IPOs that the lead VC had been involved in prior to the focal firm's IPO date (Pollock, Lee, Jin, & Lashley, 2015). We also control for *Lead VC*

Tenure, which is equal to the difference in years between the date of the first investment in the IPO firm and the IPO date. Longer VC tenure helps VC firms engage with their portfolio companies, evaluate their riskiness, and better advise them in their key strategic choices (Hall & Soskice, 2001). However, VC investment tenures have recently shortened due to technological advances and the lower costs of building a business (Ernst & Young, 2011). Many investors believe that portfolio companies could become "unicorns" in a short period, thus a long VC tenure may suggest a greater difficulty faced by the VC firm to successfully exit, which negatively affects the IPO valuation. We further control for the size of the VC syndicate (*VC Syndicate Size at IPO*), as larger VC syndicates are likely to provide portfolio firms with greater connections and access to resources, thus increasing firm value (Hochberg, Ljungqvist, & Lu, 2007).

IPO valuation depends on the issuing firm's characteristics and market conditions at the time of the IPO. *Market Capitalization* (taking natural logarithm) based on the offer price, is used as a proxy for firm size. It is expected to increase IPO valuation as larger firms are more likely to reap the benefit of growth opportunities than small firms (Bruton, Filatotchev, Chahine, & Wright, 2010). *IPO Firm Age*, that is, the number of years since inception, is also included as older firms tend to have lower uncertainty. We also include a *Loss dummy*, which is equal to "1" if the IPO firm has operating loss in the last year prior to IPO and "0" otherwise. As Jensen (1986) argues, leverage plays a monitoring role, and it may improve IPO firm's value. For this control, we use *Pre-IPO Leverage* that is equal to pre-IPO long-term debt expressed as a fraction of pre-IPO total assets, both measured in the year preceding the IPO date (Chahine & Goergen, 2013). *Participation Ratio* is the number of shares sold by initial owners as a percentage of shares offered at IPO; it indicates the participation rate of initial owners in the offering, which is likely to have a negative impact on firm value. We also control for industry membership using *Hi-Tech*, *B2C*, *B2B*, and *Infrastructure* dummies.

The regression run for our IPO valuation further controls for *Underwriter Reputation*. The reputation of the underwriter managing the offering is measured using the reputation index in Loughran and Ritter (2004). More reputable underwriters are expected to certify the quality of the issuing firm and to increase IPO firm value. IPO valuation may also be affected by market conditions. In line with prior research, a *Bubble Period Dummy* is equal to "1" if the IPO is in 1999–2000, and "0" otherwise (Chahine & Goergen, 2013).[7] Our empirical investigations for IPO valuation also include Industry dummies using the 2-digit SIC and the IPO year dummies.

4 | RESULTS

Table 1 presents the descriptive statistics in means, standard deviations, and correlations of the variables used in this study. The average initial CEO HC index is 0.88 out of five. In terms of the instrumental variable, the average distance between IPO firms and their lead VCs, measured as the shortest travel time in minutes between the headquarters of the IPO firm and the lead VC, is 166.5 min. In line with our prediction, our instrument is not correlated with IPO valuation—that is, Tobin's Q ($r = -0.021$, $p = .379$), but it is positively correlated with CEO change dummy ($r = 0.079$, $p = .009$). These correlations provide evidence suggesting that the *Lead VC-Firm Distance* affects *CEO Change dummy*, but not *IPO valuation*.

[7]Although not shown in the article, we calculated the variance inflation factors (VIFs) for all the variables. All VIFs are below 2.35, which suggests that our data does not suffer from severe multicollinearity (O'Brien, 2007).

TABLE 1 Descriptive statistics and correlation matrices

	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Tobin's Q	5.402	5.816	1.000														
2. CEO change dummy	0.408	0.492	0.078	1.000													
3. Initial CEO HC index	0.884	0.852	0.044	−0.440	1.000												
4. Lead VC-Firm distance	166.5	163.6	−0.021	0.079	−0.009	1.000											
5. Initial CEO founder	0.642	0.480	0.165	−0.150	0.015	−0.024	1.000										
6. Initial CEO age	47.835	9.627	−0.256	0.218	−0.096	0.051	−0.336	1.000									
7. Initial CEO ownership	0.136	0.151	0.103	−0.133	0.047	−0.009	0.227	−0.115	1.000								
8. IPO CEO founder	0.448	0.498	0.068	−0.611	0.227	−0.042	0.626	−0.256	0.227	1.000							
9. IPO CEO age	47.098	8.012	−0.205	0.144	−0.054	0.111	−0.206	0.682	−0.087	−0.250	1.000						
10. IPO CEO ownership	0.113	0.138	0.068	−0.347	0.118	−0.006	0.186	−0.115	0.756	0.375	−0.102	1.000					
11. IPO CEO tenure	4.701	4.313	−0.134	−0.437	0.067	−0.057	0.200	0.034	0.214	0.399	0.095	0.352	1.000				
12. Lead VC exp. at Rd. 1	13.76	22.56	0.176	0.125	−0.052	−0.014	0.043	−0.052	0.000	−0.074	−0.023	−0.052	−0.071	1.000			
13. Lead VC ownership	0.229	0.187	−0.104	0.090	−0.010	−0.055	−0.216	0.140	−0.122	−0.208	0.119	−0.176	−0.069	0.003	1.000		
14. USA dummy	0.940	0.237	0.024	0.090	−0.021	−0.316	−0.044	0.018	−0.009	−0.072	−0.005	−0.063	−0.061	0.116	0.099	1.000	
15. Private VC dummy	0.749	0.434	0.073	0.107	−0.037	−0.067	0.005	0.018	−0.073	−0.080	0.014	−0.103	−0.076	0.163	0.009	0.115	1.000
16. Corporate VC dummy	0.114	0.318	−0.005	−0.038	0.007	0.123	0.030	−0.083	0.073	0.057	−0.081	0.060	−0.065	−0.171	−0.059	−0.174	−0.620
17. Financial VC dummy	0.107	0.310	−0.065	−0.072	0.031	−0.021	−0.033	0.045	0.005	0.028	0.059	0.052	0.144	0.005	0.044	0.028	−0.593
18. Lead VC Exp. at IPO	2.090	1.600	0.185	0.125	−0.062	−0.026	0.034	−0.049	−0.025	−0.065	−0.031	−0.065	−0.056	0.941	−0.021	0.135	0.175
19. Lead VC tenure at IPO	4.102	3.079	−0.131	0.136	−0.085	0.000	0.017	0.226	−0.149	−0.023	0.217	−0.163	0.298	−0.058	−0.016	−0.030	0.092
20. Syndicate size at IPO	2.388	1.979	0.084	0.096	−0.023	0.015	0.085	−0.024	−0.292	−0.025	−0.006	−0.275	−0.076	0.073	−0.327	−0.003	0.054
21. Market capitalization	557.2	1113	0.164	0.077	−0.009	−0.021	0.000	−0.009	0.042	−0.052	0.032	−0.033	−0.082	0.127	0.064	0.031	−0.018
22. IPO age	10.42	12.66	−0.186	0.074	−0.086	0.004	−0.259	0.257	−0.022	−0.196	0.217	−0.024	0.191	−0.085	0.225	−0.016	−0.071
23. Loss dummy	0.606	0.489	0.121	0.067	−0.039	−0.021	0.130	−0.148	−0.085	0.023	−0.111	−0.075	−0.116	0.019	−0.186	−0.036	0.022
24. Pre-IPO leverage	0.289	0.289	−0.199	0.035	−0.018	−0.016	−0.173	0.192	−0.079	−0.142	0.201	−0.084	0.081	−0.103	0.330	0.051	0.000
25. Participation ratio	0.082	0.174	−0.080	−0.008	−0.010	0.006	−0.074	0.110	0.086	−0.047	0.113	0.010	0.176	−0.013	0.158	0.021	−0.050
26. Hi-tech dummy	0.452	0.498	0.256	0.095	0.009	−0.036	0.148	−0.221	0.053	0.048	−0.182	−0.004	−0.099	0.126	−0.101	0.031	0.068

