Director skill sets*

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Abstract

We characterize directors' skill sets by exploiting Regulation S-K's 2009 requirement that U.S. firms must disclose the experience, qualifications, attributes or skills that led the nominating committee to choose an individual as a director. We then examine how skills cluster on and across boards. Factor analysis indicates that the main dimension in which boards vary is the variety of skills of their directors. We find that firm performance is positively related to having more commonality in skill sets on the board and more commonality between inside and outside directors.

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I. Introduction

The literature on boards argues that directors may (or may not) add value for different reasons. Some directors may add value because of who they work for, as the literature on industry experience argues (Kor and Fredrickson, 2008; Faleye, Hoitash and Hoitash, 2012; Masulis, Ruzzier, Xiao and Zhao, 2012; Dass, Kini, Nanda, Onal and Wang, 2013; Drobetz, Von Meyerinck, Oesch and Schmid, 2013), and some have potentially valuable professional or career expertise (e.g. Krishnan, Wen and Zhao, 2011; Masulis, Wang and Xie, 2012). Others may add value because their positions in their organizations, e.g. as CEOs or CFOs, suggest that they have valuable leadership or financial expertise (e.g. Fich, 2005; Guner, Malmendier and Tate, 2008; Fahlenbrach, Low and Stulz, 2010; Bedard, Hoitash and Hoitash, 2013).

But, if outside directors with industry experience comprise only 18.9% of independent directors (Faleye, Hoitash and Hoitash, 2012) or 6.5% of the entire board (Dass, Kini, Nanda, Onal and Wang, 2013) and CEOs comprise only roughly 6.6% of new director appointments (Fahlenbrach, Low and Stulz, 2010), then an important question is: what skills do the other directors have? For example, J.C. Penney's 2010 proxy statement reports the employment experience of director R. Gerald Turner as follows:

> *President of Southern Methodist University since 1995; Chancellor of the University of Mississippi from 1984 to 1995; Co-Chairman, Knight Commission on Intercollegiate Athletics since 2005; Director of Kronos Worldwide, Inc., American Beacon Funds and the National Association of Independent Colleges and Universities.*

Mr. Turner does not seem to have direct industry experience that is relevant for J.C. Penney, a chain of American mid-range department stores. As his leadership experience lies outside the corporate sector, he also does not hold an organizational position that would normally be classified as indicative of valuable executive or financial expertise. Although Mr.

Turner's background gives the impression that he can add value, it is not obvious how to classify his expertise.

Even if directors have well-defined skills, the evidence that they add value because of these skills is not always clear. For example, while Drobetz, Von Meyerinck, Oesch and Schmid (2013), Dass, Kini, Nanda, Onal and Wang (2013) and Faleye, Hoitash and Hoitash (2012) find that directors' industry experience adds value, Kang, Kim and Lu (2013) find that the effect of industry experience is insignificant in some circumstances. Similarly, Fich (2005) finds that shareholders seem to value CEO experience of directors, while Fahlenbrach, Low and Stulz (2010) find that CEO experience does not add additional value.

We argue that whether or not a particular skill adds value may in part depend on the other skills that are represented on the board. To give an extreme example, suppose both boards A and B contain an outside director with CEO experience. Suppose further that the other directors on board A consist of lawyers and consultants, but the other directors on board B have executive experience, as CFOs, presidents or other senior executives in their companies. For board A, the CEO's skill may complement the lawyers' skills. On the other hand, the lawyers may not always understand the CEO's viewpoint and vice versa because they approach problem-solving in different ways. There may be no communication problems on board B. However, board B may lack diversity in expertise.

Rather than examining skills one at a time, in this paper we ask how skills are clustered across boards and whether there are boards with skill *sets* that lead them to systematically outperform other boards. We examine what skills directors have in a sample of 848 firms in 2010 by exploiting the 2009 amendment to Regulation S-K requiring that public U.S. firms must describe their reasons for nominating directors. According to this rule, firms have to disclose the skills they believe each director brings to the table.

We first show that directors are not one-dimensional. On average firms report that outside directors have 2.7 skills and inside director have 2.2 skills. Although one may be concerned that firms may engage in window dressing of their directors' skills, worse performing firms do not write more about their directors than better performing firms.[1] Our finding that directors are multi-dimensional suggests that it may be difficult for outsiders to understand which skills of a particular director are the most valuable.

Next, we provide a complete characterization of the director skills that firms deem important, which in turn allows us to examine how skills sets cluster on boards. Our data show that all firms have at least one director with finance and accounting skills. Other frequently represented skills on boards are industry experience (89 percent), outside executive experience (83 percent), outside board experience (74 percent), leadership skills (68 percent), corporate strategy skills (63 percent), and management experience (62 percent). Fewer than four percent of firms appoint a director with specific experience in environmental and sustainability issues.

We follow Kaplan, Klebanov and Sorenson (2012) and Custodio, Ferreira and Matos (2013), who examine commonalities in CEO characteristics, and use factor analysis to extract the main dimensions along which boards vary with respect to the skills of their directors. We find that boards vary primarily along one dimension: the variety of skills that are available on a board. Some firms assign directors with many different skills to their board, while other firms focus on a few particular skills. As such, we conclude that there is an important distinction between diverse boards and boards with substantial concentration of skills. To provide further evidence that this distinction is important, we examine whether diversity of skills is related to firm performance.

[1] Firms are also not simply disclosing committee assignments of directors as skills. For example, firms report that only 18 percent of the directors on governance committees have governance expertise. The average percentage of committee members with a skill matching the committee's purpose is 29.3 percent.

We find that a larger variety of skills on a board does not improve firm performance. To test whether this result is driven by a lack of common ground in skill sets that arises with greater diversity, we construct measures of skill concentration among directors using the Blau index (1977). Our analyses suggest that having skill-based common ground in the boardroom is beneficial for the performance of the firm. These results also hold when we employ instrumental variable analysis, and are in line with arguments in e.g. Murray (1989), Knight et al. (1999), Pelled, Eisenhardt and Xin (1999) and Simons, Pelled, and Smith (1999) that having common ground among group members can facilitate effective decision making.

To further examine the effects of having skill-based common ground, we also consider the overlap in skills between inside and outside directors. We find that common ground between inside and outside directors, i.e. a relatively high concentration of skills between inside and outside directors, is positively related to firm performance. We also document that boards with more common ground have fewer board meetings. This is suggestive evidence that directors on boards with more common ground may be able to communicate more effectively.

Our paper makes three main contributions to the literature. First, we provide a complete characterization of the skills that directors have. A particular strength of the data is that it represents the firm's perspective rather than a perspective chosen by researchers. In this regard, we complement prior studies focusing on particular skills of directors.

The second main contribution is that we characterize an important dimension along which boards vary with respect to skill. Just as Kaplan et al. (2012) and Custodio et al. (2013) expand our view on relevant CEO types, our study suggests that there are different board "types".

Finally, our paper complements the literature on board diversity (e.g. Adams and Ferreira, 2009; Anderson et al., 2011; Knyazeva et al., 2011) by showing how different

measures of skill heterogeneity relate to the value of the firm. What distinguishes our paper from this literature is that we do not start with the premise that skill diversity matters. Instead, diversity arises endogenously as an important characteristic from the factor analysis.

The remainder of this paper is organized as follows. We describe our data in Section II. Section III presents the results of our factor analysis, and we relate these results to firm performance in Section IV. Section V examines common ground in the boardroom by constructing concentration of skills measures. We conclude in Section VI.

II. Data

We describe our sample and then discuss whether the data on director qualifications appears to contain information that is not readily available from other archival sources.

II.A Sample description

We start with the 1,481 firms in the RiskMetrics database and eliminate 57 firms that are headquartered overseas and 337 utilities and financial firms (two digit SIC codes 49 and 60-69). We collect the 2010 proxy statements from SEC Edgar, which contain the first descriptions of director skill sets following the 2009 amendment to regulation S-K. We exclude 181 firms that did not disclose director skills for all directors on their boards. Since the 2010 proxy statements describe directors elected to the board for the 2010 fiscal year, we obtain data on the remaining firms' financial characteristics for fiscal year 2010 from Compustat and CRSP. We obtain board and director information and annual meeting dates from RiskMetrics and data on all board committees and directors' committee memberships from RiskMetrics and BoardEx.

Our main performance measure is a proxy for Tobin's Q which we measure as the book market of assets minus the book value of equity plus the market value of equity, divided

by the book value of assets. We use RiskMetrics' classification to define director independence. We consider a firm to have a blockholder on the board if at least one independent director has at least 5% of the firm's shares according to Riskmetrics. The Appendix provides a detailed description of the variables in our study. After eliminating 58 firms with missing financial or governance data, we end with a sample of 848 firms. Table 1 reports summary statistics of the characteristics of these firms.

[please insert Table 1 here]

The firms in our sample have an average market value of about 8.3 billion dollars. They have an average Tobin's Q of 1.867, and return on assets of 4.2%. The typical firm has 9 board members and 4 board committees, and 79% of the directors in a typical firm are classified by RiskMetrics as being independent.

II.B Regulation S-K and director skill sets

The December 16, 2009 amendments to Regulation S-K, which lays out reporting requirements for public companies in the United States, require companies to provide insight into their considerations for nominating directors. Item 401(e) of Regulation S-K states:

> *Briefly discuss the specific experience, qualifications, attributes or skills that led to the conclusion that the person should serve as a director for the registrant at the time that the disclosure is made, in light of the registrant's business and structure. If material, this disclosure should cover more than the past five years, including information about the person's particular areas of expertise or other relevant qualifications.*

The new rules became effective as of February 28, 2010 for fiscal years ending on or after December 20, 2009.[2] The rule applies to proxy and information statements, annual reports, and registration statements, but not to foreign private issuers. Guidance from the SEC emphasizes that disclosure should be provided on an individual, director-by-director basis.

