

The Effects of Board of Directors' Education on Firms' Credit Ratings

Panagiota Papadimitri^a, Fotios Pasiouras^b, Menelaos Tasiou^a, and Alexia Ventouri^c

^a *Portsmouth Business School, University of Portsmouth, UK*

^b *Montpellier Business school, Montpellier, France*

^c *King's Business School, King's College London, UK*

ABSTRACT

Using a data set of 1,618 firms from 39 countries, we examine the influence of the educational attainment of a firm's board of directors on its credit rating. We construct a Leadership Education Index that reflects the educational level of the key members of the board. We document, after controlling for firm and country-specific characteristics, that firms in which the key members of the board have a higher educational level are more likely to receive better credit ratings. To ensure robustness in our results, we conduct a number of analyses and tests designed to alleviate endogeneity and correct for sample bias. Our findings highlight the importance of hiring and retaining well-educated board members that are capable to manage firms and obtain better credit ratings.

Keywords: Corporate governance · Leadership Index · Education · Credit Ratings.

✉ Menelaos Tasiou (menelaos.tasiou@port.ac.uk)

Richmond Building, Portland St., PO1 3DE, Portsmouth, UK. +44 (0) 2392 84 4002.

Panagiota Papadimitri (panagiota.papadimitri@port.ac.uk)

Fotios Pasiouras (f.pasiouras@montpellier-bs.com)

Alexia Ventouri (alexia.ventouri@kcl.ac.uk)

Acknowledgements: Montpellier Business School (MBS) is a founding member of the public research center Montpellier Research in Management, MRM (EA 4557, Univ. Montpellier). The authors would like to thank two anonymous reviewers that greatly helped us in improving the previous state of this manuscript. Thanks are also extended to participants at the Essex Finance Centre (EFiC) 2019 conference in Banking and Corporate Finance, and the 9th International Conference of the Financial Engineering and Banking Society (FEBS). Any remaining errors are our own.

Declarations of interest: *none.*

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

1 Introduction

Credit ratings can be thought of as a connecting tissue between borrowers and issuers, reducing information asymmetries in the financial system through an independent opinion of creditworthiness (Adelson, 2012). This puts a lot of pressure on credit rating agencies (CRAs), which have come under increased scrutiny since the early 2000s due to their failure to predict the collapse of WorldCom and Enron, as well as for their role in the financial crisis. Despite some reforms introduced in the US by the Dodd-Frank Act and new EU rules introduced between 2009 and 2013, various regulators and investors continue to rely significantly on credit ratings¹. The rated firms are also significantly influenced. Studies show that credit ratings have an impact on the spreads of syndicated loans (Drago and Gallo, 2018), cash holdings management (Joe and Oh, 2018), premiums paid in mergers and acquisitions (Jory et al., 2016), capital structure adjustments (Huang and Shen, 2015), and the cost of bond issuance (Mählmann, 2009). Therefore, understanding the factors that determine the assignment of specific ratings is of paramount importance.

While regulators and policy makers -such as the SEC and the European Commission- required the agencies to disclose more of their methodology, the ratings process still remains less than transparent. For instance, Standard & Poor's (S&P) mentions in its rating methodology that it combines the financial and the business risk profile to determine an anchor, which can then be modified by aspects like financial policy, diversification/portfolio effect, and management/governance. Regardless, the weights assigned to these factors as well as their specifics are not made available, whilst S&P also highlights that indicative outcomes are not meant to be precise indications or guarantees of future rating opinions.

The purpose of the present study is to examine whether educational characteristics of the directors of the board have an impact on their firms' credit ratings. Therefore, our work is related to the literature on the determinants of credit ratings. Early studies focus on the association between traditional accounting ratios and credit ratings (Horrigan, 1966; Kaplan and Urwitz, 1979; Blume et al., 1998). More recent studies examine other determinants like earnings management (Alissa et al., 2013; Cai et al., 2019), corporate social responsibility (Jiraporn et al., 2014), operating leases (Lim et al., 2017), environmental efficiency (Chabowski et al., 2019), the structure of the ratings industry (Jiang and Packer, 2019) and the introduction of the NRSRO status by the SEC (Behr and Sonnekalb, 2012). Finally, an increasing number of studies investigate the impact of managerial related attributes like corporate governance (Ashbaugh-Skaife et al., 2006; Ham and Koharki, 2016; Khatami et al., 2016) and managerial ability related to the efficiency in

¹The current EU legislative package on CRAs consists of Regulation No 462/2013 and Directive 2013/14/EU. The first set of rules, which entered into force at the end of 2009, established a regulatory framework for CRAs and introduced a regulatory oversight regime. Additionally, CRAs were required to avoid conflicts of interest, and to have sound rating methodologies and transparent rating activities. In 2011, these rules were amended to take into account the creation of the European Securities and Markets Authority (ESMA), while a further amendment was introduced in 2013.

generating revenues (Bonsall et al., 2016; Cornaggia et al., 2017; Bui et al., 2018)².

Despite the shift of the attention to non-financial and more qualitative factors, to our knowledge no study has focused on the impact of education on credit ratings and we attempt to close this gap in the literature³. Our approach is motivated by remarks in the S&P's credit rating methodology and the findings of the literature on managerial education. For example, S&P (2012a, 2012b) highlights that “the analysis of management and governance is one of the most qualitative aspects of our rating methodology” (p. 3) as well as that “exceptional management can improve a firm’s business risk and that translates into better credit strength over the long term and, conversely, that poor management can lead to weaker debt servicing capabilities” (p. 4). While the methodological note of S&P does not explicitly refer to education, there are various reasons for which education may be an important driving factor of exceptional management, lower business risk, and consequently higher ratings. For example, S&P refers to the ability to track, adjust and control execution of strategy or the management’s operational effectiveness. As we discuss in more detail in Section 2, the literature suggests that education serves as a form of human capital that signals various characteristics of the managers (cognitive ability, problem solving capability, etc.), which are subsequently being reflected in various firm outcomes like strategic decisions, competitive movements and performance.

Therefore, on the one hand firms whose directors pose certain educational characteristics could enjoy more favourable credit ratings compared to their peers, *ceteris paribus*. On the other

²These three studies use a measure of managerial ability that was initially proposed by Demerjian et al. (2012). This index is based on data envelopment analysis (DEA) which provides an estimate of how efficiently managers use their firms’ inputs to generate revenues. There is no doubt that Demerjian et al. (2012) present an interesting and innovative exercise. However, there are also various reasons for which this index of managerial ability may not be relevant to the cognitive ability and other characteristics that are being mentioned in the literature on human capital, managerial education and abilities, that we outline in Section 2. For example, as discussed in Bui et al. (2018, p.187), “Demerjian et al. (2012) calculate a managerial ability score by the residual in a Tobit regression that uses seven observable firm characteristics to explain firm efficiency obtained from the data envelopment analysis. Intuitively, this score captures how efficiently managers can convert firm inputs into sales revenues relative to the firm’s industry competitors. High-ability managers are able to generate greater revenue from a given set of inputs. However, the residual from the Tobit regression contains not only information regarding managerial ability but also other noisy drivers of firm efficiency. As a result, a high managerial ability score in a single year may reflect luck instead of true ability”. Furthermore, the first stage analysis in Demerjian et al. (2012) continues to constitute an assessment of firm production efficiency, that is subject to certain shortcomings of the use of DEA. First, the results of DEA are influenced by the definition of the peer group and are sample specific. As discussed in Coelli et al. (2005), the efficiency scores obtained from DEA are only relative to the best firms in the sample, and the inclusion of extra firms may reduce efficiency scores. Second, DEA estimates are influenced by environmental factors that are difficult to control. Coelli et al. (2005, p.207) highlight that “not accounting for environmental differences may give misleading indications of relative managerial competence”. Third, the selection of inputs and outputs plays a very important role in DEA. For example, Coelli et al. (2005) mention that: (i) the exclusion of an important input or output can result in biased results, (ii) treating inputs and/or outputs as homogenous commodities when they are heterogenous may bias results, and (iii) standard DEA does not account for multi-period optimization nor risk in management decision making. In relation to these points, it should be mentioned that Demerjian et al. (2012) do not consider inputs that could capture risk-preferences. However, the literature suggests that if risk preferences differ, efficiency rankings obtained under the traditional assumption might be misleading (Koetter, 2008).

³Khatami et al. (2016) consider education as a control variable in their study of credit ratings. However, they are mostly interested in educational connections between directors and top executives of the credit rating agency and those of the US issuing firms. Therefore, their focus is on whether two people attended the same education institution (e.g. University) at the same time. While in one of their specifications they also control for the fraction of board members that have an MBA, MSc or PhD qualification, the present study has a different focus, and provides an in-depth analysis of the role of educational attainment on credit ratings.

hand, this might not be the case as education might be reflected in measurable firm financial fundamentals, and therefore not be considered independently by the credit rating agencies. Having said that, to the extent that higher education can be associated with higher cognitive ability and better decision-making, one could argue further that education is also associated with expectations for the future that are not adequately captured in past financial performance.

To test the hypothesis that the education of directors influences firm credit ratings, we first construct a Leadership Education Index that reflects the educational attainment of the key members of the board. The results provide robust evidence that firms in which the key members of the board have higher educational attainment are more likely to receive better credit ratings. This effect holds when we control for various firm-level financial and corporate governance characteristics and macroeconomic features, as well as different specifications and tests designed to alleviate different forms of endogeneity.

The remaining of the paper is structured as follows. Section 2 provides a more detailed background discussion. Section 3 describes our sample, data sources and variable measurements and provides descriptive statistics. Section 4 presents the empirical model used to investigate the impact of education on firms' credit ratings, along with the main results and additional analyses for robustness purposes. Section 5 concludes this study and presents its limitations and future research avenues.

2 Background discussion

Numerous reports by S&P (2012b, 2013, 2018) outline that a corporate credit rating is the combination of two opinions, referring to: (i) the business risk profile, and (ii) the financial risk profile. The first accounts for the risk and return potential of a company in the markets (industry and country) in which it operates, and the competitive advantages and disadvantages of the firm. The financial risk profile is the outcome of decisions that management makes in the context of its business risk profile and its financial risk tolerances, and it includes decisions about the manner in which management seeks funding for the company and how it constructs its balance sheet. The combination of the two profiles results in the firm's anchor which is then being modified by additional factors like capital structure, financial policy, liquidity, management and governance. Within this context, S&P (2012a) outlines that, the assessment of management and governance credit factors supplement the standard metrics credit analysis (i.e. leverage, etc.) by providing a framework that accounts for the capabilities, intentions, and tendencies of executive management and board of directors.⁴ S&P (2012b) also points out that the management and governance

⁴S&P (2012b, p.4) distinguishes between management and governance credit factors, outlining that "Separating out and distinguishing between management governance credit factors – but also considering them together – reflects the fact that management and the board have joint, but distinct, responsibilities for setting strategic direction, establishing and maintaining a competitive position for the enterprise, ensuring the timely development of products or services to retain business momentum, and navigating the risk that invariably accompany entrepreneurial activity [...] Overall, these criteria recognize that exceptional management can improve a firm's business risk and that translates into better credit strength over the long term, and conversely, that poor management can lead to weaker debt servicing capabilities. Governance is different. Defective governance attributes are closely linked to credit weakness, but strong governance practices do not translate is not a credit enhancement".

attributes generally affect the business risk profile of an enterprise. Therefore, it seems that management plays a role in the credit rating framework as it shapes several decisions but because it can also modify the initial view of the S&P rating committee as for the overall creditworthiness of the firm (S&P (2012b)).

At this point one may question: “why should education relate to credit ratings”? As we illustrate in Figure 1 and the discussion that follows, the literature suggests that education relates to many managerial characteristics like the ones mentioned above, which subsequently shape firm outcomes (e.g. strategy, competitive advantage, responses to environment challenges, past and future financial performance) that are being considered by S&P in assigning firm ratings. Before discussing the specific managerial characteristics and the credit rating criteria, we should also highlight that the main purpose of the corporate ratings is to provide an assessment of the likelihood to default within a given time period in the future (e.g. one year). The findings of Brüderl et al. (1992) might be of relevance here. While they refer to founders instead of executive directors, and new firms instead of well-established ones, they provide evidence that education (general and occupational training) is one of the most important determinants of firm survival.

[Insert Figure 1 Around Here]

Our work relates to the upper echelons theory, which states that organizational outcomes - strategic choices and performance levels - are partially predicted by background characteristics of the top executives, like education and age (Hambrick and Mason, 1984).⁵ Further, education has also been described as a traditional and reasonable measure of human capital (Brüderl et al., 1992; Barro and Lee, 2013), widely used as such in management studies. The underlying idea is that education reflects not only the information learned, but also the intellectual competence of an individual (Becker, 1994). Consequently, as discussed in Khanna et al (2014), what makes a bachelor’s degree more valuable than a high school diploma is not only the specific information learned during the program but also the fact that it can be seen as a proxy of the individual’s level of intelligence. Within the same context, Wiersema and Bantel (1992) point to various studies arguing that high levels of education result in: (i) high capacity for information processing and ability to discriminate among a variety of stimuli (Schroder et al., 1967), (ii) boundary spanning, toleration of ambiguity, and demonstration of an ability for integrative complexity (Dollinger, 1984), (iii) receptivity to innovation (Becker, 1970; Kimberly and Evanisko,

⁵In general, top level managers are being hired because of some distinguishing characteristics. As discussed in Bhagat et al. (2010) these can be observed observable and quantifiable characteristics (e.g. education and experience) and unobserved and possibly non-quantifiable characteristics (e.g. leadership and team building skills). Therefore, as discussed in Bantel and Jackson (1989), when examining the relationship between firm leaders’ personal characteristics and organizational outcomes one may follow two different approaches. The first approach is to directly assess the psychological attributes of decision-makers and examine their relationship to outcomes. The second approach is to assess demographic characteristics (e.g. age and education), under the assumption that such characteristics are related to cognitive abilities, attitudes, and expertise. Bantel and Jackson (1989) argue that when top management teams are the unit of analysis the demographic approach has the advantage of being more practical than the direct assessment approach. Along the same lines, Hambrick and Mason (1984) mention that: (i) the cognitive bases, values, and perceptions of upper level managers are not convenient to measure or even amenable to direct measurement, since it will be difficult to find a sufficient number of top executives being willing to participate in psychological batteries, and (ii) an emphasis on background characteristics, rather than on psychological dimensions, seems essential from an upper echelons perspective.

