CEO Education and the Ability to Raise Capital

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Abstract

We examine whether heterogeneity of CEO academic qualifications matters in explaining the performance of Initial Public Offerings (IPOs). We find that CEO education attainments perform a signaling role which depends not only on the level but also on the major of education. Specifically, we show that, irrespective of the level of academic achievements, IPO investors have a preference for top managers with practice or business oriented degrees as opposed to liberal arts degrees. Importantly, our findings suggest that both the level and quality of education training tend to reduce IPO underpricing, and this effect is less pronounced for less specialized degrees.

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1. Introduction

"*More and more money is being spent on higher education. Too little is known about whether it is worth it."*

[The Economist, March 26, 2015]

Does it pay to invest in higher education? In terms of salary, the answer is clearly affirmative, with numerous studies documenting that superior educational credentials result in a pay premium in the labor market for corporate executives (e.g., Custodio et al., 2013; Falato and Milbourn, 2015). What is more interesting, though, is whether and how an executive's educational background affects corporations. In this respect, research has extensively examined the effect of education on several organizational outcomes such as innovation and strategic change (Barker and Mueller, 2002; Herrmann and Nadkarni, 2013) or financial performance (Chevalier and Ellison, 1999; Li et al., 2011; Miller et al., 2015; King et al., 2016). However, only a few studies have explicitly focused on young, fast-growing entrepreneurial organizations (Chemmanur and Paeglis, 2005; Cohen and Dean, 2005; Higgins and Gulati, 2006; Colombo et al., 2019), and none in this context, have examined the role of the CEO's education, despite its prominence in shaping corporate vision and organizational policies. (Hambrick and Mason, 1984).

In this study, we explore the impact of CEO academic achievements on the most notable entrepreneurial setting, namely, Initial Public Offerings (IPOs). The IPO market represents a vital asset for the aggregate economy, given its role in facilitating entrepreneurship, job creation, and sustainable growth (Fama and French, 2004). In addition, it constitutes a major development in the evolution of an entrepreneurial firm's life, as it provides substantial financial resources to navigate the transition from the private domain to the public arena (Certo, 2003). However, the IPO firm faces pressure to establish and signal its ability to cope with the demands of financial and competitive markets. This pressure builds up in the face of uncertainties and information asymmetry between current and potential investors in relation to the firm's quality. In this turbulent environment, the CEO

can help a firm to stand out from the crowd not only by providing strategic direction but also in performing a symbolic role for the firm's external constituents (Pollock and Gulati, 2007). In this respect, educational credentials may be especially influential in communicating organizational legitimacy (Spence, 1974), since investors planning to invest in an IPO are likely to attend to such signals in order to reduce perceptions of uncertainty about the credibility of an IPO as an investment (Sanders and Boivie, 2004).

What, then, is the mechanism through which CEO education might influence IPO performance? To understand this, we initially consider the implications of educational training. As a determinant of human capital, education potentially impacts a CEO in three mutually non-exclusive ways: (1) education can potentially enhance a CEO's knowledge, skills, perspective, and ability to understand technical and abstract concepts (Bai et al., 2018); (2) higher education could be a signal of a CEO's unobservable but influential talent, intellect and capability to persevere in challenging activities (Certo, 2003); (3) the social networks acquired in college and graduate school can be helpful professionally in the future (Datta and Iskandar-Datta, 2014). Based on these arguments, it is conceivable to expect that, when valuing new firms, investors may well turn their attention to CEO educational degrees to help differentiate firms of varying quality.

Previous studies recognize that this symbolic and screening role for education is salient in highly uncertain environments, such as IPOs (e.g., Cohen and Dean, 2005; Park et al., 2016). However, they implicitly assume that educational credentials convey information that unambiguously reduces subjective uncertainty about the prospects of a firm.[1] Unlike these studies, we argue that the educational background of the CEO may not always be uncertainty-reducing. In fact, we posit that the utility of an IPO-related signal depends on its ability to enhance both a firm's visibility and credibility

[1] To illustrate this point, consider the following example: the CEO of Google (Eric Schmidt) holds a bachelor's degree in engineering from Princeton University and a master's and PhD from the University of California at Berkeley. By contrast, the 'self-made' CEO of Facebook (Mark Zuckerberg) dropped out of Harvard University at 20. Based on signaling theory, a natural hypothesis would be that the CEO of Google is more capable of managing an IPO transition than the CEO of Facebook. If this were true, we would anticipate that Google experienced less IPO underpricing than Facebook. However, both IPOs were almost fairly priced. As a consequence, it is a priori unclear how educational prestige might affect the valuation of an IPO.

in the eyes of the signal's recipient. As such, the credibility value of education is a function of the ability to verify its existence, as well as the manner in which educational attainment is perceived by the signal receiver who used it to identify differences between CEOs and to evaluate firm quality. While it is easy to verify the possession of an educational degree from an IPO prospectus, how investors make evaluative decisions based on such indicators is not straightforward. In light of this, we anticipate that the effectiveness of educational attainments in shaping investor perceptions might depend on the nature of the education, that is, the differences in the level and type of academic training involved.

Towards this end, we hypothesize practice-oriented degrees (i.e., BSc, MBA or MSc) to be more relevant in an entrepreneurial setting and for the CEO position than theoretically-based ones (i.e., BA or MA), since the former promote logical thinking and analytical skills whereas the latter tend to sharpen soft skills. This implies that practice-oriented degrees may represent a relatively more credible signal to investors than theoretically-based degrees, thereby leading to relatively lower valuation discounts (i.e. underpricing). In addition, we hypothesize that, degrees involving extensive business training (i.e., MBAs) are more relevant in developing general management skills (the standard skills for the CEO position) than research oriented degrees (i.e., MSc or MA in any discipline).Therefore, we predict that CEOs holding an MBA degree are more likely to win acceptance from potential investors, and hence, have less need to discount the issue compared to CEOs holding an MA or an MSc degree. Similarly, we hypothesize that a degree tailored to the needs of an environment with high uncertainty and increased litigation risk, such as a Juris Doctor (JD), might be more relevant for economic decision-making than highly specialized degrees (e.g., an MD or PhD). This implies that CEOs holding a JD will be associated with lower levels of discounting than CEOs holding a PhD or MD degree.

To address the above hypotheses, we carefully construct a unique hand-collected dataset that captures CEO educational qualifications for 1,601 US IPOs over the period 2000 to 2016. We

categorize each academic qualification according to the level of training, namely, undergraduate, master's or doctoral level, and identify the awarding institution from the U.S. News & World Report rankings (USNWR, 2017) in order to determine whether it is obtained from a prestigious (i.e., top-30) school in its relevant discipline. Accordingly, we examine whether CEO educational awards serve as an effective signal that enhances the ability of a firm to raise capital effectively. To do so, we focus on the market's initial response to the company's stock offering, measured as the change in the stock price during its first day of trading. This difference, known as "underpricing", is a widely used metric of IPO success, as the lower its level is, the more capital a firm has been able to raise through its IPO, in relative terms (Certo et al., 2001; Higgins and Gulati, 2006).

With respect to undergraduate qualifications, we document that firms having CEOs with a BA degree tend to experience higher levels of underpricing, whereas BSc degrees contribute to lower immediate aftermarket returns. This finding is consistent with the notion that training focused on practical facets of science rather than theoretical ones is more relevant in an entrepreneurial context (Kaplan et al., 2012). As for master's degrees, we find that, on average, only MBAs are perceived by market participants as a credible education signal, which is in accord with a long line of research highlighting the importance of business education as a reaction to increasing demand for general managerial skills in preference to technical ones (Murphy and Zabojnik, 2004; Frydman and Saks, 2010).

Lastly, consistent with the notion that highly specialized degrees are not well-suited to the demands of a CEO position (Miller et al., 2015), we find that while having a PhD is not significantly associated with IPO initial returns, medical degrees (i.e., an MD) contribute to positive first-day IPO returns. In contrast, we show that lawyer CEOs, that is, executives with Juris Doctors titles or other professional law qualifications, are negatively associated with underpricing (i.e., underpricing is suppressed), thus supporting the idea that training that cultivates a culture of conservative decision-making is valuable in settings of high informational uncertainty (Barker and Mueller, 2002).

An important issue in our sample is the need to control for endogenous firm–CEO matching (Anderson et al., 2019), wherein we anticipate that the assignment of a CEO to a particular firm is not random. This expectation is motivated by the assortative matching literature, according to which a two-sided matching process exists because managers and firms select one another, leading to strong relationships between the characteristics of the firm and those of the CEO (e.g., Gabaix and Landier, 2008). Such forms of matching may involve, for example, more talented CEOs being sorted competitively into firms with better prospects (Tervio, 2008) or executives with stronger educational credentials commanding greater value in the labor market, thereby being in a better position to self-select into the most viable IPO firms (Rivera, 2012; Nguyen et al., 2015). Alternatively, a CEO–firm match may be determined in part by the risk preferences of the firm and/or the CEO (Blankerspoor et al., 2017).

Our econometric framework accounts for endogenous firm–CEO matching by adopting a two-step Heckman approach, in which the first stage predicts the probability of obtaining an academic degree conditional on a standard set of firm characteristics, CEO attributes, and appropriate instruments that capture exogenous variation in the demand for CEO educational credentials (Falato et al., 2015). In the second stage, we control for potential selection bias and find that our baseline inferences remain unchanged. While this approach accounts for selection bias due to unobservable factors, we also repeat our analysis on a matched sample that controls for observable differences relative to firms run by a CEO with or without academic qualifications. Our results hold throughout.