[2] Thirty-one of our sample firms had annual meeting dates between January 1, 2010 and February 28, 2010. Although technically the rule did not yet apply to them, all of them followed the disclosure rule.

In total, our sample includes 6,409 outside (independent or grey) directors and 1,199 inside directors. From the 2010 proxy statements we obtain firms' justifications for hiring directors. We use these to code each director's skills. In defining skills, we try to stay as true to the firms' definitions as possible, but combine skills that are similar. For example, we combine "litigation" or "legal compliance" experience into a single category of "legal" experience. Table 2 provides an overview of our final set of 20 skills.

[please insert Table 2 here]

A classification as an "Academic" (for 8.6% of directors) indicates that the firm stresses that the director's academic position or PhD degree is an important determinant of the director's selection to serve as a board member. The classification "Company business" indicates that the firm chose the director due to experience in the firm's business. We classify a director who was selected as a board member because of experience in compensation and benefits (for 5.5% of directors) as having "Compensation" expertise. The other categories are: Entrepreneurial, Finance and accounting, Governance, Government and policy, International, Leadership, Legal, Management, Manufacturing, Marketing, Outside board, Outside executive, Risk management, Scientific, Strategic planning, Sustainability, and Technology.

Several features of our classification are worth noting. First, directors are not one-dimensional. Instead, they have skill *sets*. For example, J.C. Penney's 2010 proxy statement reports the skills of director R. Gerald Turner as follows:

> *Mr. Turner's extensive career in academia provides the Company with valuable insights and perspectives on communicating with younger customers and Associates. He also brings experience and skills in human resources and management. Mr. Turner's current experience as president of a leading university provides him with perspective into the challenges of managing complex, multi-faceted organizations. In addition, his service on the boards of other publicly-traded companies, including committee service, has given him insights and perspectives on governance and human resources and compensation which benefit the JC Penney Board.*

We code Mr. Turner as possessing expertise in the following areas: Academic, Compensation, Governance and Management. With 4 skills, Mr. Turner is above average. The average director in our sample has 2.63 skills. Figure 1 shows the distribution of the number of skills per director. Most directors have two or three important skills, regardless of whether they are inside or outside directors. While it seems obvious that directors will have expertise in several areas, we believe it is worth highlighting because most empirical work on boards typically focuses on one skill at a time, e.g. industry, leadership or professional experience.

[please insert Figure 1 here]

Another point worth noting is that firms describe more directors as being familiar with the company's business than the recent literature on industry experience does (e.g. Kor and Fredrickson, 2008; Faleye, Hoitash and Hoitash, 2012; Masulis, Ruzzier, Xiao and Zhao, 2012; Dass, Kini, Nanda, Onal and Wang, 2013; Drobetz, Von Meyerinck, Oesch and Schmid, 2013), which suggests that some directors may be misclassified based on public records. We find that firms characterize 22.43% of outside directors as having company business related expertise.

To characterize a firm's board of directors using board-level counts of expertise categories, we examine whether a particular skill is mastered by at least one of the directors on a firm's board. A category receives a value of one if at least one director possesses this skill, and is zero otherwise. Panel A of Table 3 reports the means and standard deviations of our qualification variables.

[please insert Table 3 here]

The qualification that is most common on the boards of the firms in our sample is Finance and Accounting, which is not surprising given the emphasis on the role of financial experts after SOX. About half of the firms in our sample have an expert in strategic planning

on their board, and the same applies to expertise in governance. Less than four percent of the boards include a member with experience in environmental and sustainability issues. The five skills that are most likely to be represented on a board are: finance and accounting skills, industry experience, outside executive experience, outside board experience, and leadership skills.

II.C Are firms' stated reasons for appointing directors informative?

The primary concern one may have about the regulation S-K data is that firms may not reveal the true reasons directors are valuable to them. We conduct four tests to examine whether the reported experience qualifications under Regulation S-K are actually informative. First, we examine whether the number of qualifications correlates with age and outside directorships. If the reported qualifications are informative, one would expect that people with many outside directorships have more reported qualifications. Also, directors who are older are likely to have experience in more areas. We calculate correlations between the number of skills of every director and their age and number of outside directorships. When calculating the number of total skills per director, we exclude the "outside board" experience category as this will be mechanically related to the number of directorships. Panel B of Table 3 shows that both the correlation coefficient between the number of skills and age and the correlation coefficient between the number of skills and outside directorships are positive, which suggests that the reported qualifications are informative.

Second, we examine whether the qualifications simply mirror the committee assignments directors have. If, for example, firms assign "governance" expertise to everybody on the governance committee, and do not assign skills that are not related to committee membership, then the reported skills do not provide more information than the committee memberships already do. To construct the set of committee memberships for all

directors, we start with data on committee memberships in RiskMetrics and supplement it with committee memberships from Boardex.[3] Because firms vary in how they describe committees, we combine committee names that are similar. For example, "Antitrust Compliance" and "Special Litigation" both fall into the "Legal Issue" committee category. We identify 38 types of committees in Boardex and combine them into 21 different categories. Since one of these categories (Chairman committee) does not occur in our sample, we end with a sample of 20 committees. We then calculate the percentage of directors on a committee that firms describe as having the skill associated with the committee, for example, the percentage of directors on the governance committee with "governance" expertise. Panel C of Table 3 shows the number of occurrences of committees of a given type in our sample and the committee skill match ratio. All match ratios are below 100%, which illustrates that assigned skills do not simply reflect the committees that directors are on. For example, firms have assigned governance as an area of expertise to only 18.0 percent of the directors on the governance committee and the average match ratio over all committees is only 29.3 percent. If serving on a committee gives directors skills in a particular area, as the description of R. Gerald Turner above suggests, then the low committee skill match ratio suggests firms may be underreporting director skills. We examine the effects of including and excluding skills associated with committee memberships further in Section IV.D.

Third, we examine whether firms use the director qualification section to window dress poor performance. If this is the case, then we expect poorly performing firms to write more about their directors. To examine this, we split our sample of director descriptions into those belonging to firms with positive ROA (6,802 observations) and those belonging to firms with negative ROA (806 observations) and count the average number of words that profitable and unprofitable firms use in describing the qualities of their directors. Panel D of

[3] RiskMetrics only contains information for 4 committees: compensation, audit, governance and nominating. Boardex has data on all committees. We started with RiskMetrics because it already combines committees that fulfil similar functions, whereas the data in Boardex is still in its original form and needs to be classified.

Table 3 shows the results. On average, profitable firms use 58 words to describe their directors and unprofitable firms use 55 words. Thus, if anything, profitable firms write more about their directors on average. However, the mean difference of three words is not economically significant and the standard deviations in the number of words are also fairly similar: 32.6 and 25.7 for profitable and unprofitable firms, respectively. Thus, these univariate results do not suggest that profitable and unprofitable firms behave any differently in describing their directors' skills. We examine potential window dressing further in Sections IV.D.

Fourth, we examine whether firms attribute the same skills to directors with multiple directorships. There are 1,641 directors in our sample with more than one directorship at another sample firm. The average number of within-sample directorships that these directors have is 2.87. We examine how different firms report the skills associated with the same director. If the disclosure is informative, then we do not expect firms to report exactly the same skills for the same individual as this would mean that firms simply copy directors' biographies without considering which skills they deem relevant. On the other hand, if there is no overlap in reported skills then the reported experience is also not very informative, or at least highly subjective. We calculate a "clarity score" for directors on more than one board. In calculating this score, we exclude the "Company business" category, as this category would differ across firms almost automatically. We illustrate the clarity score using an example: If a director is on three boards, and 2/3 of the descriptions report skill A, 1/3 reports skill B, and 2/3 reports skill C, then the clarity score is the average of 2/3, 1/3, and 2/3. Thus, the clarity score will be positive and has a maximum value of one, which would indicate perfect overlap. Panel E of Table 3 shows that the average clarity score is 0.561. Hence, firms do not simply report directors' biographies, but there is still some overlap in the

qualifications that they assign to directors. We exploit the information on directors with multiple directorships further in Section IV.D.

III. The main dimension along which boards vary with respect to skill

A natural question is whether certain skills appear together on the board. Table 4 shows the correlation matrix for the 20 board-level qualification variables. It suggests that some skills do cluster. For example, boards that have risk management knowledge are more likely to also have at least one director with governance qualifications, but less likely to have a director with entrepreneurial expertise. In such a setting factor analysis can be useful to capture the variability among the observed, correlated board qualifications in terms of a lower number of unobserved factors which describe characteristics that tend to vary together. For example, Kaplan, Klebanov and Sorenson (2012) use factor analysis to identify two main dimensions of ability (talent and execution skills) from 30 characteristics and abilities of CEOs in private equity transactions, and Custodio, Ferreira and Matos (2013) use factor analysis to measure a CEO's general versus specific managerial skills.

[please insert Table 4 here]

We use factor analysis to extract the main dimensions of variation in expertise on the board. We use both the maximum likelihood method (ML) as well as the iterated principal factor method (IPF), which, unlike ML, does not require the assumption of multivariate normality. Table 5 reports the results of the factor analysis, which we restrict to factor loadings above 0.1 or below -0.1. In the first four columns we report the results when using ML. The last four columns report the IPF results. The results are very similar using both methods.

[please insert Table 5 here]

The first factor has positive loadings on virtually all classifications. This shows that particular boards possess many classifications, while others do not. The main dimension along which boards vary is thus the diversity of skills on the board. This finding is understandable given the large fraction of positive correlations reported in Table 4. The second factor shows positive loadings for classifications like Academic, Manufacturing, Scientific, and Technology, and shows negative loadings for classifications like Compensation and Governance. As such, the dimension seems to capture an advising role of the board versus a monitoring role.