TABLE 1 (Continued)

	Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
27. B2C dummy	0.067	0.249	0.048	−0.017	0.028	−0.046	0.026	−0.128	0.074	0.001	−0.143	0.031	−0.088	−0.032	−0.088	−0.035	−0.078
28. B2B dummy	0.100	0.301	0.176	0.010	0.083	−0.009	0.069	−0.164	0.036	0.044	−0.193	0.026	−0.068	0.032	−0.068	0.036	0.007
29. Infrastructure	0.060	0.237	0.088	0.028	0.051	−0.004	0.104	−0.129	0.041	0.035	−0.103	0.041	−0.043	0.036	−0.044	0.017	−0.006
30. CAL dummy	0.369	0.483	0.193	0.108	−0.020	0.136	0.075	−0.079	−0.067	−0.009	−0.073	−0.052	−0.158	0.115	−0.160	−0.080	0.067
31. Underwriter reputation	8.117	1.444	0.121	0.042	−0.024	−0.006	0.003	−0.026	−0.102	−0.053	−0.037	−0.127	−0.087	0.061	0.086	0.015	0.036
32. Bubble dummy	0.390	0.488	0.388	−0.031	0.029	−0.062	0.159	−0.260	0.041	0.083	−0.238	0.058	−0.174	0.011	−0.105	0.016	−0.029

	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
16. Corporate VC dummy	1.000																
17. Financial VC dummy	−0.125	1.000															
18. Lead VC exp. at IPO	−0.197	0.024	1.000														
19. Lead VC tenure at IPO	−0.083	−0.009	0.024	1.000													
20. Syndicate size at IPO	0.022	−0.070	0.108	0.203	1.000												
21. Market capitalization	−0.019	0.012	0.118	−0.001	0.004	1.000											
22. IPO age	−0.056	0.120	−0.097	0.149	−0.175	0.089	1.000										
23. Loss dummy	0.007	−0.051	0.032	−0.077	0.221	−0.039	−0.199	1.000									
24. Pre-IPO leverage	−0.063	0.061	−0.122	0.165	−0.172	0.135	0.387	−0.207	1.000								
25. Participation ratio	−0.058	0.103	−0.015	0.235	−0.126	0.096	0.285	−0.279	0.256	1.000							
26. Hi-tech dummy	−0.003	−0.084	0.133	−0.017	0.053	0.036	−0.179	0.213	−0.158	−0.032	1.000						
27. B2C dummy	0.079	0.053	−0.042	−0.085	0.044	0.037	−0.090	0.007	−0.109	−0.031	0.009	1.000					
28. B2B dummy	0.043	−0.041	0.045	−0.120	0.036	−0.015	−0.090	0.154	−0.113	−0.075	0.200	−0.089	1.000				
29. Infrastructure	0.047	−0.040	0.047	−0.047	0.023	0.082	−0.085	0.066	−0.086	−0.024	0.197	−0.067	−0.084	1.000			
30. CAL dummy	0.007	−0.086	0.144	0.044	0.145	0.024	−0.174	0.127	−0.180	−0.070	0.217	0.026	0.037	0.049	1.000		
31. Underwriter reputation	0.014	−0.026	0.071	−0.011	0.089	0.109	−0.002	0.011	0.060	0.037	0.065	−0.026	0.076	0.043	0.062	1.000	
32. Bubble dummy	0.073	−0.039	0.046	−0.277	0.058	−0.009	−0.221	0.233	−0.304	−0.273	0.215	0.183	0.203	0.141	0.105	0.089	1.000

Note: Pearson's correlation coefficients were used for continuous variables, point biserial correlation coefficients were used for dichotomous variables (N=1,156).

4.1 | Initial CEO human capital, lead VC-firm distance, and CEO change prior to IPO

Table 2 presents the probit regression analyses. Model (1) reports the effects of our control variables on CEO change dummy. Model (2) tests H1 and H2, and Model (3) tests H3. Model (1) shows that older CEOs are more likely to be changed ($\beta = 0.034$, $p = .000$), whereas founder CEOs and those with a higher pre-IPO ownership are less likely to be changed ($\beta = -0.258$, $p = .006$ and $\beta = -0.931$, $p = .001$, respectively). In terms of lead VC characteristics, CEO change is more likely in IPOs where the lead VC has more IPO experiences ($\beta = 0.101$, $p = .000$), and has a higher level of ownership ($\beta = 0.530$, $p = .029$). CEO change is also more likely in IPOs where the lead VC is a U.S.-based VC firm ($\beta = 0.455$, $p = .017$), and is a private or a corporate VC firm ($\beta = 0.554$, $p = .05$ and $\beta = 0.602$, $p = .047$, respectively). In terms of IPO firm characteristics, Hi-tech companies, and those in California are more likely to have CEO change ($p = .01$ or lower).

H1 proposes that CEOs with a lower HC index are more likely to be changed. In Model (2), the coefficient for *Initial CEO HC Index* is negative ($\beta = -1.600$, $p = .000$), supporting this hypothesis. In terms of effect size, for a 10% increase in initial CEO HC index, the probability of CEO change decreases by 16%. In line with H2, the lead VC-firm distance is positively related to the likelihood of CEO change ($\beta = 0.181$, $p = .002$). For a 10% increase in the natural logarithm of the distance between the lead VC and an IPO firm, the probability of CEO change increases by 1.81%.

H3 proposes that the effect of the lead VC-firm distance on the likelihood of CEO change is stronger when the initial CEO HC level is low than when it is high. The results of Model (3) support this hypothesis. Specifically, we find that *CEO Change* is positively associated to *Lead VC-Firm Distance* in both IPO firms with low and high CEO HC Index ($\beta = 0.229$, $p = .001$ and $\beta = 0.142$, $p = .029$, respectively). This shows that a 10% increase in the natural logarithm of the distance between the lead VC and an IPO firm with low (high) *CEO HC Index* increases the probability of CEO change by 2.29% (1.42%). Moreover, the coefficient of *Lead VC-Firm Distance in Low CEO HC* is significantly higher than the one of *Lead VC-Firm Distance in High CEO HC* ($p = .042$). This suggests that distant lead VC firms are more likely to change CEOs with low human capital than those with high human capital, which supports H3.

