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Director capital and corporate disclosure quality

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A B S T R A C T

Conventional wisdom regarding board effectiveness emphasizes the role of board composition and incentives in alleviating conflicts of interest. We argue that board capital, however, may be a more important aspect of board efficacy since directors are the highest level agents of shareholders, meet infrequently, and shareholders have limited recourse for poor decision-making. In contrast, shareholders and the SEC can sue/prosecute directors for conflicts of interest or bias. One role of the board involves determining the depth and degree of the firm's financial disclosures. To test the idea that high capital boards seek to provide greater disclosure quality to investors, we manually collect data on director attributes and apply factor analysis to measure the networking, educational, and experience capital of the board. The results indicate that board capital is positively related to disclosure quality, with differing key attributes for inside and outside directors. These results are robust to 2SLS and difference-in-difference approaches.

1. Introduction

Does director capital affect governance effectiveness? Surprisingly, little is known about the answer to this question as there is scarce empirical research on the correlation between director capital and board effectiveness. Recent regulatory activity implies that one particular aspect of director knowledge is a critical aspect of governance efficacy; specifically, that financial expertise is an important consideration for audit committee competency (Sarbanes–Oxley Act of 2002). More generally, Becker (1964) suggests the productivity of agents (directors) depends on a broad range of attributes

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that comprise their human and social capital. Yet, the academic and popular press have primarily centered on director bias or incentives as the key issue in evaluating director efficacy. Economic theory suggests that short- and long-term incentives can mitigate moral hazard problems and that agent ability is equally important to outside shareholders (Ely and Välimäki, 2003). Moreover, board capital may be critical to shareholders as they have little recourse for poor decision-making due to limited director skills, but can seek remedy for conflicts of interest.

Casual inspection reveals that boards vary in terms of their human and social capital as directors have differing expertise, skills, and social contacts (Carpenter and Westphal, 2001). Among the variety of activities of monitoring and advising the board is involved in (Fama and Jensen, 1983), directors frequently have an impact on a fundamental feature during deliberations, namely, corporate disclosure quality. Our analysis begins from the perspective that high ability directors are concerned about safeguarding their own reputations by reducing asymmetric information between managers and outside investors. Consistent with this notion, Holmström (1999) observes that the agent's ability is a key consideration in purchasing labor services (i.e., hiring directors) and that reputation concerns are increasing in agent ability.

We investigate the role of director human and social capital on board oversight. More specifically, we posit that the education, work experience, and business networks of the board is positively related to corporate disclosure quality.[2] The underlying intuition builds on the notion that high ability agents, relative to low ability agents, seek to facilitate greater corporate transparency to allow the market to disentangle luck versus skill. In contrast, low ability directors prefer poor quality corporate disclosure in order to confound luck and skill, making it more difficult to assess their true performance. We further decompose the board into insiders and outsiders and argue that due to the different roles they play in corporate decision-making, different attributes of their human capital may have different effects on corporate disclosure quality.

To empirically test our hypothesis that board capital is related to corporate disclosure quality, we measure disclosure quality using a variation of the approach suggested by Kim and Verrecchia (2001). More specifically, we use an industry-adjusted version of their measure to further isolate the impact of firm characteristics on disclosure quality from industry factors. We also use an alternative approach developed in Anderson et al. (2009) who suggest that corporate opacity incorporates both a market scrutiny component and a factor attributable to the firms' choices regarding the divulgence of corporate information. Our measures of disclosure quality incorporate both accounting-based information (e.g., earnings quality) and market-based assessment of the overall information environment of the firm.

We manually collect data on three categories of director human capital and apply factor analysis to extract the underlying latent variables to capture the overall board capital as well as the director networking, educational, and experience capital. Our primary set of tests focuses on the relationship between board and disclosure quality, with further tests investigating the impact of each category of board capital. In another set of tests, we differentiate between outside and inside directors (e.g., inside networking capital, outside educational capital) in our examination of director capital and disclosure quality.

Using a sample comprised of industrial firms (687 firms; 6872 unique directors) in the Russell 1000 Index over the period 2003–2007, we find a significant and positive correlation between board capital and corporate disclosure quality. After controlling for firm and industry characteristics, our tests indicate that a one standard deviation increase in board capital is associated with about 18% greater disclosure quality. We also find that while the educational and experience capital of the board as a whole has a significant association with disclosure quality, networking capital appears to have little correlation to disclosure quality.

Although the results are consistent with the notion that director capital facilitates board oversight and improves disclosure quality, an alternative perspective is quite plausible. Namely, board capital could instead be a function of disclosure quality indicating that directors with greater human capital

[2] We treat the optimal level of disclosure for shareholders as exogenous. As such, our analysis suggests that shareholders in a firm requiring greater transparency should place greater emphasis on director capital in order to promote disclosure quality.

seek and accept positions in more transparent firms. A noteworthy aspect of this reverse causality concern is that it is the converse of the conventional endogeneity argument (Hermalin and Weisbach, 1998). To provide further insight into this endogeneity concern, we adopt a 2SLS-IV method, as well as a difference-in-difference approach. We develop a distinctive instrumental variable for director capital based on the distance between the corporate headquarters and the nearest metropolitan airport. We posit that traveling costs to board activities may be an important issue to directors, as more remote locations require greater time and energy to participate in corporate meetings and functions.[3] The underlying notion is that company location affects the likelihood of attracting high ability directors since better directors are likely to have busy agendas. We argue that this variable is a potentially viable instrument as it is related to board capital, but is not subject to managerial influence (at least in the short-term). Difference-in-difference regression provides us with more powerful implications regarding the causal relations. We find strong results indicating a positive impact of board capital on disclosure quality.

We also decompose the directors into outsiders and insiders and examine the effects of each type of director capital. We find that for outside directors, the aforementioned experience and education capital are the salient issue in evaluating their impact on disclosure quality. However, networking capital has little explanatory power for outside directors. We also find the same pattern appears with the insiders' capital. However, for insiders, their education capital seems to be more important than their experience capital, while for outsiders the opposite is true. Thus, the results suggest that the attributes that are important for inside and outside directors are somewhat different, with their education and experience capital being respectively the most salient issues in understanding disclosure quality.[4]

The findings of this paper have some important policy implications. The Sarbanes–Oxley Act (2002) seeks to improve corporate governance practices through greater board independence and legal liability under the assumption that governance crises stem from conflicts of interest. Our results suggest that while mandates about greater board independence may be important, director ability is at least as important to shareholders who are concerned about disclosure quality.[5] Consequently, this study provides empirical evidence to confirm that better boards are related to greater governance efficacy.

A second implication is that while mandates regarding financial expertise appear to be effective as we find they are associated with greater disclosure quality, our evidence suggests that outside shareholders' interest be promoted even more with other types of human capital that directors bring to the firm. Overall, our analysis implies that director capital is a crucial factor in governance efficacy and, as such, important to outside shareholders' interests.

2. Motivation and hypothesis development

2.1. Board efficacy, director capital and disclosure quality

The board of directors is considered one of the most important governance devices in monitoring the behavior of the CEO. Academic work regarding board effectiveness emphasizes the role of board

[3] Several issues potentially mitigate the effectiveness of this instrument. For instance, directors may have access to private aircraft, meetings may be regularly scheduled in other undisclosed locations, and firms can use video conferencing technology, all of which may serve to reduce the potential usefulness of this prospective instrument. We conduct a series of specification tests on our instrumental variable and the structural model that suggests it is an appropriate approach. Nevertheless, it is difficult to infer the nature of causality.

[4] The substantiality of the missing information on director capital in the corporate filings necessitates a laborious collection effort from a variety of sources, including: *LexisNexis*, *Google.com*, *The Dun and Bradstreet Reference Book of Corporate Management*, *Who's Who in Finance and Industry* and *MergentOnline*. Although, we were able to collect the data with substantial time and effort, our analysis suggests that outside shareholders would have difficulty collecting such information. As larger firms tend to have greater analyst following or face greater market scrutiny, our data collection may suffer from a firm size bias. To investigate this concern, we split our sample firms into large and small firms. We find that disclosure quality is positively related to director capital in both groups.

[5] Vafeas (2000) finds no effect of board composition on the earnings-return correlation, consistent with the notion that the market may be more concerned about other board characteristics on board efficacy.

composition in alleviating conflicts of interest, focusing on how board independence affects firm performance. While well publicized cases of corporate fraud and malfeasance indicate the need for guarding shareholders' interests and reducing bias, we argue that director capital should be of at least equal importance in the day-to-day operations of the firm. We posit that a crucial difference between bias and ability is that for board/director bias (or conflicts of interest problems), shareholders and government agencies can seek redress through the legal system, while there is limited recourse for poor ability.[6] Among class action litigation against boards of directors, almost all of them have accused the board of a "breach of fiduciary duty" due to conflicts of interest (Helland, 2006). In addition, the monetary compensation for shareholders from settlements in cases of conflict of interest is significant. For instance, according to the Stanford Securities Class Action Clearinghouse, the WorldCom and Enron litigations have reached settlement agreements of $6.128 and $4.760 billion, respectively. Other high profile cases see similar numbers.