Similar to the factor analysis of managerial skills in Custodio et al. (2013), the eigenvalues are not very high, with only the eigenvalue of the first factor being above one. As the eigenvalue of the first factor is more than double the eigenvalue of the second factor, we focus on the first factor, indicating the variety of skills that are available on the board, which captures about 46% of the variation in skills.[4]

IV. Skill variety and firm performance

Our factor analysis indicates that the variety of skills on a board is the primary dimension among which boards of directors vary. Organizational research emphasizes that a large variety of skills might be beneficial in decision making as it brings greater resources to problem solving and could lead to a more complete analysis of an issue (see Williams and O'Reilly (1998) for an overview). However, different personal and professional backgrounds lead to different ways in which team members "interpret and make sense of the world" and to multiple representations of a problem (Beers et al., 2006; Hambrick, 2007). Misunderstandings and disagreement can then threaten effective decision-making processes

[4] Due to the binary nature of our skill variables, we obtain factors based on a tetrachoric correlation matrix in a robustness test, which follows recommendations of Panter et al. (1997). We obtain similar factors and have confirmed that our results in the remainder of the paper are robust to using factors based on the tetrachoric correlation matrix.

within a team, as multidisciplinary teams complicate effective communication, due to diversity of knowledge systems (Bromme, 2000). Murray (1989), Knight et al. (1999), Pelled, Eisenhardt and Xin (1999) and Simons, Pelled, and Smith (1999) argue that having common ground among group members can facilitate effective decision making. Fluck and Khanna (2011) model that board members' coordination frictions in sharing information reduce firm value.

Since there may be advantages and disadvantages of having a large variety of skills on a team, it is an empirical question how director skill variety relates to performance. In Section IV.A, we examine the relationship between our factors and firm performance. In Section IV.B, we construct an intuitive counterpart to our factors and examine the role of committee skills. We address endogeneity problems using instrumental variable analysis in Section IV.C and perform robustness checks in Section IV.D.

IV.A The relationship between the factors and firm performance

We examine the relation between firm performance and the first factor from both our ML and IPF factor analysis in Table 6. Our proxy for Tobin's Q as a measure of performance is the market value of assets to the book value of assets. We regress Tobin's Q, measured at the 2010 fiscal year-end, on our factors and a set of controls that are common to governance performance regressions (e.g. Yermack, 1996; Adams and Ferreira, 2009). Our governance controls include the logarithm of board size, board independence, the logarithm of the number of board meetings, the number of committees, the average number of outside directorships, average director tenure, a CEO duality measure, a blockholder indicator, and an indicator for the CEO being older than 60. As firm-level controls, we include the logarithm of assets as a proxy for firm size, the number of segments, capital expenditures, ROA, volatility and an S&P 500 indicator. We provide the exact definitions of the control variables in the

appendix. We lag ROA by one year. All models include 2-digit SIC code industry effects and the standard errors are corrected for potential heteroskedasticity.

[please insert Table 6 here]

Model 1 of Table 6 shows that the ML variety of skills factor is negatively related to the firm's Tobin's Q. This relation is robust to controlling for other firm characteristics, as can be seen in Model 2, and to the use of the IPF factor method, as can be seen in the last two models. The firm-level controls are generally consistent with previous literature. The negative coefficient on board meetings is consistent with Vafeas (1999). Some of the other governance controls are not statistically significant. It is possible that this is because of the number of governance controls that we include.

IV.B Measuring the variety of skills

Factor analysis is sometimes unappealing because it is difficult to assess economic magnitudes of coefficients on factors. Thus, we examine whether the skill diversity factor has a more intuitive counterpart in the data. An obvious choice is to simply count the number of skills that are represented on a board. In Panel A of Table 7 we report the descriptive statistics of the different number of skills represented on a board. The typical firm has ten different skills on the board. In Panel B we report the correlations between the number of skills and the ML and IPF factors. We find that the number of skills does a good job in capturing the factor, with correlation coefficients of 0.918 and 0.930.

[please insert Table 7 here]

Table 8 shows the relation between the number of skills on the board and Tobin's Q. In the first model we confirm our finding from the factor analysis that the number of skills and Tobin's Q are negatively related.

With a more intuitive measure of skill variety in hand, it is straightforward to address the possibility that firms may be simply disclosing committee memberships as skills. We examine two variations on the number of skills. For the first measure, we assign a director any of the 20 skills belonging to committees on which he sits and that are missing from his skill description. For example, the director may sit on the finance committee, but the firm did not mention that he has expertise in finance. For the second measure, we exclude from directors' skill descriptions any skill that matches to a committee on which he sits. This accounts for the fact that some firms may simply be reporting committee memberships as skills. We then reconstruct our board-level measures of the number of skills represented on the board and rerun our performance regressions in Models 2 and 3 of Table 8. The results are qualitatively similar for both measures. However, the magnitude of the coefficient is largest and the statistical significance the highest for the number of skills measured after excluding committee skills, which suggests that this may be a more accurate measure of skill diversity on the board.

[please insert Table 8 here]

IV.C Potential Reverse Causality

While the results from Tables 6 and 8 suggest that there is a negative correlation between skill diversity and firm performance, we cannot give this relationship a causal interpretation because of potential endogeneity problems due to reverse causality. It is plausible, for example, that firms that perform poorly look for more skill diversity on their boards to get advice on new ventures or to help identify potential M&A targets. Another potential concern is that firms that perform poorly engage in window dressing by making their directors appear more talented than they really are. These arguments would predict a negative relationship between performance and skills that would overestimate the effect of

skill diversity. On the other hand, it is also possible that poorly performing firms have other concerns and pay less attention to the new regulation as a result. This argument would predict a positive relationship between performance and skills that would underestimate the coefficient on skill diversity. As Kaplan et al. (2012), Masulis et al. (2012) and Custodio et al. (2013) describe, it is difficult to rule out the fact that different types of managers and directors match with different types of firms. We attempt to formally address this concern in our set-up using an instrumental variable analysis.

[please insert Figure 2 here]

We use two instruments. The first is the number of days between the filing of the firm's proxy statement and the day Regulation S-K was announced. We believe this instrument should be correlated with the number of skills as firms with more time to incorporate Regulation S-K's requirements may, upon analyzing their directors' skill sets, recognize a gap and be more likely to appoint a new director to the board. Figure 2 provides some evidence consistent with this hypothesis: the proportion of firms appointing new directors in a given proxy month is higher the later the month occurs. On the other hand, we believe it is unlikely that the number of days between Regulation S-K and the proxy filing should be correlated with firm performance, as long as the annual meeting date does not change in response to poor performance. We examine whether firms changed their meeting dates from the previous year and conduct an IV analysis in both the full sample and the sample of firms whose meeting dates did not change.

The second instrument is the natural logarithm of the distance between the company's headquarters and the nearest major airport. The rationale for this instrument is that firms are less constrained in choosing directors when it is easy for them to attend board meetings and this may lead to an increase in skills on the board. Of course, distance to the airport may be directly correlated with firm performance because it may affect firms' transportation

networks. But we believe that to a large extent this effect should be controlled for by other variables in our regression, for example, firm size, diversification and industry. As a robustness check, we also do an IV analysis using only our first instrument with similar results.

Columns 3-6 of Table 8 show the results of the second stage of the IV regressions using the measures of skills from columns 1-3. We report the coefficient on the instrument from the first-stage regression at the bottom of the Table, along with the Kleibergen[5] Paap F-statistic, the Stock Yogo critical values and the results of the Durbin-Wu-Hausman endogeneity test. The first stage coefficients on our instrument have the expected signs and are statistically significant. The endogeneity test suggests that, under the assumption that our instruments are valid, we can reject the null hypothesis that the number of skills is not endogenous in our performance regression.

In the second stage IV regressions, the coefficients on the skill measures are always negative and statistically significant. We can interpret our results as suggestive of a negative causal effect of skill diversity on performance if our instrument satisfies the exclusion restriction. We try to rule out potential violations of the exclusion restriction in Section IV.D.

IV.D Robustness checks

In this section we report additional robustness tests. First, we control for the possibility that firms may alter their meeting dates in response to poor performance, which would invalidate our instrument. We collect annual meeting dates for 2009 and 2010 from Riskmetrics and examine whether there were any changes. Figure 3 shows the distribution of changes between the two years. As is evident from the figure, most changes occur in the -1, 0, +1, day range, which is reasonable if meetings are held close to or on the weekend.

[5] If we use the first instrument by itself, the Kleibergen Paap F-test is above the Stock Yogo critical value – 15% for reported skills, which suggests it is a reasonably strong instrument on its own.

[please insert Figure 3 here]

In Table 9, we replicate the OLS and IV regressions for reported skills after restricting our sample to the set of firms with less than 10 days difference in the annual meeting date between 2009 and 2010. The results are consistent with our previous results.

Next, we restrict our sample to firms with positive ROA in 2010 to control more explicitly for the fact that poorly performing firms might report skills differently. We replicate the OLS and IV results for reported skills in this sample and find that our results continue to hold.

[please insert Table 9 here]

Finally, we re-examine directors who are on multiple boards. For firms that have at least one director with multiple directorships, we calculate a "generosity score." We calculate the ratio of the number of skills that this firm assigns to this director divided by the average number of skills other firms assign to this director. If a firm has multiple directors with multiple directorships, we take the averages of the individual scores. A high generosity score indicates that a firm assigns more skills to a particular director than other firms. This variable is a useful control variable as it should pick up how generous particular firms are in assigning skills. That is, we need to make sure that our measure of diversity reflects the actual diversity of boards and is not purely the result from the generosity of the person writing the section on director skills.

Table 9 shows that our results are robust when we control for the generosity score. The magnitude of the coefficient of the number of skills is not very different from the magnitude for our complete sample. The coefficient is statistically less significant, but this may be because the sample is smaller.