4.1.1 | Effect of CEO change on IPO valuation

Models in Table 3, presenting the results of the two-stage least squares (2SLS) procedure for IPO valuation, test H4 that proposes that CEO change has a positive impact on IPO valuation. Model (4a) reports the results of the first-stage linear probability regression of CEO Change dummy within the 2SLS procedure of IPO valuation. Model (4a) confirms the negative association between *Initial CEO HC Index* and CEO change, as well as the negative association between *Distance in Low Initial CEO HC* and CEO change. Model (4b) presents the second-stage regression on the effect of (instrumented) *CEO Change* on IPO valuation using Tobin's Q as the dependent variable. Tobin's Q is positively related to *CEO Change* ($\beta = 1.489$, $p = .041$), supporting H4. In terms of effect size, a 10% increase in the probability of CEO change increases Tobin's Q by 14.89%.

TABLE 2 Results of probit models testing H1–H3

	DV = CEO change dummy		
	(1)	(2)	(3)
Constant	−3.028	−5.038	−5.203
	(*0.000*)	(*0.000*)	(*0.000*)
Initial CEO[a] HC index		−1.600	−1.359
		(*0.000*)	(*0.000*)
Lead VC-firm distance		0.181	
		(*0.002*)	
Distance in low initial CEO HC[b]			0.229[c]
			(*0.001*)
Distance in high initial CEO HC[b]			0.142[c]
			(*0.029*)
Initial CEO founder dummy	−0.258	−0.589	−0.608
	(*0.006*)	(*0.001*)	(*0.001*)
Initial CEO age	0.034	0.061	0.061
	(*0.000*)	(*0.000*)	(*0.000*)
Initial CEO ownership	−0.931	−1.647	−1.643
	(*0.001*)	(*0.004*)	(*0.004*)
Lead VC IPO experience at Round 1	0.101	0.145	0.147
	(*0.000*)	(*0.007*)	(*0.007*)
Lead VC ownership	0.530	1.349	1.323
	(*0.029*)	(*0.005*)	(*0.005*)
USA dummy	0.455	1.009	1.015
	(*0.017*)	(*0.008*)	(*0.008*)
Private VC dummy	0.554	1.167	1.178
	(*0.050*)	(*0.045*)	(*0.043*)
Corporate VC dummy	0.602	1.121	1.132
	(*0.047*)	(*0.070*)	(*0.066*)
Financial VC dummy	0.177	0.378	0.366
	(*0.562*)	(*0.548*)	(*0.560*)
Hi-tech dummy	0.570	0.979	0.968
	(*0.000*)	(*0.000*)	(*0.000*)
B2C dummy	0.122	0.508	0.499
	(*0.504*)	(*0.149*)	(*0.158*)
B2B dummy	0.165	0.727	0.727
	(*0.259*)	(*0.011*)	(*0.011*)
Infrastructure	0.285	0.887	0.867
	(*0.111*)	(*0.014*)	(*0.015*)

TABLE 2 (Continued)

	DV = CEO change dummy		
	(1)	(2)	(3)
CAL dummy	0.277	0.515	0.507
	(*0.002*)	(*0.003*)	(*0.003*)
Industry dummies	Yes	Yes	Yes
Year dummies	No	No	No
Number of observations	1156	1156	1156
Pseudo R^2	0.126	0.303	0.304
χ^2	191.390	461.060	463.060
Prob.	0.000	0.000	0.000

Note: The *t*-statistics are based on White (1980) heteroskedasticity-consistent standard errors and covariances. *P-values* are in parentheses and in italics below the coefficients.
[a]Initial CEO HC Index refers to the CEO at the time of receiving the first round of VC investment.
[b]Distance in low (high) initial CEO HC equals distance when initial CEO HC Index is higher (lower or equal) than the sample median, zero otherwise.
[c]Model 3 shows that the coefficient of *Distance in Low Initial CEO HC* is higher than the coefficient of *Distance in High Initial CEO HC* in affecting the probability of CEO Change at the 4.2% level.

In terms of control variables, Model (4b) shows that Tobin's Q is negatively related to CEO age, IPO firm age, and IPO leverage. Tobin's Q is positively related to Initial CEO HC index, IPO CEO ownership, lead VC's IPO experience, VC syndicate size, and IPO firm size.

In further robustness tests, we examine the effect of CEO change on changes in IPO firms' operating performance. Although not shown in our descriptive statistics table, a closer look at the operating performance of our studied IPOs indicates that the average change in operating performance around the IPO date ranges from 0.001 to 0.064 ($\Delta RoA_{-1,0} = 0.048$; $\Delta RoE_{-1,0} = 0.061$; $\Delta RoA_{0,1} = 0.004$; and $\Delta RoE_{0,1} = 0.001$). All four variables related to changes in operating performance are positively correlated with *CEO Change dummy* (correlation coefficients, r, range from 0.060 to 0.127), and they are not associated with the *Lead VC-Firm Distance* (r ranges from −0.010 to 0.025). Our empirical tests also confirm the validity of *Lead VC-Firm Distance* as an instrument in the 2SLS regression models using changes in operating performance as dependent variables.

Models (5) to (8) present the second-stage regressions of changes in operating performance around the IPO date. Models (5) and (7) show that *CEO Change* is positively related to changes in operating performance from the year prior to IPO to the end of the IPO year, as measured by both $\Delta RoA_{-1,0}$ ($\beta = 0.113$, $p = .007$) and $\Delta RoE_{-1,0}$ ($\beta = 0.210$, $p = .005$). Models (6) and (8) further indicate that *CEO Change* is positively related to changes in operating performance from the end of the IPO year to the end of the following year, measured by $\Delta RoA_{0,1}$ ($\beta = 0.030$, $p = .036$) and $\Delta RoE_{0,1}$ ($\beta = 0.092$, $p = .023$). These results demonstrate that CEO change positively affects firm operating performance around IPO and after IPO.

4.2 | Supplementary analyses and robustness checks

We conduct following supplementary analyses and robustness checks to further verify our results, and to rule out possible alternative explanations.