We also document the robustness of our findings with the use of alternative measures of education such as university rankings and Ivy League designation. Our findings are consistent with our initial results, especially for the BA, MBA and MD degrees, when we consider whether a degree is obtained from a top-30 university, and the results are similar when we use the Ivy League as a measure of educational quality, albeit statistically weaker. These results suggest that, in the IPO context, it is the nature of the CEO's educational training that matters to investors rather than the

prestige of the awarding institution. Finally, we investigate the collective impact of CEO educational credentials on investor perceptions: factor analysis reveals that although all degrees are negatively associated with underpricing, only the relationships with undergraduate and master's degrees is significant.

This study contributes to the literature in various ways. First, our work extends previous works conducted on CEO education and organizational performance (Chevalier and Ellison, 1999; Hitt et al., 2001; Barker and Mueller, 2002; Gottesman and Morey, 2006; Bhagat et al., 2010; Beber and Fabbri, 2012; King et al., 2016). Prior literature has mostly focused on the impact of such education on large, established firms. For instance, Bhagat et al. (2010) focus on the universe of the S&P 1500 firms and suggest that CEO education does not seem to be an appropriate proxy for CEO ability. We, however, demonstrate that CEO education plays an especially important role for firms that suffer from a lack of established track records (Certo, 2003).

Second, our study highlights the possibility of a heterogeneous relationship between education and performance. King et al. (2016) show that finance-related degrees are important in the banking industry, while Colombo et al. (2019) report that science-related degrees are important in identifying superior firms in the biotech sector. Although these studies provide useful insight into the role of education, their inferences are industry-specific, because they focus on a homogeneous group of firms. Unlike these studies, we consider all types of degrees and examine their influence across a wide variety of industry environments. By doing so, we demonstrate that the signaling role of educational attainment does not unambiguously reduce investor uncertainty because it may depend on the type of knowledge and, in particular, the skill set that can be acquired through the education process.

Third, our study speaks to the IPO underpricing literature, where prior research has largely focused on signals derived from firm-specific characteristics, outside parties, or the whole management team (Carter and Manaster, 1990; Megginson and Weiss, 1991; Certo, 2003). In this respect, our work is closely related to the study of Chemmanur and Paeglis (2005), who examine the

relationship between the quality of a firm's top management team and various aspects of its IPO and post-IPO performance. While their study shows that education is related negatively to underpricing, its inferences are limited to MBAs and neglect the role of the CEO, who is arguably the principal decision agent. We complement and extend their work by using a wider set of educational attainments and by examining their influence on the individual who is most responsible for shaping a corporate vision and future strategies.

The study proceeds as follows: Section 2 presents a brief background on CEO education and discusses our hypothesis development; Section 3 introduces the dataset and gives an overview of the methodology. Section 4 reports the descriptive statistics and Section 5 reports the empirical findings about the impact of CEO educational attainments on underpricing. Sections 6 and 7 provide details on the battery of tests conducted to check the robustness of the results, while Section 8 evaluates the effect of CEO academic qualifications on IPO pricing using factor analysis. Section 9 concludes the paper.

2. Human Capital and Education

Management theorists argue that strategic human capital constitutes an investment from which individuals and society can derive economic benefits (Lucas and McDonald, 1990). Broadly speaking, the term "human capital" encompasses the knowledge, skills and talent inherent in individuals (Miller et al., 2015). However, the type of human capital that is valued by corporations, as reflected in firm behaviors and outcomes, is not clear. A central tenet of human capital theory and the resource-based view is that the unique managerial capabilities and value that an executive brings to an organization is reflected in performance (Barney, 1991). In a related but distinct vein, the upper echelons theory proposes that the backgrounds of top management members influence strategic decisions and, thus, directly shape firm value creation (Hambrick and Mason, 1984). Datta and Iskandar-Datta (2014)

specifically state that one channel through which upper echelons theory has the potential to shed light on the value of managerial ability is that of formal education.

The role of educational attainment has long been recognized in the literature as an important mechanism that contributes to the efficient functioning of capital markets. For instance, Spence (1974) demonstrates that high-quality prospective employees distinguish themselves via the "costly signal of rigorous higher education", providing that the quality of such education represents an indication of skills and abilities to market participants. Based on this premise, scholars have extensively applied signaling theory to IPOs in an attempt to understand how potential investors mediate uncertainty with signals purported to indicate quality (e.g., Carter and Nabaster, 1990; Gounopoulos and Pham, 2017; Bai et al., 2018; Colombo et al., 2019). Particularly interesting in the IPO context is the study of Chemmanur and Paeglis (2005), who demonstrate that, among other characteristics, boards with MBAs improve IPO performance; however, they do not provide explicit evidence about the role of educational attainments at the CEO level, nor do they consider types of education other than MBAs.

In any case, according to existing research, the bottom line is that training and experience can shape managerial perspective and tolerance for risk (Hambrick and Mason, 1984). Extending this line of reasoning, we argue that particular types of education affect the personalities, experiences and skills development of executives in different ways. Therefore, in what follows, in order to better understand whether and to what extent CEO education affects IPO performance we develop our hypotheses by categorizing education at undergraduate, master's and doctoral levels.

2.1 Undergraduate Level of Education

To more fully appreciate the signaling role of undergraduate degrees, we split them into two broad categories, namely, Bachelor of Arts and Bachelor of Science. From an academic perspective, both BA and BSc courses provide the same recognition and value on completion. However, when it comes to the curriculum, each of them hones different strengths because they require different

coursework and teaching methods. Typically, a BA degree program is largely focused on developing extensive theoretical knowledge about subjects concentrated in the area of humanities. As such, it allows students to sharpen their communication, interpersonal, and writing skills through study of a broad variety of liberal arts subjects (e.g., languages, arts, music, communication, history).

In contrast, a Bachelor of Science degree program is designed to provide students with logical thinking and analytical skills. Bachelor of Science degrees are naturally associated with scientific disciplines (e.g., computer science, engineering, mathematics, physics) and business specializations (accounting, finance or economics). Compared to a BA that provides general and theoretical education, a BSc is often practically oriented and fosters a detailed understanding of its subject matter. Given the typical emphasis of a BSc degree on applying theory to real-world problems and the concentration of BA degrees on developing soft skills, we argue that a BSc is more relevant in an entrepreneurial setting such as an IPO.

Consistent with this idea, Kaplan et al. (2012) demonstrate that the distinction between CEO types with execution-related skills and those with interpersonal-related skills is important in practice, because performance is more strongly associated with the former than with the latter. In this regard, it is natural to expect that, in an IPO context, investors will perceive a BSc as a more credible signal than a BA. The preceding discussion yields our first hypothesis.

Undergraduate Level Hypothesis: CEOs holding a BSc degree are related to lower underpricing than those holding a BA degree.

2.2 Master's and Doctoral Level of Education

Unlike undergraduate programs that base selection on general intelligence, past achievements, and academic and non-academic aptitudes alike (Hernandez, 1997), graduate programs base selection for admission on general cognitive ability and competency within a specialized field. In the corporate context, as Miller et al. (2015) note, the overriding criterion in evaluating different types of degree is

their suitability to the task of outstanding general management. Because graduate programs base their competency on specialized areas, they constitute more discipline-focused training, which is remote from the job of CEO (Hernandez, 1997). In this regard, advanced knowledge in specialized fields such as physics, maths or chemistry will only take a CEO so far. In other words, CEO talents based on a narrow subject training are apt to be more useful in a specialized field than in dealing with the notoriously varied, ill-structured, and socially complex challenges that confront a top executive (Miller et al., 2015).

On the basis of this reasoning, it is natural to anticipate that highly specialized graduate degrees will, in general, be unrelated to IPO underpricing. However, in order to verify this notion, we classify graduate titles into master's degrees and doctoral degrees. Accordingly, we categorize the master's degrees into three, namely, Master of Arts (MA), Master of Science (MSc) and Master of Business Administration (MBA). The training in MA degrees is similar in nature to that in BAs. Hence, as explained above, its relevance to the role of CEO may also be relatively limited. Similarly, the high level of specialty of an MSc limits its usefulness for the job of CEO, given that the job market increasingly demands generalist rather than specialist executives (Custodio et al., 2013).

On the other hand, MBA training is considered the most suitable training for executive positions. Finkelstein et al. (2009) suggest that executives with MBA degrees tend to make different decisions to executives with non-MBA degrees. For instance, CEOs with MBAs tend to follow more aggressive strategies in terms of capital expenditure, financial leverage and acquisitions (Bertrand and Schoar, 2003). Given that MBA training is tailored to the specific needs of managing a business effectively, one plausible explanation for this more aggressive style of MBA-educated executives is that they are more skilled in strategic decision-making and possess greater ability in identifying business opportunities (Geletkanycz and Black, 2001). This view is supported by empirical evidence showing that executives with MBAs use more sophisticated evaluation techniques than those without (Graham and Harvey, 2002). Considering all of the above, we argue that chief executives with an

MBA have greater levels of "human capital" than executives with an MA or MSc. This leads us to our second hypothesis:

Master's Level Hypothesis: CEOs holding an MBA degree are related to lower underpricing than those holding am MA or MSc degree.

With respect to education at the doctoral level, we consider three types of degrees, Doctor of Philosophy (PhD), Juris Doctor (JD) and Medical Degree (MD). Like the MSc, a PhD and an MD are generally considered as highly specialized science degrees with limited relevance in the context of corporate decision-making. Some empirical evidence supports this notion. For instance, King et al. (2016) document that CEOs with a PhD in the banking sector are not significantly associated with differences in corporate performance. Similarly, Gottesman and Morey (2006) show that the holding of a PhD by fund managers is not generally related to mutual fund performance. As for the value of an MD, we are unaware of any study examining its value in the context of corporate finance. As such, we maintain that because medical doctors are not trained to deal with the challenges of the executive position, they are not inclined to make business decisions as effectively because such decisions are not directly related to their specialty.