V. Skill concentration in the boardroom

We documented that diversity is the main dimension along which boards vary with respect to skill. An important question is what drives the negative relationship between skill diversity and performance. A potential explanation for this finding is the importance of having common ground in the boardroom, i.e. the need for directors to share skills in order to be able to communicate effectively. We examine this potential mechanism in two ways. First, we construct a better measure of skill overlap between directors and examine how it relates to performance. Although the number of skills is likely to be negatively related to common ground in the boardroom, it is not a perfect measure because the number of skills can be high even when all board members share skills. Second, we provide some evidence that suggests that communication problems may exist when there is less common ground in the boardroom.

To measure the concentration of skills among directors, we use the Blau index. We compute the Blau index (Blau, 1977) as $1 - \Sigma p_i^2$, where p is the proportion of directors in the kth skill category. By construction, the Blau index is between zero and (K – 1)/K, where K is the maximum number of skills, which in our case provides a theoretical maximum of 19/20. A high Blau score indicates a low concentration of skills among directors, and thus low levels of common ground. As communication problems between insiders and outsider may be particularly important for decision-making, we calculate a Blau index for outsiders, as well as an inside-outside Blau index that measures the concentration of skills between insiders and outsiders. To calculate the insider-outsider index, we list the skills that all insiders on a board possess, and the skills that all outsiders on a board possess. We then consider all insiders as one entity and all outsiders as one entity and use the Blau index formula to calculate the concentration of skills between insiders and outsiders. Panel A of Table 10 shows some descriptive statistics for these Blau indices.

[please insert Table 10 here]

We find that the Blau score for outsiders has an average value of 0.848, with a minimum of 0.320. The inside-outside Blau score is slightly higher on average. Panel B of Table 10 shows the correlation between the Blau scores and the number of skills. This correlation is quite high, with correlation coefficients of 0.807 and 0.882. The higher correlation between the number skills outsiders have and the insider-outsider Blau index suggests that more skills diversity among outsiders leads to even less skill overlap with insiders than with outsiders. Panel C shows the results of replicating our OLS and IV performance regressions using the Blau scores instead of the number of skills. Consistent with our previous results, the coefficients on the Blau scores are negative and significant. The difference between these results and our previous ones, however, is that we can interpret the coefficients in terms of common ground. These results suggest that skill diversity leads to less effective decision-making because directors have less common ground (as measured by skill overlap). What is noticeable about these results is that the magnitudes of the coefficients are always larger for the insider-outsider Blau index than for the outsider Blau index. This suggests that lack of common ground between insiders and outsiders is particularly important, consistent with intuition.

To gain further insight into the channel through which skill diversity may affect performance, we ask whether common ground is related to boardroom communication, as proxied by the number of board meetings. For this analysis, we exploit information on committee membership, as an important part of board meetings consists of the reports by the committees, and Adams, Ragunathan and Tumarkin (2013) show that committee structure may play a role in how much directors interact with each other. We construct a Blau index for the common ground between the members of the three main committees (the audit, nominating, and compensation committee) and the remainder of the board, with the purpose of examining whether having such common ground increases the effectiveness of boardroom

communication. More specifically, our committee Blau score is the average of the Blau scores between the members of the audit committee and the remainder of the board, the members of the nominating committee and the remainder of the board, and members of the compensation committee and the remainder of the board. The average committee Blau score in our sample is 0.876.

[please insert Table 11 here]

In Table 11, we regress the number of board meetings on the committee Blau score, the original Blau score, and the inside-outside Blau score. We control for similar firm level controls as in Table 8 but also add the number of board committees and meeting attendance to the regression. We include meeting attendance because directors with poor attendance records may be less likely to sit on committees. We also include the proportion of female directors because Adams and Ferreira (2009) find that women are more likely to sit on key committees.

We find that both the common ground between people inside and outside key committees and the common ground between insiders and outsiders are related to a lower number of board meetings. This evidence is in line with the suggestion that boards with more common ground can communicate more effectively. We interpret the evidence in Table 11 as suggestive that commonality of skills can play an important role in executing the board's tasks.

VI. Conclusion

Directors are not one-dimensional. We believe that recognizing this fact has important implications for corporate governance. Because director characteristics are bundled, firms may not be able to optimize over individual director characteristics. Instead, firms may face multi-dimensional constrained optimization problems that may be difficult to solve. As such,

it may not be surprising that the main dimension along which boards of directors vary is the total variety of skills on their board. When examining the relation between this dimension and firm performance, we find that boards whose directors have more commonality in skill sets have better firm performance. However, increasing commonality may be difficult because of a limited supply of directors with particular skills or because directors with particular skills have other skills that are not shared by incumbent directors. Understanding how directors and firms sort to each other is an interesting topic for future research.

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Figure 1. Director skills

We present the number of skills per director in this figure. The figure is based 6,409 outside and 1,199 inside directors at 848 firms. The maximum number of skills possessed by an outside (inside) director is 10 (nine). Any director who has a skill that is not in our list of 20 skills is classified as having zero skills.

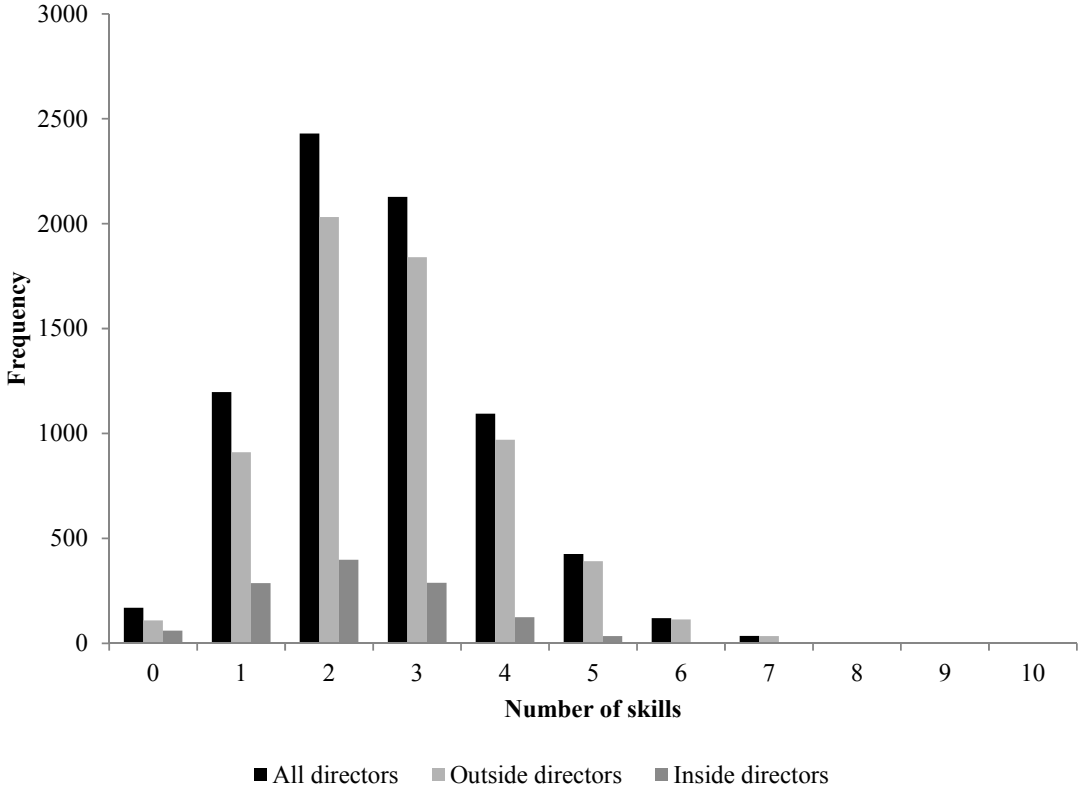

Figure 2. New directors

We examine new directors in this figure. There are 225 new director appointments in our sample of 833 firms. The horizontal axis is the number of months between the proxy statement date and the rule announcement date (December 16, 2009). The left vertical axis shows the number of new directors per firm after the rule announcement date. The right vertical axis shows the percentage of firms with proxy statements within a particular month that had new directors. For example, out of 158 firms that had proxy statements five months after the rule announcement date, there were 45 new directors which corresponds to 0.28 new directors per firm (left axis) and 18.35% of firms of those 158 firms had at least one new director.

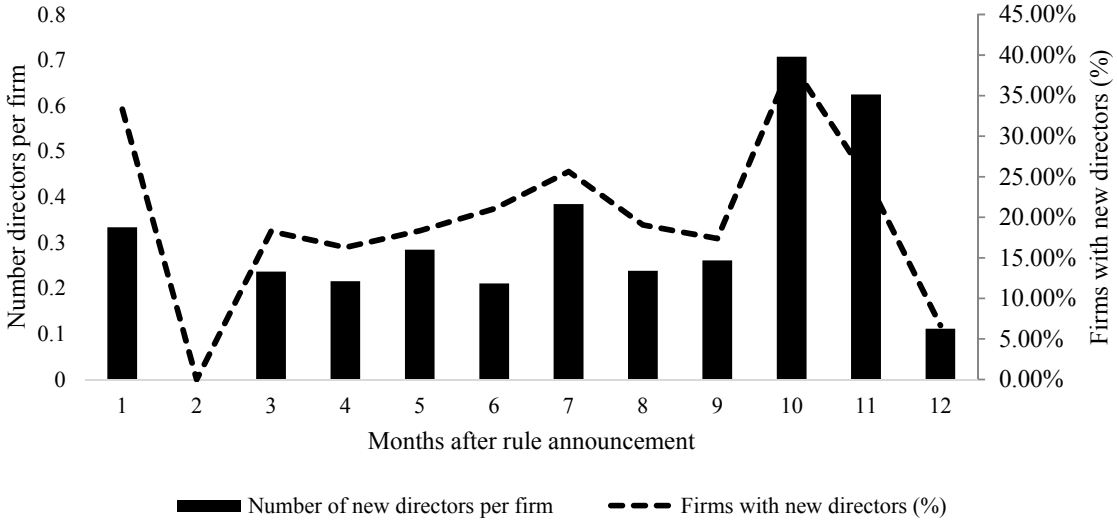

Figure 3. Annual meeting dates

The figure below examines whether firms in our sample (848 firms) hold their annual meetings the same calendar day and month every year and shows the frequency distribution of the difference between the day and month of 2010 and 2009 annual meeting dates. The vertical axis is the number of occurrences and the horizontal axis is the difference in days between annual meeting dates. The first (last number) on the horizontal axis is the frequency of 2010 annual meetings that were held 31 or more days before (after) the calendar day and month of the 2009 annual meeting.