In contrast to conflicts of interest, there is no easy recourse for director errors due to insufficient ability or skill. Veasey and Di Guglielmo (2005) suggest that the courts focus on the directors' intention and loyalty to serve the shareholders, not the outcome of the decisions. Even "stupid" decisions should not be part of the legal liability of the directors (Veasey and Di Guglielmo, 2005) even though they harm shareholders.[7] In addition, recent SEC reforms increasingly seek harsher penalties for director misconduct that stems from director bias/conflicts of interest problems, but have little to regulate director ability. The Sarbanes–Oxley Act (2002) requires that firms have "financial expert(s)" as those directors presumably are better able to prevent managerial misconduct on accounting issues. DeFond et al. (2005) and Davidson et al. (2004) find evidence that financial expertise of the audit committee matters in respect to alleviating agency issues. Brickley et al. (1999) suggest that firms do consider their abilities when selecting retired CEOs to serve on their boards. The implication is that director ability is an important component of board efficacy.

Perhaps one of the most important tasks of the board is developing the firm's corporate disclosure policy. Healy and Palepu (2001) observe that disclosure quality is a central issue for effective governance to outside shareholders. Ajinkya et al. (2005) and Karamanou and Vafeas (2005) find that the quality of managerial earnings forecasts are related to board independence. Dunn and Mayhew (2004) report that disclosure quality adds value to shareholders, which Klein (2002) intimates is a function of director characteristics. Gul and Leung (2004) find that the proportion of expert outside directors helps to mitigate the relationship between CEO power and voluntary disclosure. Furthermore, directors with greater human and social capital may have both the ability and the incentive to reduce asymmetric information issues in order to protect their own reputations. Stein (1989) observes that fear of replacement can influence agent behavior implying that high ability directors will be more willing to have more open disclosure strategies in comparison to lower ability directors.

Although measuring director ability likely requires capturing multi-dimensions, the underlying rationale for high ability directors to seek high disclosure quality seems similar across the differing aspects of ability. Intuitively, high ability directors would prefer that markets have sufficient information to disentangle performance gains/losses that are attributable to skill versus luck. In contrast, low ability directors would seem to prefer that outside investors cannot evaluate their true ability, seeking to blame poor performance on bad luck. While, one would expect this specious behavior in all types of

[6] For instance, Ribstein (2002) suggests that the common belief is that in the Enron case, the directors failed to detect and prevent the fraud due to their close ties to management rather than their poor decision-making. Vice Chancellor of the Court of Chancery Leo E. Strine (2002) suggests that "independent directors...have a trivial risk of legal liability."

[7] One high profile case is Disney's board's decision to hire the former president, Michael Ovitz, who was paid a no-fault termination package of $130 million after one year on the job. In subsequent attempts at litigation, none of the directors were found to breach their fiduciary duty (no conflicts of interest). However, the court did note that although the board's decision clearly fell short of best practices, it did not represent grounds for legal action as there was no bias in the decision-making process. The courts have consistently ruled that the key issue in shareholders seeking legal redress is the intention and/or bias of the board's decision-making, not their ability to make "good" decisions. The implication is that the judicial system does not offer recourse to shareholders concerning director ability.

directors to some extent, economic theory suggests it should be more pronounced in low ability directors relative to high ability directors (Holmström, 1999).[8]

From an outside shareholder perspective, being able to accurately assess firm activity through meaningful financial reports is an important product of the governance process as it facilitates external monitoring and the market for corporate control (Sloan, 2001). If director human and social capital improves governance efficacy, then we expect to observe a positive correlation between board capital and disclosure quality, which leads to our first hypothesis:

Hypothesis 1. Board capital is positively related to corporate disclosure quality.

Ability and individual attributes of human and social capital occur along several dimensions. This notion is widely recognized in educational testing and college admissions. Testing services attempt to capture both quantitative and qualitative skills, which may be highly correlated, but represent different aspects of student ability. College admission boards seek to evaluate test scores and other aspects of ability that focus on social capital (such as volunteer work and group membership). The underlying intuition is that each of these attributes is an important marker of student ability. Similarly, we consider three different attributes of director ability in measuring board capital. Our underlying arguments regarding board capital and corporate disclosure policy suggest that each of these individual components should exhibit a positive relationship with disclosure quality. This leads to our second hypothesis:

Hypothesis 2. Each of the individual board capital components (education, experience, and networking capital) is positively related to corporate disclosure quality.

2.2. Insiders' and outsiders' capital

Next, we decompose board capital into insiders' capital and outsiders' capital since extant research typically assumes that they have differing characteristics and roles in board monitoring. We suggest that the impact of the human and social capital of these two director types may differ due to differing director roles. Corporate insiders are thought to have detailed knowledge and understanding about the firm's operations, while independent directors act as monitors (Fama and Jensen, 1983). For instance, as the corporate insiders are the information initiators and decision-makers of the firm, the specific types of human capital that improves their information processing and decision-making ability should be important. Presumably, educational capital is related to intellectual rigor to learn and process information. In addition, a greater scope of work experience may enable the managers to be better able to gather, filter, and process various information embedded in a complex environment. Better knowledge of the firm's operations through work experience may also improve the communications and discussions with the outside directors (e.g., when they ask a question about the operations and projects). In addition, managers with greater work experience may be better able to judge and incorporate outsiders' views and opinions into further actions. Therefore, it is conceivable that the human capital proxies (education and work experience) are important for inside directors, while both human and social capital proxies are important for outside directors due to concerns about their external reputations.

Outsiders, on the other hand, are distinct from insiders in that they are thought to monitor corporate insiders, providing an objective perspective on managerial decision-making. Fama (1980) argues

[8] To illustrate this issue, consider two boards of directors in otherwise identical firms, one comprised of low ability directors and the other comprised of high ability directors. While the directors know their true ability levels, outside investors do not have this information. Firm performance is a function of both luck and ability. For simplicity, each firm, in addition to the ability component of firm performance, will face either lucky or unlucky gains/losses. With their private information on their own ability and knowing they could have either positive or negative luck in the upcoming year, the board chooses their desired disclosure policy. The chart below illustrates the relative disclosure choices each of these two boards will make given these two potential outcomes and their relative to desires for outsiders to know their respective abilities.

	Lucky Component + Ability Component	*Unlucky Component + Ability Component*
LowAbilityBoard	Weak Disclosure Quality	Weak Disclosure Quality
HighAbilityBoard	Strong Disclosure Quality	Strong Disclosure Quality

that outside directors are especially concerned with their external reputations increasing their incentive to monitor managers. Srinivasan (2005) finds that outside directors face consequences in their external board seats for financial reporting failure. In this context, if reputation is a first order concern for the directors in the directorship market, then we expect that directors with more external board seats to have stronger incentive to behave. Furthermore, outside directors who have experience in a variety of industrial and corporate environments may be better able to gather, judge, and process reports, plans, and proposals from corporate insiders and be better able to recognize any potential problems. Therefore, greater human capital of the outside directors should be positively related to disclosure quality.

This leads to our third hypothesis:

Hypothesis 3. The effects of human and social capital of the directors on corporate disclosure quality are different between insiders and outsiders.

3. Data, board capital indices, and descriptive statistics

3.1. Data source

Due to the need to manually collect data about each director, we limit our analysis to the industrial firms in the Russell 1000 Index of 2003, 2005, and 2007. We choose the 2-year gap to allow for a greater possibility of director changes. In addition, we require a firm to list its directors in the proxy statement and we focus on non-controlled companies. The final sample contains 687 industrial firms and 6872 unique directors.[9]

The disclosure regarding director capital information in the proxy statements is rather limited.[10] As such, we embark on an investigative process of manually collecting data from a variety of other sources for information about each director's work experience, lifetime board experience, educational background, professional training, industrial association affiliations, and honors and awards. We begin with the LexisNexis Academic as the primary information source for the directors.[11] To the extent that LexisNexis may be incomplete, we use alternative information sources to supplement and verify such information from MergentOnline (which also has director information under the *Executive Search* tab), Google.com, The Dun and Bradstreet Reference Book of Corporate Management, and Who's Who in Finance and Industry.[12] The data on the firm-level variables are from *CompuStat*, *ExecuComp* and *Dun & Bradstreet's American Corporate Families and International Affiliations*. This process yields 2002 firm-year observations with 59 firms with 2 years of complete data and 628 firms with 3 years of complete data.

3.2. Director capital proxies

In our analysis, board capital is measured by incorporating the human and social capital of the directors in the firm. Human capital consists of education and work experience that individual

[9] We require the directors to serve at least three months in a fiscal year to be counted in our sample for that year. We use the firms' proxy statements from 2004 as the starting point to identify the directors during fiscal 2003 (and 2006 for 2005 and 2008 for 2007). To include those directors who actually served in the sample years, but were absent from the 2004 or 2008 proxy statements due to death, resignation, or other reasons, we also conduct a thorough search on the proxy statements of the preceding year (e.g., 2002 proxy for 2003 directors).