TABLE 3 CEO change and IPO firm performance outcomes (2SLS procedure)

	CEO Change dummy	Tobin's Q	$\Delta ROA_{-1,0}$	$\Delta ROA_{0,1}$	$\Delta ROE_{-1,0}$	$\Delta ROE_{0,1}$
	First-stage	Second-stage 2SLS				
Dependent Variables:	**(4a)**	**(4b)**	**(5)**	**(6)**	**(7)**	**(8)**
Constant	0.323	−7.393	−0.048	−0.049	−0.148	−0.134
	(*0.018*)	(*0.000*)	(*0.519*)	(*0.295*)	(*0.273*)	(*0.064*)
Initial CEO[a] HC index	−0.101	0.389	0.037	0.014	0.070	0.026
	(*0.000*)	(*0.075*)	(*0.000*)	(*0.021*)	(*0.000*)	(*0.008*)
Distance in low initial CEO HC	0.031					
	(*0.000*)					
Distance in high initial CEO HC	0.008					
	(*0.245*)					
CEO change dummy (instrumented)		1.489	0.113	0.030	0.210	0.092
		(*0.041*)	(*0.007*)	(*0.036*)	(*0.005*)	(*0.023*)
Initial CEO founder dummy	0.278					
	(*0.000*)					
Initial CEO age	0.008					
	(*0.000*)					
Initial CEO ownership	0.414					
	(*0.000*)					
IPO CEO founder dummy	−0.558	0.616	0.029	0.021	0.087	0.028
	(*0.000*)	(*0.299*)	(*0.168*)	(*0.117*)	(*0.024*)	(*0.176*)
IPO CEO age	−0.004	−0.047	0.001	0.000	0.000	0.001
	(*0.006*)	(*0.021*)	(*0.484*)	(*0.682*)	(*0.907*)	(*0.368*)
IPO CEO ownership	−0.435	4.338	0.038	−0.049	−0.012	−0.026
	(*0.000*)	(*0.001*)	(*0.410*)	(*0.096*)	(*0.888*)	(*0.567*)
IPO CEO tenure	−0.030	−0.044	0.001	0.000	0.006	0.000
	(*0.000*)	(*0.454*)	(*0.777*)	(*0.774*)	(*0.107*)	(*0.981*)
Lead VC IPO experience at Round 1	−0.007					
	(*0.646*)					
Lead VC ownership	−0.043	−1.245	0.013	0.035	−0.016	0.045
	(*0.459*)	(*0.183*)	(*0.716*)	(*0.122*)	(*0.800*)	(*0.186*)
USA dummy	0.072					
	(*0.065*)					
Private VC dummy	0.037					
	(*0.496*)					
Corporate VC dummy	0.053					
	(*0.367*)					
Financial VC dummy	0.050					

TABLE 3 (Continued)

Dependent Variables:	CEO Change dummy First-stage (4a)	Tobin's Q Second-stage 2SLS (4b)	$\Delta ROA_{-1,0}$ (5)	$\Delta ROA_{0,1}$ (6)	$\Delta ROE_{-1,0}$ (7)	$\Delta ROE_{0,1}$ (8)
	(*0.406*)					
Lead VC experience at IPO	0.016	0.338	−0.001	0.003	0.011	0.004
	(*0.294*)	(*0.000*)	(*0.855*)	(*0.132*)	(*0.099*)	(*0.296*)
Lead VC tenure at IPO	0.021	−0.015	−0.002	−0.002	−0.009	−0.003
	(*0.000*)	(*0.815*)	(*0.371*)	(*0.339*)	(*0.045*)	(*0.218*)
VC syndicate size at IPO	−0.002	0.145	0.000	0.000	−0.001	0.002
	(*0.779*)	(*0.092*)	(*0.881*)	(*0.817*)	(*0.900*)	(*0.494*)
Ln market capitalization	−0.008	2.298	−0.002	−0.001	0.019	−0.002
	(*0.509*)	(*0.000*)	(*0.825*)	(*0.754*)	(*0.138*)	(*0.775*)
Firm age	0.003	−0.027	0.000	0.000	0.000	0.000
	(*0.004*)	(*0.067*)	(*0.875*)	(*0.694*)	(*0.826*)	(*0.775*)
Loss dummy	0.013	−0.064	0.026	0.020	0.102	0.046
	(*0.534*)	(*0.849*)	(*0.036*)	(*0.010*)	(*0.000*)	(*0.000*)
Pre−IPO leverage	−0.069	−1.563	−0.037	−0.001	−0.009	0.026
	(*0.074*)	(*0.012*)	(*0.103*)	(*0.946*)	(*0.820*)	(*0.235*)
Participation ratio	−0.106	0.183	0.018	0.011	−0.062	0.024
	(*0.109*)	(*0.862*)	(*0.646*)	(*0.677*)	(*0.385*)	(*0.539*)
Hi-tech dummy	0.087	0.487	0.014	−0.037	−0.052	−0.056
	(*0.002*)	(*0.286*)	(*0.423*)	(*0.001*)	(*0.092*)	(*0.001*)
B2C dummy	−0.049	−1.549	−0.010	0.014	−0.041	0.033
	(*0.238*)	(*0.019*)	(*0.664*)	(*0.369*)	(*0.346*)	(*0.154*)
B2B dummy	0.041	0.316	−0.017	0.009	−0.017	−0.002
	(*0.222*)	(*0.552*)	(*0.379*)	(*0.479*)	(*0.627*)	(*0.927*)
Infrastructure	0.041	−1.116	−0.008	0.020	−0.043	0.033
	(*0.302*)	(*0.083*)	(*0.722*)	(*0.185*)	(*0.315*)	(*0.150*)
CAL dummy	0.032					
	(*0.113*)					
Underwriter reputation	−0.009	−0.031	0.001	0.002	−0.005	0.005
	(*0.202*)	(*0.775*)	(*0.841*)	(*0.550*)	(*0.495*)	(*0.223*)
Bubble dummy	0.738	−1.350	−0.098	−0.040	−0.228	0.017
	(*0.007*)	(*0.766*)	(*0.532*)	(*0.686*)	(*0.422*)	(*0.911*)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	1156	1156	1019	1010	1019	1010
R-squared (adj. *R*-squared)	(0.650)	0.357	0.121	0.072	0.048	0.107

TABLE 3 (Continued)

Dependent Variables:	CEO Change dummy First-stage (4a)	Tobin's Q Second-stage 2SLS (4b)	$\Delta ROA_{-1,0}$ (5)	$\Delta ROA_{0,1}$ (6)	$\Delta ROE_{-1,0}$ (7)	$\Delta ROE_{0,1}$ (8)
Wald χ^2 (*F*-statistics)	(22.380)	643.440	159.200	110.290	121.270	136.930
Prob.	0.000	0.000	0.000	0.012	0.009	0.000
Prob. (Sargan $N * R$-sq test)		0.148	0.174	0.126	0.589	0.131

Note: The *t*-statistics are based on White (1980) heteroskedasticity-consistent standard errors and covariances. *P*-values are in parentheses and in italics below the coefficients. Model (4a) present the first-stage linear probability regression of CEO Change dummy in the 2SLS procedure with Tobin's Q as the dependent variable in the second-stage (Model (4b)). Models (4b), (5), (6), (7), and (8) present the second-stage regression results of our 2SLS procedures, using the STATA ivregress 2sls function. For brevity, the first-stage models for Models (5), (6), (7), and (8) are not reported here, but available from the authors upon requests.