In contrast, the business value of legal training is substantial compared to the other doctoral titles. Prior research demonstrates that, as in the case of MBAs, individuals with a JD exhibit distinctive decision-making patterns when compared to those without a legal education. For instance, Barker and Mueller (2002) suggest that top managers with legal degrees are often criticized as being too conservative with regard to business decisions. Arguably, lawyer CEOs exhibit greater sensitivity to downside outcomes due to their conservative training.

In this respect, one could argue that legal training is a valuable form of human capital because it gives CEOs an edge in managing and preventing corporate litigation as well as in the broader context of corporate governance, compliance, and risk management. This conjecture is supported by

Henderson et al. (2017), who show that legal training is not only associated with lower litigation risk but also with better monitoring and financial reporting quality. Considering all of the above, we conclude that CEOs with a JD will play a more active and constructive role than CEOs with a PhD or an MD, especially in firms where there is greater uncertainty such as pertains in an IPO setting. This leads us to our third and final hypothesis:

Doctoral Level Hypothesis: CEOs holding a JD are related to lower underpricing than those holding a PhD or MD degree.

3. Data Formation Procedure

Our data consists of three parts: IPO selection criteria, accounting and financial data, as well as education data for the CEO. We start by retrieving data from the Global New Issues database of Thomson Financial's Securities Data Company (SDC); specifically, for the population of IPOs that have been floated on US exchanges during the period 1 January 2000 to 31 December 2016. The SDC database is also employed for the collection of the offering characteristics. Consistent with the literature (e.g., Loughran and Ritter, 2002), we apply standard IPO filters to exclude foreign issues, unit offerings, reverse leveraged buyouts (LBOs), spinoffs, closed-end funds, real-estate investment trusts (REITS), royalty trusts, financial institutions, limited partnerships, and American depositary receipts (ADRs), as well as all IPOs with a filing price below $5. The remaining sample is merged with the databases of Compustat and the Center for Research in Security Prices (CRSP), from which we obtain accounting and market data, respectively.

In the next step, we manually search for the CEO name of each IPO firm using the S-1 fillings available in SEC's Electronic Data Gathering Analysis and Retrieval System (EDGAR) in order to extract CEO biographical information and develop signals based on educational track record. Hand-collecting CEO education data from IPO prospectuses is extremely cumbersome because there is no standard format for reporting this type of information. To ensure the quality of our dataset, we check

our data on educational attainments against BoardEx of Management Diagnostics Limited and supplement our dataset where necessary.[2] In doing so, we follow a conservative approach and discard firms with co-CEOs, firms without CEOs, and firms without observations. Our final sample consists of 1,601 IPOs with complete financial, accounting and education data.

3.1 Methodology and Variable Specification

To examine the effect of educational attainments on IPO pricing, we estimate the following model:

$$Y_i = \alpha + \beta Degree_i + \gamma X_i + \varepsilon_i \quad (1)$$

where Y_i is IPO underpricing. IPO underpricing represents the first-day returns and is estimated as the percentage difference between the immediate aftermarket price and the IPO offer price. It is apparent that a small discount (i.e., an offer price that is closer to the aftermarket price) is preferable, since it allows the firm to capture more of the value created. This implies that with effective signaling, the need to underprice or discount the stock price to attract investment is mitigated. Thus, reduced underpricing is viewed positively as it implies a superior ability in the firm to raise capital (Deeds et al., 1997; Daily et al., 2005).

The main variable of interest in our model is *Degree*, a binary variable indicating the existence of an academic or professional degree. β is the parameter of interest, which measures the effect of having a degree on IPO (under) pricing. X_i is a set of exogenous explanatory variables, and γ is a vector of these parameters to be estimated. Industry and Year control for industry and year fixed effects. ε_i is an error term.

[2] If we are unable to associate a CEO with a specific educational background using our primary sources, we use alternative sources available on the Web (e.g., NNDB, LinkedIn, corporate websites) on a case-by-case basis.

3.2 Control Variables

Our regressions contain a set of control variables that have been shown to account for much of the variability of returns. Specifically, we control for CEO characteristics, firm-specific characteristics, and offering characteristics. We use *CEO Age* and *CEO Tenure*, respectively, to capture the overall and firm-specific experience of the CEO. We hypothesize that older CEOs are less overoptimistic and have greater human capital than younger ones (Cline and Yore, 2016). At the same time, CEOs with a longer tenure within a firm have greater knowledge of the firm than new CEOs, and are thereby associated with less IPO underpricing. On the other hand, Certo et al. (2001) argue that founder CEOs may overestimate the strength and long-term prospects of their firms, which may lead to poor management decisions.

In addition, we use the natural logarithm of total assets to proxy for firm size and visibility. Although larger IPOs suffer less from valuation uncertainty (Beatty and Ritter, 1986), increased visibility results in a relatively bigger footprint in the investment community for larger companies, which in turn may translate into higher investor demand for a firm's shares (Gounopoulos et al., 2017). Therefore, we leave the direction of this particular relationship open to empirical investigation. Prior research shows that firms with longer operating histories have proven more resilient to market-wide shocks and thus constitute safer investments (e.g., Carter et al., 1998; Schultz, 1993). Thus, we expect firm age to be negatively associated with IPO underpricing. Furthermore, given the limited information about an IPO firm's prospects, accounting earnings may also be considered as an important determinant of IPO performance. To the extent that the pre-IPO performance is sustainable, earnings per share (EPS) should alleviate valuation uncertainty.

Lastly, Jensen (1986) posits that a reasonably high level of leverage acts as an internal deterrent mechanism to opportunistic managerial actions. Following this reasoning, we incorporate leverage into our regression and anticipate that firms relying on debt financing should leave less money on the table (i.e., show a lower level of underpricing). Furthermore, Megginson and Weiss

(1991) show that market participants demand less underpricing for venture-backed IPOs. However, Lee and Wahal (2004) find a positive relationship between venture backing and underpricing. Thus, we consider whether a firm is venture-backed but refrain from predicting the impact of venture capital (VC) on initial stock returns following an IPO. In a similar vein, we utilize the underwriter rankings that reference the perceived quality of the agent underwriting an issue. Carter and Manaster (1990) document significant underpricing by firms engaging top-tier underwriters and interpret it as a means to signal quality, because only prestigious underwriters have the reputational capital to bear such costs.

Share overhang controls for the dilution caused by the issuance. A small overhang represents a higher number of new shares issued at the IPO, which in turn makes the IPO first-day returns costlier for the pre-IPO shareholders (Bradley and Jordan, 2002). To control for the market, we include market return, estimated as the cumulative return of the value-weighted CRSP index over the 20 trading days preceding the offering (prior to the offer date), which captures the influence of overall market sentiment on IPO valuation (see, e.g., Bradley and Jordan 2002; Derrien and Womack, 2003; Lowry and Schwert, 2004; Derrien, 2005).

Finally, we use the dummy variable *Nasdaq*, which is a categorical variable that takes a value of one if the firm is listed on the Nasdaq stock exchange (and zero otherwise). The regulatory environment of Nasdaq is less restrictive than those of NYSE and AMEX, thereby serving as the preferred marketplace for small, young, and high-tech IPOs. In a similar spirit, dummy variables for technology and internet firms enter our model to account for the excessive underpricing that such firms experience (Loughran and Ritter, 2002). Lastly, we include industry and year dummies to control for differences in valuation and performance across industries and time, as well as a dummy to control for international degrees.

3.3 Measurement of Educational Variables

As already mentioned, we rely on IPO prospectuses and executive profiles provided by BoardEx to populate our universe of firms with educational data. For each CEO, we collect a number of educational institution characteristics. We begin by identifying each degree according to its level (undergraduate, master's, or doctoral) and the specific individual majors (e.g., science, liberal arts, law, medicine, business). Based on this classification, we create three dummy variables, *Undergraduate*, *Master* and *Doctoral*, to control for the level of education. Accordingly, we provide a more detailed categorization of each type of degree.

Specifically, we use two categorical variables, *BA* and *BSc*, to account for the well-established differences in curricula, teaching, and learning methods between Bachelor of Arts and Bachelor of Science degrees. In terms of graduate degrees, we are able to obtain more consistent information about different degrees, and can thus employ a more detailed categorization. In particular, we use categorical variables for whether a CEO obtained a master's in business administration (*MBA*), science (*MSc*), the arts (*MA*), or a qualification from a professional body (*Prof*). As for the more advanced qualifications, we distinguish whether a CEO holds a doctorate in philosophy (*PhD*), law (*JD*), or medicine (*MD*).

We also record the name of the institution each CEO attended, recognizing differences within schools (for example, the University of California at Berkeley is coded differently from the University of California at Los Angeles). Utilizing the name of the educational institution together with the specific major of each degree permits us to differentiate the quality among schools using the prestigious U.S. News & World Report rankings (America's Best Colleges, 2017). According to the latter, each school has a score and ranking based on a variety of factors, including peer assessment, retention, faculty resources, student selectivity, financial resources, graduation rate, and alumni giving rate.[3] Further, USNWR recognizes that degrees may differ not only in terms of their major but also in terms of the purpose of the awarding institution. For example, National Universities offer a full range

[3] See *https://www.usnews.com/education* for complete methodology and rankings.

of undergraduate majors, plus master's and doctoral programs, and emphasize faculty research. National Liberal Arts Colleges focus almost exclusively on undergraduate education and award at least 50 percent of their degrees in the liberal arts.