1981; Rogers and Shoemaker, 1971). Bantel and Jackson (1989) also mention that higher levels of education should be associated with a team's ability to generate and implement creative solutions to complex problems. Finally, education may influence financial decisions like leverage. For example, Frank and Goyal (2007) find that firms of CEOs with an MBA degree or a law degree tend to have greater leverage.

At this point, one could also distinguish between managerial behavior and achievements in terms of: (i) existing financial results and (ii) anticipation of future actions and outcomes. Education may impact both of them. For example, Hambrick et al. (1996) show that the average education level of top management team members has a positive impact on market share growth and growth in profits. Similarly, Cheng et al. (2010) show that the university degree held by the board chairman is positively associated with several measures of performance in the case of Chinese firms. Having said that, one may convincingly argue that the impact of education on past performance has been already captured in the financial ratios that are taken into account by S&P while assessing the financial risk dimension. Even if this is the case, one could still argue that education serves primarily as a proxy for the human capital of the team of executive directors, that will help in anticipating the reaction of the firm to challenges of the environment, competitive pressures, strategic changes, and subsequently future financial performance.

For example, S&P (2012b) highlights the importance of corporate strategy as part of the management component, mentioning that "We believe that firms with well-reasoned, well-resourced, and well-executed business plans are more likely to achieve a long-term competitive advantage that underpins sustainable credit strength – and that starts with having a plan in first place"⁶ Interestingly, the literature offers various insights that relate to both competitive moves and firm strategy. For example, Hambrick et al. (1996) provide evidence of a significant association between the average education level of top management team members and the firm's competitive actions and responses. Additionally, Wiersema and Bantel (1992) show that top managers with a higher education level are more likely to implement significant changes in corporate strategy. Moreover, Bertrand and Schoar (2003) conclude that managers holding an MBA degree seem to follow more aggressive strategies. Ding (2011) concludes that the founders' educational background can mitigate the constraint of organizational environments on strategy.

Further to the above, diversification appears to be another aspect that is of interest to S&P. To the extent that the ratings are forward looking, studies that relate education to diversification decisions may offer additional insights at this point. For example, Herrmann and Datta (2005) report a significant positive association between the average education level of the top management team and the level of international diversification. Most importantly, Hsu et al. (2013) find that the educational level of the CEO has a positive moderating impact on the relationship between internationalization and firm performance. They offer a potential explanation that higher education makes CEOs more confident and better equipped to effectively handle the complex problems associated with international operations, subsequently improving the firm's internationalization

⁶Criteria that are being considered in relation to the strategic positioning are: (i) strategic planning process, (ii) consistency of strategy with organizational capabilities and market place conditions, (iii) ability to track, adjust and control execution of strategy (Standard and Poor's, 2012a, p. 17).

performance.

On the basis of the above discussion, we hypothesize that:

A higher level of average education of the top executives will be associated with more favourable credit ratings.

3 Data and variables

3.1 Sample and data sources

To construct our data set, we use information from various sources. Data on credit ratings and educational characteristics are obtained from Capital IQ. For firm credit ratings, we use the Standard and Poor's (S&P) long-term issuer credit ratings. These ratings range from D/SD to AAA, and they reflect the S&P's assessment of an issuer's creditworthiness to respect its senior debt obligations. We collect information on the types of degrees held (Bachelor, Master, MBA, PhD), the major discipline of study (Business-Economics, Engineering or other) and the perceived quality of the educational institutions (Ivy League and THE-listed Universities) for each board member of interest. Data on firm-specific characteristics are also collected from Capital IQ, whereas data on the macroeconomic fundamentals and sovereign ratings are obtained from the World Bank, IMF and S&P respectively.

Our sample includes 1,618 firms operating in 39 countries.⁷ As it stands at the time of writing the paper, Capital IQ provides information for the current board composition⁸, absent, however, of the year in which each member joined the board. Thus, our analysis is restricted accordingly to the coverage of two points in time in which we collected data for our analysis, those being March 2018 and March 2019. The credit ratings that were available at these points in time correspond to end of 2017 and end of 2018, respectively. In that case, information for the financial statements and the board characteristics correspond to the preceding fiscal year (i.e. 2016 and 2017, respectively). We exclude financial firms, with the remaining ones operating in various sectors, namely: (i) energy, (ii) health, (iii) industrials, (iv) information technology, (v) staples, (vi) telecommunications, and (vii) utilities.

Table 1 summarizes the descriptive statistics for the response and explanatory variables used in our baseline model (Panel A) and the additional variables used to control for further firm and country-related characteristics (Panel B).

⁷The majority of our firms (approx. 70%) are US-based. The distribution of the remaining countries is as follows: Canada and the UK each about 4%; China and France each about 2%; Sweden, Ireland, Switzerland, Brazil, Luxembourg, Indonesia, Australia and Mexico ranging between 0.8 and 1.4%; Japan, Singapore, Spain, India, Italy, Netherlands and South Africa ranging between 0.6 and 0.7%; Denmark, Finland, Belgium, Thailand, Kazakhstan, Israel, Malaysia and Norway ranging between 0.2 and 0.4%; and Peru, Chile, Cyprus, Germany, Panama, Portugal, Qatar, UAE, Czech Republic, Lithuania and Mongolia equally participating with about 0.12%.

⁸When it comes to the education of the board, we only collected data for firms that had available information for all three key board members (two in the case that the CEO has also a chairing role). There were few cases where, for a given individual, only the highest degree was reported, e.g. a Master's or an MBA, and not the prior qualifications succeeded before obtaining that degree. For those individuals, we assume that they are also in possession of a Bachelor's degree.

[Insert Table 1 about here]

3.2 Educational variables

A core variable of interest in our study is the *Leadership Education Index* that reflects the educational level of the key members of the board. We mainly focus on this metric for two key reasons. First and foremost, as a synthetic index, it is a popular way to evaluate an aspect of interest -hereby, the board of directors' educational attainment- attaching a score to it that summarizes a multi-dimensional aspect into a single number (see, e.g. Saisana et al., 2005, p.307). Second, its methodological assumption (i.e. that implicitly assumed using the arithmetic average as an aggregation technique) allows for perfect compensation among attributes (OECD, 2008), which in this case implies that any educational shortcoming of a member of the board could be equally offset by one of the others. To construct it, we focus on the *Chair of the board* (CHAIR), the *Chief Executive Officer* (CEO), and the *Chief Financial Officer* (CFO). There are two reasons for this. First, we consider them as the three key members that influence the entire strategy of the firm, whereas the CFO is also in charge of the financial matters that are of particular interest to the present study. Second, there is a trade-off between the number of directors that are taken into account in the index and the number of firms to be included in the sample. In particular, to construct the index, we need detailed information on all board members that we consider. Therefore, expanding the coverage to, say, all the directors of the board, imposes significant restrictions and considerably reduces the number of firms that meet this requirement. The index takes positive values, with larger figures denoting greater educational attainment across the board and vice versa. It is essentially a non-weighted arithmetic average⁹, constructed for every firm, i , in our sample as follows:

$$\text{Leadership Education Index}_i = \begin{cases} \frac{\text{Chair Score}_i + \text{CEO Score}_i + \text{CFO Score}_i}{3} & \text{iff CEO Duality}_i = 0 \\ \frac{\text{CEO Score}_i + \text{CFO Score}_i}{2} & \text{iff CEO Duality}_i = 1 \end{cases} \quad (3.2.1)$$

where a Chair/CEO/CFO's score is a weighted additive function of her/his degrees, such as:

$$\text{Score} = \text{Bachelor} + 2 \times \text{Master} + 2 \times \text{MBA} + 3 \times \text{PhD}, \quad (3.2.2)$$

where 'Bachelor', 'Master', 'MBA' and 'PhD' being dummy variables taking the value '1' if a member possesses this degree, and '0' otherwise.

Hambrick and Mason (1984) propose that the 'amount', but not the 'type', of formal education of a management team will be positively associated with innovation. Along these lines, Datta and Guthrie (1994) focus on the education level of the CEO captured by the highest degree earned.

⁹Although such specifications of a non-weighted arithmetic average to construct composite indicators has encountered criticism in the past, as to the chosen weight vector, or the type of aggregation; it is seemingly the most commonly used one across constructed composite indicators (OECD, 2008). The reason being the simplicity of the additive utility function, combined with the equal weighting that is usually justified on the basis of a lack of theoretical/statistical framework to suggest otherwise (see Greco et al., 2019, for a comprehensive literature review of the methodological framework of composite indicators). Nonetheless, as far as the type of aggregation is concerned, we also made use of a geometric function to reduce the compensation among attributes (OECD, 2008), essentially finding no difference whatsoever.

Wally and Baum (1994), define formal education as the number of years of formal education beyond high school. Similarly, Hambrick et al. (1996) capture the average educational level of the top management team by the mean number of years of higher education. Hitt and Tyler (1991) and Kong and Zhang (2010) measure the amount of education with a five-point scale ranging from high school to a PhD. Along the same lines, the educational level of top management team members in Herrmann and Datta (2005) is measured on a seven-point scale based on the highest degree earned (1=high school, 2=some college, 3 = undergraduate degree, 4=some graduate school, 5 = master’s degree, 6 = attended doctoral programme, and 7 = doctorate). Some scholars use additional characteristics of education like the major area and specialization of the degree (e.g. MBA vs other degrees) and the reputation of the institution. However, these enter the analysis as separate variables rather than in a composite index.¹⁰ We follow a similar approach for the construction of our main index of education. In subsequent analysis, we use additional variables that account for the type of the degree and the reputation of the awarding institution. Furthermore, we construct an additional index that considers simultaneously for the average level of education and the reputation of the university.¹¹

In the reported results, the weight of each qualification is given, as seen in eq.(3.2.2) by an increasing constant to distinguish among levels of educational attainment¹² (i.e. undergraduate, postgraduate and doctoral studies). While we hereby choose an increasing constant of +1 for each level of studies to reflect their stepwise difference (i.e. undergraduate = 1, postgraduate = 2, doctoral = 3), one could reasonably argue that these weights are arbitrarily chosen, reflecting a subjective judgment. To lessen such concerns, we examine the robustness of the results with: (i) alternative increasing constants (e.g. +0.5, +1.5, +5 etc.) to differentiate among the levels of higher education, and (ii) no constant at all (i.e. equating all levels, thus the score function converges to a pure, non-weighted, additive function). We also explore additional weighting schemes in further analysis in section 3.2.1.

In Table 2, we provide summary statistics for the educational variables (on an individual basis) used to compute the Leadership Education Index. The upper table shows the percentage (%) of our sample (firm-year observations) according to which a member of the board (CEO/CFO/Chair) has

¹⁰For example, in addition to the variable for the level of education, Hitt and Tyler (1991) also introduce a set of dummy variables to capture the major area of the college degree (e.g. accounting, engineering, liberal arts, etc.). Slate and Dixon-Flower (2010) also use separate variables to account for: (i) the level of educational attainment ranging from 0 (no college degree) to 3 (PhD), (ii) MBA holders, (iii) rankings of the MBA program.

¹¹There is one more reason for which we avoid taking the reputation of the university into account in the calculation of the main educational index. The results in the literature mixed. On the one hand, the conventional wisdom implies that a degree from a more selective institution may signal that the managers have stronger cognitive abilities and higher quality education. King et al. (2016) offer empirical support to this argument, concluding that CEOs who graduate from top-20 US universities achieve superior bank performance. On the other hand, there are also studies who fail to support this argument. For example, the empirical results of Gottesman and Morey (2010) reveal that that firms run by CEOs from more selective schools do not outperform firms run by CEOs from less selective schools, in terms of financial performance measured by Tobin’s Q. Slate and Dixon-Flower (2010) also find that the ranking of the MBA program attended by the CEO had no effect on corporate environmental performance.

¹²For example, a director with a bachelor and an MSc would be assigned a score of 3. The same score would be assigned to a director with a bachelor and an MBA. Similarly, a director with a bachelor and both an MSc and an MBA degree would be assigned a score of 5. A director with a bachelor, an MSc (or an MBA) and a PhD would be assigned a score of 6, and so on.

obtained a Bachelor’s/Master’s/MBA/PhD degree from a(n) (IVY/THE-listed) University. Looking across the sample, almost all CEOs hold a Bachelor’s degree (99.83%), with this proportion slightly decreasing when it comes to the Chairs (96.25%) or the CFOs (93.61%). Yet, a proportionally higher percentage of Chairs holds a THE/IVY-listed Bachelor’s than CEOs (whilst CFOs come last). Moreover, more CEOs are observed to hold MBA degrees than Chairs. On the contrary, the latter are proportionally more when it comes to holding a Master’s or a PhD degree.

The above can be further disentangled through tabulating the sample between CEOs/Chairs and CFOs among being holders and non-holders of a(n) (IVY/THE-listed) University degree. This is reported on the lower part of Table 2 that contains 8 tabulations (2 individuals’ tabulations for four degrees), each summing to 100%. For brevity, we only report the IVY-listed Universities. Each tabulation shows the percentage of our sample in which a member is observed (not) having a degree in conjunction with the condition that another member does (not). Seemingly, both CEOs and Chairmen, compared to CFOs are observed to be more likely to hold any kind of IVY degree in our sample. Comparing the CEO and Chair (excluding the 35% of sample-year observations for which the CEO also chairs the board), the Chairman is always more likely to have a degree obtained from an IVY-listed University no matter the type of the degree.

[Insert Table 2 Around Here]

3.3 Control variables - Firm specific and macroeconomic characteristics

Following earlier studies (e.g. Kaplan and Urwitz, 1979; Ashbaugh-Skaife et al., 2006; Lim et al., 2017; Lin and Shen, 2015), in order to control for firm-specific financial attributes we include: (i) return on assets (hereafter ‘ROA’) as a measure of firm profitability, (ii) the ratio of loans to total assets (hereafter ‘Debt ratio’) as an indicator of leverage, (iii) the natural logarithm of total revenues in \$USDmm (hereafter ‘Revenues’) as an indicator of firm size, and (iv) the quick ratio as a measure of short-term liquidity. We also include a dummy variable to account for the average differences between firms listed in the Stock Exchange market (hereafter ‘Listed in SE’) and private ones. Additionally, in further analysis we consider several board demographics accounting for: (i) CEO duality, a dummy variable taking ‘1’ if the CEO also chairs the board; (ii) board members’ age¹³; (iii) the natural logarithm of the size of the board; (iv) board independence, as proxied by the percentage of independent directors. These are further discussed in Section 4.1.