[a]Initial CEO HC Index refers to the CEO at the time of receiving the first round of VC investment. In supplementary analysis, we dropped Initial CEO HC Index from the second-stage models, and the results still supported H4.

4.2.1 | CEO change: Initial CEO HC index versus IPO CEO HC index

In this study, we implicitly assume that if there is CEO change before IPO, the IPO-stage CEO in general has a higher HC index than the initial (replaced) CEO since the main motivation of changing CEO is to upgrade the firm's CEO human capital. To verify this assumption, Table 4 compares CEO HC Index and its components between the 684 firms that did not change CEO and the 472 firms that changed CEO. This shows an average initial CEO HC index of 0.432 in the 472 IPOs with CEO change, which is lower than the average initial CEO HC index of 1.196 for the 684 IPOs without CEO change ($p = .000$). It also indicates that the CEO HC index increases from 0.432 to 1.636 in the group of IPO firms with CEO change. As such, Table 4 provides additional evidence to support that initial CEOs with lower levels of human capital are more likely to be replaced between receiving VC funding and IPO. More important, IPO-stage CEOs of firms that change CEO on average have higher levels of human capital than initial-stage CEOs of firms that changed or did not change CEO. These results support our underlying assumption that CEO change prior to IPO is to replace a CEO with low human capital with one with high human capital.

4.2.2 | IPO-stage CEO HC index and IPO valuation and changes in operating performance

Models in Table 3 demonstrate that CEO change is positively related to firms' IPO valuation and changes in operating performance around and after IPO. Table 4 further shows that in firms that change CEO prior to IPO, IPO CEOs have higher HC Index than their predecessors and even higher than the IPO CEOs of firms without CEO change (in firms without CEO change, initial CEOs and IPO CEOs are the same). We run additional analyses to check whether IPO-stage CEO human capital, which increases as a result of CEO change (or remains

TABLE 4 Descriptive statistics of CEO human capital index

	CEO HC index	CEO education	Graduate business degree	Accounting and finance	CEO experience	Former CEO	IPO experience	Listed Firm
Initial CEO characteristics (N = 1156)								
Mean	0.884	0.352	0.211	0.141	0.532	0.317	0.028	0.188
SD	0.853	0.550	0.409	0.348	0.620	0.465	0.164	0.391
Unchanged IPO CEO characteristics (N = 684)								
Mean	1.196	0.452	0.262	0.190	0.744	0.428	0.039	0.276
SD	0.845	0.585	0.440	0.393	0.631	0.495	0.195	0.448
Predecessor CEO characteristics (N = 472)								
Mean	0.432	0.208	0.138	0.070	0.225	0.155	0.011	0.060
SD	0.635	0.460	0.346	0.255	0.452	0.362	0.103	0.237
Successor CEO characteristics (N = 472)								
Mean	1.636	0.610	0.352	0.258	1.025	0.523	0.097	0.405
SD	0.998	0.636	0.478	0.438	0.762	0.500	0.297	0.491
IPO CEO characteristics (N = 1156)								
Mean	1.375	0.516	0.299	0.217	0.859	0.467	0.063	0.329
SD	0.936	0.611	0.458	0.412	0.701	0.499	0.243	0.470
Prob. T-test for difference								
IPO CEO vs. Initial CEO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Successor CEO vs. Unchanged IPO CEO	0.000	0.000	0.001	0.005	0.000	0.001	0.000	0.000
Successor CEO vs. Predecessor CEO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Unchanged IPO CEO vs. Predecessor CEO	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

TABLE 5 IPO CEO HC and IPO valuation and changes in operating performance (2SLS procedure)

	IPO CEO HC Index	Tobin's Q	$\Delta ROA_{-1,0}$	$\Delta ROA_{0,1}$	$\Delta ROE_{-1,0}$	$\Delta ROE_{0,1}$
	First-stage	Second-stage 2SLS				
Dependent variables:	**(9a)**	**(9b)**	**(10)**	**(11)**	**(12)**	**(13)**
Constant	−0.027	−6.657	0.024	−0.035	−0.018	−0.076
	(*0.930*)	(*0.000*)	(*0.717*)	(*0.415*)	(*0.880*)	(*0.241*)
Initial CEO[a] HC index	0.853					
	(*0.000*)					
Distance in low initial CEO HC	0.053					
	(*0.003*)					
Distance in high initial CEO HC	−0.035					
	(*0.227*)					
IPO CEO[b] HC index (instrumented)		0.541	0.031	0.017	0.064	0.024
		(*0.033*)	(*0.000*)	(*0.004*)	(*0.000*)	(*0.007*)
Initial CEO founder dummy	0.355					
	(*0.000*)					
Initial CEO age	−0.001					
	(*0.871*)					
Initial CEO ownership	0.457					
	(*0.042*)					
IPO CEO founder dummy	−0.749	0.225	−0.001	0.017	0.033	0.001
	(*0.000*)	(*0.528*)	(*0.935*)	(*0.040*)	(*0.159*)	(*0.920*)
IPO CEO age	0.006	−0.047	0.000	0.000	0.000	0.001
	(*0.109*)	(*0.018*)	(*0.535*)	(*0.816*)	(*0.816*)	(*0.450*)
IPO CEO ownership	−0.316	4.112	0.028	−0.052	−0.030	−0.035
	(*0.223*)	(*0.001*)	(*0.535*)	(*0.080*)	(*0.711*)	(*0.436*)
IPO CEO tenure	−0.024	−0.079	−0.002	0.000	0.001	−0.002
	(*0.000*)	(*0.069*)	(*0.145*)	(*0.866*)	(*0.754*)	(*0.137*)
Lead VC IPO experience at Round 1	−0.031					
	(*0.381*)					
Lead VC ownership	0.160	−1.479	0.002	0.031	−0.036	0.036
	(*0.230*)	(*0.110*)	(*0.943*)	(*0.166*)	(*0.562*)	(*0.294*)
USA dummy	0.142					
	(*0.109*)					
Private VC dummy	0.135					
	(*0.275*)					
Corporate VC dummy	0.099					
	(*0.459*)					
Financial VC dummy	0.126					

TABLE 5 (Continued)

