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One size does not fit all: The conditional role of CEO education on IPO performance

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ABSTRACT

Exploiting a hand-collected dataset of US IPOs, we find that firms led by CEOs with a PhD or an MBA have three-year post-listing returns that are 12% and 11% higher, respectively, than the typical issuer. Yet these averages suppress an important dichotomy. A PhD is associated with higher IPO performance when innovation and specialized knowledge are prioritized, such as in small, young, or R&D-intensive firms. In contrast, an MBA adds value when adept management skills are required to cope with a larger firm size and organizational complexity. Additional evidence from the use of venture capital reinforces this dichotomy: CEOs with a PhD are more likely to align forces with VC firms which offer complementary management expertise. Our results caution that IPO investors remain indifferent to CEO education if this is unrelated to the issuer's main organizational and environmental challenges, which explains the inconclusive evidence of prior research.

1. Introduction

In September 2013, a great deal of publicity was generated in the US financial press when Rocket Fuel, a small high-tech firm, issued shares of stock to the general public for the first time. With an initial public offering (IPO) valuation at $1 billion and $116 million in gross proceeds, this was the top technology IPO of the year. The in-depth industry knowledge of the firm's CEO (Dr. George H. John), who holds a PhD in computer science, was regarded by market players as an important contributing factor to its success. Similar media coverage was given few years later to Stitch Fix, a personal shopping service company, which tapped the new equity market in November 2017. Valued at $1.4 billion, this IPO was led by Ms. Katrina Lake, who, at the age of 34, is the youngest female CEO to have taken a company public. The press commended the managerial skills of this Harvard MBA graduate which allowed her to thrive in an increasingly complex business sector. Even though the outcome in both cases was a successful IPO, the educational attainments of these CEOs have equipped them with fundamentally different skillsets. Relatedly, while prospective issuers can attain certification by appointing to the top executive position an individual with stellar academic credentials, the literature has yet to examine the conditions under which the type of education matters to investors. Filling this gap, we examine how an MBA degree, as a proxy for general managerial skills, and a PhD, as a proxy for specialized education, influence IPO performance.

A PhD is awarded to individuals with higher intellectual intricacy and a greater aptitude for generating new ideas (He & Hirshleifer, 2022; Hitt & Tyler, 1991). To the extent that these qualities lead to the implementation of innovative courses of action and the development of niche market strategies (Barker & Mueller, 2002; Sunder et al., 2017; Tyler & Steensma, 1998; Wiersema & Bantel, 1992), this type of education is more valuable in entrepreneurial and less established organizations, which strive to assert their presence in the market.

An MBA degree, on the other hand, cultivates general managerial skills which are in demand in complex organizational environments (Frydman, 2019; Murphy & Zabojnik, 2007). In line with this view, several studies (Andreou et al., 2017; Custodio et al., 2013; King et al., 2016) postulate that CEOs with an MBA consistently outperform their peers with different qualifications in industries dominated by high levels of administrative complexity.

Based on the above, we conjecture that insomuch as firms face different challenges, IPO investors should assign greater value to the distinctive qualities of each education type when these characteristics are aligned with key organizational needs. As a preliminary step to

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testing this intuition, we first seek to delineate whether CEO education can indeed influence IPO performance. Subsequently, we examine how the performance is moderated by the different skills that each type of education offers and identify the boundary conditions under which each type is preferable over the other.

The first boundary condition relates to issuers' size and age. Small and/or young firms – despite being easier to manage and less bureaucratic – are forced to set up niche strategies to reinforce their competitive position within an environment dominated by their more established rivals (Bertoni et al., 2013; Coff, 1999; Porter, 1990). Relevant literature (Barker & Mueller, 2002; Sunder et al., 2017) explains that a pioneering approach is more likely to be implemented by expert CEOs who withstood the rigors of doctoral education and tried to expand the boundaries of knowledge in their fields of study. Conversely, larger and more established firms, although in a better position in terms of available resources and operating experience, are mainly confronted with the challenges deriving from a heightened level of organizational complexity (Falato et al., 2015; King et al., 2016; Miller & Chen, 1994). In the latter case, the superior managerial skills acquired from an MBA program are clearly advantageous.

A second boundary condition pertains to the role of innovation in the firm's operations, for which we use research and development (R&D) as a proxy. PhD holders are better poised to lead organizations with a substantial dependence on R&D, as specialized knowledge is commonly linked with individuals who are more likely to assimilate new ideas and embrace technology, as well as those who are less risk-averse than their non-expert counterparts (Barker & Mueller, 2002). Given that R&D expenditure typically relates to long-term projects with high failure rates (Lhuillery & Pfister, 2009), we contend that CEOs with a doctorate exert a positive impact on IPO performance in knowledge-intensive industries.

In addition to performance outcomes, we posit that CEO education could determine another important aspect of the process of going public, the use of venture capital (VC). This is because the employment of VC is known to: (1) infuse portfolio firms with management expertise (Chahine et al., 2021; Megginson & Weiss, 1991), which is complementary to the specialized knowledge of a CEO with a PhD but is less needed for CEOs with an MBA; and (2) invest in high-growth, high-return businesses which match the innovative spirit of former CEOs, but contradict the more risk-averse nature of the latter (Barker & Mueller, 2002; Hitt & Tyler, 1991). Accordingly, we expect to find VC financing more frequently in firms led by CEOs with PhDs.

For the empirical investigation, we assemble a comprehensive dataset of US IPOs and hand-collect information about the educational background of CEOs directly from issuers' prospectuses filed over the period January 1, 1998, to December 31, 2018. Our special sample of interest consists of issuers led by CEOs who have obtained either a doctorate or an MBA degree from any higher academic institution in the US.

We obtain strong empirical support for our conjectures. First, when investigating the overall effect of CEO education on IPO performance, we find that both PhD and MBA degrees are associated with higher buy-and-hold abnormal returns (BHARs) three years after issuance. The economic importance of this result is substantial: new ventures led by CEOs with a PhD or an MBA perform 12 % and 11 % higher, respectively, than the average issuer. This is aligned with the basic premise of human capital theory, which regards education as a human resource investment conducive to shareholder value maximization (Aliaga, 2001; Coff & Raffiee, 2015; Hendricks, 2002).

To examine how size differentials impact the value relevance of each type of CEO education, we regress the corresponding qualifications against the three-year BHARs of issuers that belong to the lower, middle, and higher thirds of the total asset distribution. Our results show that rigorous management education, using the possession of an MBA as a proxy, attains the highest statistical significance (at the 1 % level) in the subsample with the largest (highest third) issuers. A 5 % level of significance is found for medium-sized issuers (those at the mid-third tier), while insignificant results are observed for small firms. The reverse holds true for CEOs with specialized education: a doctorate is strongly associated with higher IPO performance in small issuers but fails to generate an impact on their larger counterparts. Issuers' age gives rise to an analogous dichotomy: PhDs (MBAs) enhance the performance of young (long-lived) firms, with the strength of the relationship increasingly dissipating towards the opposite end of the age distribution.

At the industry level, we find that a specialized education is a key driver of post-IPO stock returns for firms operating within a knowledge-intensive environment. When the salience of R&D for issuers' operations abates, so does the impact of PhDs.

In a final set of tests, we document that CEO education affects not only investors' valuations but also issuers' likelihood of seeking VC. Our findings suggest that CEOs with PhDs tend to rely on VC assistance in the process of going public. On the contrary, individuals who have developed managerial skills through an MBA are more likely to forego this assistance, which is usually accompanied by the VC firm's interference in the issuer's management.

Methodologically, we place emphasis on obtaining the inferences least affected by endogeneity. If unobservable factors can influence both IPO performance and the likelihood of appointing a CEO with a particular type of education, then omitted variables can inflict significant bias in the ordinary least squares (OLS) coefficients. Our estimation strategy is based on a two-stage least squares (2SLS) model in which CEO education is instrumented by the proportion of CEOs with the same type of academic attainment in the issuer's two-digit standard industrial classification (SIC) code. This *mimicking behavior* metric is widely used in IPO research to allay concerns due to endogeneity (Bell et al., 2012; Bertoni et al., 2014; Deephouse & Carter, 2005).

Together, our findings delineate the signaling role of a CEO's education at IPO. As such, we caution that a stellar academic background is beneficial only to the extent that it can cater to specific organizational priorities; ultimately, what market investors value are the skillsets honed by the various education types, rather than scholastic achievement per se. This should have resonance for prospective issuers recruiting for the top executive position. More generally, our findings can guide nomination committees and the practice of informed corporate governance, which is crucial given the ubiquity of candidates with top-notch academic qualifications. Finally, understanding the conditional role of education is of fundamental importance for providers of academic services and the executive job market alike.

This study makes several contributions to IPO and human capital literature. First, we offer a new empirical grounding for human capital theory (Benmelech & Frydman, 2015; Lazear, 2009; Porter, 1990), which regards managerial education as a key resource for business entities. Second, we extend prior research on CEO education and corporate outcomes (Bhagat et al., 2010; Falato et al., 2015; Kaplan et al., 2012) with evidence from the stock market performance of newly listed firms. While previous IPO studies indiscriminately treat academic attainment as a signal of issuers' quality (Bonardo et al., 2011; Cohen & Dean, 2005; Colombo et al., 2019), ours is the first to consider the fit between the nature of a CEO's human capital vis-à-vis firm-specific characteristics and the industry environment, capturing a differential market response. By exposing the underlying mechanism, we show a nuanced relationship capable of reconciling the discord in literature about the role of managers' education on IPO performance. Third, and relatedly, by identifying the conditions under which academic qualifications appeal to the investment public, we extend the research on issuers' strategies for attaining certification (e.g., Carter et al., 1998; Megginson & Weiss, 1991; Wang et al., 2019). Lastly, to the best of our knowledge, this is the first study to link educational background with the use of VC, adding to the research on financing choices made enroute to an IPO (Park & Steensma, 2012).

2. Relevant literature

Several studies within the framework of human capital theory recognize that educational attainment and an individual's information processing capacity are inextricably linked (e.g., Brahma et al., 2020; Hatch & Dyer, 2004; Lazear, 2009). This stream of literature posits that educational attainment constitutes an effective proxy for cognitive abilities, which, in turn, shape social and corporate outcomes (Jensen, 1998; Lucas & McDonald, 1990). On this basis, appointments of executives who have been through rigorous academic training are both an investment in human resources (Aliaga, 2001) and a precondition for future business growth (Hendricks, 2002).