Finally, we include several macroeconomic variables to account for potential forms of heterogeneity across the countries in which the firms operate. We therefore include: (i) GDP growth (%); (ii) inflation (%); and (iii) sovereign S&P ratings. The data sources and all the variables are described in Table A.1 (see Appendix). Table A.2 further presents the correlation matrices for all variables.

¹³In the holistic approach that we examine Education with the Leadership Index, we use board members’ average age for consistency reasons with the constructed aggregate measure.

4 Empirical model and results

4.1 Ordered logit results

To examine the impact of directors' educational characteristics on credit rating assignment, we derive a model that represents credit ratings as a function of educational characteristics, firm-specific and macroeconomic variables. In its general form the model is as follows:

$$\text{Credit Rating} = f(\text{Education, Firm, Macro}). \quad (4.1.1)$$

Following empirical precedent, we estimate the model using ordered logistic regression (see e.g. Ashbaugh-Skaife et al., 2006). The response variable, S&P's long-term issuer credit rating, is coded in a 22-point scale with numeric values corresponding to the S&P's notch-scale ratings, increasing in credit quality (decreasing in credit risk): D/SD = 1, C = 2, CC = 3, CCC- = 4, CCC = 5, CCC+ = 6, B- = 7, B = 8, B+ = 9, BB- = 10, BB = 11, BB+ = 12, BBB- = 13, BBB = 14, BBB+ = 15, A- = 16, A = 17, A+ = 18, AA- = 19, AA = 20, AA+ = 21, and AAA = 22.

Column (1) in Table 3 shows the results of the baseline model. In all cases, the reported figures correspond to the proportional odds ratios¹⁴.

[Insert Table 3 Around Here]

In column (1), we investigate the impact of the overall education index of the leadership team while controlling for basic firm attributes, the macroeconomic environment, and sovereign ratings. The leadership's education index appears to have a positive and statistically significant impact on firm ratings at the 1% level. More detailed, for a one unit increase in the leadership index score, the odds of obtaining a AAA rating versus the ratings of all the other categories combined are 1.092 times greater, given the other variables are held constant in the model. Similarly, for a one unit increase in the leadership index score, the odds of the combined CC to AAA groups versus the D group are 1.092 times greater, given the other variables are held constant.

To put this into context, one may see that our index takes values between 0 and 6 in our sample (see Table 1). This means that -in our sample- comparing a firm with a fully uneducated board (where index equals zero) and a firm with a fully educated one (index equals six); the latter firm's odds of obtaining a AAA rating versus all other ratings combined is 6.552 times (1.092×6) higher than the former firm. Moreover, and as composite indicators can be fairly considered black boxes that need further analysis in their decomposition; as we described in the previous paragraph, a unit increase in the composite index increases the odds of the top tier category (AAA) versus all the other categories combined by 1.092. This unit increase could be, e.g., a single member obtaining a PhD degree in a three-member board (3 points divided by 3 members equals 1), or one member obtaining a postgraduate degree, and another obtaining an undergraduate degree.

¹⁴Using the proportional odds ratio, we compare the firms in credit rating groups greater than k versus those in groups less than or equal to k , where k is the level of the response variable. The reported figures show that, for a unit change in the predictor variable, the odds for cases in a group that is greater than k versus less than or equal to k are the proportional odds times larger. Instead of log-odds, coefficients are reported as odds ratios (i.e. e^β), and reported standard errors are calculated using the delta method (i.e. $\beta \times \text{Std.Error}$).

Of course the list of examples could go on, but the storytelling is the same. That is, firms whose CEOs, CFOs and Chairs have an overall higher educational attainment are more likely to receive better credit ratings. In principle this could be related to various abilities of educated directors like advanced knowledge (Carpena et al., 2017), greater cognitive abilities and attitudes towards innovation (Iren and Tee, 2018); implementation of new solutions to complicated problems (Bantel and Jackson, 1989); reduction of portfolio riskiness (Berger et al., 2014); achievement of successful performance outcomes (Gottesman and Morey, 2006; Kauko, 2009; King et al., 2016); and organizational strategies of new ventures (Ding, 2011).

S&P mentions that country level institutional, governance, and rule of law risk are incorporated in the country risk, and these factors influence the credit risk for every corporate entity. While our regressions already control for the S&P sovereign rating, in column (2) we also include an overall indicator of formal institutions (WGI) that captures the following six elements: (i) Voice and Accountability, (ii) Political Stability and Absence of Violence, (iii) Government Effectiveness, (iv) Regulatory Quality, (v) Rule of Law, (vi) Control of Corruption. Using a similar indicator, Mihet (2013) finds robust evidence that the better the country's formal institutions, the more risk-seeking the firms in that country will be. We find that institutions do not influence firm credit rating, and the main results hold. The insignificance of WGI is possibly due to its correlation with other variables, such as inflation ($\rho = -0.308$) and GDP growth ($\rho = -0.456$). For example, when we exclude these variables from the model, WGI is positive and statistically significant at the 1% level. This does not influence our main results. We should also note that Sovereign S&P ratings have been excluded from this model due to a very high correlation with WGI ($\rho = 0.789$).

A recent report by the International Finance Corporation (2012) asserts that credit reporting service providers can reduce information asymmetry, leading to reduced default rates, lower average interest rates, enhanced competition in the credit market, and ultimately increased access to credit. Existing evidence from Albania suggests that information sharing by means of a credit registry does not affect access to or cost of credit, but improves loan performance (Behr and Sonnekalb, 2012). Similarly, using U.S. data, Doblas-Madrid and Minetti (2013) conclude that information sharing through a credit bureau reduces contract delinquencies and defaults. Along the same lines, cross-country evidence from Argentina, Brazil and Mexico by Majnoni et al. (2004) suggests that public credit registries may improve credit access for borrowers for the same level of bank risk or reduce bank risk from the same level of credit assess. Therefore, it is possible that such country conditions could influence the firm credit ratings as well. To account for this we use an index of depth of credit information, which measures rules and practices affecting the coverage, scope and accessibility of credit information available through either a credit bureau or a credit registry. We find that the depth of credit information is positively associated with firm ratings at the 1% level (Column 3), and the leadership's education index continues to enter our specification with a statistically significant coefficient at the 1% level. In Column (4) we include the extent of shareholders' rights index. Mihet (2013) finds a positive association between the shareholders' rights index and firm standard deviation of return on assets. We find that the ex-

tent of shareholders' rights does not impact credit rights and its inclusion in the specifications does not alter our key findings.

Ashbaugh-Skaife et al. (2006) illustrate that firms with better corporate governance quality are more likely to receive higher credit ratings. Therefore, in column (5) we control for corporate governance characteristics. First, following previous studies (e.g. Core et al., 1999; Ashbaugh-Skaife et al., 2006; Nguyen et al., 2015), we include a dummy variable (hereafter 'CEO duality') that takes the value of 1, if the CEO holds a Chair position and the value of 0, otherwise. CEO duality is of paramount importance when it comes to the level of independence among a firm's board and its management; as well as the level of "freedom" that the CEO may enjoy in the case where (s)he chairs the Board. Core et al. (1999) comment that shareholder activists urge for separation among CEO and Board Chairman roles and refer to prior evidence that reveals a positive relationship between CEO duality and agency problems (Yermack, 1996). Additionally, we control for the average age of the three directors. Wiersema and Bantel (1992) discuss various reasons for which age may be an important board attribute. For example, they mention that younger executives tend to take more risks, and it is more likely to promote changes in corporate strategy. Additionally, we include the size of the board, measured by the natural logarithm of the total number of individuals on a firm's board (Core et al., 1999; Nguyen et al., 2015). On the one hand, from a resource dependence theory perspective (Pfeffer, 1972; Zald, 1969) larger boards can provide additional networking and better access to resources (Kiel and Nicholson, 2003) that should be useful in maximising firm's value. In turn, this could translate into better credit ratings. On the other hand, there is possibly an upper limit to the size of the board of directors, as coordination, communication and decision-making problems are known to impede company performance when the number of directors increases beyond a point (Yermack, 1996). We also control for board independence by including the percentage of independent directors. On the one hand, higher percentage of independent directors could be associated with more effective oversight of management (Bhojraj and Sengupta, 2003), enhanced value-added growth, innovation and strong governance (Kang et al., 2018). Yet, one could also challenge this view. For example, inside directors may enhance firm value in the case of R&D-intensive firms, for which the firm-specific knowledge is relatively important (Coles et al., 2008). In regard to its impact on credit rating assignment, existing empirical evidence appears to support the former view, concluding that independent directors is associated with higher ratings (Bhojraj and Sengupta, 2003; Ashbaugh-Skaife et al., 2006). We find that all the corporate governance characteristics enter the regression with a positive and statistically significant coefficient. The coefficient of the Leadership Education Index remains positive and significant (at the 0.05 level) and our inferences are unchanged. Therefore, the results imply that credit rating analysts look beyond corporate governance characteristics and analyse the educational attainments of the directors.

Finally, in column (6) we simultaneously control for all previous attributes (columns 1 to 5). Due to a high correlation between the WGI and the Extent of Shareholders' Rights index, the

latter is omitted¹⁵. The Leadership Education Index remains significant at the 5% level, with an odds ratio denoting that for every unit increase in the index, the odds of obtaining an AAA rating versus the ratings of all other categories combined are 1.086 times greater, other things held constant.

4.2 Additional analyses

4.2.1 Further analysis: Altering the sample, credit groups and the estimation technique of the Education Index

Following Ashbaugh-Skaife et al. (2006), we re-estimate our baseline model by merging the twenty-two categories into seven major groups according to Table 4. The results in Table 5 show that our findings are robust to this alternative classification of the firms.

[Insert Tables 4 and 5 Around Here]

Furthermore, to make sure that the results are not driven by a single industry, we estimate our regressions in the following way. We estimate each set of regressions excluding a single or pairs of industries one at a time, eventually finding no difference whatsoever. In Table 6 we present the results using our baseline model.

[Insert Table 6 Around Here]

In addition to the above, re-estimating all results with the addition of country or regional fixed effects yields qualitatively similar results. Moreover, as mentioned in Section 3.1 (see footnote 7), the majority of our firms (just under 70%) is US-based, with the remaining third of the sample drawing firms from 38 other global economies. By splitting the sample into US and non-US-based firms we find again qualitatively similar results to the ones discussed up to this point. We do not report them to conserve space, but they are available upon request.

A question that could naturally arise at this point, regards the estimation technique of our index and particularly the weights that are assigned to both the individual members' scores and their overall, aggregate educational attainment score. As we argued in section 3.2, where we presented the intuition of the composite index, we originally assigned a set of integer weights, increasing as a function of the educational level (e.g. Bachelor=1, Master/MBA=2, PhD=3). Although we found no different results by altering these weights (see section 3.2 footnote 9 for more details on the alternative specification regarding the weights and aggregation), one may argue that these are arbitrarily assigned and, as such, present a biased estimator of the board members' educational attainment. Of course, the same applies to the (equal) weights assigned when these were aggregated into an overall Leadership Education Index. Our intuition at the time of construction was that a perfect trade-off among the Board Members should exist (see section

¹⁵In separate regressions the WGI is omitted instead, finding no difference as to the statistical significance of the remaining covariates.

3.2). Nonetheless, to test the robustness of this index we re-compute it based on alternative estimation techniques. In particular, we use a ‘data-driven’¹⁶ approach to assign weights for both stages of the Leadership Education Index (see eq. 3.2.1 and 3.2.2). We do so using Factor Analysis (FA), similar to the study of King et al. (2016). In particular, FA is used in two stages¹⁷. In the first, FA is applied to each board member individually, constructing the individual “scores” as in eq. (3.2.2). Then FA is applied on these latent factors, creating the final ‘Leadership Education Index’. A comprehensive analysis of this procedure in the construction of composite indicators using FA is given in Nicoletti et al. (2000, p.22). In brief, we use the information obtained from retained factors after they are rotated (using ‘varimax’ rotation), each weighted by its explained variance. This permits us to obtain a set of weights for each degree of each member (i.e. individual educational attainment; in the first stage), and a set of weights for their aggregation into an overall Leadership Education Index (in the second stage). The obtained set of weights from this procedure is given in Table 7 and the results in Table 8. Seemingly, results hold for this specification, with the educational index being statistically significant for all model variants at the 1% level of significance.

[Insert Tables 7 and 8 Around Here]

Further to the above, King et al. (2016) suggest that, theoretically, not only the level of education counts, but perhaps also the quality. In particular, examining the impact of CEOs’s education on bank performance, they find that the level and quality of education plays a role in US banks’ performance. Notably, and contrary to the authors’ results, when we take into account quality in our composite index, we find that it does not play a role for credit ratings. In particular, we test this in three ways. First, via constructing a composite index that takes into account both level and quality via means of an added ‘bonus’ (e.g. another +0.5 score on top of the regular weight when a degree is obtained via an IVY or a Top-20 THE University). Second, we construct a composite index that only takes into account quality degrees in the first place. Third, similar to King et al. (2016), we use Factor Analysis for endogenously calculated weights taking into account not only the level dummies (undergraduate/postgraduate/doctoral), but also quality (undergraduate/postgraduate/doctoral from IVY/THE).

The difference between our results and those of King et al. (2016) could be attributed to a number of reasons. First, the nature of our sample is radically different. The authors focus on a single and homogeneous industry -banking- in a single and homogeneous market -the US. Moreover, the authors have a larger sample (1992-2011) in which, perhaps, there is large variation in ‘quality’ education, contrary to our smaller and most recent sample, as well as that the list of what is considered a quality institution (at least in terms of the THE proxy) may have changed

¹⁶A definition is given in (Decancq and Lugo, 2013, p.19): “Data-driven approaches let the data ‘speak for themselves’ and depend solely on the distribution matrix X . Data-driven weights are not based on any explicit value judgment about how the trade-offs between the dimensions should be”. Data-driven approaches are particularly used in the domain of composite indicators as an alternative to the subjective/arbitrary weight selection of the indicators (see Greco et al., 2019, section 2.3 for a comprehensive review of the literature).