	IPO CEO HC Index	Tobin's Q	$\Delta ROA_{-1,0}$	$\Delta ROA_{0,1}$	$\Delta ROE_{-1,0}$	$\Delta ROE_{0,1}$
	First-stage	Second-stage 2SLS				
Dependent variables:	(9a)	(9b)	(10)	(11)	(12)	(13)
	(*0.352*)					
Lead VC experience at IPO	0.050	0.349	0.000	0.003	0.012	0.004
	(*0.152*)	(*0.000*)	(*0.992*)	(*0.135*)	(*0.057*)	(*0.197*)
Lead VC tenure at IPO	0.029	0.007	0.000	−0.001	−0.005	−0.001
	(*0.001*)	(*0.910*)	(*0.950*)	(*0.395*)	(*0.175*)	(*0.616*)
VC syndicate size at IPO	0.024	0.126	−0.001	0.000	−0.002	0.001
	(*0.058*)	(*0.143*)	(*0.707*)	(*0.981*)	(*0.702*)	(*0.643*)
Ln market capitalization	0.046	2.250	−0.005	−0.003	0.013	−0.005
	(*0.094*)	(*0.000*)	(*0.496*)	(*0.518*)	(*0.317*)	(*0.516*)
Firm age	−0.004	−0.020	0.000	0.000	0.001	0.000
	(*0.050*)	(*0.181*)	(*0.439*)	(*0.344*)	(*0.219*)	(*0.614*)
Loss dummy	0.008	−0.034	0.029	0.021	0.107	0.049
	(*0.867*)	(*0.919*)	(*0.019*)	(*0.007*)	(*0.000*)	(*0.000*)
Pre-IPO leverage	−0.159	−1.571	−0.042	−0.001	−0.018	0.022
	(*0.069*)	(*0.010*)	(*0.056*)	(*0.950*)	(*0.650*)	(*0.324*)
Participation ratio	−0.016	0.120	0.016	0.010	−0.065	0.023
	(*0.916*)	(*0.908*)	(*0.681*)	(*0.706*)	(*0.346*)	(*0.549*)
Hi-tech dummy	0.024	0.622	0.022	−0.035	−0.035	−0.049
	(*0.702*)	(*0.156*)	(*0.168*)	(*0.001*)	(*0.229*)	(*0.003*)
B2C dummy	−0.065	−1.599	−0.014	0.013	−0.046	0.030
	(*0.490*)	(*0.014*)	(*0.560*)	(*0.381*)	(*0.271*)	(*0.195*)
B2B dummy	0.004	0.336	−0.012	0.010	−0.008	0.001
	(*0.953*)	(*0.521*)	(*0.519*)	(*0.434*)	(*0.804*)	(*0.945*)
Infrastructure	0.207	−1.184	−0.009	0.017	−0.046	0.032
	(*0.023*)	(*0.064*)	(*0.693*)	(*0.270*)	(*0.270*)	(*0.173*)
CAL dummy	0.136					
	(*0.003*)					
Underwriter reputation	−0.005	−0.037	0.000	0.002	−0.007	0.005
	(*0.726*)	(*0.735*)	(*0.992*)	(*0.557*)	(*0.376*)	(*0.270*)
Bubble dummy	0.623	−0.307	−0.022	−0.027	−0.090	0.081
	(*0.320*)	(*0.944*)	(*0.886*)	(*0.783*)	(*0.739*)	(*0.583*)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	1156	1156	1019	1010	1019	1010
R-squared (adj. *R*-squared)	(0.500)	0.366	0.146	0.073	0.087	0.115

TABLE 5 (Continued)

	IPO CEO HC Index	Tobin's Q	$\Delta ROA_{-1,0}$	$\Delta ROA_{0,1}$	$\Delta ROE_{-1,0}$	$\Delta ROE_{0,1}$
	First-stage	Second-stage 2SLS				
Dependent variables:	**(9a)**	**(9b)**	**(10)**	**(11)**	**(12)**	**(13)**
Wald χ^2 (*F*-statistics)	(12.500)	655.430	161.570	113.700	123.950	138.040
Prob.	0.000	0.000	0.000	0.010	0.007	0.000
Prob. (Sargan $N * R$-sq test)		0.079	0.114	0.298	0.533	0.118

Note: The *t*-statistics are based on White (1980) heteroskedasticity-consistent standard errors and covariances. *P*-values are in parentheses and in italics below the coefficients. Model (9a) present the first-stage linear probability regression of IPO CEO HC Index in the 2SLS procedure with Tobin's Q as the dependent variable in the second-stage (Model (9b)). Models (9b), (10), (11), (12), and (13) present the second-stage regression results of our 2SLS procedures, using the STATA ivregress 2sls function. For brevity, the first-stage models for Models (10), (11), (12), and (13) are not reported here, but available from the authors upon requests.

[a]Initial CEO HC Index refers to the CEO at the time of receiving the first round of VC investment. It is not included in the second-stage models because it is highly correlated to IPO CEO HC index (For firms that did not change CEO, these two indexes are the same.).

[b]IPO CEO refers Pl to the CEO at the time of initial public offering.

the same if there is no CEO change), is related to IPO performance. The results are reported in Table 5.

Basically, models in Table 5 replicate those in Table 3, replacing CEO change dummy with IPO-stage CEO HC in the first-stage models (Equation 1). Since CEO change is highly correlated with IPO-stage CEO HC (because CEO change increases IPO-stage CEO HC), we could not find an instrument variable that is a strong instrument variable for IPO-stage CEO HC index, but not a strong instrument variable for CEO change dummy. Lead VC-firm distance is used as an instrument for both CEO change dummy and IPO-stage CEO HC. Therefore, the results presented in Table 5 are rather suggestive.

Overall, the results in the first-stage Model (9a) show that IPO-stage CEO HC Index is positively related to *Initial CEO HC Index* ($\beta = 0.853$, $p = .000$) and *Lead VC-Firm Distance in Low Initial CEO HC* ($\beta = 0.053$, $p = .003$). Further, we find that the (instrumented) IPO-stage CEO HC has a positive relationship with IPO valuations ($\beta = 0.541$, $p = .033$, Model 9b), $\Delta RoA_{-1,0}$ ($\beta = 0.031$, $p = .000$, Model 10), $\Delta RoE_{-1,0}$ ($\beta = 0.017$, $p = .004$, Model 11), $\Delta RoA_{0,1}$ ($\beta = 0.064$, $p = .000$, Model 12), and $\Delta RoE_{0,1}$ ($\beta = 0.024$, $p = .007$, Model 13).

5 | CONCLUDING REMARKS

This study examines VCs' decisions on CEO change prior to their portfolio firms' IPO. With data on 1,156 IPOs of VC-backed firms in the United States, we find that the level of the initial CEO's human capital when a firm receives its first VC investment is negatively related to the likelihood of CEO change prior to the firm's IPO. We also find that the distance between a firm and its lead VC is positively related to the likelihood of CEO change prior to its IPO, and the distance's effect is stronger when the firm's initial CEO human capital is low than when it is high. Moreover, controlling for the endogeneity of CEO change, we find that CEO change is positively related to firms' IPO valuation and changes in their operating performance around IPO and after IPO.

6 | CONTRIBUTIONS

Our study makes important contributions to the entrepreneurship literature. First, we develop and test a coherent theoretical framework that focuses on VC monitoring in VC decisions on CEO change in their portfolio firms. Previous studies have found that geographic proximity is important for VC activities; however, VCs need to go beyond their local regions for more and better investment opportunities. So, what are alternative strategies for substituting spatial proximity? One possible strategy is an intensive use of modern measures of telecommunication; however, it does not seem to work as a substitute for regional proximity (Fritsch & Schilder, 2008). Another substituting strategy is joining VC syndication that helps overcome boundaries that otherwise would curtail investment relationships (Fritsch & Schilder, 2008; Sorenson & Stuart, 2001). However, this substituting strategy is mainly for passive syndication members and less useful for lead VCs. Our arguments and empirical results suggest that changing CEO in a portfolio firm is an important strategy for substituting spatial proximity and this strategy is particularly important if the initial CEO of a portfolio firm has a low level of human capital. Our study contributes to a better understanding of how VCs may go beyond their local regions for more and better investment opportunities.