With a focus on top management teams, accounting and finance research establishes that different types of qualifications give rise to behavioral patterns by managers which are incrementally important in explaining corporate decisions (Custodio et al., 2013; Xuan, 2009). This stream of research classifies the educational credentials of executives into two broad categories: (1) those attainments that equip individuals with specialized knowledge in one particular science; and (2) those that lead to the development of general managerial skills, with the empirical evidence suggesting that firm prospects could vary considerably with each category.

Dewar and Dutton (1986), through the paradigm of manufacturing firms, emphasize the gains of appointing managers with specialized education in a certain discipline. They further show that executives with engineering degrees are more likely to implement innovative courses of action. Similarly, Tyler and Steensma (1998) report that top executives with backgrounds in technical education favor the formation of strategic alliances to attain technological developments for their own firm. Barker and Mueller (2002), researching the effect of CEO characteristics on R&D, find that the type of higher education matters for predicting relative spending. Accordingly, CEOs with engineering-related qualifications are positively associated with R&D expenditure, while business degrees are found to be insignificant, and law school graduates account for a negative relation. Additionally, managers' backgrounds in social sciences exhibit a positive association with the firm's ability to implement changes in corporate strategy (Norburn & Birley, 1988; Wiersema & Bantel, 1992).

On the other hand, a second strand of literature documents an increasing demand, in recent years, for CEOs with a business education. The basic premise of these studies is that the escalating organizational complexity of modern corporations makes general managerial skills more relevant compared to specialized, industry-specific knowledge. Xuan (2009) finds that generalist CEOs make unbiased capital allocations in multidivisional firms, unlike specialist CEOs who tend to engage in bridge-building by favoring departments they have no prior experience with. King et al. (2016) assert that the possession of general managerial skills is valuable in the banking sector, as CEOs with MBAs deliver higher profitability and systematically outperform their peers who lack this qualification. Custodio et al. (2013) show that CEOs with general managerial skills are rewarded with increased pay, in recognition of their aptitude to carry out complex tasks in ways that minimize friction for their organizations. Relatedly, they are often trusted to navigate firms though restructurings, acquisitions, and external shocks. Andreou et al. (2017) report that, in the financial crisis of 2008, generalist CEOs outperformed specialist ones, having more efficiently managed the available resources and mitigated the impact of the crisis on corporate investment. The authors corroborate this dichotomy with auxiliary analysis using MBA and PhD qualifications as proxies for generalist and specialist backgrounds, respectively.

The fact that general managerial skills are easily transferrable across organizations and industries also entails risks for a firm. Giannetti (2011) argues that generalist CEOs are more inclined to exhibit job-hopping behavior when faced with favorable job market conditions. Mishra (2014) finds that because of this misalignment in the interests between shareholders and CEOs with managerial skills, the cost of equity is higher for corporations led by the latter. Chen et al. (2021) also associate generalist CEOs with a heightened likelihood of engaging in unrelated acquisitions. Overall, prior literature indicates that the type of a CEO's educational background defines the framework within which strategic decisions are made and thereby significantly influences firms' prospects.

The need for managerial backgrounds that are in line with firm strategy has been theoretically and empirically validated by early management research. Szilagyi and Schweiger (1984), critical of the common wisdom that competent managers are value-adding in a universalistic manner, develop a theoretical framework which lays out the criteria and the contingencies underpinning the matching of managerial skills to strategic job requirements. From the context of multidivisional firms, Govindarajan (1989) shows that managers with a high degree of specialization in R&D enhance the effectiveness for divisions implementing a differentiation strategy, but not for divisions of a low-cost strategy. At the firm-level, Thomas et al. (1991) document that when organizations align managerial human capital with strategy, they systematically outperform the competition. Thomas and Ramaswamy (1996) find that this alignment captures a greater portion of the variance in business performance than conventional performance determinants such as industry, firm size, and organizational age.

More recently, the use of the CEOs' fit to strategy in explaining performance outcomes has made some inroads to the study of corporate events. From the paradigm of divestitures, Huang (2014) contrasts two different motives for downsizing: the operational simplicity of a focused firm vis-à-vis the better assets-expertise match by retaining only the divisions in which the CEO has experience. The author finds that the latter motive (exclusively) boosts operating and stock market performance, with the effects being an increasing function of the CEO's experience. Chen et al. (2021) provide analogous evidence from acquisitions. They show that a close correspondence between the human capital antecedents of CEOs and the acquisition type leads to stronger performance in the post-deal period. Our study extends this literature by applying this conditional approach to the IPO event.

Different from listed firms, prospective IPO issuers are unknown to the market, suffering from a liability of newness. Consequently, the prime focus is on certifying firm quality, toward which managers' stellar education is argued to be uniformly beneficial, a prediction with, at best, mixed empirical support (e.g., Bonardo et al., 2011; Cohen & Dean, 2005; Colombo et al., 2019). However, despite the plethora of prestigious academic credentials in the executive job market, many IPOs will fail shortly after listing (Feng et al., 2020), which casts doubt on the postulated role of academic attainment to serve as the main conduit via which CEO education interacts with IPO performance. Thus, a more relevant question for IPO investors – compared to a beauty contest based on academic qualifications - is whether the skills and mindset developed by a particular education type are aligned with issuers' strategic objectives. We explore this question by drawing evidence from the world's most prominent IPO and executive talent market, the US.

3. Hypothesis development

3.1. CEO education and Issuer's size

The upper echelons theory by Hambrick and Mason (1984) stipulates that CEOs' characteristics and cognitive bases shape their strategic choices and thereby their organizational performance. To the extent that different firm types are faced with different challenges, the value of CEO education to firms should vary along the lifecycle and in their cross-section. Porter (1990) categorizes firms according to size, highlighting that the key challenge for small companies is to survive and grow in a competitive environment where their larger counterparts retain most of the market share. In the IPO context, Gao et al. (2013) indicate that technological advancements result in increased economies of scope for large firms, so that smaller firms, more often than not, end up becoming

acquisition targets, which puts an abrupt end to their IPO aspirations. For the latter firms, therefore, the ability to tap public equity markets is inextricably linked with the ability for radical innovation in order to seize market opportunities and create fast momentum for going public.

Given the vital role of innovation, which types of CEOs are likely to infuse organizations with the necessary exploratory spirit? Hambrick and Mason (1984) suggest that these are unlikely to be CEOs with MBAs who have been trained to value moderation and changes that are incremental in nature. Hambrick and Mason further argue that it is typically the level of education (rather than the type) that fosters innovation. As the highest scholastic attainment, a PhD degree strongly relates to innovation, according to a recent study by He and Hirshleifer (2022); because the effects are not exclusive to CEOs with technical education (e.g., science, medicine, or engineering), the evidence is also consistent with the authors' conjecture that CEOs with PhDs are generally reluctant to commit to a "quiet life" devoid of innovation. Thus, given the unique challenges faced by small IPO issuers, and the evidence of a causal relationship between the CEO background to strategy match and firm performance (Thomas et al., 1991; Thomas & Ramaswamy, 1996), we expect these issuers to perform better when led by CEOs with a doctoral education. Formally stated:

H.1.In small issuers, post-IPO performance will be positively associated with the CEO having a doctorate.

From a complementary perspective, a growing body of research highlights that as the size of the company grows, so does the significance of business education (Bhagat et al., 2010; Falato et al., 2015; King et al., 2016; Murphy & Zabojnik, 2007). The underlying premise of this proposition is twofold. First, it stems from the fact that larger corporations operate in a complex environment with multiple administrative layers and more bureaucratic procedures, which make the firm sluggish to adopt (Miller & Chen, 1994). To surpass this organizational intricacy, possession of good general managerial skills is an important quality that CEOs should have to effectively communicate and implement corporate strategy. Second, large firms are more visible to investors, as well as being more cash-affluent, and have already built a critical system of people and networks (Miller et al., 2015). Consequently, while appearing less likely to confront a scarcity of field-specific competencies, it is vital that these firms manage and allocate the existing resources efficiently. Thus, an MBA education should elicit higher market valuations following the transition to the public domain:

H.2.In large issuers, post-IPO performance will be positively associated with the CEO having an MBA.

3.2. CEO education and Knowledge-Intensive industries

Firms operating in knowledge-intensive industries are required to create and launch innovative strategies in order to sustain their competitive edge. These firms have a critical dependence on R&D and invest in risky long-term projects to pioneer new technologies and products (Mansfield, 1968). The outcome of these projects will largely determine the future of the organization. To enhance the likelihood of success, the CEO should be able to relate to the challenges of a research endeavor by adhering to a vision, and by exhibiting resilience to failure in the presence of increased uncertainty. Prior studies (Barker & Mueller, 2002; Tyler & Steensma, 1998) draw a line between the two types of education and clarify that rigorous training in specialized fields provides CEOs with the ability to understand complex technical issues and makes them more receptive to innovation and change. Thus, the educational background of CEOs, which shapes their ability to absorb and evaluate information, plays a crucial role in research-driven industry sectors. Conversely, generalist managers with a business background are perceived as more conservative and risk-averse individuals whose analytical skills are focused on the avoidance of big losses (Barker & Mueller, 2002; Hitt & Tyler, 1991). Thus, to the extent that the alignment of a CEO's human capital with organizational strategy results in better performance (e.g., Thomas et al., 1991; Thomas & Ramaswamy, 1996), we expect CEOs with a doctorate degree to have a positive impact on IPO performance in knowledge-intensive industries:

H.3.In knowledge-intensive industries, post-IPO performance will be positively associated with the CEO having a doctorate.

3.3. CEO education and VC

Beyond secondary market performance, the educational background of CEOs may also exert an influence on issuers' likelihood of seeking VC. In addition to capital, VCs contribute to the management of the entity by: (1) utilizing industry contacts to develop customer relationships and assist in market penetration; and (2) appointing their affiliates in the issuer's board of directors. To maximize return on investment, VCs need to select entrepreneurial firms with high growth potential. Amit et al. (1998) assert that VCs have both the knowledge and experience to identify such ventures and are able to monitor their performance more effectively than conventional financial intermediaries. We contend that CEOs with a doctorate degree are more receptive to VC backing as: (1) they are associated with an aptitude for risk and innovation, which matches the VC firm's investment objectives; and (2) they can complement their functional expertise with the managerial experience offered by the VC. Thus, our final hypothesis is:

H.4.Issuers led by CEOs with a doctorate are more likely to resort to VC.