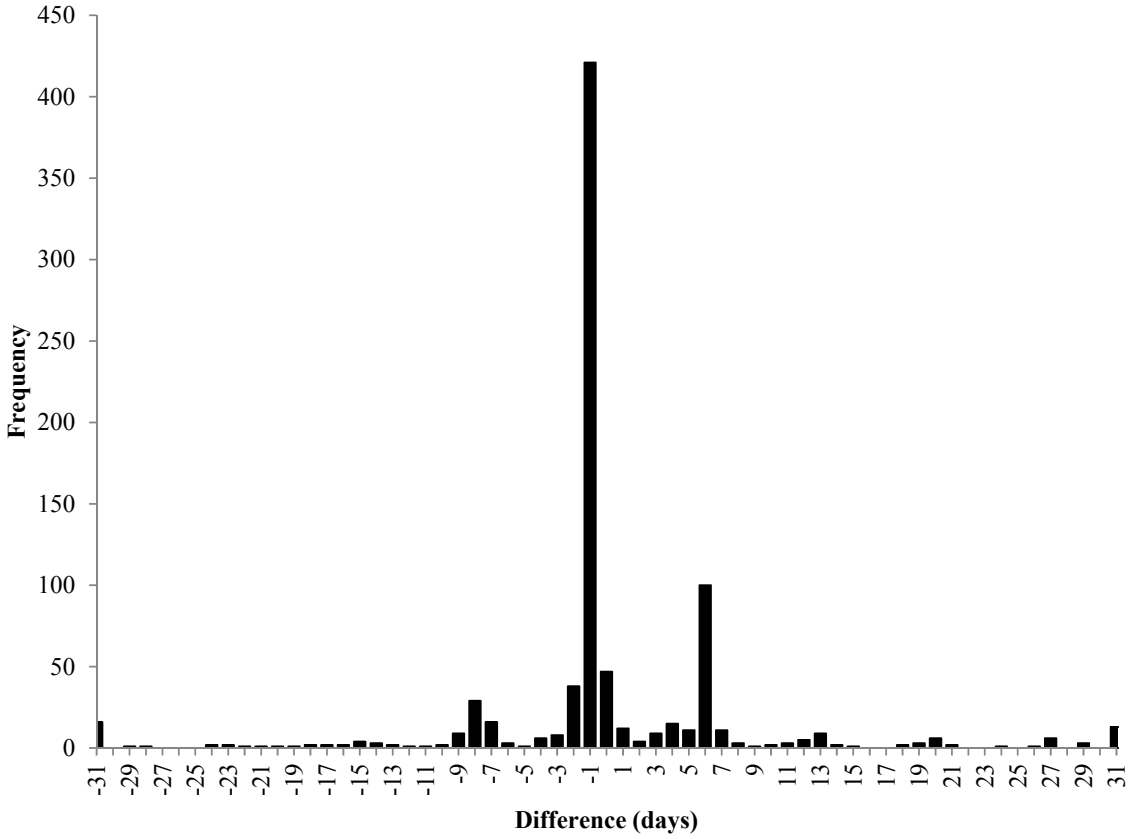

Table 1. Firm characteristics

This table reports descriptive statistics for 848 firms with data available for all variables. Financial variables except ROA are from the same fiscal year as the proxy statements. ROA is from the fiscal year end ending prior to the proxy statements. We provide the minimum and maximum of all variables except the dummies in the last two columns. See the Appendix for variable definitions.

Variables	Mean	Median	Standard Deviation	Min.	Max.
Firm size (millions of dollars)	8,276	1805	32,745	57	751,216
Tobin's Q	1.867	1.593	0.904	0.867	6.140
ROA	0.042	0.047	0.073	-0.298	0.227
Capital expenditures	0.060	0.029	0.118	0	0.810
Business segments	7.176	6	5.606	1	30
Volatility	0.023	0.022	0.008	0.010	0.051
S&P 500	0.313	0	0.464		
Board size	8.972	9	2.122	4	17
Board meetings	7.690	7	3.603	3	45
Board committees	4.337	4	0.757	2	8
Independent director ratio	0.786	0.8	0.109	0.333	1
Outside directorships	0.834	0.833	0.454	0	2.333
Director tenure	9.047	8.414	3.853	0	27
CEO - chair	0.537	1	0.499		
CEO retirement	0.288	0	0.453		
Blockholder	0.044	0	0.204		

Table 2. Experience categories

This table lists our 20 experience categories. Data are obtained from 2010 proxy statements. From the 2010 proxy statements we code each director's experience, qualifications, attributes or skills that were important in appointing the director. We code all reasons directors were appointed and combine similar reasons. For example, we combine "litigation" or "legal compliance" experience into a single category of "legal" experience. We end with a list of 35 reasons. To try to correct for the problem that firms may have simply used background information as a stated reason instead of revealing their true motivations, we examine the proportion of directors in each category and discard the category if fewer than 3% of directors are represented in that category. We add back in one skill that our 3% rule should be discarded but that we think may be important, namely "social responsibility".

Variables	Description
Academic	The director is from academia or has a higher degree (such as a Ph.D.).
Company business	The director is experienced in the firm's business or industry (or a closely related industry).
Compensation	The director has compensation and benefits experience.
Entrepreneurial	The director has entrepreneurial experience.
Finance and accounting	The director has experience in banking, finance, accounting, or economics related activities.
Governance	The director has corporate governance experience.
Government and policy	The director has governmental, policy, or regulatory experience.
International	The director has international experience.
Leadership	The director is someone that has leadership skills/experience.
Legal	The director has legal expertise.
Management	The director has management and communications skills/experience.
Manufacturing	The director has manufacturing experience.
Marketing	The director has marketing and sales skills/experience or knowledgeable in marketing activities.
Outside board	The director has outside board experience.
Outside executive	The director is an executive of another company.
Risk management	The director has risk management experience.
Scientific	The director has engineering, scientific, or R&D skills/experience.
Strategic planning	The director is someone that has strategy skills or strategy planning experience
Sustainability	The director has experience on environmental and sustainability issues.
Technology	The director has technology skills/experience.

Table 3. Descriptive statistics

We present various descriptive statistics related to our sample firms. Data in this table are obtained from 2010 proxy statements and are based on 848 firms. In Panel A, we present descriptive statistics related to 20 firm-level skill experience categories for directors. Director level statistics are provided in brackets in Panel A. Pairwise correlations between director age and the number of skills and outside directorships and the number of skills that excludes outside directorship as an experience category for 7,608 directors (6,409 outside directors and 1,199 inside directors) are reported in Panel B. Panel C reports descriptive statistics for committee skill match ratios for 20 committees. To find the committee skill match ratio, we first find the number of directors on a particular committee that has the required skills (e.g., the number of directors with compensation skills on the compensation committee). We then compute the ratio of directors with compensation skills on the compensation committee. Denominator here is the number of directors on the committee. We repeat this for all the other committees. In Panel D, we split our director-level sample into two based on whether a firm had a positive or negative ROA and examine the difference between the number of words used to describe director experiences by the ROA samples. We report the clarity score in Panel E. Clarity score is a score variable that ranges between 0 and 1 for directors on more than one board that takes into account skills reported by other boards for the same director. There are 1,641 outside directors corresponding with other directorships. Values in parentheses in Panel B (Panel D) are p-values (t-statistics). ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Panel A: Experience categories

Experience category	**Mean**	**Median**	**StDev**
Academic	0.443 [0.086]	0 [0]	0.497 [0.280]
Company business	0.889 [0.302]	1 [0]	0.314 [0.459]
Compensation	0.318 [0.055]	0 [0]	0.466 [0.228]
Entrepreneurial	0.216 [0.029]	0 [0]	0.412 [0.169]
Finance and accounting	1.000 [0.402]	1 [0]	0.123 [0.490]
Governance	0.534 [0.125]	1 [0]	0.499 [0.331]
Government and policy	0.343 [0.065]	0 [0]	0.475 [0.246]
International	0.489 [0.110]	0 [0]	0.500 [0.313]
Leadership	0.677 [0.220]	1 [0]	0.468 [0.415]
Legal	0.367 [0.056]	0 [0]	0.482 [0.230]
Management	0.616 [0.148]	1 [0]	0.487 [0.355]
Manufacturing	0.256 [0.048]	0 [0]	0.437 [0.213]
Marketing	0.430 [0 089]	0 [0]	0.495 [0.285]
Outside board	0.736 [0.232]	1 [0]	0.441 [0.422]
Outside executive	0.834 [0.282]	1 [0]	0.373 [0.450]
Risk management	0.272 [0.054]	0 [0]	0.445 [0.226]
Scientific	0.256 [0.047]	0 [0]	0.437 [0.211]
Strategic planning	0.631 [0.162]	1 [0]	0.483 [0.368]
Sustainability	0.037 [0.005]	0 [0]	0.188 [0.071]
Technology	0.468 [0.112]	0 [0]	0.499 [0.315]

Panel B: Correlations

Variables	Number of skills
Director age	0.048***
	(0.007)
Outside directorships	0.111***
	(0.000)