At this stage, it should be noted that information about the specific major of undergraduate degrees is scant. For this reason, we measure the quality of undergraduate degrees based only on the USNWR ranking of the awarding institution and not on the subject of study. To this end, we collect the rankings for the top National Liberal Arts Colleges and National Universities from USNWR and match these rankings to our sample. Following King et al. (2016), we indicate whether the individual has a *BA-Top30* or *BSc-Top30* if they attended an elite school and/or institution, as indicated by a position in the top 30 National Liberal Arts Colleges or top 30 National Universities.

USNWR also provides separate rankings for MBAs, and law and medical degrees. Because we have more consistent information about the specific major of graduate qualifications, we utilize these rankings by creating the categorical variables, *MBA-Top30, JD-Top30,* and *MD-Top30,* if the individual's awarding institution is positioned among the top 30 business, law, and medical schools, respectively. Finally, because USNWR ranks other graduate schools according to a narrow discipline (e.g., biochemistry, chemistry, mathematics), the list of the top 30 National Universities was also used to indicate whether an individual has a non-MBA master's (*MA-Top30* or *MSc-Top30*) or PhD (*PhD-Top30*) from an elite institution.

4. Descriptive Analysis

Table 1 provides a preliminary description of our sample firms based on the educational, professional, firm-specific, and offering characteristics. Detailed definitions of all variables are provided in Appendix A. Panel A shows that the average CEO holds 1.65 university degrees and spent 5.46 years in higher education. Specifically, there are 1,447 (90%) chief executives with at least one university degree and, among them, 176 obtained their degree in a non-US institution. In Panel B, a

categorization of the undergraduate degrees based on their type reveals that the majority of CEOs hold a BSc (1,043), with a BA (432) being a less prevalent university qualification.

With respect to advanced degrees, we consider both academic and professional qualifications. Panel C shows that 756 firms (47%) are run by CEOs having a master's degree. As expected, most of these CEOs chose to pursue a Master of Business Administration degree (30%); next most common is a Master of Science (MSc) degree (19%), while the proportion of CEOs with a Master of Arts (MA) degree is a mere 4%. Furthermore, we identify that 66 executives (4%) hold titles awarded by professional accountancy bodies (CPA, ACCA or CIMA). In Panel D, we split the doctoral qualifications into three categories, namely, PhD (Doctor of Philosophy), JD (Juris Doctor), and MD (Doctor of Medicine); we observe that 315 (20%) of our sample CEOs hold a doctoral qualification (11% holding a PhD and 5% each holding a JD or MD), and 62 of these obtained their doctoral title in a university outside the US.

Table 2 documents the CEO, firm and IPO characteristics used as control variables in our regressions. Panel A indicates that, on average, a CEO is approximately 51 years old and has been serving their firm for at least three years. Female CEOs account for 5% of the sample, and 31% of CEOs are a founder of their firm. Panel A also shows that, on average, IPO firms have a history of two years' operation prior to taking the decision to go public. At the same point, 42% of these firms report a loss, while the average pre-IPO leverage is 33%. Moreover, IPO issuers demonstrate initial mean returns (underpricing) of 19%. Around half of the IPOs are venture-backed, and 37% are underwritten by top-tier investment banks. In addition, 33% of firms are in the high-tech industry, 9% are in the internet sector, and 62% are listed on Nasdaq.

Concentrating on the examination of the above characteristics according to the type of education degrees reveals several interesting patterns. For example, it appears that individuals who pursue specialized graduate degrees (MSc, MD and PhD) are more likely to be founders. Another interesting observation is that CEOs holding professional qualifications or a JD are associated with the

lowest share overhangs, which is in line with the notion that these attainments are the most conservative. Further, it is noteworthy that VCs have a higher presence in firms with CEOs having an MD or a PhD, which is consistent with the idea that firms having greater needs for specific knowledge than general managerial talent are VC-backed (Kaplan et al., 2012).

Finally, Panel C of Table 2 classifies IPO firms into sectors and reveals a relatively high concentration of IPOs in the chemical products and the computer equipment and services sectors. In contrast, the food products and entertainment services sectors have the lowest representation of IPO firms. In terms of the distribution of degrees across sectors, it is interesting to observe that medical degrees are concentrated in the chemical products and scientific instruments sectors. Because these sectors typically experience relatively greater levels of underpricing (Ritter and Welch, 2002), it seems that it may be the interplay of both industry forces and CEO characteristics that influences immediate aftermarket returns.

5. Empirical Results

In this section, we examine the relationship between educational attainments and underpricing in a multivariate setting. We begin our empirical analysis by focusing on the impact of undergraduate qualifications. Specifically, in Panel A of Table 3 we initially test the conjecture that attendance in college, as proxied by CEOs holding at least one university undergraduate degree, is associated with a lower level of underpricing. Next, we delve more deeply into the relationship between higher education and IPO performance by examining the impact of the undergraduate university qualification by type.

Column 1 of Panel A shows that, on average, firms with CEOs having at least one university degree exhibit a lower level of underpricing than firms run by CEOs that did not attend college. However, the impact on initial returns is not distinguishable from zero. A possible explanation for this observation is that (primary) university degrees do not send a strong signal in the IPO market.

Alternatively, holding a BSc or a BA may be viewed as important by market participants but in diametrically opposite ways, in which case a common coefficient masks their differential impact. Columns 2 and 3 support this latter explanation. In particular, the coefficient of *BA* is positive, while the coefficient of *BSc* is negative (both types of qualification are significantly different from zero at the 1% level). In consequence, these results suggest that it is important to distinguish between different types of undergraduate degrees, because investors weigh a BA and a BSc differently. More specifically, market participants view a Bachelor of Science degree as more relevant than a Bachelor of Arts degree for a firm going public, which is in line with our first hypothesis.

Columns 1 to 4 of Panel B (Table 3) report the results for the master's level of graduate education. Along with the various graduate degrees, we also consider whether firms with executives holding any type of qualification awarded by a professional body experience better (short-run) IPO performance. Column 1 demonstrates that while there is a tendency for graduate qualifications to lower immediate aftermarket returns, their impact is not statistically significant. However, like before, we cannot rule out the possibility that the impact of different master's qualifications on underpricing is heterogeneous. Column 2 indicates that, similar to the Bachelor of Arts, a Master of Arts (MA) tends to increase initial returns to investors. By contrast, the MSc and MBA degrees are negatively associated with initial IPO returns, although only the latter degree is statistically significant in this context. Similarly, professional qualifications are found to be negatively and significantly associated with the level of initial returns. Overall, and consistent with our second hypothesis, the results at the master's level of education indicate that only the degree focused on providing formal business training (an MBA) is perceived as influential in the IPO market, with the value of an MSc or an MA being questionable.

Lastly, in Columns 5 to 8 of Panel B we explore the importance of higher education at the doctoral level. The first finding here is that merely holding a doctorate title does not seem to explain the variation in the level of underpricing. Yet, as expected, when we examine each doctorate title

separately we find that the influence varies in terms of direction and magnitude. Specifically, our results suggest that both PhD and JD doctorates are negatively associated with underpricing. However, only for CEOs with a legal education is the association with lower initial returns significant. By way of contrast, Doctor of Medicine degrees contribute to higher IPO first-day returns although their impact on these initial returns appears not to be significant. As such, the results in Panel B support our third hypothesis, which states that among the doctoral qualifications only the JD plays a certification role.

With respect to the results for the remaining control variables, their sign and significance across all specifications is generally consistent with our expectations and the existing literature. For instance, the coefficients of the CEO age and tenure are both negative, although insignificant. In contrast, founder CEOs contribute to higher initial returns (Chahine and Goergen, 2011). Consistent with Loughran and Ritter (2002), we find that the presence of prestigious underwriters and venture capitalists is associated with higher aftermarket returns. Moreover, the positive estimates on share overhang and market return are consistent with Loughran and Ritter (2002) and Dolvin and Jordan (2008). Similar to Gounopoulos et al. (2017), we find that technology and Nasdaq-listed firms tend to have higher underpricing. Finally, in line with Leone et al. (2007) and Gounopoulos et al. (2017), we find positive and statistically significant coefficients on both firm size and EPS.

6. Endogeneity Issues and Sample Selection Bias

The results so far indicate that managers with particular educational attainments tend to be associated with lower or higher underpricing. Although we interpret these results as evidence that CEOs holding a BSc, MBA or JD are more appropriate for IPO issuers, an alternative interpretation is that managers with these titles are attracted to IPO firms with lower inherent valuation difficulties or that our results are a reflection of endogenous CEO–firm matching, which may bias the estimation of the impact of CEO educational characteristics.

The inclusion of industry and year fixed effects absorbs omitted industry-variant and time-variant heterogeneity in a first attempt to address this latter issue. However, the main challenge to our identification strategy is that our results are still prone to endogeneity bias. To alleviate these concerns, and specifically to address potential selection bias between CEO educational attainment and firms as a result of unobserved characteristics, we apply a two-stage Heckman (1979) model for every type of degree to correct for potential selection bias. In the first stage, we estimate a binary choice model to predict the probability of obtaining a degree, from which we calculate the inverse Mills ratio (IMR), a transformation of the predicted probability. Then, in the second stage, we estimate the baseline model equation by including the IMR as an additional explanatory variable.