4. Empirical analysis

4.1. Data and sample identification

We retrieve the population of US IPOs over the period 1998–2018 from the SDC database. By imposing the standard restrictions of the IPO literature (e.g., Loughran & Ritter, 2004), we exclude financial firms, REITs, ADRs, closed-end funds, foreign issuers, IPOs with an offer price of less than five dollars and unit offerings. We match each IPO with stock price and accounting data from CRSP and Compustat, respectively, eliminating observations with missing values. These interventions leave us with a final sample of 2,152 IPOs, for which we obtain the prospectuses that are filed with the Securities and Exchange Commission (*SEC*) and available on the Electronic Data Gathering Analysis and Retrieval System (EDGAR).

We hand-collect all data relating to CEOs' academic background from the IPO prospectuses and carefully validate them across multiple independent sources: Boardex, Bloomberg, and S&P Capital IQ. Table 1 presents the distribution of the full sample and the subsamples formed by CEOs with PhDs and MBAs by listing year, SIC division, and issuer-specific information.

4.2. Methodology and key variables

Our hypotheses (H.1.–H.3.) predict the effect of CEO education on IPO performance as moderated by issuer-specific characteristics and the industry environment. Methodologically, these predictions share a common baseline regression equation, which can be expressed as follows:

Post-IPO performance $= \beta 0 + \beta 1 \times$ *CEO educational characteristics* $+ \beta 2 \times$ Other CEO characteristics $+ \beta 3 \times$ Board human capital $+ \beta 4 \times$ Founders' human capital $+ \beta 5 \times$ Firm and IPO-specific characteristics $+$ *Fama-French* industry *dummies* $+$ *Year dummies* $+ \varepsilon$ **Eq.(1).**

To measure post-IPO performance, we rely on three-year (36-month) BHARs:

Table 1
Sample overview.

	Full sample (N = 2,152)		*CEOs with PhD (N = 283)*		*CEOs with MBA (N = 744)*	
Year	***No.***	***% of total***	***No.***	***% of year***	***No.***	***% of year***
1998	173	8.04	16	9.25	29	16.76
1999	283	13.15	36	12.72	125	44.17
2000	118	5.48	26	22.03	27	22.88
2001	38	1.77	5	13.16	9	23.68
2002	43	2.00	5	11.63	6	13.95
2003	51	2.37	8	15.69	7	13.73
2004	139	6.46	17	12.23	39	28.06
2005	120	5.58	12	10.00	33	27.50
2006	126	5.86	12	9.52	44	34.92
2007	114	5.30	13	11.40	48	42.11
2008	18	0.84	1	5.56	5	27.78
2009	37	1.72	2	5.41	12	32.43
2010	79	3.67	9	11.39	33	41.77
2011	65	3.02	7	10.77	32	49.23
2012	81	3.76	19	23.46	31	38.27
2013	134	6.23	19	14.18	57	42.54
2014	165	7.67	28	16.97	71	43.03
2015	106	4.93	20	18.87	45	42.45
2016	69	3.21	4	5.80	23	33.33
2017	91	4.23	10	10.99	21	23.08
2018	102	4.74	14	13.73	47	46.08
SIC division	***No.***	***% of total***	***No.***	***% of division***	***No.***	***% of division***
Agriculture, forestry and fishing	5	0.23	1	20.00	2	40.00
Mining and construction industries	84	3.90	0	0.00	17	20.24
Manufacturing	772	35.87	181	23.45	247	31.99
Transportation, communication, and utilities	166	7.71	7	4.22	32	19.28
Wholesale and retail trade	174	8.09	8	4.60	43	24.71
Service industries	748	34.76	69	9.22	309	41.31
All other	203	9.43	17	8.37	94	46.31
Firm-specifics	***No.***	***% of total***	***No.***	***% of specific***	***No.***	***% of specific***
R&D IPOs	996	46.28	157	15.76	337	33.84
Internet IPOs	175	8.13	17	9.71	91	52.00
VC-backed IPOs	1,020	47.40	218	21.37	468	45.88
NASDAQ IPOs	1,487	69.10	256	17.22	571	38.40

This table presents the sample of 2,152 US IPO issuers from 1 January 1998 to 31 December 2018 and the subsamples of issuers led by CEOs with PhD and MBA degrees. The IPOs are listed in absolute and relative terms by issue year, SIC division, and firm-specifics. The source is the Securities Data Company (SDC) database.

$$BHAR^{i}_{0,36} = \prod_{t=1}^{36}(1+r^{i}_{t}) - \prod_{t=1}^{36}(1+r^{m}_{t}),$$

where *BHAR* is the buy-and-hold abnormal return realized by a firm *i* over 1 to 36 months after listing, (r^{i}_{t}) is the raw return for firm *i* in month t (starting from the next trading day after the issuance date), and r^{m}_{t} is the market-adjusted return based on the CRSP value-weighted index. All returns are expressed in percentage. As in Loughran and Ritter (1995), when a firm delists, we truncate the *BHAR* at the delisting date and use this return for all longer-term returns for that firm.

As proxies for the type of CEO education, we use a) the *MBA CEO* variable, which is a binary indicator taking the value of 1 for CEOs holding a Master of Business Administration degree and 0 otherwise; and (b) the *PhD CEO* dichotomous variable, which is equal to 1 for CEOs holding a doctorate title and 0 otherwise. To capture the investor response to the skillsets honed by each education type net of the possible confounding influence of the networking and prestige benefits from attending a highly regarded institution, we specify the variables: a) *top university*, a binary indicator flagging the possession of any degree from a top 25 university based on the US News University Rankings; and (b) *eigenvector,* capturing the CEO's personal connections weighted by their relative importance.[1] We control for a number of other CEO characteristics that prior research (e.g., Dunbar et al., 2020; Kallias et al., 2022) shows influence firm performance: *duality*, as CEOs enjoy more degrees of freedom when they also preside over board meetings, *gender* and *age* for likely variation in CEOs' management style by these important demographic characteristics, *cash compensation*, with non-variable compensation leading to increased risk aversion, and *political ties*, which could benefit firms via several conduits.

Additionally, we control for the board's human capital with the variables of: (1) *board educational level,* capturing the board's average of post-high school education years for a likely confounding influence on the CEO's own education; (2) *board industry experience,* the average number of previous managerial positions for each board director in the issuer's industry (as in Kor & Misangyi, 2008), so that the effects are incremental to industry-specific knowledge; (3) *board functional breadth,* the average number of functional domains in which each board director has experience, in the spirit of Mannor et al. (2019), so that the effects are also incremental to the functional diversity of work experience; and (4) *board size,* which as per stewardship (agency) theory can enhance or (dissipate) firm value. We separately construct the former three variables for the founders remaining with the issuing firm until listing, whom IPO investors tend to view as "untested management" (Certo et al., 2001).

The firm and IPO-specific characteristics are common in Equations 1 and 2, closely follow prior research (Carter et al., 1998; Loughran & Ritter, 1995, 2004; Ritter, 1991; Zhang et al., 2022), and include the following variables: *firm age*, with valuation uncertainty being greater among younger firms due to information scarcity; *offer size*, as mature and financially stable issuers tend to be more confident and thus offer a larger portion of their equity to the investment public; *underwriter*, which captures the tendency of established investment banks to avoid issuers of dubious quality in order to protect their reputation in the market; *Earnings Per Share (EPS)*, which, when positive, disseminates a signal of managerial ability, as the resource-constrained environment of the pre-IPO period is not conducive to profitability and forces many issuers to defer this objective for the post-IPO period; *venture capital* firms, that, besides the provision of financing and management skills, are repeat players in the IPO market, which confers certification benefits on new equities; *leverage*, which invites more rigorous monitoring for the management, with the potential to mitigate agency costs and increase stock market performance over the long run; *market return*, which represents general market momentum; *overhang*, which relates to the dilution of ownership, a culprit for weak stock market performance due to agency conflicts; *dot.com period*, controlling for the overheated market of the late 1990 s; *NASDAQ*, which accounts for differences in market microstructure (for example, Reinganum, 1990, reports that NASDAQ-listed small firms consistently underperform similarly-sized NYSE-listed firms); *assets,* for larger issuers' ability to cope better with the increased disclosure and other regulatory requirements of the public domain; and *total blockholders,* another conduit via which increased monitoring can exert a disciplinary influence. Lastly, we include industry (based on the Fama-French industry classification) and calendar year fixed effects to address IPO clustering as a probable source of bias. All the variables are defined in the Appendix.

To test H.4., in the spirit of Jiang et al. (2014), we specify the following probit regression model:

Probit (venture capital) = $\beta 0 + \beta 1 \times$ CEO educational characteristics

[1] For a formal mathematical explanation and analysis of *eigenvector* see, for instance, El-Khatib et al.'s (2015) Appendix A.

Table 2
Summary statistics.