Panel C: Committee skill match ratios

Committee Name	N	Mean	Median	StDev	Min	Max
Academic	1	0.667	0.667		0.667	0.667
Audit	848	0.558	0.600	0.275	0	1
Company business	23	0.314	0.333	0.309	0	1
Compensation	848	0.108	0.000	0.200	0	1
Finance	133	0.429	0.400	0.255	0	1
Governance	820	0.180	0.000	0.249	0	1
Government	4	0.167	0.167	0.192	0	0.333
International	2	0.500	0.500	0.236	0.333	0.667
Leadership	4	0.479	0.375	0.375	0.167	1
Legal	5	0.267	0.000	0.435	0	1
Management	2	0.000	0.000	0.000	0	0
Marketing	1	0.857	0.857		0.857	0.857
Nominating	836	0.322	0.250	0.314	0	1
Real estate	1	0.333	0.333		0.333	0.333
Risk management	10	0.030	0.000	0.067	0	0.200
Scientific	17	0.297	0.250	0.307	0	1
Securities	3	0.301	0.154	0.396	0	0.750
Strategic planning	30	0.212	0.208	0.221	0	0.667
Sustainability	47	0.045	0.000	0.108	0	0.500
Technology	43	0.257	0.200	0.305	0	1
Committee skill match ratio	848	0.293	0.250	0.175	0	1

Panel D: Number of words and firm profitability

ROA sign	N	Mean	StDev
Positive ROA	6,802	58.073	32.635
Negative ROA	806	54.634	25.698
Difference		3.439	
		(2.86)***	

Panel E: Clarity Score

Variable	N	Mean	Median	StDev	Min	Max
Clarity score	1,641	0.561	0.500	0.200	0.125	1

Table 4. Correlations

We present pairwise correlation coefficients for 20 director skill categories. The correlations are based on 848 firms. ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Academic (1)	1																			
Company business (2)	0.020	1																		
Compensation (3)	0.012	0.040	1																	
Entrepreneurial (4)	0.115***	0.030	0.011	1																
Finance and accounting (5)	0.015	-0.014	0.044	-0.051	1															
Governance (6)	0.020	-0.029	0.293***	0.042	0.057*	1														
Government and policy (7)	0.095***	-0.045	0.119***	0.013	0.050	0.172***	1													
International (8)	0.076**	-0.030	0.015	0.020	0.045	0.058*	0.147***	1												
Leadership (9)	0.053	-0.003	0.034	0.038	0.016	0.123***	0.053	0.101***	1											
Legal (10)	0.001	-0.028	0.068**	0.017	-0.045	0.117***	0.197***	0.043	0.003	1										
Management (11)	0.012	-0.017	0.056	0.049	0.020	0.045	-0.001	0.017	0.035	-0.017	1									
Manufacturing (12)	-0.028	0.001	0.029	0.027	0.029	0.044	0.083**	0.204***	-0.005	-0.009	0.069**	1								
Marketing (13)	-0.009	-0.141***	0.096***	0.077**	0.089***	0.081**	0.019	0.140***	0.010	0.001	0.065*	0.145***	1							
Outside board (14)	0.061*	0.027	0.122***	0.048	-0.031	0.159***	0.056	0.057*	0.129***	0.034	0.038	0.027	-0.030	1						
Outside executive (15)	0.054	0.044	0.067*	0.034	0.022	0.040	-0.004	0.089***	0.084**	-0.022	-0.001	0.059*	0.043	0.207***	1					
Risk management (16)	-0.013	0.030	0.128***	-0.102***	0.055	0.194***	0.127***	0.100***	0.083**	0.095***	0.048	0.042	0.089***	0.066*	0.067*	1				
Scientific (17)	0.238***	-0.060*	-0.012	0.041	-0.015	0.038	0.066*	0.048	-0.046	0.047	0.014	0.139***	-0.013	0.045	0.037	0.036	1			
Strategic planning (18)	0.009	0.002	0.182***	0.039	0.084**	0.202***	0.038	0.084**	0.088**	-0.016	0.109***	0.062*	0.176***	0.041	0.026	0.194***	0.023	1		
Sustainability (19)	0.029	0.029	0.015	-0.072**	0.024	0.018	0.124***	0.111***	0.041	0.021	-0.027	0.059*	0.059*	0.017	0.053	0.121***	0.059*	0.045	1	
Technology (20)	0.062*	-0.045	-0.012	0.036	0.021	0.033	-0.021	0.060*	-0.029	-0.018	0.057	0.029	0.082**	0.037	0.095***	0.010	0.105***	0.042	0.006	1

Table 5. Factor analysis

This table report the results of factor analysis based on 20 experience categories. We present unrotated factor loadings on the first four factors using the maximum likelihood method in the first four columns and the iterated principal factor method in the last four columns. Factor loadings less than ｜0.10｜ are set to blank.

	Maximum Likelihood				Iterated Principal Factor			
Experience Categories	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**
Eigenvalue	1.323	0.551	0.516	0.462	1.320	0.559	0.519	0.449
Percentage explained	0.464	0.193	0.181	0.162	0.464	0.197	0.182	0.158
Academic	0.124	0.211	0.219	0.168	0.136	0.322	0.172	
Company business		-0.115		0.114			0.120	0.102
Compensation	0.398	-0.253			0.378	-0.246		
Entrepreneurial				0.149		0.126		0.151
Finance and accounting	0.123		-0.120		0.123		-0.132	
Governance	0.510	-0.246			0.492	-0.226	0.112	
Government and policy	0.380		0.327	-0.273	0.366		0.230	-0.350
International	0.293	0.291			0.307	0.218	-0.105	
Leadership	0.200			0.119	0.201			0.110
Legal	0.185		0.224	-0.176	0.170		0.197	-0.216
Management	0.124		-0.129		0.130		-0.113	
Manufacturing	0.212	0.277			0.223	0.203	-0.174	
Marketing	0.274	0.208	-0.362		0.288		-0.419	
Outside board	0.265		0.146	0.345	0.266		0.230	0.291
Outside executive	0.182			0.306	0.194	0.110		0.252
Risk management	0.362				0.364	-0.131		
Scientific	0.138	0.277	0.181		0.155	0.369		
Strategic planning	0.373		-0.267		0.376	-0.140	-0.205	
Sustainability	0.167	0.122			0.173			-0.135
Technology		0.179		0.140	0.105	0.180		0.121

Table 6. Tobin's Q and factor analysis

We present the results of Tobin's Q regressions on the first factors. The dependent variable is Tobin's Q. Factor 1 in the first two columns is from the maximum likelihood estimation method (ML) and in the last two columns is from the iterated principal factor method (IPF). We control for industry effects by including industry dummies based on two-digit SIC codes. All other variables are defined in the Appendix. T-statistics are reported in parentheses below coefficient estimates and are based on heteroskedasticity corrected standard errors. ***, **, * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Variables	ML method		IPF method	
	(1)	(2)	(1)	(2)
Factor 1	-0.120***	-0.072**	-0.118***	-0.071**
	(-3.17)	(-2.04)	(-3.09)	(-2.01)
Log of firm size		-0.204***		-0.204***
		(-5.65)		(-5.66)
Capital expenditures		0.607		0.606
		(1.52)		(1.52)
ROA		4.765***		4.767***
		(8.47)		(8.47)
Segment number		-0.013***		-0.013***
		(-2.89)		(-2.90)
Volatility		2.296		2.284
		(0.39)		(0.39)
S&P 500		0.615***		0.615***
		(7.73)		(7.72)
Log of board size		-0.287*		-0.287*
		(-1.80)		(-1.80)
Log of board meetings		-0.229***		-0.229***
		(-3.07)		(-3.07)
Board committees		0.031		0.032
		(0.88)		(0.88)
Outside directorships		0.075		0.075
		(1.00)		(1.00)
Director tenure		-0.015*		-0.015*
		(-1.90)		(-1.90)
Independent director ratio		-0.250		-0.250
		(-0.85)		(-0.85)
CEO - chair		-0.009		-0.009
		(-0.15)		(-0.14)
CEO retirement		-0.053		-0.053
		(-0.85)		(-0.85)
Blockholder		0.056		0.056
		(0.37)		(0.37)
Constant	1.867***	4.253***	1.867***	4.254***
	(62.61)	(9.60)	(62.59)	(9.62)
Industry dummies	Yes	Yes	Yes	Yes
Adj. R-squared	0.078	0.309	0.077	0.309
N	848	848	848	848

Table 7. Descriptive statistics for the number of skills

We present descriptive statistics for our number of skills measure that also include and exclude committee skills from committee assignments in this table. We provide summary statistics in Panel A and we show correlations with the two factors in Panel B. Values in parentheses are p-values. ***, **, and * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Panel A: Summary statistics

Variable	Mean	Median	StDev	Min	Max
Number of skills	9.797	10	2.730	2	19
Number of skills including committee skills	11.006	11	2.424	3	19
Number of skills excluding committee skills	8.745	9	2.633	1	17

Panel B: Correlations

Variable	Factor 1 (ML)	Factor 1 (IPF)
Factor 1 (ML)	1	
Factor 1 (IPF)	0.999***	1
	(0.000)	
Number of skills	0.918***	0.930***
	(0.000)	(0.000)
Number of skills including committee skills	0.805***	0.827***
	(0.000)	(0.000)
Number of skills excluding committee skills	0.840***	0.855***
	(0.000)	(0.000)

Table 8. Tobin's Q and the number of skills

This table shows how our number of skills variable is related to Tobin's Q. The dependent variable is Tobin's Q in main and second stage models. The dependent variable in the first stage models is the number of skills. The first model is based on the reported skills. We then add to this any unreported committee assignments as skills in the next model. Finally, we remove skills from the reported skills that match to committee assignments in the last model. We repeat this for the IV regressions in the last three models. The coefficients from the first-stage on our instruments (time since announcement and log of airport distance) are provided after IV regressions along with Kleibergen-Paap rk Wald F statistic and endogeneity test statistic. We control for industry effects by including industry dummies based on two-digit SIC codes. All other variables are defined in the Appendix. T-statistics are reported in parentheses below coefficient estimates and are based on heteroskedasticity corrected standard errors. ***, **, * indicate statistical significance at the 1, 5, 10% levels, respectively.