[10] The proxy statements provide information regarding each director's name, age, gender, and director tenure. Regarding the human and social capital information of the directors, there is a large variation across firms in terms of their disclosure of this information. In their proxy statements, firms often disclose directors' most recent work experience and current external corporate board membership.

[11] More specifically, we use the "Research People" widget of the LexisNexis Academic database, which enables us to search for each individual director in a wide coverage of business-related news and databases. Within "Research People," we used "Biographies" (and databases like "Zoom People Information" and "Marquis Who's Who" within Biographies), and "Recent News Stories" to obtain the education, working experience, certification, and other human capital attributes.

[12] Larger firms usually have more media coverage and analyst following and, consequently, have more information available. We split our sample into large and small firm subsamples (by the median sample firm size) and we find in both subsamples our findings hold, suggesting that our results are not biased by the data collection process.

directors obtain cumulatively. Social capital is a measure of the directors' external network with outside institutions, corporations, or governments. The specific proxies used to measure board capital and other variables of interest are listed in the Appendix and discussed below.

We use several director characteristics to develop our measure of networking or social capital. The first characteristic is the current number of corporate boards a director sits on during the year. Gilson (1990) and Kaplan and Reishus (1990) suggest that directorship represents the market value of the director's ability and performance. The second is the current number of nonprofit boards a director sits on. Nonprofit boards often have a more diverse composition of directors and, as such, greater networking ties (O'Regan and Oster, 2005). We measure the number of nonprofit boards that a director has served during their life time. Next, we include any current or prior government position (e.g., department secretary, member of the Joint Chiefs of Staff, or other elected/nominated official) and government board service of the directors. Government board membership is designated or nominated by government agents (such as the president, governor, or mayor) or agencies (such as Congress or state and municipal governments). Finally, we collect information about the national-level professional affiliations (such as IEEE) and honors/awards of the directors. Reputational directors often have greater social connections and networking ties.

We also collect data on the educational capital of directors. Vafeas (2009) finds that the educational quality of high-ranking accounting officers is related to a more positive market perception. We use dummy variables to indicate whether a director has obtained a bachelor's degree, master's degree, law degree or medical degree, as well as a Ph.D. The individual directors' educational status are then aggregated to represent the overall board's educational capital by the number of the firm's directors with a bachelor's degree, an MBA, a master's degree other than MBA (such as JD and MD), or a Ph.D. Furthermore, social studies find that individuals with education from elite institutions are more likely to ascend to the upper level of social hierarchies including board membership and executive ranks (Useem and Karabel, 1986; Domhoff, 2002) suggesting that directors with such backgrounds tend to have more direct and indirect social ties with the elite class. As such, we include the number of directors with an undergraduate degree from elite colleges and directors with a prominent MBA degree as additional education variables. Following Useem and Karabel's (1986) classification of top-ranked colleges and prominent MBA programs, we collected the number of directors with degrees from such schools for each firm.[13]

The third type of board capital is the directors' working experience, which we define as the diversity of the directors' expertise established during their careers. We measure directors' expertise by searching their working history in five areas, namely, law, investment bank/venture capital, management consulting, accounting,[14] or academia. We then use the number of directors with experience in those five areas as our first proxy for the director experience capital.

We also capture director information regarding professional certification, such as CPA, CFA, or certified fraud examiner. Next, we collect the number of positions higher than vice president (Chemmanur and Paeglis, 2005) that directors have held during their lifetime. Additionally, we count the number of firms with which the directors have worked during their lifetime.

In Table 1, we report descriptive statistics for the 6872 unique directors in our sample. Panel A presents the number and percentage of directors with the specific educational characteristics. Among the directors in the sample firms, 86.2% of them have at least a bachelor's degree, while 61% report some form of graduate degree (or simply indicate a higher degree). Panel B reports descriptive statistics on various aspects of director experience capital. One interesting pattern is that it appears that outside directors have greater experience capital than inside directors, consistent with the notion that

[13] The timing of the ranking of schools generally matches with the age profile of most of today's board directors. Since the rankings may not be unanimous, we also used U.S. News & World Report for college and MBA rankings and Business Week for MBA rankings. We count directors with top 10 comprehensive undergraduate colleges and directors with MBA degrees from top 10 programs by either magazine in 2006. Not surprisingly, the rankings from different sources generate a very high correlation of 0.96 and yield virtually identical results regardless of the source of ranking.

[14] Srinivasan (2005) find that financial/accounting experts experience a reputation effect in the directorship market.

Table 1
Director statistics.

	Board	Insiders	Outsiders
Panel A: director educational backgrounds			
Bachelor's	86.23	81.66	87.48
MBA	30.67	27.34	31.89
Master's	57.05	49.10	59.21
Law	11.13	9.62	11.54
Ph.D.	9.83	6.01	10.87
Higher degree	61.00	51.73	63.52
Elite School	27.00	21.73	28.79
Panel B: director experience capital			
Certified	6.00	4.26	6.47
Professional experience	40.85	33.10	42.08
Honors and awards	3.90	1.64	4.52
Associations	14.88	11.86	15.71
Professor	9.90	2.81	11.83
Politician	7.70	2.40	9.14
Government board	10.41	5.07	11.86
Panel C: director networking capital			
Firms worked	2.30	2.19	2.33
Higher posts	4.71	5.10	4.60
Total boards	2.72	1.97	2.92
Nonprofit boards	1.17	1.01	1.22
Nonprofit ever	1.95	1.42	2.09
Company boards	1.54	0.95	1.71

This panel reports the percentage of individual directors with different levels of education within the board, the insiders and outsiders, respectively. "Higher degree" refers to a master's degree or above. Elite School refers to top 10 universities and top 10 MBA programs by Business Week and US News and World Report.
Certified refers to directors with professional certifications (e.g., CPA). Professional Experience includes directors with working experience as a partner/executive in law firms, accounting firms, consulting firms, and/or investment banking firms. Professor is a director with academic experience. Honors & Awards refers to national-level honors and awards (e.g., Hall of Fame). Associations refer to membership in a professional or industrial association. Politician is a director with prior government position experience. Government Board refers to the membership of directors on any government board designated or nominated by government agents or agencies (such as Congress or state and municipal governments).
Firms Worked refers to the number of firms the directors have worked with. Higher posts is the number of higher posts (higher than vice president) a director has obtained in a lifetime. Total Boards is the total number of boards (corporate and nonprofit) a director currently sits on. Nonprofit measures the number of nonprofit boards on which a director currently serves. Nonprofit Ever is the number of all the nonprofit boards a director has ever served on. Company Boards measures the number of corporate boards a director currently serves on.

outsiders are perceived to bring in more external resources.[15] Panel C indicates that outside directors have worked for only slightly more firms and have held fewer high level corporate posts.[16]

3.3. Director capital: aggregation from proxies

We apply factor analysis to our proxies (standardized by board size and we calculate the factor score to represent the underlying latent board capital).[17] The goal of using factor analysis is to "extract"

[15] The percentage of directors in law firm, accounting firm, consulting firm, IB/venture capital firm, and academia is 7.2%, 4.9%, 12.3%, 15.7%, and 10.7%, respectively.

[16] As mentioned above, human and social capital information about directors disclosed in proxy statements is rather limited. For instance, most of the sample firms do not disclose directors' educational background and/or specific degrees obtained. The quality/consistency of the information disclosed about directors also varies within a given firm with some directors having greater information provided about their human and social capital. In addition, even for the same director, different firms may disclose different levels of information about director capital.

[17] We use the average measure because board size is apparently an endogenous choice of the managers. Thus, the aggregate measure may be confounded with board size.

the underlying single measure from a group of noisy proxies. By design, factor score has a mean of 0 and standard deviation of 1. Because the latent variable presumably represents the commonality of the underlying proxies, we conduct some specification tests (Cronbach's alpha, TLI, CFI and RMSEA to ensure the construct validity of the factor analysis in Appendix Panel A).[18]

Our factor analysis on the 14 proxies suggests that they are loaded on one factor with an Eigen value of 2.22.[19] The second factor has an Eigen value of 0.92. We use the factor score on the first factor to represent the overall board capital. The validity tests all verify that this single factor can explain the majority of the variations of all the proxies. Similarly, we apply the same process to develop the categorical board capital measure. The validity tests shown in the Panel A of the Appendix suggest that a single factor is valid to represent the commonalities among the proxies.

Developing the respective director capital measures allows us to test the notion that the board capital components may have different effects on disclosure quality, as they conceptually measure different aspects of directors' human and social resources.