	Full Sample (N=2,152)			IPOs with CEO PhD (N = 283)			IPOs with CEO MBA (N = 744)			*Difference in mean (p-value)*	*Difference in median (p-value)*
	Mean	St.dev.	Median	Mean	St. dev.	Median	Mean	St.dev.	Median		
BHAR	−0.17	0.24	−0.16	−0.04	0.32	0.02	−0.08	0.30	−0.03	0.14	0.18
PhD CEO	0.13	0.34	0.00								
MBA CEO	0.17	0.38	0.00								
Top university	0.28	0.45	0.00	0.27	0.44	0.00	0.28	0.45	0.00	0.75	0.47
Eigenvector	0.19	0.39	0.13	0.18	0.38	0.14	0.24	0.43	0.23	0.06	0.00
Other CEO characteristics											
CEO duality	0.45	0.50	0.00	0.49	0.50	0.00	0.46	0.50	0.00	0.78	0.50
CEO gender	0.96	0.20	1.00	0.97	0.17	1.00	0.95	0.22	1.00	0.24	0.51
CEO age	49.70	5.68	48.00	50.80	3.71	49.00	50.30	4.01	48.00	0.12	0.52
CEO cash compensation (in thousands)	649.00	52.00	358.00	647.00	57.00	632.00	656.00	59.00	318.00	0.05	0.04
CEO political ties	0.17	0.38	0.00	0.16	0.37	0.00	0.23	0.39	0.00	0.02	0.67
Board human capital											
Board educational level	6.03	1.01	4.00	6.34	1.23	4.00	6.21	1.29	4.00	0.27	0.63
Board industry experience	1.69	0.28	1.00	1.71	0.23	1.00	1.69	0.39	1.00	0.62	0.39
Board functional breadth	3.33	1.22	3.00	3.35	1.13	3.00	3.33	1.01	3.00	0.79	0.48
Board size	6.91	1.38	6.00	7.12	1.59	7.00	6.94	1.52	6.00	0.20	0.19
Founder human capital											
Founder educational level	3.38	1.47	4.00	4.03	1.70	4.00	3.86	1.79	4.00	0.32	0.51
Founder industry experience	0.94	0.47	1.00	1.00	0.45	1.00	0.99	0.47	1.00	0.75	0.40
Founder functional breadth	2.06	1.48	3.00	1.99	1.67	3.00	1.97	1.59	3.00	0.86	0.48
Firm and IPO-specific											
Firm age	15.29	22.08	7.00	9.11	9.01	7.00	12.92	18.01	8.00	0.00	0.13
Offer size	0.30	0.19	0.27	0.27	0.19	0.25	0.28	0.18	0.27	0.89	0.69
Underwriter	0.62	0.49	1.00	0.52	0.50	1.00	0.75	0.43	1.00	0.00	0.09
EPS	0.44	0.50	0.00	0.21	0.41	0.00	0.49	0.50	0.00	0.00	0.05
Venture capital	0.43	0.50	0.00	0.73	0.44	1.00	0.49	0.50	1.00	0.00	0.06
Leverage	1.39	2.90	0.92	2.21	6.14	1.09	1.46	2.73	1.12	0.10	0.09
Market return	0.04	0.17	0.33	0.02	0.22	0.02	0.04	0.20	0.03	0.36	0.53
Overhang	3.57	3.54	2.88	3.74	4.30	3.30	4.28	5.51	3.09	0.19	0.12
Dotcom period	0.30	0.46	0.00	0.34	0.47	0.00	0.30	0.46	0.00	0.44	0.48
NASDAQ	0.66	0.47	1.00	0.88	0.32	1.00	0.68	0.47	1.00	0.00	0.05
Assets	1,141	10,540	59.18	959.52	9,558	52.32	2,623	10,218	71.08	0.03	0.00
Total blockholders	0.61	0.36	0.52	0.59	0.32	0.49	0.62	0.38	0.52	0.41	0.31

This table presents summary statistics for the variables in our sample of 2,152 US IPOs issued from 1 January 1998 to 31 December 2018. The statistics are based on the full sample and the subsamples of issuers led by CEOs with a doctorate and an MBA degree. The difference in the mean (median) value between the subsamples is examined by t-tests (Wilcoxon rank sum tests). The IPO deals are retrieved from Securities Data Company (SDC) and the data on CEO education are hand-collected from IPO prospectuses. All accounting and stock price data come from Compustat and CRSP, respectively.

$+ \beta 2 \times$ Other CEO characteristics $+ \beta 3 \times$ Board human capital $+ \beta 4 \times$ Founders' human capital $+ \beta 5 \times$ Firm and IPO-specific characteristics + Fama-French industry dummies + Year dummies $+ \varepsilon$ **Eq.(2)**.

Here, *venture capital* is used as the dependent variable and it is equal to unity for issuers who pivot on VC investors to cover their financing needs until listing, and 0 otherwise. All are other variables are defined as in Equation 1.

4.3. Endogeneity control

In our analysis, we exercise caution to obtain the statistical inferences least affected by endogeneity. The OLS coefficients are likely to suffer from endogeneity if the issuer's decision to appoint a CEO with a certain educational background is influenced by homophily, a bias toward appointments with academic backgrounds similar to those of incumbent management members. It is also possible that CEOs with an exploratory mindset (formal managerial training) are inclined to join firms with more decentralized (hierarchical) organizational structures. Yet another possibility is that the CEO's ability to excel academically, regardless of the education type, stems from unobservable innate qualities that can also benefit firm performance. Certo et al. (2016) affirms that when several potential sources are likely to account for the endogenous setting, a 2SLS model has a definite advantage compared to other estimation methods. Following this process, we specify a model in which CEO education is instrumented in the first stage by the proportion of CEOs with an MBA or PhD qualification in the issuer's industry at the two-digit level of the SIC code. We choose this instrument for our analysis as it harmonizes with the notion of mimicking behavior, which is commonly employed by firms and individuals as a means to attain social legitimacy (Deephouse & Carter, 2005; Leary & Roberts, 2014). In addition, this factor is unlikely to exert an influence on the dependent variable (Bertoni et al., 2014), which is a necessary condition for satisfying the exclusion restriction.

When assessing the impact of CEO education on VC likelihood, both the outcome variable and the endogenous regressor are binary. Accordingly, we account for bias in treatment assignment using a recursive bivariate probit (RBP) with full information maximum likelihood. As per Greene (2012, pp. 778–789), this method mitigates endogeneity concerns, while the simultaneous processing of the selection and outcome equations enhances estimation efficiency.[2]

4.4. Descriptive statistics

Table 2 presents descriptive statistics for the full sample (N = 2,152) and the subsamples of firms led by CEOs with a doctorate degree (N = 283) and with an MBA (N = 744). The IPOs in the full sample display a mean (median) *BHAR* of −17 % (-16 %) with a standard deviation of 24 %. Consistent with the notion that education plays an important role in a

[2] Also refer to Zhang et al. (2021) for an empirical application of the RBP model.

successful IPO, the *BHARs* become higher in the subsamples (means of −4% and −8% for CEOs with PhD and MBA degrees, respectively). The typical issuer offers almost one third of the total shares outstanding and is underwritten by a reputable institution. Moreover, the mean ratio of ownership retained by pre-IPO investors to the total equity handed over is 3.57. Almost one out of three issuers were listed during the period of the 1999–2000 Internet bubble. Additionally, we observe that an IPO takes place 15.29 years after the firm's foundation. However, the average age is lower for both subsamples (9.11 for issuers led by experts in a specialized discipline and 12.92 years for issuers that have individuals with general managerial skills as CEOs).

The univariate analysis, conducted for the differences in means and medians of the two subsamples, provides preliminary evidence in support of our main conjectures. Specifically, we observe that the MBA subsample includes larger issuers, which are in a better financial position, as evidenced by lower leverage and increased profitability. These issuers are also less likely to use VC. Finally, we obtain partial evidence suggesting a younger age for the PhD sample, which is, however, unsupported by the comparison of the medians.

By means of pairwise correlation analysis and inspection of the variance inflation factor (VIF) values (less than 5 in all regressions), we ensure that the subsequent multivariate analysis is unaffected by multicollinearity.[3]

4.5. Empirical results

Prior to investigating our hypotheses, we test the effect of CEO education on the full sample of IPO issuers to affirm that academic attainments, on average, have the capacity to drive investor sentiment in the new equity markets. Table 3 presents the results. As shown, regressing the *PhD CEO* and *MBA CEO* variables on IPO performance yields coefficients which are positive and statistically significant across both models. Because the Hausman test statistics attain all conventional levels of statistical significance, we discard the OLS estimates and base our inferences on the 2SLS model. Correcting for bias due to endogeneity, this model reports a slight decrease in the statistical significance: *PhD CEO* and *MBA CEO* are both significant at the 5 % level. The economic importance of the results remains substantial: firms led by CEOs with a doctorate elicit a 12 % higher *BHAR* over the three-year period following the IPO than the rest of the sample, whereas CEOs with an MBA degree outperform their counterparts by 11 %. These results are incremental to the effect of networking, as captured by the significantly positive coefficients on the *eigenvector* variable. The rest of the control variables, when significant, conform to their theoretically predicted role. In the selection equations, the instrumental variable of *mimicking behavior* (positive and significant at the 1 % level) confirms the tendency of issuers to appoint CEOs with backgrounds based on the relative preferences of the industry.

After establishing that CEO education is an important factor in IPO performance, we argue that the effect of academic attainments on *BHARs* is not homogenous in the cross-section and varies with issuers' size. Considering that small firms are in greater need of innovation to compete with their more established peers, we anticipate the positive influence of specialized education to be a decreasing function of issuers' size and more salient for issuers at the low end of the asset distribution.

To test this hypothesis (H.1.), we focus on CEOs with PhD degrees based on the logic that this qualification is awarded to individuals who have demonstrated their ability to conduct original research in a specialized area wherein they are perceived as experts. We investigate how the impact of this type of human capital on IPO performance varies for small, medium, and large issuers, i.e., issuers falling within the lower (< $27.84 million), middle ($27.84 to $165.26 million) and top (> $165.26 million) thirds of the total asset distribution, respectively. Table 4 reports the results for each size category. CEOs with a doctorate exhibit a strong and positive association with *BHAR* for the sample of the smaller issuers. Specifically, the coefficient on *PhD CEO* is statistically significant at the 1 % level for small IPOs (Columns 1–3). The significance level drops at the 5 % for medium sized issuers (Columns 4–6) and completely disappears for firms at the high end of the asset distribution (Columns 7–9). Once again, the Hausman test attests the existence of endogeneity and justifies the use of the 2SLS approach. Overall, small issuers, unlike their larger peers, are shown to bank on the exploratory mindset and skills of CEOs with doctorates to attain higher abnormal returns. Consistent with H.1., this evidence is aligned with Wiersema and Bantel (1992), Tyler and Steensma (1998), Barker and Mueller (2002), and Bertoni et al. (2013) who advocate the suitability of a specialized education for businesses that seek to reinforce their competitive position in the market.

Next, we focus on CEOs holding MBA degrees to assess the effect that business education exerts on IPO performance. While in small firms, an exploratory mindset is necessary to distinguish the business apart from the competition and attain sustainability, in larger firms, competition typically does not pose an existential threat, nor is so restrictive. However, as organizational complexity gradually exceeds the CEO's capacity, effective management becomes the dominant challenge, necessitating a shift in focus from expansion to stability (i.e., stabilizing the firm's market position and rectifying shortcomings in organizational structure and marketing strategy) via interventions which are of a targeted and incremental nature (Dodge et al., 1994). This perspective – less aligned with an exploratory mindset which could induce firm leaders to more radical change and thereby divert attention away from the improvement of the existing processes and strategies – suggests that large businesses making coordination and integration the top priority are better poised to succeed in the public domain. Table 5 presents the results from testing H.2. As issuer size increases, so does the impact of management education on post-IPO abnormal returns, lending support to its theoretically predicted function. Specifically, we observe that in the subsample with the small issuers, the coefficient on *MBA CEO* remains insignificant. Then, it becomes significant (at the 5 % level) for medium-sized IPOs and highly significant (at 1 %) for the largest firms of the sample.