For reliable implementation of this method, we need to identify valid instrumental variables.[4] To this end, we follow Falato et al. (2015) in order to capture exogenous variation in the relative demand for CEO educational credentials. To do so, we consider the characteristics of UK CEOs as instruments for the characteristics of their US counterparts and construct an industry-wide (based on the Fama–French 48-industry classification) average of CEO educational credentials for firms headquartered in the UK.[5] The identifying assumption behind this approach is that, to the extent that the same industries in the US and the UK share common fundamental factors such as technology and barriers to entry, changes in the observed CEO credentials across industries in the United Kingdom should be predictive of those in the US but are orthogonal to any endogenous interdependencies present in the US data that arise from reverse causality (see Ellison et al., 2010).

Table 4 presents the results from the Heckman procedure. In all first-stage regressions, we find that all the instruments are positively and statistically related to their respective credential proxies, thus lessening the possibility that weak instruments are contaminating our inferences. Turning to the

[4] For an instrument to be valid, it must be exogenous and satisfy the exclusion restriction. In other words, we need variables that are potentially correlated to CEO educational credentials (relevancy condition) but affect IPO pricing only through their effect on CEO educational credential (exclusion criterion), that is, variables that are orthogonal to (unobserved) firm characteristics. If this is the case, any association between the instrumental variable and the dependent variable in the second-stage regression should be indirect and act only through the IMR variable estimated from the first-stage model.

[5] We retrieve data from BoardEx to construct our instrument.

second-stage regressions, the coefficient for the IMR is statistically insignificant, implying the absence of selection bias. Coinciding with this inference, the coefficients for all degrees are closely comparable in magnitude between an ordinary least squares (OLS) and the Heckman estimations, confirming that the IMR control is inessential.

Another way to address the endogenous matching of CEOs and firms is to consider whether such matching occurs due to observable characteristics. In this case, we anticipate that CEOs with specific personal characteristics match with firms that have demand for those characteristics. This implies that a firm selects a CEO with specific characteristics and preferences (more conservative or more aggressive) because it believes that the CEO will imprint his or her personal preferences on the firm. Although this explanation is not inconsistent with a causal impact interpretation of CEO educational attainment on IPO performance, it makes it more difficult to discern whether the association between education and underpricing is attributable to the characteristics of the CEO or the firm.

To alleviate this concern, we employ propensity score matching to compare the effect on firms of CEOs with and without certain degrees. This method allows us to identify a control sample of firms with a given CEO educational attainment that exhibit no observable differences in characteristics relative to firms with a CEO without that attainment. To obtain the closest equivalent (propensity score) for each firm with a CEO with a specific type of degree (treatment group), we run a probit model on a series of carefully selected control variables on a one-to-one basis according to the estimated propensity score.[6]

Based on these matched sets of treatment and control firms, we re-examined the impact of CEO educational attainments on IPO underpricing using the OLS method. Our results in Table 5 show that the signs and statistical significance of our variables of interest remain the same as in our earlier

[6] For each treatment firm with a CEO with a specific type of degree, we select a matching control firm with a CEO without that type of degree from the same year–industry, with the requirement that the propensity score does not exceed 0.01.

results and, as a consequence, our estimation findings continue to hold and support our hypotheses. For example, we find that firms with a CEO with a BSc degree are negatively associated with underpricing, whereas firms with a CEO with a BA degree are positively related to IPO first-day returns. Furthermore, our findings suggest that firms with a CEO with a JD degree are associated with lower immediate aftermarket returns.

7. Does the Quality or Quantity of Education Affect Initial IPO Returns?

Our analysis thus far concentrates on the heterogeneous impact of different types and levels of degree, neglecting potential differences arising from distinctions between the awarding institutions other than the major involved and the associated level of study. From this perspective, a legitimate question is whether the influence of each of the educational attainments under consideration is contingent on the quality or prestige underlying its awarding institution. To examine this possibility, we exploit the college rankings provided by USNWR. As previously described, USNWR provides separate rankings for National Universities, National Liberal Arts Colleges, MBAs, JDs and MDs. For the remaining degrees, we proxy for the institution quality using the rankings of the National Universities. As an alternative, we proxy for the institutional quality and prestige using a narrower definition, the Ivy League designation.

Table 6 provides a picture that is consistent with our existing results. Specifically, CEOs graduating from elite undergraduate institutions, as captured by the coefficients for both *BA-Top30* and *BSc-Top30*, are associated with lower initial returns. Similarly, CEOs with MBA qualifications from top 30 MBA programs are strongly associated with lower levels of underpricing. Interestingly, the MSc degree appears to be significant at the 10% level when we consider the ranking of the awarding institution. On the other hand, the MA degree continues to be insignificant, as in every step of our previous analysis. Finally, the results in relation to the quality of doctoral qualifications are in

line with our earlier results: the PhD degree continues to be insignificant; JD degrees significantly reduce underpricing levels; the MD degree is highly significant in economic and statistical terms.

In Panel B of Table 6 we replicate the previous analysis but we use the Ivy League designation as a proxy for quality of education. Because the Ivy League list is a relatively narrow list compared to the broader one used before, it is reasonable to expect weaker results. An inspection of Panel B confirms this conjecture. Although all coefficients are in line with the previously documented results, only BA and MD degrees appear to be significant in this context. Overall, it is worthy of mention that because the directional influence of the educational attainments does not alter when using institutional rankings to proxy for educational quality, the dominant factor that shapes market perceptions of the role of academic degrees is the type of degree and not the underlying quality of the awarding institution.

Given our previous findings, it is important to understand to what extent the number of degrees and years of education affect the initial stock returns following IPO. The results in Table 7 indicate that neither of these variables shows a significant relationship with underpricing levels. In particular, investors do not seem to consider the number of degrees and years of education of the CEO in any systematic manner when they take an interest in a firm. Overall, we find evidence that the quality of educational and professional qualifications matters more than quantity in relation to underpricing.

Finally, we examine whether the educational field of each degree can impact these relationships. To test this conjecture, we repeat the baseline regressions and, because of data unavailability, examine only the degrees of MSc and PhD. In Panel A of Table 8, we find that most CEOs that hold an MSc or PhD degree do so in the fields of engineering and pharmaceuticals. In addition, the results in Panel B (Table 8) show that the relationships between MSc, PhD, and underpricing are strongest when the CEOs graduated from pharmacy departments or schools in their master's or doctoral studies.

8. What is the Cumulative Impact of CEO Education Qualifications on IPO Pricing?

Our analysis so far offers a rigorous treatment of whether and how CEO educational attainments affect IPO pricing. Consistent with our expectations, not all types of CEO education produce a homogeneous effect on IPO pricing, even at the same level of education. However, this finding does not provide any insights into the cumulative impact of educational qualifications on investors' perceptions. This deficiency is critical, since unlike prior studies on education (e.g., King et al., 2016; Colombo et al., 2019), we do not focus on homogeneous sectors, but rather study the signaling role of educational credentials across a variety of industry settings. This begs the following question: which signaling effect dominates in the eyes of investors having considered all types of educational degree?

One way to address this question is to repeat our analysis by simultaneously including all levels of education in the same regression. However, this approach is subject to measurement issues as a result of high intercorrelation of our education variables. Another method would be to construct a weighted average index of education; however, this measure introduces bias arising from subjective judgment due to the potential arbitrariness of assigning weights to each category of education. Finally, factor analysis could be used to extract the underlying structure from the variance–covariance matrix of our education categories (Tetlock, 2007). Apart from making intuitive sense, this method is preferable because it mitigates issues arising from multicollinearity and subjective research judgments (Kaplan et al., 2012; Custodio et al., 2013).

Following King et al. (2016), we employ the level of each CEO degree together with the quality (Top 30 designation) of its awarding institution. Panel A of Table 9 reports the factor solution for our proposed CEO education index. Taken together, factor analysis yields a three-dimensional CEO education index (undergraduate, master's, and doctoral) based on the common variance of the

level and quality of CEO degrees.[7] Whether these factors represent a meaningful economic relationship is further explored in a regression framework. As Panel B of Table 9 indicates, all factors tend to reduce underpricing levels. However, only the association between undergraduate or master's degrees and underpricing is significant. As a consequence, we conclude that although the nature of educational training may differentially affect investor perceptions, even for the same level of education, when we account for the collective impact of academic qualifications across all levels of education, CEO educational attainments tend to reduce IPO underpricing.

9. Conclusion

Most of the existing literature has focused on the impact of CEO educational attainments on corporate outcomes at the top-management-team level of analysis. We conceptually and empirically extend this stream of literature by studying the role of CEO educational attainments in relation to IPOs. In particular, we investigate whether and how education degrees impact investor perceptions of a firm as reflected in IPO underpricing.

Building upon upper echelon and signaling capital theories, we predict and find that firms having CEOs with a BA degree are associated with higher levels of underpricing, while firms having CEOs with a BSc degree tend to experience lower IPO first-day returns. With respect to master's degrees, we document that only MBAs provide the most credible education signal. Finally, our analysis indicates that, in general, a PhD degree is not significantly associated with immediate aftermarket returns, but MD degrees are strongly and positively associated with underpricing. On the other hand, CEOs with JD degrees or professional qualifications are negatively associated with initial returns to investors. In general, our results are robust to regressions using OLS, industry and year fixed effects, the Heckman model, and matching estimators.

[7] Three factors represent vectors in the six-dimensional space and these factors capture 73% of the variance. The first factor (Master Education) loads significantly on two key items: Level and Quality of Master Education (MSc or MA). The next factor (Doctoral Education), is a combination of two key variables: Level and Quality of PhD, MD or JD degrees. The third factor (Undergraduate Education) loads significantly on two variables: Level and Quality of BA or BSc degrees.