¹⁷The purpose of this is purely to resemble the current way of construction. Even if FA is applied in one stage, results do not alter as to their significance.

in two decades' time. Last, but not least, our response variable is something that is subjectively determined by a ratings agency -in a sort of a 'black box' framework- instead of something objective and simple to observe, such as performance or any other financial fundamental. Regardless, in an attempt to shed further light on this, we also estimate the model with the use of dummy variables for quality. These dummies turn out to be insignificant, providing an explanation as to why the overall index that considers simultaneously the level and quality of education is insignificant as well. These results appear consistent with other studies that mention that the rankings of the institutions do not matter (Gottesman and Morey, 2010; Slater and Dixon-Fowler, 2010).

Up to this point, we have used a metric to highlight the educational level of a firm's board. However, one may wonder if this metric is conditioned on other characteristics of the three key board members. The underlying reason behind this question is that education alone is unlikely to solely explain such firm differences. For instance, individuals may have a wealth of experience from past tenures, as well as having developed a network of individuals during the course of their successful careers (either through a University's alumni/colleagues, or elsewhere). This reasoning is in line with studies finding that personal characteristics (Benmelech and Frydman, 2015) and past experiences (Bernile et al. 2017) shape a director's decisions on corporate outcomes. To test this question, we condition the educational leadership index on the board's age¹⁸, by interacting the two variables. The results in Table 9 confirm a conditional effect of the board's age on the leadership education index. The observed effect is negative (odds ratio < 1) and statistically significant at the 5% level (except when controlling for other corporate governance attributes - column (5) - where it falls to the 10% level, p -value = 0.056), implying that a board's educational attainment becomes less positively influential when the seniority of the board increases. This could also be an indication that a well-educated board is a very important factor particularly when the board lacks experience.

[Insert Table 9 Around Here]

Last, but not least, we test the robustness of all the above-mentioned results in three different restrictive settings. First, we restrict our sample to a balanced panel sample (1,096 firms operating in both years, a total of 2,192 firm-year observations - a small decrease from the total of 2,487) to observe the results for the same firms. Second, we restrict our sample to listed firms only (86% of our firm-year sample), and sharpen our estimation by also including the price-to-book ratio in the list of co-variates to control for the market's perception of the company's valuation. Third, we include quadratic terms of the governance characteristics to account for non-linear effects. Only the board's (average) age seem to have a statistically significant quadratic term at the 5% level, implying an inverse U-shaped effect between the board's seniority and its effect on a firm's credit rating. The main results hold (unreported to conserve space) with the Leadership Education Index's statistical significance ranging between the 1% and 5% levels.

¹⁸Ideally, proxies showing the tenure of directors in the firm, or any past connections and experience in particular would permit testing each conditional root mentioned above, yet our data set prohibits such testings. Instead, we hereby use the key directors' (average) age as a proxy for seniority, e.g. assuming that a more mature board is also more experienced, and potentially more connected.

4.2.2 Endogeneity

One potential concern is whether our results are influenced by endogeneity due to either omitted variables or selection bias. Therefore, this section presents additional analyses, as an attempt to lessen such concerns.

Selection bias could be related to a two-way firm-executive matching, which may not be randomly assigned. For example, past studies suggest forms of ‘matching’ around CEO talent and firm size (Gabaix and Landier, 2008; Tervio, 2008), managerial attributes and firm growth potential (Pan, 2015) as well as CEO education and higher performance (King et al., 2016). In the context of our study, one could argue that good quality firms are more likely to recruit human capital of better quality. For instance, large and well-established firms may be more likely to hire executives with higher educational levels. From an alternative viewpoint, one could also argue that executives with high educational attainments are more likely to choose to work for high quality firms. To account for these issues, we follow King et al. (2016) and we employ an Ordered Probit model with sample selection, also known as Two-stage Heckman Ordered Probit¹⁹. The first stage of our analysis discriminates between the observed and unobserved sample according to the probability of an educated board being into the largest firms. This is achieved in the form of a binary regression, where the dependent is a dummy variable that takes the value of ‘1’ if a firm is in a top-tier percentile according to its size, and the value of ‘0’ otherwise²⁰. In the second stage, we use the estimated probabilities from the first stage regression to re-estimate the baseline model outlined in Equation (4.1.1) (see De Luca and Perotti, 2011 for a description of the maximum likelihood estimator used in this process). The results in Table 10 (Column 1a) show that our main finding holds when we account for sample selection bias. More detailed, the leadership education index remains positive and it is significant at the 5% level. The results remain qualitatively the same if we assume that selection is based on the top tier of profitable firms (i.e. top 10% according to their industry) as shown in Column 1b.

[Insert Table 10 Around Here]

As discussed earlier, another endogeneity concern relates to omitted variable bias and/ or measurement error. In particular, the relationship between education and credit rating assignment may be driven by other factors, which are either not taken into account in our analysis or may not be observable at all, thus leading to omitted variables bias. In addition, our results could be driven by measurement error of the control variables. To address these issues, and given the classification nature of our dependent variable, we re-estimate the baseline model outlined in Equation (4.1.1) with two alternative approaches: (i) a Two-stage Residual Inclusion (2SRI) re-

¹⁹This approach is suitable for cases where the outcome of interest is ordinal (i.e. credit rating), and simultaneously there exists a restriction, which is governed by a ‘binary selection mechanism’ when observing the data (De Luca and Perotti, 2011). Thus, it enables the estimation of parameters of a regression model, whose dependent variable is ordinal in nature, for a non-random sample (i.e. the selected sample).

²⁰Following King et al. (2016), the largest firms are defined as the ones in the top 10 percentile of our sample. The results do not change when we adopt alternative definitions of ‘largest firms’ using a threshold of the 5th percentile (Top 5) or the 25th percentile (Top 25) of firm size.

gression system and (ii) an Ordered Probit Regression model that accommodate for endogenous covariates²¹.

Finding an appropriate instrument is a non-trivial task. In particular, the selected instrument ought to be related conceptually and statistically to the first stage dependent variable (i.e. in our case the Leadership Education Index), whilst not being related to the residuals of the second stage regression. Long (2008) highlights that various papers, beginning with Card (1993), use college proximity as an instrument for years of education completed. Additionally, Long (2008) uses the average quality of colleges within a certain radius of the student as an instrument for the quality of the college at which the student attends. Building on this, in our cross-country setting we define this radius at the country level and we use a proxy for a country’s overall quality educational system. We retrieve this information from the IMD World Talent Ranking Survey which provides survey answers to the question “Does the educational system meet the needs of a competitive economy?”. The answers to this question range between 1 and 10, with higher values denoting higher perceived quality. We have no reason to believe that this variable influences directly the firm-level ratings of Standard & Poor’s, whilst at the same time it is statistically associated with our educational index.

Column (2) in Table 10 reports the results obtained from the Ordered Probit with endogenous co-variables model, whereas Column (3) reports the results obtained from the Two-stage Residual Inclusion model (2SRI). In both cases, the core variable of interest retains its positive sign and is statistically significant between the 1% and 5% level. This suggests that even when controlling for endogeneity-related issues, the results remain statistically significant. Finally, in unreported results we estimate the aforementioned two-stage set up by making use of at two-stage least square (2SLS) linear model and the results remain the same in terms of sign and significance. An advantage of using this method is that it provides further diagnostics²² on the validity of the employed instrument, confirming its suitability for our analysis.

4.2.3 Individual educational background

In an attempt to shed further light on our findings, in this section we consider the educational levels of the three board members on an individual basis. In particular, we re-estimate the specifications of Table 3 by replacing the Leadership’s Educational Index score with the individual educational characteristics of the CEO, the CFO and the Chair. These are captured through a

²¹Both approaches are executed in a two-stage set-up. In the first stage, the endogenous variable (i.e. Leadership Education Index) is regressed on selected instruments and the exogenous variables considered in Equation (4.1). In the second stage, we then estimate the baseline model in Equation (4.1) taking into account the first stage in different ways. The core difference among these two approaches mainly lies in their assumptions. In brief, 2SRI uses the first-stage residuals as another covariate of the second stage, whereas the alternative model uses the estimates of the first stage as replacement for the second stage endogenous variable. For a more detailed discussion on the 2SRI and ordered probit for endogenous covariates, we refer the readership to the works of Terza et al. (2008) and Wooldridge (2010) respectively.

²²These refer to the *weak* (Kleibergen-Paap rk Wald F statistic), *under* (Kleibergen-Paap rk LM statistic) and *over* (Hansen J statistic)-identification tests that normally accompany a 2SLS regression. The latter does not apply in our case, as our equation is exactly identified, but both former diagnostics pass the desired benchmarks (Chi-sq p-value < 0.01 and Kleibergen-Paap rk Wald F statistic > Stock-Yogo weak ID test critical values).

set of dummies that denote each member's: (i) topic of major (Business/Economics, Engineering, Other), (ii) type of degree²³ (Master's, MBA, PhD) and (iii) the quality of the awarding institution. The results are reported in Table 11. In general, the results hold when we control in turn for: (i) corporate governance, (ii) shareholders' rights, (iii) institutions, (iv) credit depth. To conserve space, we only present the results for the baseline model; however, we discuss the differences in the results (if any) when controlling for these additional attributes.

[Insert Table 11 Around Here]

Starting with the Majors, we find that the discipline of the undergraduate degree seems to be associated with higher ratings when it comes to the CEO or Chair of the board when that director has a Major in Engineering. This relationship's statistical significance varies between the 1% and 5% levels. In particular, the odds of obtaining a AAA rating versus the ratings of all the other categories combined is around 1.3. The results still hold when we use sub-samples focusing on CEOs/Chairmen without a dual role.

While this finding appears to be surprising at first, this should not necessarily be the case. For example, the latest ranking of the 100 top-performing CEOs by Harvard Business Review (2018) reveals that engineering degrees have become slightly more prevalent among these CEOs than the finance- and strategy-focused MBAs. Overall, 34 of the top 100 CEOs in 2018, had an engineering degree, compared to 32 who had an MBA. Most interestingly, 10 of the top 20 ranked CEOs had an engineering degree, compared with 4 MBAs. Tyler and Steensma (1998) mention that schooling in science and engineering creates managers that have a more complete understanding of technology and innovation, and they are also more committed to technological developments than executives with formal training in nontechnical areas such as business or liberal arts. Apparently, nowadays in the era of substantial technological advancements, such intangible assets are more valuable than ever and companies that cannot cope with technological changes could be easily run out of business. Additionally, Wiersema and Bantel (1992) conclude that that academic specialization in science and engineering within the top management team results in firms with higher likelihood to adopt strategic changes. Finally, Al-Saleh (2014) argues that engineers may become great CEOs because they tend to be detail-oriented, analytical and trained in systematic problem-solving.

Looking at the members' degrees in particular, we find that a CFO with a Master's degree is associated with a higher odds ratio to obtain a AAA rating of around 1.4 (statistically significant at the 1% level; Columns 7 and 10), whilst a Chairman with a PhD is associated with a higher odds ratio of around 1.3 (at the 5% level; Columns 14 and 15). Andreou et al. (2017) use the PhD threshold to describe a director as a 'specialist', an individual with more firm-specific skills and a capacity to process information in a very specific manner and get better decisions. He and Hirshleifer (2018) put forward a hypothesis that explains why leading board directors with a PhD degree can be particularly valuable for their firms. More detailed, they propose that directors with

²³Bachelor's degree does not enter the equation as it is already controlled through the Major's dummy denoting the Major of a director's Undergraduate studies.

an exploratory mindset, proxied by having a PhD degree, are skillful at managing innovation, possibly owing to their long-term orientation and strong intrinsic motivation. Their findings confirm that firms with such directors produce more patents with greater novelty, generality and originality. Therefore, while directors with a PhD focus less on short-term results, their firms achieve superior long-run profitability²⁴.

Finally, looking at the individual members' education, there is no consistent pattern when it comes to the question of what matters for a firm's credit rating. Regardless, there should not necessarily be one as, perhaps, it is simply that different attributes are important for different roles. Moreover, looking at the individuals one overlooks that synergistic effects could exist in the board, which is the essence of the Leadership Education Index in the first place. That is, pooling the board's key members' educational attributes together in a synergistic way that adds value to the firm and is reflected in its corporate outcomes. This is conceptually well in line with the aggregation function chosen for this index (eq. 3.2.1) that permits perfect compensation (see, e.g. OECD, 2008) between board members.

5 Conclusions

This study investigates whether and how the educational attainment of key board members influences the credit ratings assigned to their firm. We find evidence that both an overall education index of the key board members as well as a variety of educational attributes considered on an individual basis explain firm credit ratings. Specifically, we find that firm credit ratings are: (i) positively related to an index of the board leadership's educational level providing aggregate information on whether the CEO, CFO, and the Chair hold undergraduate, postgraduate and doctoral degrees, (ii) positively related to having a CEO or Chairman with a Major in Engineering, and (iii) positively related to having a CFO with master's degree or a Chairman with a PhD degree. The results hold when we use various approaches to account for firm-executive matching and other forms of endogeneity.

Our findings are important for at least two reasons. First, they shed light on the determinants of credit ratings, an issue that remains, to a large extent, a black box. Most importantly, they provide evidence on the impact of educational attributes on credit ratings, an issue that has not

²⁴He and Hirshleifer (2018) focus on the case of CEO with a PhD. However, being the CEO's boss, attributes like the ones discuss in He and Hirshleifer (2018) might be even more important in the case of the board chair. Krause (2017) recently challenged the traditional CEO/Chair duality view, proposing that the role of a separate board chair is not necessarily to control the CEO but that she or he can also play a collaborative role. The main idea is that a collaboration-oriented board chair can achieve his or her intended objective by providing advice and guidance to the CEO and simultaneously removing the burdens of board leadership from the CEO's list of demands. This issue has also been highlighted in Lorsch and Zelleke (2005), arguing that "Although strategy formulation is a core executive responsibility - clearly in the domain of the CEO - many British chairmen can and do offer valuable input in the strategy discussion before a proposal is brought to the full board. Finally, the chairman can be a mentor, adviser and confidant to the CEO, providing someone to talk with more openly than might be possible with subordinates" (p. 72). Furthermore, many firms appoint board chairs for the individual human and social capital they can bring to the role, making them an appropriate adviser for the CEO (Krause et al., 2016; Krause, 2017). Consequently, we would expect that chairs with an exploratory mindset aiming for long-term results can be of great value to the CEOs and the rest of the board.

been investigated in the past. Second, looking at the broader picture, they show that the education of the key board members is added value for the firms at least in the form of better ratings.