3.4. Dependent variable and control variables

We use an industry-adjusted variation of the approach suggested by Kim and Verrecchia (2001) as our market measure of the disclosure quality. They argue that since security prices are affected by both disclosed (public) information and privately-held information, we can infer the magnitude of private information by observing the relationship between share price changes and share trading volume. More specifically, Kim and Verrecchia (2001) posit that due to adverse selection, the cost for informed traders will be larger when the disclosure quality is poor. This happens because the information disclosed to the public is incorporated into the trading volume and the price. When the firm discloses less, the traders who rely on trading activities will be hurt as trading activities reflect less information regarding the firm. Consequently, trading volume will have less association with security prices in firms with poor disclosure quality. This notion leads to the following proxy of disclosure quality, which is the coefficient of the trading volume in the following regression:

$$Ln\left|\frac{P_t - P_{t-1}}{P_{t-1}}\right| = \beta_0 + \beta_1(VOL_t - AVGVOL) + \varepsilon_t \quad (1)$$

where P_t is the daily stock closing price, VOL_t is the daily trading volume of the stock in thousands of shares, and AVGVOL is the average of the daily stock trading volume within the previous 6 months (we use 182 days) in thousands of shares.

We run the time series regression in Eq. (1) based on the daily stock price/volume for every stock in the CRSP database for 2003, 2005, and 2007, respectively. For each firm each year, we have one estimate of β_1 as the proxy for its disclosure quality. To control for the impact of industry effect on firm disclosure, we use the raw β_1 minus the industry median value of β_1 by 49 Fama–French (1997) industry groups. When the firm discloses more, the industry-adjusted β_1 will be lower as traders will rely less on trading activities as a source for corporate information. That is, the information incorporated in the trading activities will be a smaller portion of the overall information set for the company, which consists of both public and private information. Note that the coefficient is an inverse measure of disclosure quality.[20] Therefore, we use the inverse of this coefficient for each firm as our primary measure of disclosure quality. This provides a measure where disclosure quality is increasing as the number gets larger.[21]

[18] The commonly accepted criteria suggest that TLI and CFI should be larger than 0.90, while RMSEA should be smaller than 0.10 to indicate a valid construct from the CFA test.

[19] We choose factor from factor analysis based on the selection criterion of an Eigen value larger than one.

[20] Also, for ease of presentation, we multiply the coefficient by −1000 so that a larger value means higher disclosure quality.

[21] The Kim and Verrecchia (2001) measure of disclosure quality, while theoretically appealing, is not a direct measure of disclosure quality and depends on the assumptions (e.g., market efficiency) used to derive it. To examine the appropriateness of this measure in the context of this analysis, we examine the adverse selection component of the bid-ask spread (Glosten and Harris, 1988). We find that our results are stronger in the subset of the sample with the greatest potential adverse selection problem. For additional robustness, we use an alternative measure of disclosure quality in our tests.

We also use an alternative non-market measure of disclosure quality. Kim and Verrecchia (2001) note that a firm's other information disclosure activities, such as analyst following, may subsume the trading volume implication on a firm's disclosure quality. Anderson et al. (2009) suggest that the overall or observed corporate opacity consists of two components, the internal component and the external component. The internal component is how much information management conveys to the market, while the remaining component is due to market scrutiny (e.g., analysts' following). For the overall corporate opacity, they develop an index based on four proxies: (1) the number of analysts, (2) analyst forecast errors, (3) bid-ask spreads, and (4) trading volume. Then, in a regression framework, they regress the corporate opacity index on three proxies for the internal disclosure component: (1) the CGQ (corporate governance quotient) from ISS (Institutional Shareholder Services), (2) earnings quality, and (3) the change in earnings per share. They observe that the predicted value from this regression captures the portion of the corporate opacity attributable to the firm's disclosure quality (Anderson et al., 2009). Our second measure of disclosure quality is theirs multiplied by −1 so that a higher value represents greater disclosure quality. Further, we adjust for industry effect by the aforementioned method.

We also include a set of control variables. First, we control for competition within the same industry since the collateral cost associated with disclosure may be greater in a more competitive industry. We use a Herfindahl index based on sales (SalesHHI) among firms in the same Fama–French (1997) industry group to measure industry competition. We include board size and board independence (Outsider ratio) to control for the effects from other board characteristics on disclosure quality. Board size is measured as the log of the number of directors.[22] Outsider ratio is measured as outside directors divided by the total number of directors. To control for the incentives for insiders, we include insiders' ownership as the percentage of equity held by corporate insiders (i.e., the top five executives and the directors). The insider ownership data is from proxy statements, annual reports, and ExecuComp.

We control for firm size (log of total sales) as larger firms may have greater information intermediary coverage and greater analyst following. We control for debtholders' concern on disclosure quality by leverage (long-term debt divided by total assets). We also include R&D, measured as Research & Development expense divided by total sales. Intangible investments, such as R&D, may be subject to the managerial manipulations of accounting earnings, suggesting a negative relationship between R&D and disclosure quality. We include the lag ROA, which is income before extraordinary items divided by total assets, to control for the effects of firm performance on disclosure quality. We use the total percentage of common equity ownership as a measure for institutional investors' influence.[23] Finally, we include stock return volatility to control for firm risk.

3.5. Sample descriptive statistics

Panel A in Table 2 provides summary statistics for firm characteristics including board capital and the three components, as well as the control variables used in our tests. The average disclosure quality by Kim and Verrecchia's (2001) measure is −0.16 and the median 0.00, while those of Anderson et al.'s (2009) measure are 0.16 and 0.01, respectively. The average board in our sample has about 10 directors, with 79% of them independent. On average, over 70% of the common equity is owned by institutional investors. Finally, as we use factor scores from factor analysis to measure board capital, the mean and the standard deviation are structured to be around zero and one. Similarly, the components (networking, education, and experience capital) all demonstrate the same pattern, with a mean of zero and standard deviation around one.

In Panel B of Table 2, we present the correlation matrix between the variables. It indicates that board capital is positively correlated with both measures of disclosure quality. Additionally, we find

[22] Recent studies offer a somewhat different view than the conventional wisdom on board size effect (Yermack, 1996). Boone et al. (2007) suggest that board size reflects the monitoring costs and benefits under contingencies. Coles et al. (2008) find that complex firms benefit from larger boards to accommodate their needs for greater monitoring.

[23] Institutional investors are perceived to have better access to information, as well as better information processing ability. In addition, their stakes in the firm make them more vulnerable to information asymmetry or adverse selection problems, leading to greater diligence regarding corporate disclosure practice from institutional investors.

Table 2
Board capital information.

	Mean	Median	Max	Min	Standard deviation
Panel A: firm characteristics (N = 2002)					
Disclosure quality (kV, 2001)	−0.16	0.00	1.54	−2.94	0.59
Disclosure quality (ADR, 2009)	0.16	0.01	3.34	−6.46	0.95
Networking capital (Board)	0.00	0.00	4.51	−1.56	1.00
Experience capital (Board)	0.00	0.00	3.36	−3.18	0.94
Education capital (Board)	0.00	0.00	2.45	−2.79	0.94
Board capital	0.00	0.00	3.27	−3.64	1.00
Board size (# of directors)	9.70	10.00	20.00	5.00	2.23
Firm size (log of sales)	8.07	8.00	12.70	0.02	1.43
Outsider ratio	0.79	0.81	1.00	0.36	0.11
Leverage	0.19	0.18	1.39	0.00	0.17
ROA	0.06	0.06	0.40	−1.32	0.10
R&D (%)	0.05	0.003	0.81	0.00	0.11
INSTOWN	0.72	0.73	1.00	0.22	0.17
Risk (stock return volatility)	0.42	0.37	3.50	0.12	0.22
SalesHHI	0.40	0.34	1.00	0.10	0.24
InsideOwn (%)	2.57	0.46	58.30	0.00	6.96

		1	2	3	4	5	6	7	8	9	10	11	12
Panel B: pair−wise correlation matrix (N = 2002)													
1	Disclosure Quality (kV, 2001)	1.00											
2	Disclosure Quality (ADR, 2009)	0.47*	1.00										
3	Board Capital	0.15*	0.24*	1.00									
4	Board Size	0.05	0.05	0.18*	1.00								
5	Firm Size (log of sales)	0.27*	0.14	0.26*	0.53*	1.00							
6	Outsider Ratio	0.07	0.06	0.29*	0.14*	0.16*	1.00						
7	Leverage	0.03	0.02	0.07*	0.06*	−0.01	0.08*	1.00					
8	ROA	−0.09*	−0.04	−0.07*	0.01	0.11*	−0.09	−0.32*	1.00				
9	R&D (%)	−0.01	−0.04	0.02	−0.04	−0.16*	−0.02	0.03	−0.24*	1.00			
10	INSTOWN	−0.01	0.02	−0.02	−0.22*	−0.22*	0.09	0.07*	−0.09*	0.05	1.00		
11	Risk (stock return volatility)	0.21*	0.22*	−0.07*	−0.29*	−0.31*	−0.06	−0.04*	−0.27*	0.30*	0.13*	1.00	
12	SalesHHI	−0.04	−0.02	0.04	0.10*	0.10*	0.03	0.08*	0.05*	−0.01	−0.02	−0.11*	1.00
13	InsideOwn (%)	−0.06	−0.02	−0.07*	−0.16*	−0.12*	−0.09*	−0.02	0.05*	−0.01	−0.04	0.09*	−0.00