In conclusion, this study makes the following contributions. First, we extend previous works conducted on CEO education and organizational performance. Second, we expand the literature on CEO educational attainments in relation to IPOs, where prior research has largely focused on signals based on firm-specific characteristics, outside parties, or the level of the top management team. Finally, our results have important implications for corporate decision-making by providing evidence of the role of CEO educational attainments as screening devices for prospective issuers, as well as a quality signal in the financial and labor market for individual executives.

Appendix A: Definitions of Variables

Variable	Definition
	Panel A: IPO Pricing
Underpricing	The difference between the first secondary market closing price available in CRSP and the IPO offer price, divided by the IPO offer price.
	Panel B: Education Characteristics
Years of Education	Total number of years of CEO educational study.
Number of Degrees	Total number of university degrees held by the CEO.
Undergraduate Degree	Dummy variable equal to 1 if the CEO holds an undergraduate degree, 0 otherwise.
Undergraduate Degree International	Dummy variable equal to 1 if the CEO holds an undergraduate degree from an international university, 0 otherwise.
BA	Dummy variable equal to 1 if the CEO holds a BA degree, 0 otherwise.
BA International	Dummy variable equal to 1 if the CEO holds a BA degree from an international university, 0 otherwise.
BA-Top30	Dummy variable equal to 1 if the CEO received a BA from a school ranked in the USNWR Top 30 National Universities, and 0 otherwise.
BSc	Dummy variable equal to 1 if the CEO holds a BSc degree, 0 otherwise.
BSc International	Dummy variable equal to 1 if the CEO holds a BSc degree from an international university, 0 otherwise.
BSc-Top30	Dummy variable equal to 1 if the CEO received a BSc from a school ranked in the USNWR Top 30 National Universities, and 0 otherwise.
Graduate Degree	Dummy variable equal to 1 if the CEO holds a master's degree, 0 otherwise.
Graduate Degree International	Dummy variable equal to 1 if the CEO holds a master's degree from an international university, 0 otherwise.
MA	Dummy variable equal to 1 if the CEO holds an MA degree, 0 otherwise.
MA International	Dummy variable equal to 1 if the CEO holds an MA degree from an international university, 0 otherwise.
MA-Top30	Dummy variable equal to 1 if the CEO received an MA from a school ranked in the USNWR Top 30 National Liberal Arts Colleges, and 0 otherwise.
MSc	Dummy variable equal to 1 if the CEO holds an MSc degree, 0 otherwise.
MSc International	Dummy variable equal to 1 if the CEO holds an MSc degree from an international university, 0 otherwise.
MSc-Top30	Dummy variable equal to 1 if the CEO received an MSc from a school ranked in the USNWR Top 30 National Universities, and 0 otherwise.
MBA	Dummy variable equal to 1 if the CEO holds an MBA degree, 0 otherwise.
MBA International	Dummy variable equal to 1 if the CEO holds an MBA degree from an international university, 0 otherwise.
MBA-Top30	Dummy variable equal to 1 if the CEO received a MBA from a school ranked in the USNWR Top 30 Business Schools, and 0 otherwise.
Prof	Dummy variable equal to 1 if the CEO holds a professional qualification (e.g., CPA, ACCA, CFA or ICEAW), 0 otherwise.
Doctoral Degree	Dummy variable equal to 1 if the CEO holds a doctoral degree, 0 otherwise.
Doctoral Degree International	Dummy variable equal to 1 if the CEO holds a doctoral degree from an international university, 0 otherwise.
MD	Dummy variable equal to 1 if the CEO holds an MD degree, 0 otherwise.
MD International	Dummy variable equal to 1 if the CEO holds an MD degree from an international university, 0 otherwise.
MD-Top30	Dummy variable equal to 1 if the CEO received an MD from a school ranked in the USNWR Top 30 Medical Schools, and 0 otherwise.
JD	Dummy variable equal to 1 if the CEO holds a JD degree, 0 otherwise.
JD International	Dummy variable equal to 1 if the CEO holds a JD degree from an international university, 0 otherwise.
JD-Top30	Dummy variable equal to 1 if the CEO received a JD from a school ranked in the USNWR Top 30 Law Schools, and 0 otherwise.
PhD	Dummy variable equal to 1 if the CEO holds a PhD degree, 0 otherwise.
PhD International	Dummy variable equal to 1 if the CEO holds a PhD degree from an international university, 0 otherwise.
PhD-Top30	Dummy variable equal to 1 if the CEO received a PhD from a school ranked in the USNWR Top 30 National Universities, and 0 otherwise.
Instrument	The average value of the respective credential proxy among all UK firms that are in the same industry group [following Falato et al., 2015].
	Panel C: CEO and Firm Characteristics
CEO Age	Age of CEO (in years).

Gender	Dummy variable equal to 1 if the CEO is male, and 0 otherwise.
Founder	Dummy variable equal to 1 if the CEO is both founder and CEO, and 0 otherwise.
CEO Tenure	Number of years working as CEO in the firm before the IPO.
Firm Age	The number of years elapsed from firm's foundation to IPO date, using foundation dates from the Thomson Financial database as well as from the Field–Ritter dataset. The variable is transformed into the regressions by adding 1 and taking the natural logarithm.
Size	The natural logarithm of pre-IPO total assets.
Leverage	The ratio of total liabilities over total assets in the fiscal year prior to IPO.
EPS	Dummy variable equal to 1 for positive earnings per share in the fiscal year prior to IPO, and 0 otherwise.
	Panel D: IPO (Offering Characteristics)
Overhang	The ratio of shares retained by the pre-IPO shareholders over shares issued in the offering.
Nasdaq	Dummy variable equal to 1 for Nasdaq-listed IPOs, and 0 otherwise.
Underwriter	Dummy variable equal to 1 for the most prestigious underwriters, 0 otherwise. Most-reputable underwriters are those with a ranking score of 9.0 or above in Jay Ritter's underwriter (prestige) rankings.
VC	Dummy variable equal to 1 for venture-capital-backed firms, and 0 otherwise.
Technology	Dummy variable: one for IPO firms 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 (communications services), 7371, 7372, 7373, 7374, 7375, 7378, and 7379 (software).
Internet	Dummy variable set to 1 for IPOs of Internet firms, and 0 otherwise. Internet firms are classified as those with a business description containing any of the words "Internet", "Online", "eBusiness", "eCommerce", or "Website".
Market Return	The compounded daily return on the CRSP value-weighted index over the 20 trading days trailing the IPO.

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Table 1: Descriptive Statistics of Educational Characteristics

This table presents descriptive statistics for the main education variables used in our analysis. Apart from the years of education and the number of degrees, the variables include CEO graduate educational qualifications at the undergraduate (BA and BSc), master's (MA, MSc and MBA), and doctoral (PhD, JD and MD) levels of study. Professional qualifications are also included. The sample consists of 1,601 IPOs announced between 1 January 2000 and 31 December 2016. CEO educational and professional characteristics were hand-collected from EDGAR and BoardEx. All variables are defined in Appendix A.

	N	Mean	SD
Panel A: General Education Indicators			
Years of Education	1,601	5.46	2.61
Number of Degrees	1,601	1.65	0.85
Panel B: Undergraduate Degrees			
Undergraduate Degree	1,447	0.90	0.29
Undergraduate Degree International	176	0.11	0.31
Bachelor of Science (BSc)	1,043	0.65	0.48
BSc International	152	0.09	0.29
BSc-Top30	236	0.15	0.35
BSc Ivy League	43	0.03	0.16
Bachelor of Arts (BA)	432	0.27	0.44
BA International	24	0.01	0.12
BA-Top30	206	0.13	0.33
BA Ivy League	81	0.05	0.22
Panel C: Master and Professional Degrees			
Graduate Degrees	756	0.47	0.49
Graduate Degrees International	73	0.04	0.20
Master of Science (MSc)	300	0.19	0.39
MSc International	52	0.03	0.18
MSc-Top30	148	0.09	0.29
MSc Ivy League	20	0.01	0.11
Master of Arts (MA)	38	0.02	0.15
MA International	5	0.00	0.05
MA-Top30	18	0.01	0.10
MA Ivy League	6	0.01	0.06
Master of Business Admin. (MBA)	491	0.30	0.46
MBA-Top30	303	0.19	0.39
MBA Ivy League	139	0.08	0.28
MBA International	17	0.01	0.10
Professional (Prof)	66	0.04	0.20
Panel D: Doctoral Degrees			
Doctoral Degree	315	0.20	0.40
Doctoral Degree International	62	0.04	0.19
Doctor of Philosophy (PhD)	180	0.11	0.31
PhD International	41	0.02	0.15
PhD-Top30	97	0.06	0.24
PhD Ivy League	11	0.01	0.08
Juris Doctor (JD)	81	0.05	0.22
JD International	3	0.01	0.04
JD-Top30	38	0.02	0.15
JD Ivy League	11	0.01	0.08
Medical Doctor (MD)	85	0.05	0.22
MD International	25	0.01	0.12
MD-Top30	38	0.02	0.15
MD Ivy League	15	0.01	0.09

Table 2: Summary Statistics by Degree

This table presents descriptive statistics for a sample of 1,601 US IPOs from 1 January 2000 to 31 December 2016. All IPOs are retrieved from the Thomson Financial database. Education data are retrieved from EDGAR and BoardEx, and accounting data from CRSP. The statistics provided include the mean for all control variables used in the regression analysis. Panel A describes the firm and CEO characteristics and Panel B the IPO characteristics; Panel C reports the distribution of education degrees by industry.