The results so far have shown that the effect of CEO credentials on IPO performance is not homogenous across the sample, but varies according to issuer size. If specialized CEO education is vital in environments where differentiation matters the most, then it should also be important in industries with high R&D intensity.

To test the conditional role of CEO education based on R&D, we follow Barlevy (2007) and divide the sample into industries with high and low R&D intensity. Table 6 provides details of the sampling criteria and presents the results. In alignment with H.3., CEOs with a PhD consistently relate to better post-IPO returns in knowledge-intensive environments, but fail to support a systematic association in conventional industries. In a consistent manner to Tyler and Steensma (1998) and Barker and Mueller (2002), who posit that expert CEOs are keen to adopt innovative strategies in knowledge-intensive industries, IPO investors are shown to trust in expert CEOs' ability to effectively implement such strategies, so that, in this context, a PhD sends out a powerful signal.

The evidence presented so far helps to clarify IPO investors' perceptions of CEO educational capital and its optimal allocation along the cross-section of issuers. For small firms whose prospects depend on the creation of niche strategies (Bertoni et al., 2013; Coff, 1999; Porter, 1990) and for issuers that belong to knowledge-intensive industries, IPO performance increases when they are led by CEOs with a PhD. However, with a growing issuer's size, market preferences shift toward business school graduates with a background in general management, who are viewed as a better match to complex organizational environments. Given how sharply this division of managerial human capital – based on

[3] In the interest of space, the correlation and VIF values are suppressed but remain available on request.

Table 3
The effect of CEO education on IPO performance.

Dependent variable: *BHAR*	OLS	2SLS		OLS	2SLS	
		1st Stage	2nd Stage		1st Stage	2nd Stage
	(1)	(2)	(3)	(4)	(5)	(6)
PhD CEO	0.10***		0.12**			
	(0.03)		(0.06)			
MBA CEO				0.09***		0.11**
				(0.03)		(0.05)
Top university	0.22	0.42**	0.21	0.17	0.38**	0.19
	(0.20)	(0.21)	(0.19)	(0.19)	(0.18)	(0.18)
Eigenvector	0.42***	0.36	0.44***	0.39***	0.46	0.40***
	(0.13)	(0.33)	(0.14)	(0.11)	(0.43)	(0.13)
Other CEO characteristics						
CEO duality	0.20*	0.57**	0.18*	0.18*	−0.25*	0.20*
	(0.12)	(0.25)	(0.10)	(0.09)	(0.13)	(0.11)
CEO gender	0.25	−0.22**	0.27	0.23	−0.17**	0.27
	(0.22)	(0.10)	(0.24)	(0.20)	(0.07)	(0.23)
Ln(CEO age + 1)	0.03	−0.56	0.05	0.04	−0.47	0.06
	(0.04)	(0.48)	(0.05)	(0.04)	(0.50)	(0.06)
Ln(CEO cash compensation + 1)	−0.05***	0.24	−0.06***	−0.06***	0.22	−0.06***
	(0.01)	(0.25)	(0.01)	(0.01)	(0.23)	(0.02)
CEO political ties	0.04***	−0.38**	0.04**	0.04***	0.25**	0.04***
	(0.01)	(0.17)	(0.02)	(0.01)	(0.12)	(0.01)
Board human capital						
Board educational level	0.26	0.14*	0.25	0.32	0.21	0.27
	(0.20)	(0.08)	(0.21)	(0.29)	(0.18)	(0.23)
Board industry experience	0.03***	0.03***	0.03***	0.03***	0.04**	0.04***
	(0.00)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
Board functional breadth	0.03*	−0.24**	0.03*	0.03*	−0.33***	0.04**
	(0.02)	(0.11)	(0.02)	(0.02)	(0.09)	(0.02)
Board size	−0.03***	0.51	−0.04***	−0.03***	0.45	−0.03***
	(0.01)	(0.46)	(0.01)	(0.01)	(0.49)	(0.01)
Founder human capital						
Founder educational level	−0.36	0.52	−0.43	−0.31	0.49	−0.46
	(0.35)	(0.57)	(0.48)	(0.32)	(0.53)	(0.48)
Founder industry experience	0.29	0.53	0.29	0.29	0.55	0.27
	(0.25)	(0.49)	(0.32)	(0.28)	(0.49)	(0.32)
Founder functional breadth	0.08	−0.10*	0.07	0.07	−0.07*	0.06
	(0.11)	(0.06)	(0.11)	(0.08)	(0.04)	(0.08)
Firm and IPO-specific						
Ln(Firm age + 1)	0.02	−0.15*	0.02*	0.02	0.02	0.01
	(0.07)	(0.08)	(0.01)	(0.06)	(0.05)	(0.01)
Offer size	0.12**	−0.20	0.08***	0.14**	−0.32	0.12***
	(0.05)	(0.22)	(0.03)	(0.07)	(0.27)	(0.03)
Underwriter	0.04***	0.01	0.04***	0.04***	0.13	0.04***
	(0.01)	(0.06)	(0.01)	(0.01)	(0.26)	(0.01)
EPS	−0.04	−0.10	−0.05	−0.08	0.09	−0.08
	(0.08)	(0.12)	(0.07)	(0.11)	(0.08)	(0.15)
VC	0.06	0.09***	0.08	0.05	0.14*	0.09
	(0.07)	(0.03)	(0.08)	(0.07)	(0.08)	(0.62)
Leverage	0.05***	0.02	0.06***	0.07***	0.01	0.04***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Market return	0.11***	−0.22	0.12**	0.13***	−0.08	0.15***
	(0.03)	(0.22)	(0.05)	(0.04)	(0.13)	(0.04)
Overhang	0.06	0.02	0.06	0.05	0.02	0.08
	(0.05)	(0.02)	(0.05)	(0.05)	(0.02)	(0.08)
Dot.com period	−0.20***	−0.06	−0.22***	−0.21***	−0.16**	−0.23***
	(0.05)	(0.08)	(0.05)	(0.06)	(0.08)	(0.06)
NASDAQ	−0.04***	0.14	−0.02**	−0.02**	−0.07	−0.04***
	(0.01)	(0.11)	(0.01)	(0.01)	(0.07)	(0.01)
Ln(Assets + 1)	0.03***	0.16***	0.04***	0.03***	0.08***	0.03***
	(0.01)	(0.04)	(0.01)	(0.01)	(0.03)	(0.01)
Total blockholders	0.13*	0.43	0.13*	0.15*	0.37	0.14*
	(0.07)	(0.39)	(0.07)	(0.08)	(0.35)	(0.08)
Fama-French industry classification	YES	YES	YES	YES	YES	YES
Calendar year fixed effect	YES	YES	YES	YES	YES	YES
Instrumental variables						
Mimicking behavior (PhD)		0.07***				
		(0.02)				
Mimicking behavior (MBA)					0.18***	
					(0.05)	
Constant	1.27***	−2.59***	1.51*	1.42**	−0.81***	1.09
	(0.52)	(0.73)	(0.82)	(0.69)	(0.19)	(1.61)
Hausman Test (χ^2)			11.79***			10.71***

(*continued on next page*)

Table 3 (*continued*)

Dependent variable: *BHAR*	OLS	2SLS		OLS	2SLS	
		1st Stage	2nd Stage		1st Stage	2nd Stage
	(1)	(2)	(3)	(4)	(5)	(6)
Weak Instrument F Test			12.21***			13.29***
Observations	2,152		2,152	2,152		2,152
Adj. R. Squared (OLS)	0.28			0.28		

This table presents the results of the regressions of CEO education on IPO three-year buy-and-hold abnormal return for a sample of 2,152 US IPOs over the period 1998–2018. Columns 1–3 analyze the impact on IPO three-year buy-and-hold abnormal return of CEOs with a doctorate, using the estimation methods of OLS (Column 1) and 2SLS (Columns 2–3). Columns 4–6 repeat this analysis for CEOs with an MBA degree. In the 2SLS regressions, CEO education is instrumented by using the *mimicking behavior* variable as explained in the methodology. The robust standard errors feature in parentheses. One, two, and three asterisks denote significance at the 10%, 5%, and 1% level, respectively.

Table 4
The effect of specialized education on IPO performance by issuer size.

Dependent variable: *BHAR*	Small IPOs			Medium Sized IPOs			Large IPOs		
	OLS	2SLS		OLS	2SLS		OLS	2SLS	
		1st Stage	2nd Stage		1st Stage	2nd Stage		1st Stage	2nd Stage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
PhD CEO	0.22***		0.21***	0.13**		0.14**	0.11		0.12
	(0.06)		(0.07)	(0.06)		(0.07)	(0.17)		(0.17)
Top university	0.18	0.39**	0.19	0.19	0.37**	0.22	0.17	0.36**	0.22
	(0.21)	(0.19)	(0.17)	(0.19)	(0.18)	(0.19)	(0.20)	(0.19)	(0.19)
Eigenvector	0.40***	0.38	0.42***	0.41***	0.37	0.39***	0.38***	0.35	0.43***
	(0.11)	(0.39)	(0.12)	(0.13)	(0.40)	(0.11)	(0.13)	(0.33)	(0.14)
Other CEO characteristics	YES	YES	YES	YES	YES	YES	YES	YES	YES
Board human capital	YES	YES	YES	YES	YES	YES	YES	YES	YES
Founder human capital	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm and IPO-specific	YES	YES	YES	YES	YES	YES	YES	YES	YES
Fama-French industry classification	YES	YES	YES	YES	YES	YES	YES	YES	YES
Calendar year fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES
Mimicking behavior		0.29***			0.07***			0.17***	
(PhD)		(0.11)			(0.02)			(0.04)	
Constant	4.53***	−0.64*	5.22	4.08***	−1.69***	3.77***	1.85***	−0.99***	3.69**
	(1.31)	(0.32)	(4.39)	(0.81)	(0.22)	(1.08)	(0.66)	(0.20)	(1.83)
Hausman Test (χ^2)			16.39***			14.27***			12.31***
Weak Instrument F Test			22.34***			19.73***			18.38***
Observations	717		717	718		718	717		717
Adj. R. Squared (OLS)	0.28			0.20			0.15		

This table presents the results of the analysis of the effect specialized CEO education exerts on IPO three-year buy-and-hold abnormal return. In our analysis, we use the PhD degree as proxy of specialized CEO-education and we regress this against IPO three-year buy-and-hold abnormal return for small, medium and large sized IPOs that belong to the lower, mid and top one-third of the total asset distribution (respectively) via OLS and 2SLS estimation. In the 2SLS regression models, CEO education is instrumented by using the *Mimicking behavior* variable as explained in the methodology. The robust standard errors feature in parentheses. One asterisk denotes significance at the 10% level, two denote significance at the 5% level and three denote significance at the 1% level. All variables are defined in the Appendix.

organizational and environmental contingencies – maps onto IPO performance, our next set of tests aims to delineate whether the CEOs' own perceptions about their human capital align with those of the market.