	Disclosure quality (kV, 2001)		
	High[a] capital	Low[a] capital	t-Test p-value[b]
Panel C: univariate statistics (N = 2002)			
Board capital	−0.31	−0.50	<0.000
Networking capital	−0.36	−0.43	0.058
Education capital	−0.39	−0.48	0.010
Experience capital	−0.32	−0.54	<0.000
Insiders' capital	−0.38	−0.48	0.014
Outsiders' capital	−0.28	−0.53	<0.000

This table provides descriptive statistics of the variables. Disclosure Quality (kV) is the measure in Kim and Verrecchia (2001) and Disclosure Quality (ADR) is the inverse of the disclosure quality measure in Anderson et al. (2009). We adjust both measures for industry effect by subtracting the industry median, based on the 49 Fama–French (1997) industry groups. Firm Size is the logarithm of annual sales. Board Size is log of the number of directors. Outsider Ratio is the number of outside directors divided by the board size. Leverage is long-term debt divided by total assets. ROA is the net income before extraordinary items divided by total assets. R&D is the research & development expenses divided by total sales. INSTOWN is the total percentage of equity ownership of all the institutional investors. Risk is the volatility of the monthly stock returns of the previous 60 months. SalesHHI is the Herfindahl index based on sales among firms in the same Fama–French (1997) industry group. InsideOwn is the percentage of equity held by top corporate executives and directors. Networking (Education, Experience) Capital is the factor scores based on the respective proxies in the Appendix. Board Capital is the factor score developed from all 14 proxies.

* Denotes significant at 5%.

[a] High refers to firms with a capital value equal to or larger than the 75th quartile. Low includes those with a capital value equal to or lower than the 25th quartile.

[b] The p-value is from a t-test for equal means of disclosure quality between those two groups of firms.

that board capital is positively related with board size, board independence, and leverage, while negatively associated with risk and insider ownership. In Panel C of Table 2, we present the univariate tests on the means of disclosure quality (we use the Kim and Verrecchia, 2001 measure) between firms with high rankings by each of the board capital measures and those with low rankings. "High" refers to rankings equal to or higher than the 75th percentile of each measure and "Low" is equal to or lower than the 25th percentile.

Comparing firms with high and low director capital, we find that high board capital firms have statistically better disclosure quality than firms with low board capital (−0.31 of disclosure quality for high firms and −0.50 for low firms). Moreover, we determine that firms with higher networking, education, and experience capital have better disclosure quality than low capital firms. Notably, we find that firm disclosure quality differs most dramatically when outsiders' capital are different, with a gap of 0.25 between high outsiders' capital firms and low capital firms.

4. Multivariate test results

4.1. Board capital and disclosure quality

Our first test examines the correlation between board capital and disclosure quality. We use the following specification to test Hypothesis 1:

$$\begin{aligned}\text{Disclosure quality} = {} & \alpha + \beta_1 \times \mathit{Boardcapital} + \beta_2 \times \mathit{Outsiderratio} + \beta_3 \times \mathit{FirmSize} + \beta_4 \\ & \times \mathit{Leverage}\ \beta_5 \times \mathit{Boardsize} + \beta_6 \times \mathit{R\&D} + \beta_7 \times \mathit{ROA} + \beta_8 \times \mathit{INSTOWN} \\ & + \beta_9 \times \mathit{RISK} + \beta_{10} \times \mathit{SalesHHI} + \beta_{11} \times \mathit{InsideOwn} + \xi \end{aligned} \quad (2)$$

We use two measures for disclosure quality. The first is the inverse of the Kim and Verrecchia (2001) measure and the other was used in Anderson et al. (2009). Both measures are industry-adjusted. Our primary variable of interest is board capital capturing the human and social capital of all the directors on the board.

Column (1) in Table 3 presents the results of the OLS regression based on the Hubert–White Sandwich estimator clustered on the firm level (Froot, 1989). The results indicate that board capital is positively related to firm disclosure quality. Specifically, we find that the coefficient estimate of board capital is 0.033 and statically significant at 1% level (t = 3.82). A positive coefficient estimate for board capital is consistent with Hypothesis 1. This suggests that board capital improves governance efficacy by promoting greater disclosure quality. These results are also economically significant. Specifically, the results indicate that after controlling for other factors, a one standard deviation increase in board capital is associated with 20.6% higher disclosure quality.[24]

A potential concern when using OLS regression is that the results are driven by endogeneity. One possibility is that some omitted variables may be related to both board capital and disclosure quality. Another issue is the self-selection bias. Our findings can be simply interpreted as a "matching" story (i.e., high capital directors deliberately choose those firms with better disclosure quality to join). Although, this explanation is the opposite of the standard board endogeneity argument, it is certainly a plausible alternative. As such, we attempt to address the endogeneity concerns by the 2SLS-IV approach first. Then, we apply difference-in-difference methodology to further address the reverse causality issue.

For our instrument variable selection, we posit that the directors, especially those with greater capital, are typically busy individuals who must consider the traveling difficulties associated with their board activities. More specifically, we use the distance between the firm's corporate headquarters and the nearest metropolitan airport as a proxy for the traveling difficulties. The metropolitan areas include the following 10 cities: New York City, Los Angeles, Chicago, Washington–Baltimore, San Francisco, Philadelphia, Boston, Detroit, Dallas, and Houston. Other than travel considerations,

[24] We calculate this as follows. As the standard deviation of board capital is 1.00, the associated increase of the dependent variable is 0.033 ∗ (1.00) = 0.033, which is a 20.6% increase from the mean of the dependent variable (0.033/0.16).

metropolitan areas also provide greater networking opportunities and diversity. As such, they may be more desirable for directors than rural areas. Since the distance between the headquarters location and major airports is not typically a managerial choice in the short/medium term, we argue that it makes it a potentially important and robust instrument in our tests. We measure *Distance* as the log of mileage between the firm's headquarters and the nearest major airport (using Google Maps). A list of the firms and the distance to the closest major airport is available upon request.

In the first stage of the process, we use the instrument variable, *Distance*, to explain the cross-section board capital index. We find that *Distance* is negatively and significantly associated with board capital.[25] Specifically, we find that every 100% increase in the distance is associated with a 16% decrease in board capital, consistent with the notion that directors consider travel costs when choosing the firms they wish to serve. Given that the sample average distance to the nearest metropolitan airport is 195 miles and the range stretches from 2.7 miles to 1093 miles, we believe that transportation difficulties may provide a meaningful and exogenous instrument for board capital.

Column (2) of Table 3 presents the regression results for the second stage of the tests. The results are qualitatively similar to both the basic OLS results and the firm-level fixed effects regression results. In the 2SLS regressions, we find that the coefficient estimate of board capital is 0.047 and significant at 1% level ($t = 2.80$). In Columns (3) and (4), we present the OLS and 2SLS results using the Anderson et al. (2009) measure of disclosure quality. We again find that board capital demonstrates a positive correlation with disclosure quality. Overall, the results in Table 3 are consistent with Hypothesis 1.

4.2. Components of board capital and disclosure quality

In order to examine the relationship between the individual board capital components and disclosure quality (Hypothesis 2), we use the following specification:

$$\begin{aligned}\text{Disclosure Quality} = {} & \alpha + \beta_1 \times \textit{Networking} + \beta_2 \times \textit{Educational} + \beta_3 \times \textit{Experience} + \beta_4 \\ & \times \textit{OutsiderRatio} + \beta_5 \times \textit{FirmSize} + \beta_6 \times \textit{Leverage} + \beta_7 \times \textit{BoardSize} \\ & + \beta_8 \times \textit{R\&D} + \beta_9 \times \textit{ROA} + \beta_{10} \times \textit{INSTOWN} + \beta_{11} \times \textit{RISK} + \beta_{12} \\ & \times \textit{SalesHHI} + \beta_{13} \times \textit{InsideOwn} + \xi \end{aligned} \tag{3}$$

Our arguments suggest that the components of board capital (networking, education, and experience) may have different effects on disclosure quality. Table 4 demonstrates that both the firm-clustered and firm fixed effects models generate qualitatively and quantitatively similar results. More specifically, in Columns (1) and (2), we present the results using Kim and Verrecchia (2001) measure as disclosure quality. We find that networking capital is positive, but insignificant.[26] In contrast, the educational and experience capital components are both found to be positive and significantly related to disclosure quality. Further, the magnitude of the coefficients indicates that experience capital may have the greatest influence on disclosure quality. The results in Columns (3) and (4) provide a similar picture when we use Anderson et al.'s (2009) measure. The results suggest that all components of director capital have significant effects on disclosure quality, while the experience capital seems to have the