	OLS			IV		
Variables	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
	Reported Skills	**Including Committee Skills**	**Excluding Committee Skills**	**Reported Skills**	**Including Committee Skills**	**Excluding Committee Skills**
Number of skills	-0.021**	-0.022*	-0.022**	-0.274***	-0.376***	-0.306***
	(-2.04)	(-1.80)	(-2.09)	(-3.06)	(-2.91)	(-3.04)
Log of firm size	-0.205***	-0.205***	-0.205***	-0.218***	-0.224***	-0.220***
	(-5.67)	(-5.66)	(-5.67)	(-5.08)	(-4.79)	(-4.94)
Capital expenditures	0.627	0.624	0.621	0.570	0.498	0.490
	(1.57)	(1.55)	(1.55)	(1.28)	(1.03)	(1.06)
ROA	4.778***	4.785***	4.793***	5.108***	5.352***	5.335***
	(8.50)	(8.52)	(8.54)	(8.02)	(7.73)	(8.00)
Segment number	-0.013***	-0.013***	-0.013***	-0.012**	-0.014**	-0.012**
	(-2.87)	(-2.90)	(-2.86)	(-2.03)	(-2.18)	(-1.97)
Volatility	2.059	2.065	2.126	-1.143	-2.222	-0.436
	(0.35)	(0.35)	(0.36)	(-0.17)	(-0.31)	(-0.06)
S&P 500	0.614***	0.616***	0.614***	0.569***	0.594***	0.559***
	(7.72)	(7.71)	(7.70)	(5.33)	(5.17)	(4.99)
Log of board size	-0.270*	-0.278*	-0.255	0.943**	1.263**	1.240**
	(-1.65)	(-1.68)	(-1.51)	(2.03)	(2.13)	(2.22)
Log of board meetings	-0.229***	-0.230***	-0.229***	-0.197**	-0.219**	-0.203**
	(-3.07)	(-3.08)	(-3.07)	(-2.29)	(-2.34)	(-2.30)
Board committees	0.033	0.039	0.022	0.069	0.187***	-0.075
	(0.92)	(1.07)	(0.62)	(1.38)	(2.58)	(-1.22)
Outside directorships	0.073	0.072	0.075	0.243**	0.281**	0.281**
	(0.97)	(0.95)	(0.99)	(2.16)	(2.19)	(2.28)
Director tenure	-0.014*	-0.014*	-0.014*	-0.014	-0.011	-0.014
	(-1.86)	(-1.84)	(-1.87)	(-1.41)	(-0.99)	(-1.40)
Independent director ratio	-0.268	-0.286	-0.273	-0.057	-0.277	-0.107
	(-0.92)	(-0.97)	(-0.93)	(-0.14)	(-0.66)	(-0.27)
CEO - chair	-0.008	-0.006	-0.004	0.029	0.084	0.087
	(-0.13)	(-0.09)	(-0.07)	(0.40)	(0.97)	(1.06)
CEO retirement	-0.050	-0.050	-0.051	-0.083	-0.092	-0.103
	(-0.81)	(-0.81)	(-0.83)	(-1.06)	(-1.06)	(-1.25)
Blockholder	0.062	0.062	0.059	0.011	0.008	-0.030

	(0.40)	(0.41)	(0.39)	(0.06)	(0.04)	(-0.16)
Constant	4.440***	4.477***	4.441***	4.114***	4.527***	4.003***
	(10.25)	(10.31)	(10.25)	(5.56)	(6.48)	(5.93)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.309	0.308	0.309			
N	848	848	848	848	848	848
1st stage – time since announcement				0.098***	0.071**	0.095***
				(2.96)	(2.57)	(3.16)
1st stage – log of airport distance				-2.074***	-1.516***	-1.690***
				(-3.34)	(-2.86)	(-2.88)
Kleibergen-Paap rk Wald F statistic				10.340	7.740	9.813
Stock Yogo critical value – 10%				19.93	19.93	19.93
Stock Yogo critical value – 15%				11.59	11.59	11.59
Stock Yogo critical value – 20%				8.75	8.75	8.75
Endogeneity test				13.321***	13.802***	12.972***
Chi-square(1) p-value				(0.000)	(0.000)	(0.000)

Table 9. Sub-sample analyses

This table shows how our number of skills variable is related to Tobin's Q for three different sub-samples. The dependent variable is Tobin's Q in the OLS and the second stage IV models and the number of skills in the first stage IV models. The coefficients from the first-stage on our instruments (time since announcement and log of airport distance) is provided after IV regressions along with Kleibergen-Paap rk Wald F statistic and endogeneity test statistic. In the first OLS model, we restrict the sample to the firms that had their 2010 annual meeting within 10 days of their 2009 annual meeting month and day and regress Tobin's Q on the variables in Table 6. In the second, we consider only profitable firms, defined as firms with ROAs above zero. In the third model, we only focus on firms with outsider directors that had directorships in other companies and use our generosity score as an additional control variable. Generosity score is defined as the number of skills that a firm assigns to a particular director divided by the average number of skills other firms assign to the same director. We control for industry effects by including industry dummies based on two-digit SIC codes. All other variables are defined in the Appendix. T-statistics are reported in parentheses below coefficient estimates and are based on heteroskedasticity corrected standard errors. ***, **, * indicate statistical significance at the 1, 5, and 10% levels, respectively.

	OLS			IV		
Variables	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
	Meeting date	**Profitable firms**	**Directors**	**Meeting date**	**Profitable firms**	**Directors**
Number of skills	-0.024**	-0.013	-0.018	-0.259***	-0.276***	-0.352***
	(-2.17)	(-1.17)	(-1.61)	(-2.99)	(-2.86)	(-2.79)
Generosity score			-0.038			0.331**
			(-0.97)			(2.13)
Log of firm size	-0.210***	-0.214***	-0.217***	-0.217***	-0.213***	-0.249***
	(-5.31)	(-5.53)	(-5.57)	(-4.76)	(-4.57)	(-4.85)
Capital expenditures	0.541	0.643	0.390	0.452	0.392	0.384
	(1.31)	(1.42)	(0.92)	(1.00)	(0.74)	(0.77)
ROA	4.989***	5.352***	4.602***	5.089***	5.546***	4.943***
	(8.11)	(8.15)	(7.63)	(7.62)	(7.64)	(6.69)
Segment number	-0.011**	-0.014***	-0.014***	-0.010	-0.013**	-0.010
	(-2.31)	(-3.03)	(-3.04)	(-1.52)	(-1.99)	(-1.45)
Volatility	2.664	6.305	3.207	0.638	1.501	-3.724
	(0.41)	(0.97)	(0.47)	(0.09)	(0.20)	(-0.44)
S&P 500	0.630***	0.647***	0.663***	0.584***	0.531***	0.661***
	(7.45)	(7.63)	(7.69)	(5.31)	(4.33)	(5.29)
Log of board size	-0.252	-0.307*	-0.307*	0.908*	0.937*	1.201*
	(-1.41)	(-1.81)	(-1.69)	(1.96)	(1.90)	(1.94)
Log of board meetings	-0.289***	-0.259***	-0.239***	-0.222**	-0.215**	-0.196*
	(-3.60)	(-3.25)	(-2.80)	(-2.35)	(-2.32)	(-1.79)
Board committees	0.018	0.017	0.072**	0.050	0.065	0.094*
	(0.45)	(0.46)	(1.97)	(0.94)	(1.20)	(1.67)
Outside directorships	0.036	0.057	0.042	0.182	0.274**	0.166
	(0.43)	(0.70)	(0.49)	(1.59)	(2.14)	(1.32)
Director tenure	-0.017**	-0.013	-0.008	-0.020*	-0.016	-0.002
	(-2.03)	(-1.61)	(-0.82)	(-1.87)	(-1.42)	(-0.12)
Independent director ratio	-0.237	-0.052	-0.108	-0.237	0.128	0.034
	(-0.74)	(-0.17)	(-0.34)	(-0.58)	(0.29)	(0.07)
CEO - chair	-0.005	-0.029	-0.009	0.041	0.001	0.019

	(-0.08)	(-0.46)	(-0.14)	(0.53)	(0.01)	(0.21)
CEO retirement	-0.056	-0.089	-0.068	-0.068	-0.128	-0.165
	(-0.82)	(-1.38)	(-1.05)	(-0.84)	(-1.54)	(-1.54)
Blockholder	0.053	0.073	0.091	-0.021	0.021	0.047
	(0.34)	(0.43)	(0.49)	(-0.11)	(0.10)	(0.20)
Constant	4.653***	4.392***	4.319***	3.985***	3.953***	3.857***
	(9.80)	(9.47)	(8.25)	(5.40)	(4.97)	(4.02)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.322	0.330	0.329	-0.079		
N	748	757	703	748	757	703
1st stage – time since announcement				0.110***	0.111***	0.086**
				(3.08)	(3.19)	(2.30)
1st stage – log of airport distance				-2.168***	-1.762***	-1.845***
				(-3.18)	(-2.61)	(-2.79)
Kleibergen-Paap rk Wald F statistic				10.743	8.850	6.517
Stock Yogo critical value – 10%				19.93	19.93	19.93
Stock Yogo critical value – 15%				11.59	11.59	11.59

Table 10. Tobin's Q and common ground

We report summary statistics for the common ground proxies in Panels A and B, and the results of regression that shows how the proxies are related to Tobin's Q in Panel C. Our first common ground proxy is the outsider Blau score. Blau score is our measure of concentration of skills among directors and calculated as $1 - \Sigma p_i^2$ (Blau, 1977). By construction, the Blau index is between zero and (K – 1)/K where K is the maximum number of skills, which in our case provides a theoretical maximum of 19/20. A high Blau score indicates a low concentration of skills among directors, and thus low levels of common ground. Our second common ground proxy is the inside-outside Blau score. This measure is calculated similar to the Blau score by treating inside and outside directors as separate groups. The numbers in parenthesis in Panel B are p-values. The dependent variable in Panel C is Tobin's Q in the OLS and the second-stage IV models and the common ground proxies in the first-stage IV models. The coefficients from the first-stage on our instruments (time since announcement and the log of airport distance) are provided after IV regressions along with Kleibergen-Paap rk Wald F statistic and endogeneity test statistic. We control for industry effects by including industry dummies based on two-digit SIC codes. All other variables are defined in the Appendix. T-statistics are reported in parentheses below coefficient estimates in Panel C and are based on heteroskedasticity corrected standard errors. ***, **, * indicate statistical significance at the 1, 5, and 10% levels, respectively.