Second, previous studies in the literature either focused on the incident of CEO change prior to IPO (e.g., Boeker & Karichalil, 2002; Pollock et al., 2009) or took a snapshot approach to investigate the characteristics of CEOs, the top management team, or the board of directors *at the time of IPO* (e.g., Certo, Covin, Daily, & Dalton, 2001; Cohen & Dean, 2005). In this study, we hand-collected data on the human capital of the initial CEO when a firm receives its first VC investment and the IPO-stage CEO (if there is a CEO change). We empirically verified that CEOs with a low level of human capital are more likely to be replaced after receiving VC investments and that in general there is an upgrade of human capital in the CEO position when CEO change occurs. Our study helps redirect academic and practical attention from CEO change per se to "who is replaced" (and "by whom") in the CEO change process of an entrepreneurial firm.

Third, as well noted, CEO change in portfolio firms is an endogenous decision for VCs. Without carefully controlling for such endogeneity, empirical evidences on the performance consequences of CEO change in IPO firms are speculative at best. In this study, using the distance between the lead VC and a portfolio firm as an instrument variable, we provide strong empirical evidence to show that CEO change prior to IPO can improve a firm's IPO valuation and changes in its operating performance around IPO and after IPO. We also demonstrate that IPO-stage CEO human capital, which typically increases following the change in CEO, is positively associated with IPO valuation and changes in operating performance around and after IPO.

7 | LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

This study has some limitations that offer fruitful opportunities for future research. First, in this study, we focused on the role of VC monitoring in CEO change in IPO firms. Accordingly, we tested our hypotheses using a sample of VC-backed IPO firms. Naturally, our arguments and results related to VC monitoring are irrelevant to non-VC-backed IPO firms. Moreover, VC backing is not random so that VC-backed IPO firms may be fundamentally different from non-

VC-backed IPO firms. Without monitoring and counterbalance of VCs, CEOs and management teams of non-VC-backed firms tend to be more powerful than their counterparts in VC-backed firms. Therefore, our arguments and results regarding the role of CEO human capital in CEO change and the effect of CEO change on IPO firms' performance may not be applicable to non-VC-backed ventures. Future studies need to examine antecedents and consequences of CEO change in non-VC-backed firms and compare them with VC-backed firms.

Second, while our study focused on the role CEO human capital in IPO firms, the value of a CEO's human capital may depend upon his/her other personal traits. For example, recent studies have examined the effect of CEO narcissism in public-listed companies (e.g., Chatterjee & Hambrick, 2011). It is possible that a narcissistic CEO, even with a high level of human capital, may alienate other senior executives, board members and VC investors of the firm, which discounts the value of his/her human capital. In our view, the possible interaction effects between CEO human capital and personality represent a fruitful direction for future research to better understand the role of CEOs in IPO firms.

In conclusion, in this study, we examined how VCs make decisions on CEO change and the performance consequences of such decisions in their portfolio firms. Our arguments and results highlight the critical roles of CEO human capital and VC monitoring in the CEO change process in entrepreneurial firms. Our study can not only enrich the entrepreneurship literature, but also offer important practical suggestions to entrepreneurs, professional managers working in entrepreneurial firms, and VC investors.

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REFERENCES

Andrieu, G., & Groh, A. P. (2012). Entrepreneurs' financing choice between independent and bank-affiliated venture capital firms. *Journal of Corporate Finance*, *18*, 1143–1167.

Arend, R. J., Patel, P. C., & Park, H. D. (2014). Explaining post-IPO venture performance through a knowledge-based view typology. *Strategic Management Journal*, *35*, 376–397.

Audia, P. G., Locke, E. A., & Smith, K. G. (2000). The paradox of success: An archival and a laboratory study of strategic persistence following radical environmental change. *Academy of Management Journal*, *43*, 837–853.

Bartel, A. P., & Lichtenberg, F. R. (1987). The comparative advantage of educated workers in implementing new technology. *The Review of Economics and Statistics*, *69*(1), 11.

Becker, G. S. (1964). In National Bureau of Economic Research (Ed.), *Human capital: A theoretical and empirical analysis, with special reference to education*. Cambridge, MA: University of Chicago Press.

Becker, G. S. (1993). *Human capital: A theoretical and empirical analysis, with special reference to education* (3rd ed.). Chicago, IL: The University of Chicago Press.

Beckman, C. M., & Burton, M. D. (2008). Founding the future: Path dependence in the evolution of top management teams from founding to IPO. *Organization Science*, *19*, 3–24.

Bengtsson, O., & Ravid, S. A. (2009). *The importance of geographical location and distance on venture capital contracts*. Available at: SSRN 1331574.

Bernstein, S., Giroud, X., & Townsend, R. R. (2016). The impact of venture capital monitoring. *The Journal of Finance*, *71*, 1591–1622.

Blau, P. M. (1977). A macrosociological theory of social structure. *American Journal of Sociology*, *83*, 26–54.

Boeker, W., & Karichalil, R. (2002). Entrepreneurial transitions: Factors influencing founder departure. *Academy of Management Journal*, *45*, 818–826.

Bruton, G., Fried, V., & Hisrich, R. D. (1997). Venture capitalist and CEO dismissal. *Entrepreneurship Theory and Practice*, *21*, 41–54.

Bruton, G. D., Filatotchev, I., Chahine, S., & Wright, M. (2010). Governance, ownership structure, and performance of IPO firms: The impact of different types of private equity investors and institutional environments. *Strategic Management Journal*, *31*, 491–509.

Certo, S. T., Covin, J. G., Daily, C. M., & Dalton, D. R. (2001). Wealth and the effects of founder management among IPO-stage new ventures. *Strategic Management Journal*, *22*, 641–658.

Chahine, S., & Goergen, M. (2013). The effects of management-board ties on IPO performance. *Journal of Corporate Finance*, *21*, 153–179.

Chatterjee, A., & Hambrick, D. C. (2011). Executive personality, capability cues, and risk taking: How narcissistic CEOs react to their successes and stumbles. *Administrative Science Quarterly*, *56*, 202–237.

Chen, H., Gompers, P., Kovner, A., & Lerner, J. (2010). Buy local? The geography of venture capital. *Journal of Urban Economics*, *67*, 90–102.

Cohen, B. D., & Dean, T. J. (2005). Information asymmetry and investor valuation of IPOs: Top management team legitimacy as a capital market signal. *Strategic Management Journal*, *26*, 683–690.