Our work is not without limitations. For example, future work could examine longer time periods. Alternatively, one could compare the three large rating agencies. Data availability has not allowed us to undertake these exercises. In addition, one could focus on banking institutions, an industry that was excluded from the present work. Finally, while we provide a preliminary analysis on the importance of different educational degrees of individuals in the board, our study focuses on the overall education of the three key board members. Thus, we assume that it is the overall picture and potential complementarities between board members that matter the most. However, since different directors have different tasks and therefore they need different skills and education, future analysis could provide a more in-depth analysis of the education of individual board members. Additionally, one could examine the possession of professional qualifications, data for which were not available in our case.

References

- Adelson, M. H. (2012). The role of credit ratings in the financial system. Technical Report. Standard & Poor's, Global Credit Portal, Ratings Direct, Available: http://www.markadelson.com/pubs/Role_of_Ratings_in_the_Financial_System.pdf.
- Al-Saleh, Y. (2014). Why engineers make great ceos. April 24, INSEAD Knowledge, available at: <https://knowledge.insead.edu/>.
- Alissa, W., Bonsall, S., Koharki, K., and Penn Jr, M. W. (2013). Firms' use of accounting discretion to influence their credit ratings. *Journal of Accounting and Economics*, 55(2-3):129–147.
- Andreou, P. C., Karasamani, I., Louca, C., and Ehrlich, D. (2017). The impact of managerial ability on crisis-period corporate investment. *Journal of Business Research*, 79:107–122.
- Ashbaugh-Skaife, H., Collins, D. W., and LaFond, R. (2006). The effects of corporate governance on firms' credit ratings. *Journal of Accounting and Economics*, 42(1-2):203–243.
- Bantel, K. A. and Jackson, S. E. (1989). Top management and innovations in banking: Does the composition of the top team make a difference? *Strategic Management Journal*, 10(S1):107–124.
- Barro, R. J. and Lee, J. W. (2013). A new data set of educational attainment in the world, 1950–2010. *Journal of development economics*, 104:184–198.
- Becker, G. S. (1994). *Human capital: A theoretical and empirical analysis, with special reference to education*. 3rd Edition, University of Chicago Press.
- Becker, M. H. (1970). Sociometric location and innovativeness: Reformulation and extension of the diffusion model. *American sociological review*, pages 267–282.

- Behr, P. and Sonnekalb, S. (2012). The effect of information sharing between lenders on access to credit, cost of credit, and loan performance - Evidence from a credit registry introduction. *Journal of Banking & Finance*, 36(11):3017–3032.
- Benmelech, E. and Frydman, C. (2015). Military ceos. *Journal of Financial Economics*, 117(1):43–59.
- Berger, A. N., Kick, T., and Schaeck, K. (2014). Executive board composition and bank risk taking. *Journal of Corporate Finance*, 28:48–65.
- Bernile, G., Bhagwat, V., and Rau, P. R. (2017). What doesn't kill you will only make you more risk-loving: Early-life disasters and ceo behavior. *The Journal of Finance*, 72(1):167–206.
- Bertrand, M. and Schoar, A. (2003). Managing with style: The effect of managers on firm policies. *The Quarterly journal of economics*, 118(4):1169–1208.
- Bhagat, S., Bolton, B. J., and Subramanian, A. (2010). Ceo education, ceo turnover, and firm performance. Available at SSRN: <https://ssrn.com/abstract=1670219>.
- Bhojraj, S. and Sengupta, P. (2003). Effect of corporate governance on bond ratings and yields: The role of institutional investors and outside directors. *The Journal of Business*, 76(3):455–475.
- Blume, M. E., Lim, F., and MacKinlay, A. C. (1998). The declining credit quality of us corporate debt: Myth or reality? *The Journal of Finance*, 53(4):1389–1413.
- Bonsall, S., Holzman, E. R., and Miller, B. P. (2016). Managerial ability and credit risk assessment. *Management Science*, 63(5):1425–1449.
- Brüderl, J., Preisendörfer, P., and Ziegler, R. (1992). Survival chances of newly founded business organizations. *American sociological review*, pages 227–242.
- Bui, D. G., Chen, Y.-S., Hasan, I., and Lin, C.-Y. (2018). Can lenders discern managerial ability from luck? evidence from bank loan contracts. *Journal of Banking & Finance*, 87:187–201.
- Cai, Y., Kim, Y., Li, S., and Pan, C. (2019). Tone at the top: Ceos' religious beliefs and earnings management. *Journal of Banking & Finance*.
- Card, D. (1993). Using geographic variation in college proximity to estimate the return to schooling. Technical report, National Bureau of Economic Research.
- Carpena, F., Cole, S., Shapiro, J., and Zia, B. (2017). The ABCs of financial education: experimental evidence on attitudes, behavior, and cognitive biases. *Management Science*.
- Chabowski, B., Chiang, W.-C., Deng, K., and Sun, L. (2019). Environmental inefficiency and bond credit rating. *Journal of Economics and Business*, 101:17–31.

- Cheng, L. T., Chan, R. Y., and Leung, T. (2010). Management demography and corporate performance: Evidence from china. *International Business Review*, 19(3):261–275.
- Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., and Battese, G. E. (2005). *An introduction to efficiency and productivity analysis*. Springer Science & Business Media.
- Coles, J. L., Daniel, N. D., and Naveen, L. (2008). Boards: Does one size fit all? *Journal of Financial Economics*, 87(2):329–356.
- Core, J. E., Holthausen, R. W., and Larcker, D. F. (1999). Corporate governance, chief executive officer compensation, and firm performance¹. *Journal of Financial Economics*, 51(3):371–406.
- Cornaggia, K. J., Krishnan, G. V., and Wang, C. (2017). Managerial ability and credit ratings. *Contemporary Accounting Research*, 34(4):2094–2122.
- Datta, D. K. and Guthrie, J. P. (1994). Executive succession: Organizational antecedents of ceo characteristics. *Strategic Management Journal*, 15(7):569–577.
- De Luca, G. and Perotti, V. (2011). Estimation of ordered response models with sample selection. *The Stata Journal*, 11(2):213–239.
- Decancq, K. and Lugo, M. A. (2013). Weights in multidimensional indices of wellbeing: An overview. *Econometric Reviews*, 32(1):7–34.
- Demerjian, P. R., Lev, B., Lewis, M. F., and McVay, S. E. (2012). Managerial ability and earnings quality. *The Accounting Review*, 88(2):463–498.
- Ding, W. W. (2011). The impact of founders' professional-education background on the adoption of open science by for-profit biotechnology firms. *Management Science*, 57(2):257–273.
- Doblas-Madrid, A. and Minetti, R. (2013). Sharing information in the credit market: Contract-level evidence from us firms. *Journal of Financial Economics*, 109(1):198–223.
- Dollinger, M. J. (1984). Environmental boundary spanning and information processing effects on organizational performance. *Academy of Management Journal*, 27(2):351–368.
- Drago, D. and Gallo, R. (2018). Do multiple credit ratings affect syndicated loan spreads? *Journal of International Financial Markets, Institutions and Money*.
- Frank, M. Z. and Goyal, V. K. (2007). Corporate leverage: How much do managers really matter? Available at SSRN: <https://ssrn.com/abstract=971082>.
- Gabaix, X. and Landier, A. (2008). Why has ceo pay increased so much? *The Quarterly Journal of Economics*, 123(1):49–100.
- Gottesman, A. A. and Morey, M. R. (2006). Manager education and mutual fund performance. *Journal of Empirical Finance*, 13(2):145–182.

- Gottesman, A. A. and Morey, M. R. (2010). Ceo educational background and firm financial performance. *Journal of Applied Finance (Formerly Financial Practice and Education)*, 20(2).
- Greco, S., Ishizaka, A., Tasiou, M., and Torrissi, G. (2019). On the methodological framework of composite indices: A review of the issues of weighting, aggregation and robustness. *Social Indicators Research*, 141:61–94.
- Ham, C. and Koharki, K. (2016). The association between corporate general counsel and firm credit risk. *Journal of Accounting and Economics*, 61(2-3):274–293.
- Hambrick, D. C., Cho, T. S., and Chen, M.-J. (1996). The influence of top management team heterogeneity on firms' competitive moves. *Administrative science quarterly*, pages 659–684.
- Hambrick, D. C. and Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of management review*, 9(2):193–206.
- He, Z. and Hirshleifer, D. (2018). The exploratory mindset and corporate innovation. Mimeo, December, available at: <https://sites.google.com/site/zhaozhaohe/research>.
- Herrmann, P. and Datta, D. K. (2005). Relationships between top management team characteristics and international diversification: An empirical investigation. *British Journal of Management*, 16(1):69–78.
- Hitt, M. A. and Tyler, B. B. (1991). Strategic decision models: Integrating different perspectives. *Strategic management journal*, 12(5):327–351.
- Horrigan, J. O. (1966). The determination of long-term credit standing with financial ratios. *Journal of Accounting Research*, pages 44–62.
- Hsu, W.-T., Chen, H.-L., and Cheng, C.-Y. (2013). Internationalization and firm performance of smes: The moderating effects of ceo attributes. *Journal of World Business*, 48(1):1–12.
- Huang, Y.-L. and Shen, C.-H. (2015). Cross-country variations in capital structure adjustment—the role of credit ratings. *International Review of Economics & Finance*, 39:277–294.
- International Finance Corporation (2012). *Credit Reporting Knowledge Guide*, Washington, DC. World Bank, Retrieved from <https://openknowledge.worldbank.org/handle/10986/21545>.
- Iren, P. and Tee, K. (2018). Boardroom diversity and innovation in the uae banks. *International Journal of Innovation Management*, 22(03):1850029.
- Jiang, X. and Packer, F. (2019). Credit ratings of chinese firms by domestic and global agencies: Assessing the determinants and impact. *Journal of Banking & Finance*, 105:178–193.
- Jiraporn, P., Jiraporn, N., Boeprasert, A., and Chang, K. (2014). Does corporate social responsibility (CSR) improve credit ratings? Evidence from geographic identification. *Financial Management*, 43(3):505–531.

- Joe, D. Y. and Oh, F. D. (2018). Credit ratings and corporate cash holdings: Evidence from Korea's corporate reform after the 1997 Asian financial crisis. *Japan and the World Economy*, 45:9–18.
- Jory, S. R., Ngo, T. N., and Wang, D. (2016). Credit ratings and the premiums paid in mergers and acquisitions. *Journal of Empirical Finance*, 39:93–104.
- Kang, S., Kim, E. H., and Lu, Y. (2018). Does independent directors' ceo experience matter? *Review of Finance*, 22(3):905–949.
- Kaplan, R. S. and Urwitz, G. (1979). Statistical models of bond ratings: A methodological inquiry. *Journal of Business*, 52(2):231–261.
- Kauko, K. (2009). Managers and efficiency in banking. *Journal of Banking & Finance*, 33(3):546–556.
- Khanna, P., Jones, C. D., and Boivie, S. (2014). Director human capital, information processing demands, and board effectiveness. *Journal of Management*, 40(2):557–585.
- Khatami, S. H., Marchica, M.-T., and Mura, R. (2016). Rating friends: The effect of personal connections on credit ratings. *Journal of Corporate Finance*, 39:222–241.
- Kiel, G. C. and Nicholson, G. J. (2003). Board composition and corporate performance: How the Australian experience informs contrasting theories of corporate governance. *Corporate Governance: An International Review*, 11(3):189–205.
- Kimberly, J. R. and Evanisko, M. J. (1981). Organizational innovation: The influence of individual, organizational, and contextual factors on hospital adoption of technological and administrative innovations. *Academy of management journal*, 24(4):689–713.
- King, T., Srivastav, A., and Williams, J. (2016). What's in an education? Implications of CEO education for bank performance. *Journal of Corporate Finance*, 37:287–308.
- Koetter, M. (2008). The stability of bank efficiency rankings when risk preferences and objectives are different. *European Journal of Finance*, 14(2):115–135.
- Kong, V. X. and Zhang, J. (2010). The effect of managerial education and firm-ownership structure: empirical evidence from Chinese listed firms. *Chinese Economy*, 43(6):34–53.
- Krause, R. (2017). Being the ceo's boss: An examination of board chair orientations. *Strategic Management Journal*, 38(3):697–713.
- Krause, R., Semadeni, M., and Withers, M. C. (2016). That special someone: When the board views its chair as a resource. *Strategic Management Journal*, 37(9):1990–2002.
- Lim, S. C., Mann, S. C., and Mihov, V. T. (2017). Do operating leases expand credit capacity? evidence from borrowing costs and credit ratings. *Journal of Corporate Finance*, 42:100–114.

- Lin, Y.-M. and Shen, C.-A. (2015). Family firms' credit rating, idiosyncratic risk, and earnings management. *Journal of Business Research*, 68(4):872–877.
- Long, M. C. (2008). College quality and early adult outcomes. *Economics of Education review*, 27(5):588–602.
- Lorsch, J. W. and Zelleke, A. (2005). Should the ceo be the chairman? *MIT Sloan management review*, 46(2):71.
- Mählmann, T. (2009). Do bond issuers shop for a better credit rating? *Work ing Paper, URL: <http://www.bis.org/bcbs/events/rtf06maehlmann.pdf>*, Stand, 30:2009.
- Majnoni, G., Miller, M., Mylenko, N., and Powell, A. (2004). *Improving credit information, bank regulation, and supervision: on the role and design of public credit registries*. The World Bank.
- Mihet, R. (2013). Effects of culture on firm risk-taking: a cross-country and cross-industry analysis. *Journal of Cultural Economics*, 37(1):109–151.
- Nguyen, D. D., Hagendorff, J., and Eshraghi, A. (2015). Which executive characteristics create value in banking? evidence from appointment announcements. *Corporate Governance: An International Review*, 23(2):112–128.
- Nicoletti, G., Scarpetta, S., and Boylaud, O. (2000). Summary indicators of product market regulation with an extension to employment protection legislation. OECD, ECO Working Paper No. 226.
- OECD (2008). *Handbook on Constructing Composite Indicators: Methodology and User Guide*. OECD Publishing, Paris.
- Pan, Y. (2015). The determinants and impact of executive-firm matches. *Management Science*, 63(1):185–200.
- Pfeffer, J. (1972). Size and composition of corporate boards of directors: The organization and its environment. *Administrative Science Quarterly*, pages 218–228.
- Review, H. B. (2018). The best-performing ceos in the world. The CEO 100, 2018 Edition, available at: <https://hbr.org/2018/11/the-best-performing-ceos-in-the-world-2018>.
- Rogers, E. M. and Shoemaker, F. (1971). *Communication of innovations; a cross-cultural approach*. New York: Free Press.
- Saisana, M., Saltelli, A., and Tarantola, S. (2005). Uncertainty and sensitivity analysis techniques as tools for the quality assessment of composite indicators. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, 168(2):307–323.
- Schroder, H. M., Driver, M. J., and Steufert, S. (1967). *Human information processing*. New York: Holt Rinehart & Winston.