[25] In the first stage test, we use the following specification, *Board Capital* = $\alpha + \beta_1$ *Distance* + β_2 *Outsider Ratio* + β_3 *Firm Size* + β_4 *Risk* + β_5 *Leverage* + β_6 *Board Size* + β_7 *R&D* + β_8 *ROA* + β_9 *INSTOWN* + β_{10} *SALESHHI* + β_{11} *INSIDEOWN* + ζ. We conduct a series of specification tests on our instrumental variable and the structural model. Our first test is the Hausman endogeneity test that examines whether the IV estimator significantly differs from the OLS estimator indicating an endogeneity concern (Hayashi, 2000). The results of the test provide a χ^2-statistic of 7.671 with an associated p-value < 0.01, indicative of endogeneity concerns and the use of a 2SLS approach to estimate the relation between firm performance and board heterogeneity. Then, we conduct the under-identification and weak-identification tests to determine whether the instrument variable meets the relevance and exclusion conditions. The relevance condition refers to the fact that the instrument variable needs to have significant explanatory power on the endogenous variable, even after all the exogenous variables. The exclusion condition states that the instrument variable has effect on the dependent variable only through its influence on the endogenous variable. We find that both tests generate highly significant statistics, suggesting that the instrument variable satisfies both conditions. For instance, the weak-identification test has the Kleibergen-Paap F-statistic of 25.23, which is well above the threshold proposed in Stock and Yogo (2005) suggesting sufficient explanatory power for the instrument.

[26] Our measure of networking capital may also capture the effect of director "business" (Fich and Shivdasani, 2006) which may be negatively related to disclosure quality.

Table 3
Board capital and disclosure quality.

Variable	Dependent variable			
	Disclosure quality (kV, 2001)		Disclosure quality (ADR, 2009)	
	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
Intercept	−1.888***	−1.933***	−2.202***	−2.142***
	(−4.18)	(−5.20)	(−4.82)	(−4.11)
Board capital	**0.033*** **	**0.047*** **	**0.051** **	**0.060** **
	(3.82)	**(2.80)**	**(2.52)**	**(2.52)**
Outsider ratio	0.300	0.181	0.540**	0.422**
	(1.32)	(1.41)	(2.02)	(2.21)
Firm size	0.076***	0.077***	0.128***	0.151**
	(5.44)	(4.59)	(2.93)	(3.16)
Leverage	0.150*	0.163*	−0.126*	−0.172**
	(1.70)	(1.85)	(−1.85)	(−2.29)
Board size	−0.071	−0.085	0.098	0.258*
	(−0.84)	(−0.92)	(1.57)	(1.80)
R&D	−0.011***	−0.034***	0.777	0.810**
	(−2.90)	(−3.51)	(1.64)	(2.37)
ROA (lag)	−0.840***	−0.423**	−0.569**	−0.539*
	(−3.52)	(−2.00)	(−2.15)	(−1.94)
INSTOWN	−0.031	−0.028	0.033**	0.058**
	(−0.77)	(−0.80)	(2.33)	(2.30)
Risk	0.445***	0.168**	0.156	0.168
	(7.73)	(2.02)	(1.24)	(1.01)
SalesHHI	−1.474**	−1.349**	−0.239*	−0.472**
	(−2.12)	(−2.08)	(−1.90)	(−2.00)
InsideOwn	−0.050	−0.084	−0.177**	−0.162**
	(−1.33)	(−1.38)	(−2.22)	(−2.20)
Industry & year dummy	Yes	Yes	Yes	Yes
Observations	2002	2002	2002	2002
Adjusted R^2	0.38	0.40	0.30	0.33

This table presents the results of regressing board capital on the disclosure quality and the control variables. Disclosure quality (kV) is the Kim and Verrecchia (2001) measure multiplied by −1000 so that a larger value indicates a higher disclosure quality. Disclosure quality (ADR) is the inverse of the disclosure quality measure in Anderson et al. (2009). We adjust both measures for industry effect using the Fama and French (1997) classifications. Firm Size is the logarithm of annual sales. Board Size is the log of the number of directors. Outsider Ratio is the number of outside directors divided by the board size. Leverage is long-term debt divided by total assets. ROA is the net income before extraordinary items divided by total assets. R&D is the research and development expenses divided by total sales. INSTOWN is the total percentage equity ownership of all the institutional investors. Risk is the volatility of the monthly stock returns of the previous 60 months. SalesHHI is the Herfindahl index based on sales among firms in the same industry. InsideOwn is the percentage of equity held by top corporate executives and directors. Board Capital is a factor score developed from 14 proxies in the Appendix. *t*-Statistics (by Huber–White Sandwich estimates, allowing for correlation of all observations of a given firm) are in parentheses.

* Statistical significance at the 10% levels, respectively.

** Statistical significance at the 5% levels, respectively.

*** Statistical significance at the 1% levels, respectively.

greatest impact.[27] Taken together, these results imply that directors' educational, as well as experience, capital assist them in shaping the corporate disclosure practice. As the three components exhibit relatively high correlations, we also orthogonized each of the measures and found similar results. Overall, these findings suggest that H2 is not supported entirely.

Next, we explore the disclosure quality implications of inside and outside director capital (Hypothesis 3). We suggest that outside director networking ties or social capital is an especially important aspect of directors' reputational concerns. Even though our previous results are insignificant regarding networking capital, this could occur once we mingled inside and outside directors together. Moreover,

[27] *F*-tests indicate that the experience capital coefficient is significantly larger than that of education capital in all four regressions.

Table 4
Board capital components and disclosure quality.

Dependent variable	Disclosure quality: (kV, 2001)		Disclosure quality: (ADR, 2009)	
	(1) Firm clustered	(2) Firm fixed effects	(3) Firm clustered	(4) Firm fixed effects
Intercept	−1.211***	−1.120***	2.169***	2.173***
	(−3.72)	(−3.99)	(3.99)	(4.11)
Networking capital	**0.029**	**0.015**	**0.022**	**0.025**
	(1.55)	**(0.99)**	**(1.38)**	**(1.24)**
Educational capital	**0.012****	**0.019****	**0.013****	**0.011***
	(2.25)	**(2.21)**	**(2.07)**	**(1.92)**
Experience capital	**0.024*****	**0.033****	**0.047****	**0.041****
	(2.92)	**(2.35)**	**(2.39)**	**(2.01)**
Outsider ratio	−0.355	0.180	0.411	0.211
	(−1.45)	(0.83)	(1.22)	(1.45)
Firm size	0.078***	0.076***	0.224***	0.247***
	(6.77)	(6.81)	(3.02)	(3.20)
Leverage	0.142*	0.227	−0.025	−0.035
	(1.70)	(1.40)	(−1.21)	(−1.55)
Board size	−0.065	−0.073	0.262	0.111
	(−1.13)	(−0.95)	(1.34)	(1.52)
R&D	−0.010**	−0.034***	0.751***	0.725***
	(−2.22)	(−4.37)	(2.66)	(2.63)
ROA (lag)	−0.834***	−0.439**	−0.603	−0.582
	(−3.53)	(−4.47)	(−1.25)	(−1.33)
INSTOWN	−0.070	−0.154	0.035**	0.054**
	(−1.02)	(−1.26)	(2.32)	(2.22)
Risk	0.440***	0.141*	0.372	0.043
	(7.55)	(1.74)	(0.99)	(1.02)
SalesHHI	−1.348**	−1.458**	−0.200*	−0.201*
	(−2.02)	(−2.19)	(−1.84)	(−1.88)
InsideOwn	−0.042	−0.055	−0.169**	−0.170**
	(−1.21)	(−1.00)	(−2.12)	(−2.09)
Industry & year dummy	Yes	Yes	Yes	Yes
Observations	2002	2002	2002	2002
Adjusted R^2	0.33	0.31	0.30	0.27

This table presents the results of regressing board capital components on firm disclosure quality. Disclosure quality (kV) is the Kim and Verrecchia (2001) measure multiplied by −1000 so that a larger value indicates higher disclosure quality. Disclosure quality (ADR) is the inverse of the disclosure quality measure in Anderson et al. (2009). We adjust both measures for industry effect using the Fama and French (1997) classifications. Firm size is the logarithm of annual sales. Board size is the log of the number of directors. Outsider Ratio is the number of outside directors divided by the board size. Leverage is long-term debt divided by total assets. ROA is the net income before extraordinary items divided by total assets. R&D is research and development expenses divided by total sales. INSTOWN is the total percentage equity ownership of all the institutional investors. Risk is the volatility of the monthly stock returns of the previous 60 months. SalesHHI is the Herfindahl index based on sales among firms in the same industry. InsideOwn is the percentage of equity held by top corporate executives and directors. Networking, Educational, and Experience Capital is a factor score developed from proxies in the Appendix. *t*-Statistics (by Huber–White Sandwich estimates, allowing for correlation of all observations of a given firm) are in parentheses.