De Clercq, D., Fried, V. H., Lehtonen, O., & Sapienza, H. J. (2006). An entrepreneur's guide to the venture capital galaxy. *Academy of Management Perspectives*, *20*, 90–112.

Eesley, C. E., & Roberts, E. B. (2012). Are you experienced or are you talented? When does innate talent versus experience explain entrepreneurial performance? *Strategic Entrepreneurship Journal*, *6*, 207–219.

Eisenhardt, K. M. (1989). Making fast strategic decisions in high-velocity environments. *Academy of Management Journal*, *32*, 543–576.

Ernst & Young. (2011). *Global venture capital insights and trends report* (p. 2011). New York, NY: Ernst & Young.

Finkelstein, S., & Hambrick, D. C. (1990). Top-management-team tenure and organizational outcomes: The moderating role of managerial discretion. *Administrative Science Quarterly*, *35*, 484–503.

Finkelstein, S., Hambrick, D. C., & Cannella, A. A. (2009). *Strategic leadership: Theory and research on executives, top management teams, and boards*. Oxford, England: Oxford University Press.

Fischer, H. M., & Pollock, T. G. (2004). Effects of social capital and power on surviving transformational change: The case of initial public offerings. *Academy of Management Journal*, *47*, 463–481.

Fried, V. H., & Hisrich, R. D. (1995). The venture capitalist: A relationship investor. *California Management Review*, *37*, 101–113.

Friedman, S. D., & Saul, K. (1991). A leader's wake: Organization member reactions to CEO succession. *Journal of Management*, *17*, 619–642.

Fritsch, M., & Schilder, D. (2008). Does venture capital investment really require spatial proximity? An empirical investigation. *Environment and Planning A*, *40*, 2114–2131.

Gimmon, E., & Levie, J. (2010). Founder's human capital, external investment, and the survival of new high-technology ventures. *Research Policy*, *39*, 1214–1226.

Gompers, P., & Lerner, J. (1996). The use of covenants: An empirical analysis of venture partnership agreements. *Journal of Law and Economics*, *39*, 463–498.

Gorman, M., & Sahlman, W. A. (1989). What do venture capitalists do? *Journal of Business Venturing*, *4*, 231–248.

Hall, P. A., & Soskice, D. (2001). Introduction. In P. A. Hall & D. Soskice (Eds.), *Varieties of capitalism: The institutional foundations of comparative advantage* (pp. 1–68). Oxford, England: Oxford University Press.

Hambrick, D. C., & Fukutomi, G. D. S. (1991). The seasons of a CEO's tenure. *Academy of Management Review*, *16*, 719–742.

Hasan, I., Kobeissi, N., & Wang, H. (2011). Global equity offerings, corporate valuation, and subsequent international diversification. *Strategic Management Journal*, *32*, 787–796.

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, *46*, 1251–1271.

Hendry, J. (2002). The principal's other problems: Honest incompetence and the specification of objectives. *Academy of Management Review*, *27*, 98–113.

Hochberg, Y. V., Ljungqvist, A., & Lu, Y. (2007). Whom you know matters: Venture capital networks and investment performance. *Journal of Finance*, *62*, 251–301.

Hsu, D. H. (2007). Experienced entrepreneurial founders, organizational capital, and venture capital funding. *Research Policy*, *36*, 722–741.

Jain, B. A., & Kini, O. (1994). The post-issue operating performance of IPO firms. *Journal of Finance*, *49*, 1699–1726.

Jain, B. A., & Tabak, F. (2008). Factors influencing the choice between founder versus non-founder CEOs for IPO firms. *Journal of Business Venturing*, *23*, 21–45.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review*, *76*, 323–329.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*, 305–360.

Lerner, J. (1995). Venture capitalists and the oversight of private firms. *Journal of Finance*, *50*, 301–318.

Levin, J. S. (2002). *Structuring venture capital, private equity and entrepreneurial transactions*. Frederick, MD: Panel Publishers.

Loughran, T., & Ritter, J. (2004). Why has IPO underpricing changed over time? *Financial Management*, *33*, 5–37.

Lutz, E., Bender, M., Achleitner, A. K., & Kaserer, C. (2013). Importance of spatial proximity between venture capital investors and investees in Germany. *Journal of Business Research*, *66*, 2346–2354.

Murphy, K. J., & Zabojnik, J. (2004). CEO pay and appointments: A market-based explanation for recent trends. *American Economic Review*, *94*, 192–196.

Nelson, T. (2003). The persistence of founder influence: Management, ownership, and performance effects at initial public offering. *Strategic Management Journal*, *24*, 707–724.

O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity*, *41*, 673–690.

Offstein, E. H., & Gnyawali, D. R. (2005). CEO compensation and firm competitive behavior: Empirical evidence from the U.S. pharmaceutical industry. *Journal of Engineering and Technology Management*, *22*, 201–225.

Pollock, T. G., Fund, B. R., & Baker, T. (2009). Dance with the one that brought you? Venture capital firms and the retention of founder-CEOs. *Strategic Entrepreneurship Journal*, *3*, 199–217.

Pollock, T. G., Lee, P. M., Jin, K., & Lashley, K. (2015). (Un)tangled: Exploring the asymmetric coevolution of new venture capital firms' reputation and status. *Administrative Science Quarterly*, *60*, 482–517.

Rubenson, G. C., & Gupta, A. K. (1992). Replacing the founder: Exploding the myth of the entrepreneur's disease. *Business Horizons*, *35*, 53–57.

Sahlman, W. A. (1990). The structure and governance of venture-capital organizations. *Journal of Financial Economics*, *27*, 473–521.

Sapienza, H. J., & Gupta, A. K. (1994). Impact of agency risks and task uncertainty on venture capitalist-CEO interaction. *Academy of Management Journal*, *37*, 1618–1632.

Sorenson, O., & Stuart, T. E. (2001). Syndication networks and the spatial distribution of venture capital investments. *American Journal of Sociology*, *106*, 1546–1588.

Wasserman, N. (2003). Founder-CEO succession and the paradox of entrepreneurial success. *Organization Science*, *14*, 149–172.

Wasserman, N. (2012). The founder's dilemmas: Anticipating and avoiding the pitfalls that can sink a startup. In *Kauffman foundation series on innovation and entrepreneurship*, Princeton, NJ: Princeton University Press.

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, *48*, 817–838.

Wooldridge, J. M. (2002). *Econometric analysis of cross section and panel data*. Cambridge, MA: The MIT Press.

Wright, M., & Lockett, A. (2003). The structure and management of alliances: Syndication in the venture capital industry. *Journal of Management Studies*, *40*, 2073–2102.

Yang, Q., Zimmerman, M., & Jiang, C. (2011). An empirical study of the impact of CEO characteristics on new firms' time to IPO. *Journal of Small Business Management*, *49*, 163–184.

Zimmerman, M. A. (2008). The influence of top management team heterogeneity on the capital raised through an initial public offering. *Entrepreneurship Theory and Practice*, *32*, 391–414.

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