For this investigation, we draw evidence from another important aspect of the process of going public, the use of VC. This is because VC firms, in addition to their main function as providers of finance, tend to actively engage in the management of portfolio firms, which, given their accumulated expertise, can be of vital importance. Consequently, assuming a constant demand for capital, H.4. predicted a higher likelihood of VC in issuers led by CEOs with a PhD. Our results in Table 7 confirm that education influences the VC decision as per H.4. Both the probit (Column 1) and the RBP model (Columns 2–3) conclude that when externally sourced managerial ability can complement a CEO's existing skillset, as in the case of PhD holders, the probability of VC increases. The subsample analysis reveals an interesting twist to the results: the statistical significance decreases as the categories increase in issuer size, and completely disappears for the large issuers, where both the capital and managerial skills of a VC firm are more easily replaceable. Furthermore, it is within the latter sample (exclusively) where the Wald test for the correlation of error terms refutes the existence of endogeneity via an insignificant χ^2.

In additional tests, we repeat the above analysis for CEOs with MBAs and find that they exhibit no systematic preference for VC; the results are statistically insignificant for the full sample and each of the subsamples. In the interest of space, these results are made available upon request.

4.6. Additional robustness checks

To confirm the comparative advantage of specialized CEO education in environments of high uncertainty, we turn our attention to issuers undertaking an IPO shortly after their foundation. Unproven young firms, in a similar manner to small-sized corporations, strive to sustain their competitive edge in the market via the creation of niche strategies devised by expert CEOs (Islam & Zein, 2020; Pollock et al., 2010). If specialized education drives post-IPO returns for resource-constrained issuers (as previously explained), it should also be important for young, non-established entities which similarly rely on CEO expertise to certify their quality to uninformed outsiders. To test this supposition, we regress each type of CEO education against the three-year BHARs for issuers falling within the lower (<5 years), middle (5 to 12 years) and top (>12 years) thirds of the firm age distribution. Tables A1 and A2 in the Online Appendix report the results. Table A1 indicates a positive and strongly significant association between CEOs with a PhD and post-IPO returns for the youngest firms in the sample. This relation fades and

Table 5
The effect of general business education on IPO performance by issuer size.

Dependent variable:	Small IPOs			Medium sized IPOs			Large IPOs		
BHAR	OLS	2SLS		OLS	2SLS		OLS	2SLS	
		1st Stage	2nd Stage		1st Stage	2nd Stage		1st Stage	2nd Stage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MBA CEO	0.07		0.13	0.12***		0.11**	0.18***		0.19***
	(0.10)		(0.14)	(0.04)		(0.05)	(0.06)		(0.07)
Top university	0.17	0.41**	0.23	0.17	0.33**	0.23	0.18	0.35**	0.25
	(0.20)	(0.20)	(0.21)	(0.20)	(0.15)	(0.21)	(0.21)	(0.17)	(0.23)
Eigenvector	0.45***	0.37	0.46***	0.44***	0.31	0.42***	0.36***	0.39	0.47***
	(0.15)	(0.38)	(0.16)	(0.15)	(0.42)	(0.12)	(0.12)	(0.34)	(0.16)
Other CEO characteristics	YES	YES	YES	YES	YES	YES	YES	YES	YES
Board human capital	YES	YES	YES	YES	YES	YES	YES	YES	YES
Founder human capital	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm and IPO-specific	YES	YES	YES	YES	YES	YES	YES	YES	YES
Fama-French industry classification	YES	YES	YES	YES	YES	YES	YES	YES	YES
Calendar year fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES
Mimicking behavior		0.16***			0.07***			0.04***	
(MBA)		(0.03)			(0.02)			(0.01)	
Constant	3.65**	−0.89***	9.33	0.87***	−0.99***	0.73***	0.74***	−0.99***	0.72*
	(1.71)	(0.31)	(7.82)	(0.27)	(0.22)	(0.24)	(0.23)	(0.31)	(0.37)
Hausman Test (χ^2)			16.35***			13.69***			14.36***
Weak Instrument F Test			22.39***			18.95***			12.71***
Observations	717		717	718		718	717		717
Adj. R. Squared (OLS)	0.15			0.24			0.23		

This table presents the results of the analysis of the effect CEO general business education exerts on IPO three-year buy-and-hold abnormal return. In our analysis, we use the MBA degree from a business school in the US as proxy of general business CEO education, and we regress this against IPO three-year buy-and-hold abnormal return for issuers that belong to the lower, mid and top third of the total asset distribution via OLS and 2SLS estimation. In the 2SLS regression models, CEO education is instrumented by using the *Mimicking behavior* variable as explained in the methodology. The robust standard errors feature in parentheses. One asterisk denotes significance at the 10% level, two denote significance at the 5% level and three denote significance at the 1% level. All variables are defined in the Appendix.

Table 6
The effect of specialized CEO education on IPO performance by R&D intensity.

Dependent variable:	*R&D intensive industries*			*Non-R&D intensive industries*		
BHAR	OLS	2SLS		OLS	2SLS	
		1st Stage	2nd Stage		1st Stage	2nd Stage
	(1)	(2)	(3)	(4)	(5)	(6)
PhD CEO	0.23***		0.23***	0.17		0.18
	(0.07)		(0.08)	(0.15)		(0.20)
Top university	0.16	0.39**	0.27	0.19	0.43**	0.24
	(0.19)	(0.19)	(0.25)	(0.21)	(0.21)	(0.24)
Eigenvector	0.41***	0.33	0.43***	0.46***	0.35	0.43***
	(0.09)	(0.35)	(0.15)	(0.17)	(0.39)	(0.13)
Other CEO characteristics	YES	YES	YES	YES	YES	YES
Board human capital	YES	YES	YES	YES	YES	YES
Founder human capital	YES	YES	YES	YES	YES	YES
Firm and IPO-specific	YES	YES	YES	YES	YES	YES
Fama-French industry classification	YES	YES	YES	YES	YES	YES
Calendar year fixed effect	YES	YES	YES	YES	YES	YES
Mimicking behavior (PhD)		0.41***			0.04***	
		(0.10)			(0.01)	
Constant	1.09***	−1.01*	1.19***	1.01***	−1.08***	1.13***
	(0.31)	(0.54)	(0.41)	(0.26)	(0.29)	(0.36)
Hausman Test (χ^2)			11.99***			12.67***
Weak Instrument F Test			22.42***			15.82***
Observations	9,75		9,75	1,177		1,177
Adj. R. Squared (OLS)	0.23			0.21		

This table presents the results of the analysis of the effect of specialized CEO education on IPO three-year buy-and-hold abnormal return in R&D intensive vs non-R&D intensive industries. The PhD degree is used as proxy of specialized CEO education. As R&D-intensive, we classify IPO firms with SIC codes 2833, 2834, 2835, 2836 (i.e. pharmaceutical products); 3571, 3572, 3575, 3577, 3578 (i.e. computer hardware); 3661, 3663, 3669 (i.e. communications equipment); 3671, 3672, 3674, 3675, 3677, 3678, 3679 (i.e. electronics); 3812 (i.e. navigation equipment); 3823, 3825, 3826, 3827, 3829 (i.e. measuring and controlling devices); 3841, 3845 (i.e. medical instruments); 4812, 4813 (i.e. telephone equipment); 4899 (i.e. communications services); and 7371, 7372, 7373, 7374, 7375, 7378,7379 (i.e. software). In the 2SLS regression models, CEO education is instrumented by using the *mimicking behavior* variable as explained in the methodology. The robust standard errors feature in parentheses. One asterisk denotes significance at the 10% level, two denote significance at the 5% level and three denote significance at the 1% level. All variables are defined in the Appendix.

Table 7
Issuer's likelihood to seek VC backing if the CEO has specialized education.

Dependent Variable: *VC*	*Full Sample*			*Small IPOs*			*Medium sized IPOs*			*Large IPOs*		
	Probit	RBP		Probit	RBP		Probit	RBP		Probit	RBP	
		1st Stage	2nd Stage		1st Stage	2nd Stage		1st Stage	2nd Stage		1st Stage	2nd Stage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
PhD CEO	0.30**		1.05***	0.18***		0.80***	0.34*		1.43**	0.28		1.47
	(0.13)		(0.34)	(0.06)		(0.25)	(0.19)		(0.64)	(0.26)		(1.39)
Top university	0.17	0.37**	0.29	0.18	0.38**	0.31	0.19	0.38**	0.31	0.16	0.36**	0.28
	(0.18)	(0.18)	(0.27)	(0.17)	(0.19)	(0.28)	(0.18)	(0.19)	(0.28)	(0.19)	(0.17)	(0.26)
Eigenvector	0.42***	0.35	0.42***	0.44***	0.37	0.41***	0.43***	0.36	0.47***	0.41***	0.33	0.41***
	(0.18)	(0.34)	(0.12)	(0.17)	(0.36)	(0.11)	(0.16)	(0.33)	(0.14)	(0.16)	(0.35)	(0.13)
Other CEO characteristics	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Board human capital	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Founder human capital	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm and IPO-specific	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Fama-French industry classification	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Calendar year fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Mimicking behavior (PhD)		1.19***			0.33***			2.11***			1.90***	
		(0.25)			(0.12)			(0.62)			(0.42)	
Constant	0.73***	−0.61**	−0.41	−0.46	−0.09	−0.11	0.26	0.81**	−0.02	−0.07	−0.03	−1.71
	(0.25)	(0.30)	(0.56)	(0.32)	(0.15)	(0.18)	(0.34)	(0.39)	(0.06)	(0.35)	(0.15)	(2.40)
Wald test of endogeneity (χ^2)			7.37***			6.79***			8.27***			0.51
Observations	2,152		2,152	717		717	718		718	717		717
Pseudo R. Squared (probit)	0.25			0.22			0.23			0.14		

This table presents the results of estimating issuers' likelihood to seek VC backing if the CEO has specialized education. In our analysis, we use the PhD degree as proxy of specialized CEO- education and we regress this against VC for small, medium and large sized IPOs that belong to the lower, mid and top one-third of the total asset distribution (respectively) via probit and RBP estimation. In the RBP regression models, CEO education is instrumented by using the mimicking behavior variable as explained in the methodology. The robust standard errors feature in parentheses. One asterisk denotes significance at the 10% level, two denote significance at the 5% level and three denote significance at the 1% level. All variables are defined in the Appendix.

eventually vanishes for the older companies in the sample. Once again, we observe the value-creating role of specialized CEO education in the presence of high operational risks and low organizational complexity. Table A2 presents results showing that the value relevance of an MBA degree increases with the issuer's age.