* Statistical significance at the 10% levels, respectively.

** Statistical significance at the 5% levels, respectively.

*** Statistical significance at the 1% levels, respectively.

the human capital of inside directors may be especially important as they control the day-to-day operations of the firm and they can play a critical role in determining disclosure quality.

Splitting insiders and outsiders, we adopt the same factor analysis process on the 14 proxies to develop board capital measures for outsiders and insiders, respectively. We use the conventional definition of independent directors (i.e., directors affiliated with the company only through their board service).[28]

[28] We also include the insiders with external board seats as outsiders to capture their commonality in terms of incentives to monitor due to reputation concerns. Alternatively, we reclassify gray directors as insiders. We find similar results regardless of these alternations.

Table 5 reports the regression results using both measures of disclosure quality. In Column (1), we present the results using the aggregate board capital indexes for outsiders and insiders. We find that our previous results are primarily driven by the outsiders' capital, consistent with the notion that disclosure quality is a crucial aspect of board governance and monitoring. It also reinforces our notion that the directors' reputation in the job market may be of great concern in their monitoring efficacy.[29] In Columns (2) and (3), we examine the specific components of board capital of outsiders and insiders. The findings suggest that among outsiders, their experience capital seems to be the salient factor related to greater disclosure quality. For insiders, we find that it is both their education and experience capital that are related to disclosure quality. Consistent with the results for the board as whole, the networking capital of both insiders and outsiders are not related to firm disclosure quality.

The results in Columns (4)–(6) demonstrate similar patterns when we use Anderson et al.'s (2009) measure for disclosure quality. Again, we find that outsider's capital exhibits greater effect on disclosure quality than insiders' capital. In addition, the results show that outsiders' and insiders' education and experience capital are important to disclosure quality, consistent with the notion that different attributes of the insiders and outsiders may play different roles in the monitoring of managers.

Shareholders may benefit most by bringing in monitors with sufficient experience and expertise that they are able to disseminate information to the outside. Under the premise that educational capital reflects the innate ability of directors, the results imply that firms with high ability directors are less inclined to keep shareholders in the dark about corporate activities. In general, these results indicate that shareholders value different characteristics for outsiders and insiders that will match-up with their particular job descriptions for the firm.

4.3. Difference-in-difference and other robustness tests

In this section, we conduct a series of robustness tests. First and foremost, we address the reverse causality concern of board capital with a difference-in-difference test approach. More specifically, we use the following specification in Eq. (4):

$$Disclosurequality_{t-(t-2)} = \alpha + \beta_1 \times Boardcapital_{t-(t-2)} + \beta_x \times Controls_{t-(t-2)} + \xi \quad (4)$$

In Eq. (4), t indicates the year of 2007 (2005). For each variable in the equation, we use their 2007 (2005) value minus their 2005 (2003) value for each firm. We run OLS regressions based the differenced variables and we present the results in Table 6. In Columns (1) and (2), the results indicate that board capital has a strong positive impact on both measures of disclosure quality. In Column (3), board capital also has a positive and significant impact on firm performance. Together with our other tests, we believe that our prior findings are not likely to be confounded by endogeneity. The difference-in-difference test confirms that board capital has a causal effect on disclosure quality and firm performance.

As we measure a comprehensive set of human and social capital of the directors, our findings may be also consistent with the notion that it is actually just the accounting/financial expertise of the directors that promotes disclosure quality. To explore this possibility, we include accounting/financial expertise in the regressions and we recalculate board capital without accounting/financial expertise. We measure accounting/financial expertise by the ratio of directors with experience as a CFO, chief accounting officer, controller, treasurer, VP-finance (or other accounting/finance related positions), with CPA/CFA certificate, or with accounting/auditing firm partner experience.[30] We find that our measure of financial/accounting expertise is positive and significantly associated with disclosure quality. However, board capital remains qualitatively and quantitatively similar to our prior results.[31] We

[29] F-tests reject the equality of the coefficients of outsiders' capital and insiders' capital ($p < 0.00$).

[30] We use the narrow definition of "financial expertise" as the literature suggests that such expertise has the effect on corporate governance, rather than the broad definition by Sarbanes–Oxley Act, which includes other executive experience such as CEO, president, etc.

[31] Economically, we find that a one standard deviation (0.1) increase of financial expertise is associated with a 3.1% and 2.4% increase in kV and ADR measure of disclosure quality, respectively, while a one standard deviation (1.0) increase in board capital is related to a 17.5% and 20.6% increase in the corresponding measure of disclosure quality, respectively.

Table 5
Outsiders' and insiders' capital on disclosure quality.

Dependent variable	Disclosure quality: (kV, 2001)			Disclosure quality: (ADR, 2009)		
	Firm clustered (1)	Firm clustered (2)	Fixed effects (3)	Firm clustered (4)	Firm clustered (5)	Fixed effects (6)
Intercept	−1.111***	−1.100***	−2.755***	2.193***	2.222***	2.136***
	(−3.77)	(−3.92)	(−3.48)	(3.21)	(3.39)	(3.11)
Outsidercapital	**0.027*** **	–	–	**0.032** **	–	–
	(3.58)			**(2.40)**		
Insidercapital	**0.011***	–	–	**0.019***	–	–
	(1.90)			**(1.89)**		
Networking capital (outsiders)	–	**0.022**	**0.021**	–	**0.024**	**0.023**
		(1.03)	**(0.83)**		**(1.18)**	**(1.24)**
Educational capital (outsiders)	–	**0.007***	**0.005***	–	**0.018***	**0.018***
		(1.93)	**(1.79)**		**(1.88)**	**(1.87)**
Experience capital (outsiders)	–	**0.018*** **	**0.017*** **	–	**0.031** **	**0.030** **
		(2.82)	**(2.70)**		**(1.99)**	**(2.10)**
Networking capital (insiders)	–	**0.014**	**−0.063**	–	**−0.018**	**−0.020**
		(0.89)	**(−1.02)**		**(−1.00)**	**(−1.01)**
Educational capital (insiders)	–	**0.013***	**0.012***	–	**0.012***	**0.011***
		(1.92)	**(1.71)**		**(1.92)**	**(1.87)**
Experience capital (insiders)	–	**0.008** **	**0.007** **	–	**0.015** **	**0.016** **
		(2.21)	**(2.01)**		**(2.04)**	**(2.11)**
Outsider ratio	0.110	0.344	0.122	0.118	0.115	0.110
	(1.22)	(1.42)	(1.04)	(1.20)	(1.22)	(1.29)
Firm size	0.076***	0.074***	0.038***	0.117**	0.120**	0.102**
	(6.63)	(6.32)	(3.81)	(2.20)	(2.15)	(2.12)
Leverage	0.155*	0.153*	0.219	−0.117	−0.120	−0.141
	(1.70)	(1.91)	(1.35)	(−1.32)	(−1.20)	(−1.29)
Board size	−0.079	−0.077	−0.061	0.108	0.114	0.277
	(−0.94)	(−0.94)	(−1.32)	(1.02)	(1.05)	(1.55)
R&D	−0.010**	−0.011**	−0.034**	0.177**	0.166***	0.173***
	(−2.24)	(−2.43)	(−2.31)	(2.50)	(2.63)	(2.60)
ROA (lag)	−0.842***	−0.833***	−0.422**	−0.499	−0.560	−0.555
	(−2.59)	(−3.52)	(−2.02)	(−1.23)	(−1.22)	(−1.15)
INSTOWN	−0.174	−0.187	−0.235*	0.338**	0.341**	0.329**
	(−1.22)	(−1.30)	(−1.71)	(2.20)	(2.30)	(2.23)
Risk	0.425***	0.431***	0.152*	0.385**	0.398**	0.341**
	(7.37)	(7.44)	(1.88)	(2.00)	(1.99)	(1.99)
SalesHHI	−1.456**	−1.318*	−0.923*	−0.419*	−0.411*	−0.150*
	(−2.20)	(−1.90)	(−1.74)	(1.82)	(−1.90)	(−1.83)
InsideOwn	−0.045	−0.040	−0.049	−0.175	−0.170	−0.164
	(−1.19)	(−1.11)	(−1.08)	(−1.22)	(−1.20)	(−1.22)
Industry & year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2002	2002	2002	2002	2002	2002
Adjusted R^2	0.36	0.35	0.35	0.35	0.31	0.33

This table reports the results of regressing insiders' and outsiders' capital on firm disclosure quality. Disclosure quality (kV) is the Kim and Verrecchia (2001) measure multiplied by −1000 so that a larger value means higher disclosure quality. Disclosure quality (ADR) is the inverse of the disclosure quality measure in Anderson et al. (2009). We adjust both measures for industry effect using the Fama and French (1997) classifications. Firm Size is the logarithm of annual sales. Board Size is the log of the number of directors. Outsider Ratio is the number of outside directors divided by the board size. Leverage is long-term debt divided by total assets. ROA is the net income before extraordinary items divided by total assets. R&D is the research and development expenses divided by total sales. INSTOWN is the total percentage equity ownership of all the institutional investors. Risk is the volatility of the monthly stock returns of the previous 60 months. SalesHHI is the Herfindahl index based on sales among firms in the same industry. InsideOwn is the percentage of equity held by top corporate executives and directors. Outsidercapital (Insidercapital) is a factor score developed from proxies in the Appendix for outside and inside directors, respectively. *t*-Statistics (by Huber–White Sandwich estimates, allowing for correlation of all observations of a given firm) are in parentheses.