Panel A: CEO Attributes and Firm Characteristics

	Sample	BA	BSc	MA	MSc	MBA	Prof	MD	JD	PhD
CEO Age	50.72	49.75	50.92	51.58	52.10	50.28	51.19	50.57	51.62	52.47
Gender	0.95	0.94	0.96	0.95	0.95	0.95	0.95	0.99	0.97	0.92
Founder	0.31	0.34	0.30	0.26	0.40	0.24	0.14	0.50	0.29	0.48
CEO Tenure	3.03	3.09	3.01	4.08	3.88	2.85	2.81	3.07	2.73	3.41
Firm Age	1.99	1.99	1.97	1.99	2.03	1.98	1.65	1.73	1.80	2.01
Size	4.15	4.08	4.13	3.47	4.13	4.16	3.90	4.36	4.00	3.68
Leverage	0.33	0.33	0.32	0.17	0.27	0.32	0.33	0.19	0.31	0.36
EPS	0.42	0.39	0.42	0.34	0.42	0.40	0.53	0.19	0.34	0.26

Panel B: IPO (Offering) Characteristics

Underpricing	18.82	21.73	18.40	17.17	23.62	17.61	9.05	17.63	11.23	20.81
Overhang	3.60	3.82	3.59	3.66	4.20	3.60	2.63	3.15	2.72	3.57
Nasdaq	0.62	0.67	0.61	0.68	0.68	0.59	0.44	0.89	0.58	0.85
Underwriter	0.37	0.39	0.36	0.26	0.38	0.40	0.33	0.27	0.38	0.26
VC	0.47	0.54	0.48	0.39	0.60	0.50	0.18	0.75	0.39	0.78
Technology	0.33	0.29	0.37	0.26	0.49	0.33	0.16	0.17	0.27	0.28
Internet	0.09	0.13	0.08	0.10	0.13	0.09	0.01	0.03	0.07	0.05

Panel C: Education Degrees by Industry

	SIC2	BA	BSc	MA	MSc	MBA	Prof	MD	JD	PhD
Oil and Gas	(13)	9	68	7	7	25	5	1	7	5
Food Products	(20)	6	6	-	-	7	-	-	1	
Chemical Products	(28)	111	182	8	59	98	6	58	14	92
Manufacturing	(30-34)	8	26	1	6	15	2	-	1	1
Computer Equipment & Services	(35, 73)	108	273	7	83	125	13	-	17	19
Electronic Equipment	(36)	18	116	-	62	44	1	-	5	28
Scientific Instruments	(38)	39	74	4	25	37	3	12	8	14
Transportation & Public Utilities	(41, 42, 44-49)	33	93	-	2	41	15	-	-	2
Wholesale & Retail Trade	(50-59)	43	79	4	9	42	8	-	6	2

Table 3: Cross sectional regression analysis (OLS) of Educational Degrees

This table displays the effects of undergraduate, master's, professional, and doctoral degrees held by CEOs on IPO first-day returns using ordinary least squares (OLS) regressions. The dependent variable is IPO first-day returns, calculated as the percentage change from the first-day closing price to offer price. Year and industry fixed effects are included but coefficient estimates are not reported. T-statistics are included in parentheses and are adjusted for heteroscedasticity-robust standard errors clustered by industry and year. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Appendix A.

Panel A: Undergraduate Degrees

	(1)	(2)	(3)
	Undergraduate	BA	BSc
Degree	-2.47	5.28***	-6.04***
	(-0.66)	(2.84)	(-3.05)
International Degree	9.96	6.47	9.94
	(1.10)	(0.57)	(1.43)
CEO Age	-0.02	-0.01	-0.02
	(-0.53)	(-0.42)	(-0.48)
Gender	5.68	6.52	5.61
	(1.06)	(1.15)	(1.05)
Founder	6.14***	6.24***	6.03***
	(3.22)	(3.13)	(3.36)
CEO Tenure	-0.32	-0.34	-0.34
	(-1.05)	(-1.05)	(-1.05)
Firm Age	-0.95	-0.86	-0.89
	(-1.06)	(-0.94)	(-0.94)
Size	0.50	0.56	0.50
	(0.46)	(0.52)	(0.48)
Leverage	-0.28	0.04	-0.29
	(-0.10)	(0.01)	(-0.10)
EPS	3.54	3.58	3.70
	(1.17)	(1.17)	(1.27)
Overhang	1.19***	1.18***	1.18***
	(10.43)	(9.39)	(9.50)
Nasdaq	2.93	2.96	2.98
	(0.88)	(0.90)	(0.90)
Underwriter	5.40**	5.22**	5.31**
	(2.33)	(2.34)	(2.31)
VC	12.81**	12.60**	13.14**
	(2.60)	(2.50)	(2.61)
Technology	5.47**	6.12**	6.25**
	(2.00)	(2.22)	(2.24)
Internet	-5.69	-6.10	-6.49
	(-1.22)	(-1.37)	(-1.37)
Market Return	0.17	0.21	0.22
	(1.56)	(1.58)	(1.54)
Year Fixed Effects	Y	Y	Y
Industry Fixed Effects	Y	Y	Y
N	1,601	1,601	1,601
Adjusted R^2	0.2609	0.2639	0.2624

Panel B: Master, Professional, and Doctoral Degrees

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Master	MA	MSc	MBA	Doctoral	MD	JD	PhD
Degree	-1.26	6.01	-1.41	-1.78***	0.19	3.44	-4.80***	-2.16
	(-0.57)	(1.09)	(-0.82)	(-2.96)	(0.06)	(0.47)	(-2.97)	(-1.02)
International Degree	6.51	-4.59	8.76	2.97	10.54	5.92	0.01	10.80
	(1.24)	(-0.3)	(1.32)	(0.68)	(0.97)	(0.68)	(0.70)	(0.97)
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Year and Industry Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
N	1,601	1,601	1,601	1,601	1,601	1,601	1,601	1,601
Adjusted R^2	0.2573	0.2567	0.2574	0.2568	0.2584	0.2559	0.2570	0.2576

Table 4: Heckman Two-Step Model Analysis

This table displays the multivariate analysis using a Heckman two-stage model. Panel A presents the first-stage results (selection), while Panel B reports the second-stage results (outcome). The sample consists of initial public offerings from 2000 to 2016 in the US stock market. T-statistics are included in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Appendix A.

Panel A: Bachelor Degrees

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	BA	BSc	MA	MSc	MBA	Prof.	MD	JD	PhD
Instrument	1.31**	1.23**	1.05**	2.66***	1.87**	1.10**	0.81*	1.22**	0.91**
	(2.20)	(2.18)	(2.39)	(3.00)	(2.56)	(2.38)	(1.94)	(2.08)	(2.21)
Int. Degree	7.18	7.37	8.64	7.54	7.12		8.79	7.65	8.18
	(0.41)	(1.33)	(1.39)	(1.28)	(1.31)		(1.43)	(1.54)	(1.31)
CEO Age	-0.01	0.01	0.01	0.01***	-0.01	-0.01	0.01	0.01	0.01**
	(-1.15)	(0.72)	(0.34)	(2.85)	(-1.08)	(-0.05)	(0.67)	(0.24)	(2.17)
Gender	-0.24	0.28	0.09	-0.13	-0.01	-0.06	0.91*	0.17	-0.31
	(-1.28)	(1.53)	(0.24)	(-0.64)	(-0.09)	(-0.15)	(1.94)	(0.52)	(-1.49)
Founder	0.03	-0.05	-0.14	0.17	-0.35***	-0.25	0.36**	0.05	0.35***
	(0.36)	(-0.58)	(-0.74)	(1.63)	(-4.32)	(-1.39)	(2.45)	(0.41)	(3.16)
CEO Tenure	0.01	-0.01	0.03*	0.03***	-0.01	-0.25	-0.04	-0.01	0.01
	(0.25)	(-0.22)	(1.84)	(3.59)	(-0.65)	(-1.35)	(-1.64)	(-0.14)	(0.94)
Firm Age	-0.03	-0.01	0.08	-0.01	-0.01	-0.05	-0.26***	-0.03	0.03
	(-0.76)	(-0.08)	(0.94)	(-0.28)	(-0.11)	(-1.14)	(-2.68)	(-0.54)	(0.34)
Size	-0.04*	0.02	-0.05	0.01	0.01	-0.04	-0.09*	0.01	-0.01
	(-1.75)	(1.09)	(-1.04)	(0.25)	(0.07)	(-0.64)	(-1.87)	(0.01)	(-0.30)
Leverage	-0.06	-0.09	-0.56*	-0.32***	-0.06	0.17	0.09	0.01	0.09
	(-0.65)	(-1.05)	(-1.94)	(-2.82)	(-0.69)	(1.08)	(0.62)	(0.11)	(0.87)
EPS	-0.12	0.06	-0.18	0.11	-0.08	0.26*	-0.40**	-0.17	-0.32***
	(-1.21)	(0.98)	(-0.95)	(1.29)	(-1.12)	(1.75)	(-2.29)	(-1.32)	(-2.74)
Overhang	0.01	-0.01	0.01	0.01	-0.01	-0.02	-0.01	-0.03	-0.01
	(0.43)	(-0.34)	(0.75)	(0.94)	(-0.11)	(-0.11)	(-0.35)	(-1.34)	(-0.25)
Nasdaq	0.04	-0.14	0.16	-0.08	-0.17**	-0.03	0.74**	0.02	0.25*
	(0.44)	(-1.38)	(0.64)	(-0.79)	(-1.98)	(-0.25)	(2.35)	(0.14)	(1.75)
Underwriter	0.12	-0.07	0.05	-0.01	0.04	-0.03	-0.06	0.07	-0.03
	(1.28)	(-0.92)	(0.26)	(-0.11)	(0.54)	(-0.18)	(-0.36)	(0.56)	(-0.29)
VC	0.13	0.13	-0.09	0.33***	0.25***	-0.48***	0.49***	-0.14	0.65***
	(1.24)	(1.47)	(-0.44)	(2.89)	(2.74)	(-2.69)	(2.84)	(-0.93)	(4.91)
Technology	-0.45***	0.42***	-0.27	0.44***	-0.06	-0.12	-0.57***	-0.08	-0.39***
	(-5.15)	(4.17)	(-1.25)	(4.47)	(-0.73)	(-0.68)	(-3.14)	(-0.61)	(-3.24)
Internet	0.42***	-0.38***	0.27	0.09	-0.07	-0.55	-0.17	-0.03	-0.14
	(3.41)	(-2.78)	(1.06)	(0.66)	(-0.39)	(-1.35)	(-0.62)	(-0.15)	(-1.05)
Market	-0.01	-0.74	-2.37	-0.78	-0.08	-1.24	0.11	-1.59	-0.96
Return	(-0.01)	(-0.76)	(-1.16)	(-0.68)	(-0.10)	(-0.75)	(-0.07)	(-0.98)	(-0.67)
Year & Industry Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pseudo R^2	0.0626	0.0718	0.1438	0.1208	0.0458	0.1740	0.2057	0.0762	0.1839
N	1,601	1,601	1,601	1,601	1,601	1,601	1,601	1,601	1,601