- Slater, D. J. and Dixon-Fowler, H. R. (2010). The future of the planet in the hands of mbas: An examination of ceo mba education and corporate environmental performance. *Academy of Management learning & education*, 9(3):429–441.
- Standard and Poor's (2012a). General criteria: Methodology: Management and governance credit factors for corporate entities and insurers. November 13.
- Standard and Poor's (2012b). How we use management and governance credit factors. November 13.
- Standard and Poor's (2013). Corporate methodology. November 19.
- Standard and Poor's (2018). How management & governance risks and opportunities factor into global corporate ratings. November 7.
- Tervio, M. (2008). The difference that ceos make: An assignment model approach. *American Economic Review*, 98(3):642–68.
- Terza, J. V., Basu, A., and Rathouz, P. J. (2008). Two-stage residual inclusion estimation: addressing endogeneity in health econometric modeling. *Journal of health economics*, 27(3):531–543.
- Tyler, B. B. and 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.
- Wally, S. and Baum, J. R. (1994). Personal and structural determinants of the pace of strategic decision making. *Academy of Management journal*, 37(4):932–956.
- Wiersema, M. F. and Bantel, K. A. (1992). Top management team demography and corporate strategic change. *Academy of Management journal*, 35(1):91–121.
- Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.
- Yermack, D. (1996). Higher market valuation of companies with a small board of directors. *Journal of Financial Economics*, 40(2):185–211.
- Zald, M. N. (1969). The power and functions of boards of directors: A theoretical synthesis. *American journal of Sociology*, 75(1):97–111.

Table 1: Summary Statistics

The table reports the number of observations in sample as well as the mean, standard deviation, and quantiles of the variables used in the empirical analysis. For a definition of the variables see Table A.1. Note that, summary statistics for macroeconomic variables are provided at the country level.

Variable	Obs.	Min	25th	Mean	Median	75th	Max	Std. Dev.
<i>Dependent Variable</i>								
S&P Credit Rating	2,487	1.00	10.00	12.26	13.00	15.00	22.00	3.19
Panel A. Variables used in the baseline Model								
<i>Firm-specific characteristics</i>								
Leadership Education Index	2,487	0.00	1.33	2.20	2.00	3.00	6.00	1.11
ROA	2,487	-0.24	2.61	4.69	4.11	6.50	11.80	3.05
Debt Ratio	2,487	0.16	0.33	0.51	0.49	0.66	0.93	0.21
Revenues (\$USDmm)	2,487	303.8	1,156.0	7,340.6	3,027.0	8,814.9	38,946.0	10,028.2
Quick Ratio	2,487	0.22	0.54	1.01	0.86	1.28	2.67	0.64
Listed in NYSE	2,487	0.00	1.00	0.86	1.00	1.00	1.00	0.34
<i>Macroeconomic characteristics</i>								
GDP growth (%)	78	1.47	1.54	2.71	2.26	3.62	5.02	1.24
Inflation rate (%)	78	0.32	0.48	1.45	1.51	2.56	2.56	0.90
Country's S&P Rating	78	7.00	15.00	17.69	18.00	22.00	22.00	3.94
Panel B. Additional variables to the baseline model								
<i>Corporate Governance</i>								
CEO Duality	2,487	0.00	0.00	0.35	0.00	1.00	1.00	0.48
No. of Board Members	2,383	6.00	8.00	9.50	10.94	10.99	20.00	1.27
Board Independence (%)	2,383	0.10	0.14	0.51	0.50	0.88	1.00	0.34
CEO's Age	2,487	32.00	52.00	56.16	56.00	60.00	83.00	6.47
CFO's Age	2,487	30.00	47.00	51.62	52.00	56.00	78.00	6.56
Chair's Age	2,487	32.00	57.00	62.58	62.00	68.00	95.00	8.22
Board's (Avg.) Age	2,487	37.00	53.00	56.39	56.50	59.50	80.50	4.83
<i>Governance & Quality of Credit</i>								
World Governance Index (WGI)	78	0.24	0.43	0.65	0.69	0.87	0.93	0.23
Depth of Credit Index	78	0.00	6.00	6.70	7.00	8.00	8.00	1.44
<i>Financial Stakeholder Rights & Relations</i>								
Extent of Shareholders' Rights Index	78	3.32	4.30	4.84	5.00	5.35	6.20	0.71

Table 2: Descriptive statistics for educational variables

This (upper) table reports the percentage (%) of firms in our sample (firm-year observations), for which the CEO/CFO/CHAIR holds a (THE/IVY) Bachelor's/Master's/MBA/PhD degree, as well as the proportion of our sample in which holders obtained a degree from an IVY/THE (FT for MBAs) listed University.

CEO	% of Sample	% of holders	CFO	% of Sample	% of holders	CHAIR	% of Sample	% of holders
<i>Bachelor's</i>	99.83%		<i>Bachelor's</i>	93.61%		<i>Bachelor's</i>	96.25%	
<i>IVY</i>	19.84%	19.87%	<i>IVY</i>	11.21%	11.98%	<i>IVY</i>	21.33%	22.16%
<i>THE</i>	31.18%	31.23%	<i>THE</i>	21.97%	23.47%	<i>THE</i>	32.83%	34.11%
<i>Master's</i>	45.17%		<i>Master's</i>	20.35%		<i>Master's</i>	47.34%	
<i>IVY</i>	5.81%	12.86%	<i>IVY</i>	1.40%	6.86%	<i>IVY</i>	6.15%	12.99%
<i>THE</i>	14.40%	31.87%	<i>THE</i>	5.90%	28.98%	<i>THE</i>	15.17%	32.04%
<i>MBA</i>	52.51%		<i>MBA</i>	45.88%		<i>MBA</i>	49.76%	
<i>IVY</i>	14.85%	28.28%	<i>IVY</i>	7.92%	17.26%	<i>IVY</i>	15.25%	30.65%
<i>THE</i>	24.30%	46.27%	<i>THE</i>	19.86%	43.28%	<i>THE</i>	24.43%	49.10%
<i>FT</i>	14.37%	27.37%	<i>FT</i>	14.46%	31.52%	<i>FT</i>	14.31%	28.76%
<i>PhD</i>	11.96%		<i>PhD</i>	3.15%		<i>PhD</i>	15.13%	
<i>IVY</i>	1.40%	11.72%	<i>IVY</i>	0.27%	8.57%	<i>IVY</i>	1.71%	11.32%
<i>THE</i>	2.97%	24.83%	<i>THE</i>	0.68%	21.43%	<i>THE</i>	3.50%	23.13%

This (lower) table reports tabulations of CEO/CHAIR, and CFOs's degrees based on our sample. It comprises of 8 tabulations (each sums to 100%), showing the proportions (%) of our firm-year sample that a CEO/CHAIR holds a (Bachelor's/Master's/MBA/PhD) degree (from an IVY University) in conjunction with the condition that a CFO does (not).

	<i>Bachelor's</i>		<i>Master's</i>		<i>MBA</i>		<i>PhD</i>	
	CFO non-IVY	CFO IVY	CFO non-IVY	CFO IVY	CFO non-IVY	CFO IVY	CFO non-IVY	CFO IVY
CEO non-IVY	75.72%	5.77%	94.09%	0.37%	81.04%	5.04%	98.72%	0.09%
CEO IVY	13.19%	5.31%	4.54%	1.01%	11.04%	2.89%	1.01%	0.18%
CHAIR non-IVY	74.54%	5.42%	93.81%	0.36%	80.60%	5.15%	98.41%	0.09%
CHAIR IVY	14.34%	5.69%	4.83%	1.00%	11.48%	2.78%	1.32%	0.18%

To tabulate CEOs and Chairs between holding or not a given degree, we use a reduced sample (excluding the 35% of firm-year observations in sample in which the CEO is also the Chairman of the board).

	<i>Bachelor's</i>		<i>Master's</i>		<i>MBA</i>		<i>PhD</i>	
	CHAIR non-IVY	CHAIR IVY	CHAIR non-IVY	CHAIR IVY	CHAIR non-IVY	CHAIR IVY	CHAIR non-IVY	CHAIR IVY
CEO non-IVY	75.02%	4.55%	92.66%	1.52%	80.52%	3.98%	98.10%	0.57%
CEO IVY	2.40%	18.03%	1.14%	4.68%	3.23%	12.27%	0.06%	1.27%

Table 3: Leadership Education Index & Firm Credit Ratings.

VARIABLES	(1) BASELINE	(2) WGI	(3) DEPTH	(4) SHAREHOLD	(5) CG	(6) ALL
Leadership Education Index	1.092*** (0.0351)	1.091*** (0.0351)	1.087*** (0.0349)	1.093*** (0.0351)	1.087** (0.0358)	1.086** (0.0358)
WGI		0.629 (0.210)				1.430 (0.502)
Depth of Credit			1.099*** (0.0403)			1.115*** (0.0453)
Extent of Shareholders' Rights				0.935 (0.0898)		
CEO Duality					1.497*** (0.124)	1.506*** (0.124)
Board Age (Avg)					1.016* (0.00857)	1.015* (0.00861)
Ln (No. of Board Members)					2.661*** (0.526)	2.506*** (0.486)
Board Independence (%)					2.618*** (0.434)	2.423*** (0.418)
ROA	1.174*** (0.0156)	1.176*** (0.0157)	1.176*** (0.0157)	1.175*** (0.0156)	1.175*** (0.0159)	1.177*** (0.0160)
Debt Ratio	0.0235*** (0.00527)	0.0213*** (0.00489)	0.0216*** (0.00490)	0.0225*** (0.00510)	0.0141*** (0.00349)	0.0136*** (0.00336)
Ln (Revenues)	1.876*** (0.0682)	1.861*** (0.0674)	1.872*** (0.0682)	1.864*** (0.0674)	1.790*** (0.0709)	1.787*** (0.0708)
Quick Ratio	0.740*** (0.0484)	0.735*** (0.0478)	0.736*** (0.0482)	0.731*** (0.0477)	0.717*** (0.0482)	0.720*** (0.0481)
Listed in SE	0.532*** (0.0757)	0.524*** (0.0745)	0.524*** (0.0742)	0.534*** (0.0758)	0.471*** (0.0728)	0.462*** (0.0701)
GDP growth (%)	0.873*** (0.0412)	0.838*** (0.0413)	0.886** (0.0423)	0.854*** (0.0413)	0.959 (0.0497)	0.957 (0.0556)
Inflation (%)	0.564*** (0.0390)	0.541*** (0.0395)	0.529*** (0.0392)	0.561*** (0.0388)	0.730*** (0.0602)	0.671*** (0.0641)
Country's S&P Rating	1.017 (0.0181)		1.012 (0.0179)		1.058*** (0.0198)	
Firm-year observations	2,487	2,487	2,487	2,487	2,383	2,383
Unique firms	1,618	1,618	1,618	1,618	1,531	1,531
Countries	39	39	39	39	36	36
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.0959	0.0963	0.0964	0.0959	0.104	0.104

Ordered Logit results on eq.(4.1.1). Column (1) reports results for the 'Baseline' model. Columns (2) to (5) report results controlling for additional firm (corporate governance) and macro (institutional, depth of credit information and extent of shareholders' rights) level characteristics as detailed in section 3.1, whilst column (6) involves variables from models (1) to (5). The variables are defined in Table A.1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Firm Credit Ratings (Alternative Classification).

S&P's Rating	Score (Alternative)	Score (Baseline)	Firm-year obs. (Alternative)	Firm-year obs. (Baseline)	% of sample (Alternative)	% of sample (Baseline)
AAA	7	22	5	5	0.2	0.2
AA+	6	21	6		0.24	
AA	6	20	7	37	0.28	1.49
AA-	6	19	24		0.97	
A+	5	18	49		1.97	
A	5	17	87	335	3.5	13.47
A-	5	16	199		8	
BBB+	4	15	294		11.82	
BBB	4	14	312	877	12.55	35.26
BBB-	4	13	271		10.9	
BB+	3	12	205		8.24	
BB	3	11	258	695	10.37	27.95
BB-	3	10	232		9.33	
B+	2	9	176		7.08	
B	2	8	193	474	7.76	19.06
B-	2	7	105		4.22	
CCC+	1	6	44		1.77	
CCC	1	5	11		0.44	
CCC-	1	4	1	64	0.04	2.57
CC	1	3	2		0.08	
C	1	2	0		0	
D/SD	1	1	6		0.24	
<i>Total</i>			<i>2,487</i>	<i>2,487</i>	<i>100</i>	<i>100</i>

Notes: Firm credit ratings are the long-term issuer credit ratings compiled by Standard & Poor's. The ratings range from AAA (highest rating) to D-S/D (lowest rating). These ratings reflect S&P's assessment of the creditworthiness of the obligor with respect to its senior debt obligations. For purposes of our analysis, the multiple ratings are collapsed into seven categories according to the schedule provided above. S&P classifies ratings below BBB- as speculative

Table 5: Leadership Education Index & Firm Credit Ratings (Alternative Classification).