Panel A: Summary statistics

Variables	Mean	Median	StDev	Min	Max
Outsider Blau score	0.848	0.861	0.056	0.320	0.924
Inside-outside Blau score	0.877	0.889	0.043	0.444	0.941

Panel B: Correlation

Variables	Number of skills
Outsider Blau score	0.807***
	(0.000)
Inside-outside Blau score	0.882***
	(0.000)

Panel C: Regressions

	OLS		IV	
Variables	(1)	(2)	(1)	(2)
Outsider Blau score	-0.926**		-19.468**	
	(-2.02)		(-2.51)	
Inside-outside Blau score		-1.425**		-23.327***
		(-2.22)		(-2.61)
Log of firm size	-0.206***	-0.206***	-0.244***	-0.230***
	(-5.69)	(-5.68)	(-4.61)	(-4.68)
Capital expenditures	0.639	0.633	0.781	0.659
	(1.60)	(1.59)	(1.25)	(1.27)
ROA	4.782***	4.799***	5.413***	5.539***
	(8.51)	(8.56)	(6.75)	(6.92)
Segment number	-0.013***	-0.013***	-0.016**	-0.016**
	(-2.92)	(-2.92)	(-2.23)	(-2.35)
Volatility	2.199	2.153	-0.376	-0.539
	(0.38)	(0.37)	(-0.05)	(-0.07)
S&P 500	0.615***	0.613***	0.565***	0.536***
	(7.72)	(7.71)	(4.22)	(4.31)
Log of board size	-0.321**	-0.281*	0.710	1.128*
	(-2.09)	(-1.77)	(1.47)	(1.88)
Log of board meetings	-0.229***	-0.227***	-0.183	-0.160
	(-3.06)	(-3.04)	(-1.61)	(-1.51)

Board committees	0.033	0.031	0.101	0.051
	(0.92)	(0.87)	(1.39)	(0.79)
Outside directorships	0.074	0.076	0.377**	0.341**
	(0.99)	(1.01)	(2.21)	(2.28)
Director tenure	-0.015*	-0.015**	-0.030*	-0.028*
	(-1.96)	(-1.98)	(-1.68)	(-1.66)
Independent director ratio	-0.264	-0.243	0.175	0.412
	(-0.90)	(-0.83)	(0.33)	(0.73)
CEO - chair	-0.011	-0.010	-0.017	0.003
	(-0.19)	(-0.17)	(-0.19)	(0.03)
CEO retirement	-0.047	-0.048	-0.031	-0.065
	(-0.75)	(-0.78)	(-0.35)	(-0.74)
Blockholder	0.066	0.067	0.080	0.082
	(0.44)	(0.44)	(0.39)	(0.41)
Constant	5.132***	5.498***	18.178***	21.114***
	(9.50)	(8.49)	(3.28)	(3.28)
Industry dummies	Yes	Yes	Yes	Yes
Adj. R-squared	0.309	0.310		
N	848	848	848	848
1st stage – time since announcement			0.001**	0.001**
			(1.99)	(2.13)
1st stage – log of airport distance			-0.027*	-0.022*
			(1.90)	(1.90)
Kleibergen-Paap rk Wald F statistic			4.928	5.712
Stock Yogo critical value – 10%			19.93	19.93
Stock Yogo critical value – 15%			11.59	11.59
Stock Yogo critical value – 20%			8.75	8.75
Endogeneity test			13.535***	12.975*
Chi-square(1) p-value			(0.000)	(0.000)

Table 11. Blau scores and number of board meetings

We report the results of regressions that show how the common ground is related to board meetings. We estimate a Poisson model of board meetings on three different Blau scores and other control variables. Blau score is our measure of concentration of skills among directors and calculated as $1 - \Sigma p_i^2$ (Blau, 1977). By construction, the Blau index is between zero and (K – 1)/K where K is the maximum number of skills, which in our case provides a theoretical maximum of 19/20. A high Blau score indicates a low concentration of skills among directors, and thus low levels of common ground. Our first common ground proxy is the Blau score between committee members and the rest of the board. We use the audit, compensation, and corporate governance and nomination committees to find committee Blau scores. Specifically for each committee, we calculate the Blau score between the committee members and the rest of the board and take an average of the Blau scores for each committee to come a single Blau score for a firm. The second common ground proxy is the Blau score for the board, which considers all board members as in Table 10. Our third common ground proxy is the inside-outside Blau score. This measure is calculated similar to the Blau score for the board by treating inside and outside directors as separate groups. We control for industry effects by including industry dummies based on two-digit SIC codes. All other variables are defined in the Appendix. T-statistics are reported in parentheses below coefficient estimates in Panel C and are based on heteroskedasticity corrected standard errors. ***, **, * indicate statistical significance at the 1, 5, and 10% levels, respectively.

	Board meetings		
Variables	**(1)**	**(2)**	**(3)**
Committee Blau	0.516*		
	(1.71)		
Blau		0.268	
		(1.13)	
Insider-outsider Blau			0.498*
			(1.68)
Log of firm size	0.045***	0.044***	0.045***
	(3.07)	(3.03)	(3.05)
Capital expenditures	0.179	0.179	0.182
	(1.12)	(1.12)	(1.13)
ROA	-0.633***	-0.628***	-0.633***
	(-2.83)	(-2.81)	(-2.83)
Segment number	0.001	0.001	0.001
	(0.37)	(0.36)	(0.37)
Volatility	2.365	2.350	2.351
	(1.16)	(1.15)	(1.15)
S&P 500	0.014	0.013	0.014
	(0.37)	(0.35)	(0.37)
Log of board size	-0.147*	-0.127*	-0.144*
	(-1.94)	(-1.71)	(-1.92)
Board committees	-0.003	-0.004	-0.003
	(-0.18)	(-0.21)	(-0.19)
Meeting attendance	0.660	0.641	0.656
	(1.42)	(1.38)	(1.41)
Outside directorships	-0.028	-0.026	-0.028
	(-0.81)	(-0.74)	(-0.79)
Female directors	-0.073	-0.065	-0.072
	(-0.51)	(-0.45)	(-0.51)
Independent director ratio	0.630***	0.634***	0.627***
	(5.28)	(5.30)	(5.24)
CEO - chair	-0.074***	-0.073***	-0.074***
	(-2.76)	(-2.74)	(-2.76)
Constant	0.971***	1.154***	0.986***
	(3.10)	(4.14)	(3.18)
Observations	840	840	840

Industry FE	Yes	Yes	Yes
Pseudo R-squared	0.0354	0.0351	0.0354

Appendix: Variable definitions

Variable	Definition
Firm size	Total assets (#at) in millions of dollars.
Capital expenditures	Capital expenditures over sales (#capx / #sale).
Tobin's Q	The sum of total assets (#at) and market value of equity less book equity (#ceq), divided by total assets
ROA	Net income (#ni) less extraordinary items (#xido) divided by total assets.
Negative ROA	A dummy that equals one if ROA is negative.
Segment number	The number of business segments that the firm has.
Volatility	Standard deviation of the firm's daily stock return in the prior fiscal year.
S&P500	A dummy that equals one if the firm is included in the S&P500 index.
Board size	The number of directors on the board.
Board meetings	The annual number of board meetings in the prior fiscal year.
Meeting attendance	The ratio of directors on the board with a less than 75% attendance record.
Board committees	The number of combined board committees that the firm has as reported in BoardEx and RiskMetrics.
Outside directorships	The average number of outside directorships held by the firm's outside directors.
Female directors	The ratio of female directors on the board.
Director tenure	The average director tenure on the board. Director tenure is the number of years that a director has served on the board.
Independent director ratio	The ratio of independent directors on the board to board size
CEO – chair	A dummy that equals one if the CEO is also the chairman of the board.
CEO retirement	A dummy that equals one if the CEO is over 60.
Blockholder	A dummy variable set to one if there is an outside director on the board with at least a 5% ownership.
Number of skills	The number of skills that are represented on a board (out of 20)
Time since rule announcement	The difference in days between the date of proxy filing and the rule announcement by the SEC divided by 30.
Airport distance	The average distance of the firm's headquarters to an airport in miles.
Generosity score	The average ratio of the number of skills assigned to outside directors with multiple directorships by the firm over the average number of skills assigned to the same directors by other firms.
Outsider Blau score	The concentration of skills among outside directors, calculated with the Blau index (1977). We calculate the outsider Blau score as $1 - \Sigma p_i^2$. By construction, the Blau index is between zero and (K – 1)/K where K is the maximum number of skills, which in our case provides a theoretical maximum of 19/20. A high Blau score indicates a low concentration of skills among directors, and thus low levels of common ground.
Inside-outside Blau score	The concentration of skills between inside and outside directors. This measure is calculated similar to the outsider Blau score by treating inside and outside directors as separate groups.
Committee Blau score	The concentration of skills between directors in the key committees and directors not in these committees. The measure is the average of the Blau score between the members of the audit committee and the remainder of the board, the members of the nominating committee and the remainder of the board, and members of the compensation committee and the remainder of the board.