Panel B: Second-Stage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	BA	BSc	MA	MSc	MBA	Prof	MD	JD	PhD
Degree	4.37**	-6.18***	5.84	-1.73*	-1.75**	-3.81***	2.59	-4.24**	-2.68
	(2.41)	(3.67)	(1.23)	(-1.68)	(-2.34)	(-2.39)	(0.35)	(-2.24)	(-0.78)
Inverse	-0.01	1.61	-0.01	0.01	-0.05	-0.01**	-1.63	-0.05	-1.41
Mills Ratio	(-0.11)	(0.98)	(-0.52)	(0.04)	(-0.12)	(-2.35)	(-0.42)	(-0.58)	(-0.76)
N	1,601	1,601	1,601	1,601	1,601	1,601	1,601	1,601	1,601
Adjusted R^2	0.2510	0.2522	0.2535	0.2610	0.2523	0.2555	0.2435	0.2578	0.2465

Table 5: Propensity Score Matching

This table displays the analysis of the effect of CEO educational attainments on IPO first-day returns using a one-to-one propensity score matching (PSM) procedure. The dependent variable is IPO first-day returns, calculated as the percentage change from the first-day closing price to the offer price. Year and industry fixed effects are included but coefficient estimates are not reported. T-statistics are included in parentheses and are adjusted for heteroscedasticity-robust standard errors clustered by industry and year. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Appendix A.

	BA	BSc	MSc	MBA	Prof	MD	JD	PhD
Degree	7.73**	-7.04**	-4.95**	-1.48*	-9.73*	7.26*	-8.78**	-0.84*
	(2.46)	(-2.54)	(-2.51)	(-1.99)	(-1.75)	(1.88)	(-2.06)	(-1.82)
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
N	626	728	346	744	100	78	120	202
Adjusted R^2	0.2098	0.2195	0.2814	0.2697	0.3628	0.3627	0.2983	0.3084

Table 6: The Impact of Institutional Rankings and Ivy League Designation on Underpricing

This table displays the effects of educational quality on IPO first-day returns using ordinary least squares (OLS) regressions. The sample consists of initial public offerings from 2000 to 2016 in the US stock market. The dependent variable is IPO first-day returns, calculated as the percentage change from the first-day closing price to the offer price. Panel A presents OLS regression results by using the top 30 rankings provided by USNWR to measure the quality of each university. Panel B displays the effects of the quality (Ivy League designation) of university qualifications held by CEOs on IPO first-day returns using ordinary least squares (OLS) regressions. Year and industry fixed effects are included but coefficient estimates are not reported. T-statistics are included in parentheses and are adjusted for heteroscedasticity-robust standard errors clustered by industry and year. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Appendix A.

Panel A: The Effect of Educational Institution Quality on IPO First-Day Returns

	BA-Top30	BSc-Top30	MA-Top30	MSc-Top30	MBA-Top30	MD-Top30	JD-Top30	PhD-Top30
Degree	5.85*	-0.83***	4.14	-2.78*	-2.94***	9.25***	-6.25*	-2.25
	(1.71)	(-2.74)	(1.42)	(-1.89)	(-2.82)	(8.16)	(-1.76)	(-0.40)
Control Variables	Y	Y	Y	-Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
N	1,438	1.438	1,438	1,438	1,438	1,438	1,438	1,438
Adjusted R^2	0.2608	0.2606	0.2565	0.2576	0.2572	0.2579	0.2570	0.2574

Panel B: The Effect of Ivy League Designation on IPO First-Day Returns

	BA	BSc	MA	MSc	MBA	MD	JD	JD
Degree	5.87***	-1.77	1.17	-1.42	-1.90***	15.09***	-0.77	-0.77
	(3.11)	(-0.65)	(0.20)	(-0.27)	(-6.33)	(7.30)	(-0.16)	(-0.16)
Control Variables	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
N	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438
Adjusted R^2	0.2596	0.2565	0.2564	0.2573	0.2566	0.2579	0.2566	0.2566

Table 7: The Impact of Education Years and Number of Degrees on Underpricing

This table presents the effects of the number of education years and the number of degrees on underpricing using ordinary least squares (OLS) regressions. The sample consists of initial public offerings from 2000 to 2016 in the US stock market. T-statistics are included in the parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Appendix A.

	(1)	**(2)**
Education Years	0.08	
	(0.63)	
Number of Degrees		-0.35
		(-0.46)
Control Variables	Y	Y
Year & Industry FE	Y	Y
N	1,601	1,601
Adjusted R^2	0.2540	0.2515

Table 8: The Impact of Educational Field of Each Degree on Underpricing

This table displays the effects of the educational field of university qualifications held by CEOs on IPO first-day returns using ordinary least squares (OLS) regressions. The sample consists of initial public offerings from 2000 to 2016 in the US stock market. The dependent variable is IPO first-day returns, calculated as the percentage change from the first-day closing price to the offer price. Panel A presents the descriptive statistics of the major education field of master's and doctoral degrees. Panel B reports OLS regression results for master's and doctoral degrees. The number of observations of master's and doctoral degrees are 300 and 180, respectively. The percentage of the major of each degree is based on the above numbers of observations. Year and industry fixed effects are included but coefficient estimates are not reported. T-statistics are included in parentheses and are adjusted for heteroscedasticity-robust standard errors clustered by industry and year. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Appendix A.

Panel A: Descriptive Statistics

Major Degree	**MSc**		**PhD**	
	N	Percentage (%)	N	Percentage (%)
Engineering	177	59	52	29
Business	52	17	0	0
Pharmaceutical	18	6	38	21
Biosciences	0	0	53	29
Other	31	10	20	11

Panel B: Master and Doctoral Degrees

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	MSc in Engin.	MSc in Business	MSc in Pharmac.	MSc in Other	PhD in Engin.	PhD in Biosciences	PhD in Pharmac.
Degree	-0.48	-3.47	-7.25**	-2.45	5.87	4.50	-8.87***
	(-0.21)	(-1.26)	(-1.98)	(-1.45)	(1.14)	(1.50)	(-4.41)
Control Variables	Y	Y	Y	Y	Y	Y	Y
Year & Industry FE	Y	Y	Y	Y	Y	Y	Y
N	1,601	1,601	1,601	1,601	1.601	1.601	1,601
Adj. R^2	0.2515	0.2517	0.2518	0.2530	0.2520	0.2518	0.2524

Table 9: CEO Education Index-Factor Analysis

This table reports additional analysis by using factor loadings on the first three factors based on six characteristics for 1,601 observations in our sample from 2000 to 2016. Factor loadings are presented after a normalized orthogonal varimax rotation. Factor loadings with absolute values below 0.5 are not shown. The factors have been sorted by the percentage of variance they explain. Panel A presents the factor loadings, while Panel B reports results from OLS regressions of a three-factor CEO education index on IPO underpricing. T-statistics are included in parentheses and are adjusted for heteroscedasticity-robust standard errors clustered by industry and year. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. All variables are defined in Appendix A.

Panel A: Factor Loadings

	Factor 1:	Factor 2:	Factor 3:
	Master Education	Doctoral Education	Undergraduate Education
Undergraduate Degree			0.7500
Master Degree	0.5494		
Doctoral Degree		0.5344	
Quality of Education			
Undergraduate-TOP30			0.5952
Master-TOP30	0.5633		
Doctoral-TOP30		0.5597	
Model Statistics			
Eigenvalue	1.6494	1.4858	1.2400
%Variance explained	0.2749	0.2476	0.2067
Cumulative %variance explained	0.2749	0.5225	0.7292

Panel B: Three-factor CEO Education Index and IPO underpricing

	(1)	(2)	(3)	(4)
Undergraduate Degree	-2.26**			-2.40**
	(-2.41)			(-2.23)
Master Degree		-1.33**		-1.43*
		(-2.10)		(-1.76)
Doctoral Degree			-0.52	-0.50
			(-0.90)	(-1.22)
Control Variables	Y	Y	Y	Y
Industry & Year Fixed Effects	Y	Y	Y	Y
N	1,601	1,601	1,601	1,601
Adjusted R^2	0.2522	0.2520	0.2516	0.2528