VARIABLES	(1) BASELINE	(2) WGI	(3) DEPTH	(4) SHAREHOLD	(5) CG	(6) ALL
Leadership Education Index	1.105*** (0.0378)	1.103*** (0.0378)	1.101*** (0.0376)	1.105*** (0.0378)	1.100*** (0.0386)	1.097*** (0.0386)
WGI		0.511 (0.274)				1.307 (0.472)
Depth of Credit			1.083** (0.0416)			1.093** (0.0456)
Extent of Shareholders' Rights				0.880 (0.0878)		
CEO Duality					1.539*** (0.136)	1.548*** (0.136)
Board Age (Avg)					1.011 (0.00920)	1.010 (0.00922)
Ln (No. of Board Members)					2.632*** (0.545)	2.506*** (0.512)
Board Independence (%)					2.765*** (0.485)	2.589*** (0.472)
ROA	1.160*** (0.0161)	1.163*** (0.0162)	1.162*** (0.0162)	1.162*** (0.0161)	1.161*** (0.0164)	1.164*** (0.0165)
Debt Ratio	0.0232*** (0.00550)	0.0208*** (0.00504)	0.0216*** (0.00520)	0.0220*** (0.00530)	0.0130*** (0.00347)	0.0126*** (0.00336)
Ln (Revenues)	1.888*** (0.0714)	1.875*** (0.0707)	1.884*** (0.0713)	1.880*** (0.0709)	1.794*** (0.0749)	1.792*** (0.0748)
Quick Ratio	0.709*** (0.0478)	0.704*** (0.0474)	0.706*** (0.0476)	0.700*** (0.0472)	0.679*** (0.0474)	0.682*** (0.0475)
Listed in SE	0.570*** (0.0836)	0.560*** (0.0825)	0.562*** (0.0828)	0.572*** (0.0839)	0.506*** (0.0799)	0.496*** (0.0778)
GDP growth (%)	0.878*** (0.0441)	0.841*** (0.0440)	0.888** (0.0451)	0.859*** (0.0440)	0.965 (0.0526)	0.962 (0.0587)
Inflation (%)	0.535*** (0.0382)	0.510*** (0.0383)	0.507*** (0.0388)	0.540*** (0.0384)	0.702*** (0.0605)	0.653*** (0.0648)
Country's S&P Rating	1.002 (0.0185)		0.997 (0.0183)		1.042** (0.0197)	
Firm-year observations	2,487	2,487	2,487	2,487	2,383	2,383
Unique firms	1,618	1,618	1,618	1,618	1,531	1,531
Countries	39	39	39	39	36	36
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.151	0.152	0.152	0.151	0.164	0.165

Ordered Logit results on eq.(4.1.1). Column (1) reports results for the 'Baseline' model. Columns (2) to (5) report results controlling for additional firm (corporate governance) and macro (institutional, depth of credit information and extent of shareholders' rights) level characteristics as detailed in section 3.1, whilst column (6) involves variables from models (1) to (5). The variables are defined in Table A.1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Leadership Education Index & Firm Credit Ratings (excluding Industries).

VARIABLES	(1) excl. TELEC	(2) excl. STAPL	(3) excl. ENER	(4) excl. HEALTH	(5) excl. IND	(6) excl. INF	(7) excl. MAT	(8) excl. UTILIT
Leadership Education Index	1.084** (0.0359)	1.068** (0.0353)	1.114*** (0.0378)	1.072** (0.0357)	1.105*** (0.0395)	1.102*** (0.0381)	1.083** (0.0368)	1.108*** (0.0368)
ROA	1.161*** (0.0161)	1.157*** (0.0156)	1.186*** (0.0177)	1.171*** (0.0161)	1.153*** (0.0164)	1.157*** (0.0164)	1.181*** (0.0168)	1.211*** (0.0161)
Debt Ratio	0.0298*** (0.00697)	0.0222*** (0.00512)	0.0165*** (0.00404)	0.0263*** (0.00605)	0.0234*** (0.00573)	0.0210*** (0.00504)	0.0260*** (0.00615)	0.0297*** (0.00694)
Ln (Revenues)	1.913*** (0.0730)	1.848*** (0.0684)	1.717*** (0.0672)	1.805*** (0.0667)	1.820*** (0.0695)	1.793*** (0.0666)	1.844*** (0.0693)	2.228*** (0.0942)
Quick Ratio	0.736*** (0.0517)	0.755*** (0.0508)	0.713*** (0.0501)	0.737*** (0.0493)	0.723*** (0.0496)	0.689*** (0.0474)	0.749*** (0.0516)	0.764*** (0.0525)
Listed in SE	0.492*** (0.0737)	0.519*** (0.0752)	0.536*** (0.0767)	0.511*** (0.0731)	0.502*** (0.0727)	0.534*** (0.0736)	0.486*** (0.0713)	0.399*** (0.0672)
GDP growth (%)	0.854*** (0.0413)	0.880*** (0.0430)	0.891** (0.0435)	0.922 (0.0462)	0.817*** (0.0418)	0.865*** (0.0416)	0.888** (0.0453)	0.926 (0.0486)
Inflation (%)	0.560*** (0.0399)	0.558*** (0.0405)	0.588*** (0.0438)	0.542*** (0.0402)	0.597*** (0.0447)	0.561*** (0.0403)	0.546*** (0.0401)	0.556*** (0.0408)
Country's S&P Rating	1.038** (0.0191)	1.022 (0.0177)	1.020 (0.0214)	1.013 (0.0174)	1.015 (0.0182)	1.021 (0.0172)	1.013 (0.0206)	0.998 (0.0188)
Firm-year observations	2,244	2,273	2,120	2,266	1,999	2,180	2,137	2,190
Unique firms	1,449	1,472	1,375	1,470	1,313	1,427	1,399	1,421
Countries	39	39	39	39	39	39	39	39
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.0932	0.0933	0.0934	0.0910	0.0914	0.0915	0.0939	0.113

Ordered Logit results on eq.(4.1.1). This table refers to the 'Baseline' specification (see section 3.1) and is the equivalent of Table 3 [Column (1)] if excluding each time a single industry from the sample. Columns (1) to (8) report these results. Industries excluded in each column are: energy (ENERG), health care (HEALTH), industrials (IND), information technology (INF), materials (MAT), consumer staples (STAPL), communication service (TELEC), utilities (UTIL). The variables are defined in Table A.1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7: ‘Data-driven’ weights in Education Index construction (Re-scaled output from FA).

	<i>Contribution in CEO’s score:</i>	<i>Contribution in CFO’s score:</i>	<i>Contribution in Chair’s score:</i>
Bachelor’s Degree	32.29%	29.33%	19.28%
Master’s Degree	28.89%	21.71%	29.55%
MBA Degree	15.55%	30.56%	24.50%
PhD Degree	23.27%	18.40%	26.67%
	<i>CEO’s contribution</i>	<i>CFO’s contribution</i>	<i>Chair’s contribution</i>
Leadership Education Index	30.64%	43.59%	25.77%

Weights obtained from Factor Analysis (using Principal Component Analysis and ‘varimax’ rotation). Retained factors are weighted with the variance they explain (eigenvalues). Weights were re-scaled to a 0-100 range. For a more detailed analysis of this approach, see Nicoletti et al. (2000, p.22).

Table 8: Leadership Education Index & Firm Credit Ratings (using FA weights).

VARIABLES	(1) BASELINE	(2) WGI	(3) DEPTH	(4) SHAREHOLD	(5) CG	(6) ALL
Leadership Education Index	2.126*** (0.523)	2.132*** (0.523)	2.045*** (0.503)	2.155*** (0.528)	1.955*** (0.496)	1.935*** (0.489)
WGI		0.620 (0.206)				1.388 (0.485)
Depth of Credit			1.097** (0.0403)			1.111*** (0.0453)
Extent of Shareholders' Rights				0.933 (0.0892)		
CEO Duality					1.486*** (0.123)	1.494*** (0.123)
Board Age (Avg)					1.017** (0.00857)	1.016* (0.00861)
Ln (No. of Board Members)					2.635*** (0.522)	2.486*** (0.483)
Board Independence (%)					2.593*** (0.430)	2.401*** (0.414)
ROA	1.174*** (0.0156)	1.177*** (0.0157)	1.176*** (0.0157)	1.176*** (0.0156)	1.175*** (0.0159)	1.178*** (0.0160)
Debt Ratio	0.0229*** (0.00517)	0.0208*** (0.00479)	0.0212*** (0.00483)	0.0220*** (0.00501)	0.0139*** (0.00345)	0.0134*** (0.00333)
Ln (Revenues)	1.877*** (0.0682)	1.863*** (0.0674)	1.873*** (0.0682)	1.866*** (0.0674)	1.794*** (0.0710)	1.791*** (0.0709)
Quick Ratio	0.738*** (0.0483)	0.733*** (0.0477)	0.734*** (0.0481)	0.729*** (0.0475)	0.716*** (0.0481)	0.719*** (0.0480)
Listed in SE	0.531*** (0.0753)	0.523*** (0.0740)	0.523*** (0.0738)	0.533*** (0.0753)	0.470*** (0.0725)	0.461*** (0.0699)
GDP growth (%)	0.873*** (0.0412)	0.838*** (0.0413)	0.885** (0.0423)	0.854*** (0.0413)	0.959 (0.0497)	0.956 (0.0555)
Inflation (%)	0.562*** (0.0389)	0.539*** (0.0393)	0.528*** (0.0391)	0.559*** (0.0387)	0.726*** (0.0599)	0.668*** (0.0638)
Country's S&P Rating	1.013 (0.0176)		1.008 (0.0174)		1.051*** (0.0190)	
Firm-year observations	2,487	2,487	2,487	2,487	2,383	2,383
Unique firms	1,618	1,618	1,618	1,618	1,531	1,531
Countries	39	39	39	39	36	36
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.0960	0.0965	0.0965	0.0961	0.104	0.104

Ordered Logit results on eq.(4.1.1). Index was constructed using the weights reported in Table 7. Column (1) reports results for the 'Baseline' model. Columns (2) to (5) report results controlling for additional firm (corporate governance) and macro (institutional, depth of credit information and extent of shareholders' rights) level characteristics as detailed in section 3.1, whilst column (6) involves variables from models (1) to (5). The variables are defined in Table A.1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Leadership Education Index & Firm Credit Ratings - Conditional effect.

VARIABLES	(1) BASELINE	(2) WGI	(3) DEPTH	(4) SHAREHOLD	(5) CG	(6) ALL
Leadership Education Index	2.608*** (0.961)	2.652*** (0.979)	2.615*** (0.963)	2.671*** (0.984)	2.230** (0.846)	2.337** (0.889)
Board Age (Avg)	1.039** (0.0167)	1.041** (0.0167)	1.039** (0.0168)	1.041** (0.0167)	1.044*** (0.0172)	1.044*** (0.0172)
Leadership Education Index × Board Age (Avg)	0.985** (0.00635)	0.984** (0.00637)	0.985** (0.00635)	0.984** (0.00635)	0.987* (0.00655)	0.987** (0.00658)
WGI		0.613 (0.191)				1.422 (0.497)
Depth of Credit			1.099** (0.0404)			1.115*** (0.0449)
Extent of Shareholders' Rights				0.921 (0.0879)		
CEO Duality					1.486*** (0.122)	1.492*** (0.123)
Ln (No. of Board Members)					2.652*** (0.524)	2.504*** (0.485)
Board Independence (%)					2.600*** (0.431)	2.413*** (0.416)
ROA	1.175*** (0.0155)	1.178*** (0.0156)	1.177*** (0.0157)	1.176*** (0.0156)	1.175*** (0.0159)	1.178*** (0.0160)
Debt Ratio	0.0242*** (0.00545)	0.0219*** (0.00503)	0.0222*** (0.00506)	0.0232*** (0.00527)	0.0145*** (0.00358)	0.0139*** (0.00345)
Ln (Revenues)	1.873*** (0.0685)	1.857*** (0.0677)	1.869*** (0.0685)	1.861*** (0.0676)	1.791*** (0.0709)	1.788*** (0.0708)
Quick Ratio	0.742*** (0.0488)	0.736*** (0.0482)	0.738*** (0.0486)	0.732*** (0.0481)	0.720*** (0.0484)	0.723*** (0.0484)
Listed in SE	0.532*** (0.0752)	0.523*** (0.0740)	0.524*** (0.0737)	0.533*** (0.0753)	0.473*** (0.0727)	0.464*** (0.0700)
GDP growth (%)	0.876*** (0.0420)	0.839*** (0.0424)	0.888** (0.0429)	0.858*** (0.0421)	0.957 (0.0494)	0.956 (0.0554)
Inflation (%)	0.569*** (0.0394)	0.544*** (0.0397)	0.534*** (0.0395)	0.567*** (0.0390)	0.734*** (0.0604)	0.675*** (0.0645)
Country's S&P Rating	1.012 (0.0173)		1.007 (0.0172)		1.051*** (0.0187)	
Firm-year observations	2,487	2,487	2,487	2,487	2,383	2,383
Unique firms	1,618	1,618	1,618	1,618	1,531	1,531
Countries	39	39	39	39	36	36
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
R-squared	0.0964	0.0968	0.0968	0.0965	0.104	0.105

Ordered Logit results on eq.(4.1.1). The conditional effect of board's seniority (average age) on the Leadership Education Index is tested. Column (1) reports results for the 'Baseline' model. Columns (2) to (5) report results controlling for additional firm (corporate governance) and macro (institutional, depth of credit information and extent of shareholders' rights) level characteristics as detailed in section 3.1, whilst column (6) involves variables from models (1) to (5).. The variables are defined in Table A.1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 10: Leadership Education Index - Dealing with endogeneity.

VARIABLES	(1a) HECKMAN	(1b) HECKMAN	(2) IVOPROBIT	(3) 2SRI
Leadership Education Index	1.105** (0.0557)	1.097** (0.0442)	1.720*** (0.335)	3.133** (1.647)
First Stage Residuals				0.339** (0.179)
ROA	1.132*** (0.0291)	1.084*** (0.0305)	1.086*** (0.0194)	1.193*** (0.0165)
Debt Ratio	0.263*** (0.0905)	0.206*** (0.0504)	0.163*** (0.0387)	0.0200*** (0.00621)
Ln (Revenues)	5.331*** (1.848)	2.162*** (0.121)	1.283*** (0.100)	1.718*** (0.117)
Quick Ratio	1.964*** (0.323)	1.031 (0.0710)	0.857*** (0.0323)	0.713*** (0.0716)
Listed in SE	2.148 (1.023)	1.282 (0.329)	0.854** (0.0542)	0.760* (0.113)
GDP growth (%)	1.101 (0.0685)	0.954 (0.0590)	0.935** (0.0250)	0.846*** (0.0440)
Inflation (%)	0.683*** (0.0695)	0.715*** (0.0625)	0.742*** (0.0607)	0.534*** (0.0425)
Country's S&P Rating	1.124*** (0.0339)	1.142** (0.0284)	1.007 (0.0105)	1.004 (0.0180)
Firm-year observations	2,487	2,487	2,487	2,487
Unique Firms	1,618	1,618	1,618	1,618
Countries	39	39	39	39
Industry Dummies	YES	YES	YES	YES
Year Dummies	YES	YES	YES	YES

Ordered Logit results on eq.(4.1.1). This table refers to the 'Baseline' specification (see section 3.1). Columns (1a) and (1b) list the results of the two-stage Heckman Ordered Probit estimation, with a dummy denoting whether a firm is in the top 10% of an industry according to size (revenues) (1a) or profitability (ROA) (1b) as the first stage instrument. Columns (2) and (3) list the results of the baseline model in a two-stage instrumentation setting (2SRI and Ordered Probit with endogenous covariates respectively). Instrument reflect the survey response to the question "Does the educational system meet the needs of a competitive economy?", obtained from the IMD World Talent Raking Survey. A.1. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 11: Board's Educational Characteristics & Firm Credit Ratings.