* Statistical significance at the 10% levels, respectively.
** Statistical significance at the 5% levels, respectively.
*** Statistical significance at the 1% levels, respectively.

Table 6
Difference-in-difference regressions.

Dependent variable	Disclosure quality (kV, 2001) (1)	Disclosure quality (ADR, 2009) (2)
Intercept	−0.015*	−0.043
	(−1.91)	(−1.42)
BoardCapital	**0.042*** **	**0.033** **
	(4.11)	**(2.31)**
Outsider ratio	0.750***	0.804*
	(2.69)	(1.91)
Firm size	0.066	−0.266**
	(1.35)	(−2.11)
Leverage	0.437**	−0.137
	(2.03)	(−0.83)
Board size	0.223	0.033
	(1.27)	(0.92)
R&D	−0.010*	0.513
	(−1.69)	(0.88)
ROA (lag)	−0.610	−0.134
	(−1.20)	(−1.11)
INSTOWN	0.030**	0.045**
	(2.11)	(2.16)
Risk	−1.222***	0.093
	(−5.02)	(1.36)
SalesHHI	−1.633	−0.123
	(−0.92)	(−0.56)
InsideOwn	−0.041	−0.112
	(−1.01)	(−0.79)
Industry and year dummy	Yes	Yes
Observations	1315	1315
Adjusted R^2	0.32	0.33

This table presents the OLS regression results of Eq. (4). For each variable in the table, we use their 2007 (2005) value minus their 2005 (2003) value for each firm. Disclosure quality (kV) is the measure in Kim and Verrecchia (2001) multiplied by −1000 so that a larger value means higher disclosure quality. Disclosure quality (ADR) is the inverse of the disclosure quality measure in Anderson et al. (2009). We adjust both measures by industry using the Fama and French (1997) classifications. Firm Size is the logarithm of annual sales. Board Size is the log of the number of directors. Outsider Ratio is the number of outside directors divided by the board size. Leverage is long-term debt divided by total assets. ROA is the net income before extraordinary items divided by total assets. R&D is the research and development expenses divided by total sales. INSTOWN is the total percentage equity ownership of all the institutional investors. Risk is the volatility of the monthly stock returns of the previous 60 months. SalesHHI is the Herfindahl index based on sales among firms in the same industry. InsideOwn is the percentage of equity held by top corporate executives and directors. BoardCapital is a factor score developed from 14 proxies in the Appendix. *t*-Statistics (by Huber–White Sandwich estimates, allowing for correlation of all observations of a given firm) are in parentheses.
* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.

interpret these results to imply that the "fullness" of director human and social capital plays an important role in corporate disclosure policy, beyond the financial expertise mandated by the SEC and stock exchanges.

Another potential concern is that our findings may simply reflect the effect of director age since directors first obtain their educational training followed by their working experience and then build up their social networks and reputations. In other words, our board capital measure may be confounded with director age. To address this concern, we employ additional tests with different approaches to incorporate the effect of director age along with board capital. We include the total board age (sum of all the directors) or the average director age in our regressions. We find that director age is insignificantly related to disclosure quality, while director capital is qualitatively and quantitatively similar. Alternatively, we orthogonalize board capital by director age and we do not find that this specification changes our prior findings. We then repeat our regressions with standardized director capital (by director age) and find similar results.

Another potential confounding effect may come from the top management team. Since managers usually have greater control regarding corporate disclosure practices, they may be more important than directors in the decision-making process. Additionally, managers with greater abilities may be more concerned about their performance and reputations and, as such, may be more likely to hire high ability directors. We focus on the top five highest paid executives and measure their ability by multiple proxies such as their age, tenure, education, and work experience. Similar to the construction of board capital, a factor analysis is applied to these proxy variables. We use alternative specifications to include top managerial ability in the regressions (adding managerial ability as a control variable, orthogonalizing board capital and managerial ability, and calculating our board capital measures without the managerial members on the board). We find that our results are largely unchanged with managerial ability included in the regressions.

5. Concluding remarks

In this study, we examine the correlation between board efficacy and board capital. While conventional wisdom suggests that mitigation of conflicts of interest may be the focus to improve board effectiveness, we suggest that, on a day-to-day basis, directors' capital should be of great importance to shareholders as they have little recourse for poor decision-making due to limited ability or skills. In contrast, in a robust legal system with relatively strong safeguards, shareholders and the SEC can sue or prosecute directors for board errors due to conflicts of interest. Moreover, economic theory implies that agent ability is quite important to outside shareholders (Fudenberg and Levine, 1992) which is consistent with the notion that ability is an important factor in explaining performance. Building on these ideas, we posit that shareholders focus on the ability of directors in evaluating board effectiveness, complementing other recent studies on board characteristics beyond independence on board effectiveness (e.g., Anderson et al., 2011).

Based on proxies for director's educational background, working experience, and networking ties, we develop a single index for board capital by factor analysis. Using disclosure quality as proxy for board efficacy, we find that board capital is positively associated with board efficacy, even after controlling for other factors that influence disclosure policy and potential endogeneity of director capital. Splitting board capital into educational, experience, and networking capital, we find director educational and experience capital appear to have greater impact. In contrast, director networking capital is unrelated to disclosure quality. Decomposing board capital into insiders' and outsiders', we find that the relationship between board capital and disclosure quality is a function of outsider director experience and insider director educational capital. These results suggest that shareholders should weigh the attributes of insiders and outsiders differently, although both groups can contribute to greater disclosure quality.

Our study expands the agency perspective to explore the notion that board efficacy, which encompasses both monitoring and advising roles, is a function of directors' human capital and social capital. Apparently, our study is not without limitations. For instance, we do not explore the idea that the performance implication of certain types of director capital may be more prominent under certain circumstances. One example is that industry expertise may be especially valuable when the firm is involved in related mergers and acquisitions. Another pertinent area to explore may be the matching process between the firms and directors, which still remains a black-box to us. How firms select specific director attributes remains an interesting topic for future research. Which director characteristics come into play in the bargaining and negotiation process between firms and their prospective directors? How will such pairing affect board effectiveness? These are all future areas for exploration.

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Appendix A:. construction of board capital measures

Board capital of a firm is measured by a factor analysis based on the following proxies for human capital (education and experience) and social capital of all directors of the firm. The results of the factor analysis are provided in Panel A.

Social capital:

1. number of external board seats in other corporations held by directors;
2. number of nonprofit board seats held by directors (current and past);
3. number of boards of government/government agencies that directors have served on;
4. number of national-level professional affiliations and honors and awards received by directors.

Education capital:

1. number of directors with a bachelor's degree;
2. number of directors with an MBA degree;
3. number of directors with a master's degree other than MBA, such as JD and MD;
4. number of directors with a doctorate degree;
5. number of directors with a bachelors' degree from a top ten college according to *US News and World Report*, 2006;
6. number of directors with a top ten MBA degree according to *US News and World Report*, 2006;

Experience capital:

1. number of directors with experience in investment banking/venture capital, accounting, consulting, law, and academia. (If a director has experience in more than one area, we count them all);
2. number of directors with professional certifications;
3. number of high positions (corporate vice president or higher) held by the directors during their lifetime;
4. number of firms where the directors have worked with during their lifetime;

Factor analysis statistics	Board capital	Education capital	Experience capital	Social capital
Panel A: factor analysis statistics on board capital				
Eigen value of first factor	2.22	1.83	1.45	2.25
Eigen value of second factor	0.92	0.50	0.22	0.77
Cronbach's alpha	0.80	0.84	0.74	0.80
TLI (Tucker Lewis index)	0.94	0.94	0.94	0.94
CFI (comparative fit index)	0.95	0.95	0.95	0.94
RMSEA (root mean square error of approximation)	0.05	0.05	0.06	0.06

The proxies load significantly on a single factor if the Eigen value of the first factor is larger than one while that of the second factor is smaller than one. We also provide Cronbach's alpha, which is a measure of construct consistency for the latent variable in the presence of multiple proxies. These, along with other test statistics from Confirmatory Factor Analysis, namely TLI, CFI and RMSEA, indicate the

degree of validity of the factor analysis. Often a sound validity comes with TLI and CFI larger than 0.90 and RMSEA smaller than 0.10.

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