We conduct a series of additional robustness checks: (1) using different measures of IPO performance, with the two- and five-year *BHARs* as alternate response variables; (2) excluding issuers with CEO changes in the period starting 90 days before the first-round investment from the VC and ending on the IPO date; (3) censoring *BHAR* at the first and 99th percentiles in addition to the fifth and 95th percentiles to account for outliers; (4) conducting propensity score matching and an entropy balancing analysis to estimate the average treatment effects of CEO education on IPO performance; and (5) applying a maximum likelihood estimation, which also enables us to test residual independence via the Wald test. The resulting coefficients in all of these estimations are qualitatively similar with our tabulated results and, for concision, are suppressed.

5. Conclusion

A stellar CEO education may disseminate a positive signal to IPO investors, but unlike other reputable affiliations, it creates different connotations based on the particular type. The present study unravels the conditions under which CEO education becomes incrementally important in IPO performance.

Using hand-collected data from the US, we find that CEOs with a doctorate, as well as those who hold an MBA, exert a positive and strongly significant impact on IPO performance. However, this impact is not homogenous across the sample, but varies with issuer size and age. Specifically, we demonstrate that specialized education, for which the PhD degree is a proxy, creates incremental value in small and/or young firms where the need for entrepreneurial spirit is greater. The opposite holds true for CEOs with rigorous general management education, whose effect on valuation is strongest at the high end of issuer size and age distributions. Furthermore, in knowledge-intensive industries, higher valuations are assigned to issuers led by CEOs with a PhD. Drawing separate evidence from the likelihood of resorting to VC, we show that CEOs' behavior conforms to investors' perceptions. Because VC firms infuse portfolio firms with management expertise as well as encourage risk-taking, all else being equal, PhD holders are more likely to use VC.

Our findings speak to the IPO literature in several ways. Our first contribution relates to the anomaly of IPOs underperforming the market in the years following the listing, which is a pervasive problem for the majority of IPOs with even more severity among small issuers (Ritter, 1991). We show how efficient human capital allocation in the run-up to an IPO can effectively mitigate this problem, and pinpoint the optimal leadership by issuer type. Our second contribution is to advance understanding of the signaling role of CEO education. A common thread running through the IPO literature is that a CEO education appeals to stock market investors with little to no attention to the underlying mechanism. Because MBAs and PhDs share the qualities of an intensive curriculum and a selective admission process, if a rigorous CEO

education is an unequivocal signal of managerial quality, both degrees should unconditionally link to better performance in the secondary market. However, we document circumstances wherein their possession fails to elicit a systematic market response. Instead, the market appears to factor in CEO education only to the extent that the latter can be a proxy for specific solutions to the firm's internal and environmental problems. The clear implication of our findings is that CEO backgrounds should be evaluated from a contingency lens that is attentive to the lifecycle stage and the firm's competitive position. As such, our study also speaks to the substantial research examining pre-IPO strategies employed by issuers in pursuit of certification (e.g., using prestigious executives, political connections, joint alliances, etc.), cautioning that in the absence of a similar contingency lens, these strategies could burden issuers at a period wherein resource scarcity is the norm, without attaining the intended effect on IPO performance.

In the spirit of the present study, we invite future research to expose the underlying dynamics of other executive characteristics whose interaction with firm value is likely to be more complex than that currently documented in the literature; professional experience is one such characteristic that could significantly moderate investors' expectations on CEOs' latent ability.

CRediT authorship contribution statement

Antonios Kallias: Writing – review & editing, Writing – original draft, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Konstantinos Kallias:** Writing – review & editing, Writing – original draft, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ioannis Tsalkamas:** Writing – review & editing, Writing – original draft, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Song Zhang:** Writing – review & editing, Writing – original draft, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Variable definitions

BHAR	The issuing firm's buy-and-hold abnormal return (in percentage) during the three-year period following the IPO, calculated as detailed in Section 4.2.
PhD CEO	Categorical variable equal to 1 if the CEO of the issuing firm holds a doctorate from a higher academic institution in the US, and 0 otherwise.
MBA CEO	Categorical variable equal to 1 if the CEO of the issuing firm holds an MBA from a higher academic institution in the US, and 0 otherwise.
Top university	Categorical variable equal to 1 if the CEO holds a degree from a top 25 university in the US according to the *US News University Rankings*, and 0 otherwise.
Eigenvector	The CEO's eigenvector centrality in networks of past relationships as reported in the Boardex database.
CEO duality	Categorical variable equal to 1 if the CEO is also the chairman of the board, and 0 otherwise.
CEO gender	Categorical variable equal to 1 if the CEO is male, and 0 otherwise.
CEO age	The age of the CEO in years.
CEO cash compensation	The sum of the CEO's salary and bonus in thousands of US dollars for the last fiscal year before the IPO.
CEO political ties	Categorical variable equal to 1 if the CEO has a record of political contributions on the Federal Election Commission's website, and 0 otherwise.
Board educational level	The total (across all directors) post-high school education years divided by the number of directors.
Board industry experience	The total (across all directors) prior managerial positions held in the issuer's industry (at the two-digit level of the SIC code), divided by the number of directors.
Board functional breadth	Cumulative count of directors' different domains of experience (i.e., sales, human resources, direct management, marketing/advertising, information technology, legal services, accounting, and finance), divided by the number of directors.
Board size	The number of directors on the issuing firm's board.
Founder educational level	Total years of post-high school education for the issuing firm's founders, divided by the number of founders.
Founder industry experience	The total (across all founders) prior managerial positions held in the issuer's industry (at the two-digit level of the SIC code), divided by the number of founders.
Founder functional breadth	Cumulative count of founders' different domains of experience (i.e., sales, human resources, direct management, marketing/advertising, information technology, legal services, accounting, and finance), divided by the number of founders.
Firm age	The number of years elapsed from the company's foundation to the day of the IPO. Foundation dates are obtained from the Field-Ritter database.
Offer size	The ratio of the number of shares offered to shares outstanding.
Underwriter	Categorical variable equal to 1 for issuers employing underwriters of the highest prestige ranking, based on the Loughran and Ritter (2004) database of underwriters' rankings, and 0 otherwise.
Earnings per share (EPS)	Categorical variable equal to 1 for positive EPS at the fiscal year preceding the IPO, and 0 otherwise.
Venture capital (VC)	Categorical variable equal to 1 for firms with venture capital backing, and 0 otherwise.
Leverage	The ratio of total debt to total assets at the fiscal year preceding the IPO.
Market return	The composite daily return on the CRSP value-weighted index over the 30 trading days preceding the date of listing.
Overhang	The ratio of shares retained by pre-IPO shareholders over the total number of shares issued at the offering.
Dotcom period	Binary indicator equal to 1 for IPOs within the 1999–2000 period, and 0 otherwise.
NASDAQ	Categorical variable equal to 1 for NASDAQ listings, and 0 otherwise.
Assets	The book value of pre-IPO assets in millions of US dollars.
Total blockholders	Total equity holdings (in percentage) of shareholders owning at least 5 % of the issuer's common stock.
Mimicking behavior (PhD)	The proportion of CEOs with a doctorate in the same two-digit SIC code with the issuing firm.
Mimicking behavior (MBA)	The proportion of CEOs with an MBA degree in the same two-digit SIC code with the issuing firm.

Appendix B. Supplementary Material

Supplementary material to this article can be found online at https://doi.org/10.1016/j.jbusres.2022.113560.

References

Aliaga, A. O. (2001). Human capital HRD and the knowledge organization. In *Academy of Human Resource Development conference proceedings* (pp. 427–434). ARCHD.

Amit, R., Brander, J. A., & Zott, C. (1998). Why do venture capital firms exit? Theory and Canadian evidence. *Journal of Business Venturing, 13*(6), 441–466.

Andreou, P. C., Karasamani, I., Louca, C., & Ehrlich, D. (2017). The impact of managerial ability on crisis-period corporate investment. *Journal of Business Research, 79*, 107–122.

Barlevy, G. (2007). On the cyclicality of research and development. *American Economic Review, 97*(4), 1131–1164.

Barker, V. L., & Mueller, G. C. (2002). CEO characteristics and firm R&D spending. *Management Science, 48*(6), 782–801.

Benmelech, E., & Frydman, C. (2015). Military CEOs. *Journal of Financial Economics, 117*(1), 43–59.

Bertoni, F., Colombo, M. G., & Croce, A. (2013). Corporate governance in high-tech firms. In M. Wright, D. Siegel, K. Keasey, & I. Filatotchev (Eds.), *Oxford handbook of corporate governance* (pp. 365–388). Oxford University Press.

Bertoni, F., Meoli, M., & Vismara, S. (2014). Board independence, ownership structure, and the valuation of IPOs in continental Europe. *Corporate Governance: An International Review, 22*(2), 116–131.

Bhagat, S., Bolton, B., & Subramanian, A. (2010). *CEO education, CEO turnover, and firm performance* (p. 1670219). Article: SSRN.

Bonardo, D., Paleari, S., & Vismara, S. (2011). Valuing university-based firms: The effects of academic affiliation on IPO performance. *Entrepreneurship: Theory and Practice, 35*(1), 755–776.

Brahma, S., Chioma, N., & Boateng, A. (2020). Board gender diversity and firm performance: The UK evidence. *International Journal of Finance & Economics*, 1–16.