VARIABLES	CEO					CFO					CHAIR				
	(1) odds ratio	(2) odds ratio	(3) odds ratio	(4) odds ratio	(5) odds ratio	(6) odds ratio	(7) odds ratio	(8) odds ratio	(9) odds ratio	(10) odds ratio	(11) odds ratio	(12) odds ratio	(13) odds ratio	(14) odds ratio	(15) odds ratio
Major in Business/ Economics	0.901 (0.0822)	0.916 (0.0859)	0.922 (0.0862)	0.914 (0.0858)	0.919 (0.0863)	1.122 (0.100)	1.037 (0.109)	1.029 (0.110)	1.023 (0.108)	1.049 (0.111)	0.890 (0.0797)	0.883 (0.0809)	0.885 (0.0808)	0.886 (0.0809)	0.892 (0.0818)
Major in Engineering	1.262** (0.129)	1.275** (0.133)	1.289** (0.135)	1.273** (0.132)	1.287** (0.135)	1.282 (0.238)	1.136 (0.216)	1.158 (0.225)	1.167 (0.226)	1.120 (0.215)	1.324*** (0.140)	1.316** (0.141)	1.325*** (0.142)	1.316** (0.141)	1.331*** (0.143)
Master's Degree		0.994 (0.0779)			1.001 (0.0824)		1.354*** (0.139)			1.388*** (0.149)		1.038 (0.0811)			0.992 (0.0854)
MBA Degree			0.888 (0.0695)		0.889 (0.0696)			1.038 (0.0884)		1.070 (0.0915)			0.908 (0.0715)		0.904 (0.0713)
PhD Degree				0.950 (0.114)	0.959 (0.122)				1.135 (0.283)	0.897 (0.234)				1.312** (0.159)	1.322** (0.178)
ROA	1.172*** (0.0161)	1.173*** (0.0163)	1.174*** (0.0164)	1.173*** (0.0163)	1.173*** (0.0164)	1.176*** (0.0170)	1.176*** (0.0185)	1.174*** (0.0185)	1.175*** (0.0184)	1.175*** (0.0185)	1.174*** (0.0161)	1.170*** (0.0162)	1.171*** (0.0162)	1.170*** (0.0162)	1.172*** (0.0163)
Debt Ratio	0.0263*** (0.00625)	0.0247*** (0.00599)	0.0244*** (0.00588)	0.0245*** (0.00596)	0.0242*** (0.00587)	0.0250*** (0.00616)	0.0305*** (0.00791)	0.0280*** (0.00724)	0.0284*** (0.00734)	0.0303*** (0.00786)	0.0267*** (0.00584)	0.0271*** (0.00600)	0.0260*** (0.00575)	0.0273*** (0.00602)	0.0265*** (0.00587)
Ln (Revenues)	1.936*** (0.0752)	1.963*** (0.0777)	1.962*** (0.0777)	1.965*** (0.0781)	1.964*** (0.0782)	1.879*** (0.0737)	1.928*** (0.0820)	1.921*** (0.0825)	1.921*** (0.0819)	1.926*** (0.0825)	1.918*** (0.0666)	1.924*** (0.0673)	1.919*** (0.0672)	1.916*** (0.0673)	1.910*** (0.0672)
Quick Ratio	0.748*** (0.0526)	0.741*** (0.0530)	0.737*** (0.0527)	0.741*** (0.0531)	0.737*** (0.0528)	0.763*** (0.0543)	0.788*** (0.0605)	0.775*** (0.0597)	0.778*** (0.0598)	0.785*** (0.0605)	0.767*** (0.0516)	0.765*** (0.0517)	0.758*** (0.0515)	0.763*** (0.0516)	0.756*** (0.0513)
Listed in SE	0.571*** (0.0848)	0.557*** (0.0843)	0.556*** (0.0841)	0.556*** (0.0842)	0.555*** (0.0840)	0.533*** (0.0793)	0.456*** (0.0745)	0.447*** (0.0730)	0.448*** (0.0732)	0.458*** (0.0748)	0.578*** (0.0701)	0.575*** (0.0702)	0.572*** (0.0697)	0.576*** (0.0702)	0.574*** (0.0700)
GDP growth (%)	0.874*** (0.0457)	0.858*** (0.0457)	0.861*** (0.0455)	0.859*** (0.0457)	0.862*** (0.0462)	0.858*** (0.0442)	0.865*** (0.0464)	0.861*** (0.0464)	0.863*** (0.0464)	0.864*** (0.0465)	0.880** (0.0450)	0.881** (0.0454)	0.886** (0.0457)	0.881** (0.0454)	0.885** (0.0456)
Inflation (%)	0.570*** (0.0400)	0.571*** (0.0410)	0.580*** (0.0417)	0.571*** (0.0409)	0.579*** (0.0416)	0.556*** (0.0410)	0.589*** (0.0468)	0.586*** (0.0468)	0.588*** (0.0467)	0.586*** (0.0468)	0.573*** (0.0412)	0.575*** (0.0417)	0.583*** (0.0426)	0.580*** (0.0422)	0.588*** (0.0431)
Country's S&P Rating	1.015 (0.0180)	1.012 (0.0181)	1.014 (0.0181)	1.012 (0.0181)	1.013 (0.0181)	1.027 (0.0195)	1.052** (0.0220)	1.043** (0.0216)	1.045** (0.0219)	1.050** (0.0223)	1.020 (0.0189)	1.017 (0.0190)	1.018 (0.0190)	1.018 (0.0191)	1.020 (0.0191)
Firm-year observations	2,487	2,487	2,487	2,487	2,487	2,487	2,487	2,487	2,487	2,487	2,487	2,487	2,487	2,487	2,487
Unique firms	1,618	1,618	1,618	1,618	1,618	1,618	1,618	1,618	1,618	1,618	1,618	1,618	1,618	1,618	1,618
Countries	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.163	0.165	0.164	0.165	0.165	0.157	0.157	0.157	0.157	0.158	0.162	0.162	0.162	0.162	0.162

Ordered Logit results on eq.(4.1.1) on an individual basis for the 'Baseline' model as detailed in section 3.2. Columns (1) to (15) report results for the 'Baseline' model on CEO (Columns 1-5), CFO (Columns 6-10) and CHAIR's (Columns 11-15) educational attributes individually and combined. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 1: Education and Firm Credit Ratings

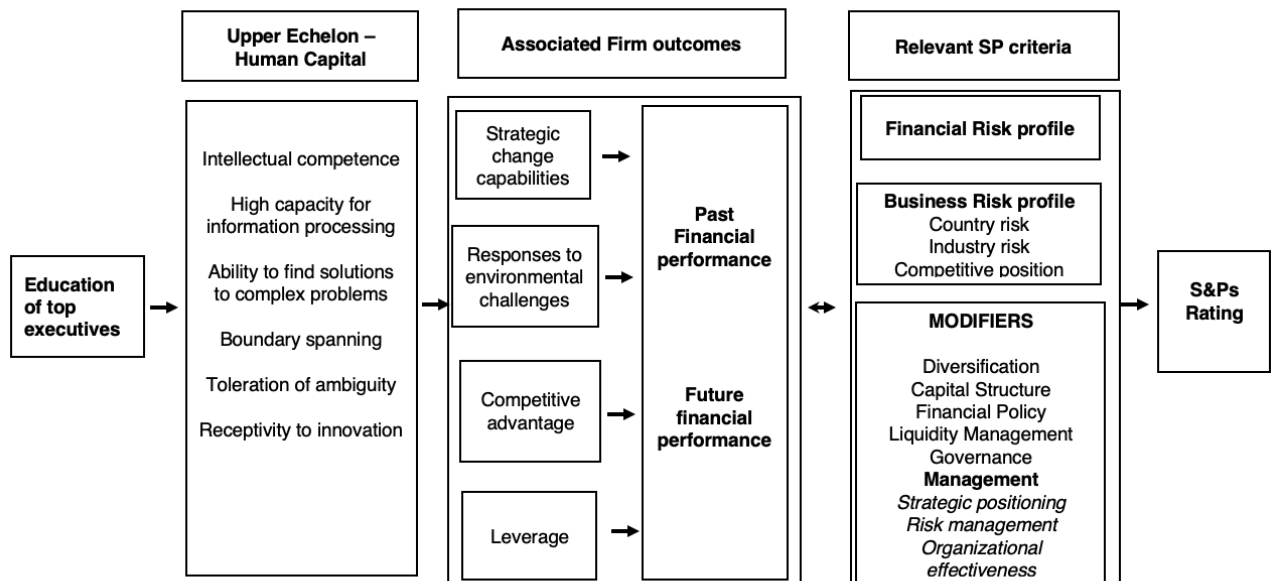


Table A1. Variable Description & Sources

	<i>Response Variable</i>	
S&P's Credit Rating	Standard and Poor's long-term issuer credit rating assigned to firms. Ratings range from AAA (highest rating=22) to D/SD (lowest rating=1). Originally, we use all 22 categories as defined by S&P. In further analysis, we follow Ashbaugh-Skaife et al. (2006) and collapse these ratings into 7 categories	Capital IQ
<i>Educational characteristics</i>		
Leadership Education Index	Composite index showing the educational attainment of the key members of the board (Chair, CEO, CFO). Construction according to eqs. (2.2.1) - (2.2.2)	Authors' elaboration on Capital IQ data
Major in <i>X</i>	This refers to an individual's major of undergraduate studies. All majors were classified into 'Business/Economics', 'Engineering' and 'OTHER', in the form of dummy variables	Authors' elaboration on Capital IQ data
Type of degree	Type of degree relates to four distinct dummy variables (i.e. Bachelor's, Master's, MBA, PhD), that take the value '1' if an individual holds such degree, and '0' otherwise	Authors' elaboration on Capital IQ data
Quality of degree	Quality of degree relates to the perceived quality of the institution from which an individual holds a type of degree. Three types of qualities were explored, IVY- and THE-listed Universities (for all types of degrees) and FT-listed Universities (for only the MBAs)	Authors' elaboration on Capital IQ data
<i>Corporate governance</i>		
CEO Duality	Dummy variable that takes "1" if same person holds CEO and Chair position, "0" otherwise	Capital IQ
Log (No. of Board)	Natural logarithm of total number of individuals on firm's board.	Authors' elaboration on Capital IQ data
Board Independence (%)	Ratio of total number of external owners divided by total number of board	Capital IQ
Board's Age	Average age of BoD key members calculated by the arithmetic average of the key BoD members in our analysis. Note: We compute the average of only the CEO and CFO when CEO holds a Chair position as well.	Capital IQ
<i>Firm specific characteristics</i>		
ROA	Net income before extraordinary items divided by total assets	Capital IQ
Debt ratio	Total loans divided by total assets	Capital IQ
Revenues	Total revenues (in USDmm)	Capital IQ
Quick ratio	Sum of total cash and short term investments, total accounts receivable, finance division accounts receivable, finance division cash and cash equivalents, finance division short-term investments and other receivables, divided by total current liabilities	Capital IQ
Listed in SE	Dummy variable that takes '1' if firm is listed in stock exchange, '0' otherwise	Capital IQ
<i>Macroeconomic variables</i>		
GDP growth (%)	Country's GDP growth	World Bank
Inflation (%)	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly	IMF
Country's S&P Rating	Sovereign ratings (Long-term foreign currency ratings)	S&P
Shareholder's rights index	Extent of Shareholder's rights in a country (ranges in the [0-10] interval)	World Bank
World governance indicators (WGI)	Country's (Aggregate) governance indicators. The arithmetic average of the 6 dimensions was used, re-scaled to the [0,1] range (using the 'min-max' method)	World Bank
Credit depth	Depth of Credit information index (ranges in the [0-10] interval)	World Bank

Table A2. Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Leadership Education Index	1														
(2) Board's Age	0.00614	1													
(3) CEO Duality	-0.00346	-0.180***	1												
(4) Ln(No. of Board)	0.0628***	0.0517**	-0.0291	1											
(5) Board Independence(%)	0.0644***	-0.0306	0.0533**	-0.0404*	1										
(6) ROA	0.0504**	0.0291	0.000489	0.0992***	-0.0332	1									
(7) Debt Ratio	0.0475**	-0.0237	0.0398**	-0.0370	0.510***	0.000943	1								
(8) Ln(Revenues)	0.112***	0.0738***	0.0428***	0.425***	-0.00453	0.230***	-0.0771***	1							
(9) Quick Ratio	0.0501**	0.0576**	-0.0567**	-0.0422*	-0.00158	0.154***	-0.131***	-0.182***	1						
(10) Listed in SE	0.0243	0.0114	-0.0555**	0.200***	-0.0803***	0.107***	-0.0520**	0.113***	0.123***	1					
(11) GDP growth (%)	-0.000456	-0.173***	-0.00224	0.0838***	-0.315***	-0.0101	-0.240***	0.0124	-0.00207	0.0437*	1				
(12) Inflation (%)	-0.0687***	-0.0398*	0.0206	-0.0692***	-0.574***	0.0282	-0.345***	-0.115***	0.00969	0.0224	0.225***	1			
(13) Sovereign S&P Rating	-0.000780	0.122***	0.00663	-0.223***	-0.0175	0.00839	0.0253	-0.0467*	-0.0530**	-0.00785	-0.346***	-0.174***	1		
(14) WGI	-0.0214	0.172***	-0.0654***	-0.160***	-0.0270	0.0196	-0.00796	-0.0208	-0.0307	-0.000723	-0.456***	-0.308***	0.798***	1	
(15) Extent of Shareholders' Rights	-0.0179	0.137***	-0.0350	-0.204***	-0.233***	-0.00226	-0.134***	-0.0788***	-0.0297	0.0202	-0.253***	0.148***	0.764***	0.723***	1
(16) Depth of Credit	0.0551**	0.0409**	0.0835***	-0.0987***	-0.00159	-0.0233	0.0725***	-0.0760***	0.0101	0.00721	-0.150***	0.255***	0.0971***	-0.0873***	0.109***

The variables are defined in Table A.1. *** p<0.01, ** p<0.05, * p<0.1