Carter, B., Dark, F., & Singh, R. (1998). Underwriter reputation, initial returns, and the long run performance of IPO stocks. *Journal of Finance, 53*(1), 285–311.

Certo, S. T., Busenbark, J. R., Woo, H. S., & Semadeni, M. (2016). Sample selection bias and Heckman models in strategic management research. *Strategic Management Journal, 37*(13), 2639–2657.

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*(6–7), 641–658.

Chahine, S., Filatotchev, I., Bruton, D. G., & Wright, M. (2021). "Success by association": The impact of venture capital firm reputation trend on initial public offering valuations. *Journal of Management, 47*(2), 368–398.

Chen, G., Huang, S., Meyer-Doyle, P., & Mindruta, D. (2021). Generalist versus specialist CEOs and acquisitions: Two-sided matching and the impact of CEO characteristics on firm outcomes. *Strategic Management Journal, 42*(6), 1184–1214.

Coff, R. (1999). When competitive advantage doesn't lead to performance: The resource-based view and stakeholder bargaining power. *Organization Science, 10*(2), 119–133.

Coff, R., & Raffiee, J. (2015). Toward a theory of perceived firm-specific human capital. *The Academy of Management Perspectives, 29*(3), 326–341.

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*(7), 683–690.

Colombo, M. G., Meoli, M., & Vismara, S. (2019). Signaling in science-based IPOs: The combined effect of affiliation with prestigious universities, underwriters, and venture capitalists. *Journal of Business Venturing, 34*(1), 141–177.

Custodio, C., Ferreira, M. A., & Matos, P. (2013). Generalists versus specialists: Lifetime work experience and chief executive officer pay. *Journal of Financial Economics, 108*(2), 471–492.

Deephouse, D. L., & Carter, S. M. (2005). An examination of differences between organizational legitimacy and organizational reputation. *Journal of Management Studies, 42*(2), 329–360.

Dewar, R., & Dutton, J. (1986). The adoption of radical and incremental innovations: An empirical analysis. *Management Science, 32*(11), 1422–1433.

Dodge, H. R., Fullerton, S., & Robbins, J. E. (1994). Stage of the organizational life cycle and competition as mediators of problem perception for small businesses. *Strategic Management Journal, 15*(2), 121–134.

Dunbar, C., Li, Z. F., & Shi, Y. (2020). CEO risk-taking incentives and corporate social responsibility. *Journal of Corporate Finance, 64*, Article 101714.

El-Khatib, R., Fogel, K., & Jandik, T. (2015). CEO network centrality and merger performance. *Journal of Financial Economics, 116*(2), 349–382.

Falato, A., Li, D., & Milbourn, T. (2015). Which skills matter in the market for CEOs? Evidence from pay for CEO credentials. *Management Science, 61*(12), 2845–2869.

Feng, C., Patel, P. C., & Xiang, K. (2020). The well-trodden path: Complementing market and entrepreneurial orientation with a strategic emphasis to influence IPO survival in the United States. *Journal of Business Research, 110*, 370–385.

Frydman, C. (2019). Rising through the ranks. The evolution of the market for corporate executives, 1936–2003. *Management Science, 65*(11), 4951–4979.

Gao, X., Ritter, J. R., & Zhu, Z. (2013). Where have all the IPOs gone? *Journal of Financial and Quantitative Analysis, 48*(6), 1663–1692.

Giannetti, M. (2011). Serial CEO incentives and the structure of managerial contracts. *Journal of Financial Intermediation, 20*(4), 633–662.

Govindarajan, V. (1989). Implementing competitive strategies at the business unit level: Implications of matching managers to strategies. *Strategic Management Journal, 10*(3), 251–269.

Greene, W. H. (2012). *Econometric analysis* ((7th ed.).). Pearson Education Limited.

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review, 9*(2), 193–206.

Hatch, N., & Dyer, J. (2004). Human capital and learning as a source of sustainable competitive advantage. *Strategic Management Journal, 25*(12), 1155–1178.

He, Z., & Hirshleifer, D. (2022). The exploratory mindset and corporate innovation. *Journal of Financial and Quantitative Analysis, 57*(1), 127–169.

Hendricks, L. (2002). How important is human capital for development? Evidence from immigrant earnings. *American Economic Review, 92*(1), 198–219.

Hitt, M. A., & Tyler, B. B. (1991). Strategic decision models: Integrating different perspectives. *Strategic Management Journal, 12*(5), 327–352.

Huang, S. (2014). Managerial expertise, corporate decisions and firm value: Evidence from corporate refocusing. *Journal of Financial Intermediation, 23*(3), 348–375.

Islam, E., & Zein, J. (2020). Inventor CEOs. *Journal of Financial Economics, 135*(2), 505–527.

Jensen, A. R. (1998). *The g factor: The science of mental ability*. Praeger.

Jiang, P., Cai, C. X., Keasey, K., Wright, M., & Zhang, Q. (2014). The role of venture capitalists in small and medium-sized enterprise initial public offerings: Evidence from China. *International Small Business Journal, 32*(6), 619–643.

Kallias, A., Kallias, K., & Zhang, S. (2022). Can we trust the accounting discretion of firms with political money contributions? Evidence from US IPOs. *Journal of Accounting and Public Policy, 106999*.

Kaplan, S. N., Klebanov, M. M., & Sorensen, M. (2012). Which CEO characteristics and abilities matter? *Journal of Finance, 67*(3), 973–1007.

King, T., Srivastav, A., & Williams, J. (2016). What's in an education? Implications of CEO education for bank performance. *Journal of Corporate Finance, 37*, 287–308.

Kor, Y. Y., & Misangyi, V. F. (2008). Outside directors' industry-specific experience and firms' liability of newness. *Strategic Management Journal, 29*(12), 1345–1355.

Lazear, E. P. (2009). Firm-specific human capital: A skill-weights approach. *Journal of Political Economy, 117*(5), 914–940.

Leary, M., & Roberts, M. (2014). Do peer firms affect corporate financial policy? *Journal of Finance, 69*(1), 139–178.

Lhuillery, S., & Pfister, E. (2009). R&D cooperation and failures in innovation projects: Empirical evidence from the French CIS data. *Research Policy, 38*(1), 45–57.

Loughran, T., & Ritter, J. R. (1995). The new issues puzzle. *The Journal of Finance, 50*(1), 23–51.

Loughran, T., & Ritter, J. R. (2004). Why has IPO underpricing changed over time? *Financial Management, 33*(3), 5–37.

Lucas, D., & McDonald, R. (1990). Equity issues and stock price dynamics. *Journal of Finance, 45*(4), 1019–1043.

Mannor, M. J., Matta, F. K., Block, E. S., Steinbach, A. L., & Davis, J. H. (2019). A liability of breadth? The conflicting influences of experiential breadth on perceptions of founding teams. *Journal of Management, 45*(4), 1540–1568.

Mansfield, E. (1968). *Industrial Research and Technological Innovation*. Norton.

Megginson, W. L., & Weiss, K. A. (1991). Venture capitalist certification in initial public offerings. *Journal of Finance, 46*(3), 903–979.

Miller, D., & Chen, M. J. (1994). Sources and consequences of competitive inertia: A study of the U.S. airline industry. *Administrative Science Quarterly, 39*(1), 1–23.

Miller, D., Xu, X., & Mehrotra, V. (2015). When is human capital a valuable resource? The performance effects of Ivy league selection among celebrated CEOs. *Strategic Management Journal, 36*(6), 930–944.

Mishra, K. (2014). Employability skills that recruiters demand. *IUP Journal of Soft Skills, 8*(3), 50–55.

Murphy, K. J., & Zabojnik, J. (2007). Managerial capital and the market for CEOs. *SSRN, 984376*.

Norburn, D., & Birley, S. (1988). The top management team and corporate performance. *Strategic Management Journal, 9*(3), 225–237.

Park, H. D., & Steensma, H. K. (2012). When does corporate venture capital add value for new ventures? *Strategic Management Journal, 33*(1), 1–22.

Pollock, T. G., Chen, C. C., Jackson, R., & Hambrick, D. C. (2010). How much prestige is enough? Assessing the value of multiple types of high-status affiliates for young firms. *Journal of Business Venturing, 25*(1), 6–23.

Porter, M. (1990). *The competitive advantage of nations*. Free Press.

Reinganum, M. R. (1990). Market microstructure and asset pricing: An empirical investigation of NYSE and NASDAQ securities. *Journal of Financial Economics, 28*(1–2), 127–147.

Ritter, J. R. (1991). The long-run performance of initial public offerings. *The Journal of Finance, 46*(1), 3–27.

Sunder, J., Sunder, S., & Zhang, J. (2017). Pilot CEOs and corporate innovation. *Journal of Financial Economics, 123*(1), 209–224.

Szilagyi, A. D., Jr., & Schweiger, D. M. (1984). Matching managers to strategies: A review and suggested framework. *Academy of Management Review, 9*(4), 626–637.

Thomas, A. S., Litschert, R. J., & Ramaswamy, K. (1991). The performance impact of strategy-manager coalignment: An empirical examination. *Strategic Management Journal, 12*(7), 509–522.

Thomas, A. S., & Ramaswamy, K. (1996). Matching managers to strategy: Further tests of the Miles and Snow typology. *British Journal of Management, 7*(3), 247–261.
Tyler, B. B., & Steensma, H. K. (1998). The effects of executives' experiences and perceptions on their assessment of potential technological alliances. *Strategic Management Journal, 19*(10), 939–965.
Wang, T., Qureshi, I., Deeds, D., & Ren, Y. (2019). How do technology ventures signal IPO quality? A configurational approach. *Journal of Business Research, 99*, 105–114.
Wiersema, M. F., & Bantel, K. A. (1992). Top management team demography and corporate strategic change. *Academy of Management Journal, 35*(1), 91–121.
Xuan, Y. (2009). Empire-building or bridge-building? Evidence from new CEOs' internal capital allocation decisions. *Review of Financial Studies, 22*(12), 4919–4948.
Zhang, S., Han, L., Kallias, K., & Kallias, A. (2021). The value of in-person banking: Evidence from U.S. small businesses. *Review of Quantitative Finance and Accounting, 57*(4), 1393–1435.
Zhang, S., Han, L., Kallias, K., & Kallias, A. (2022). Bank switching of US small businesses: New methods and evidence. *Review of Quantitative Finance and Accounting, 58*(4), 1393–1435.

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