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Board diversity and corporate investment oversight☆

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ABSTRACT

Drawn from theories in group diversity and group performance, this study examines the association between board diversity, measured in both relation-oriented dimension (i.e., gender, race, and age) and task-oriented dimension (i.e., tenure and expertise), and board performance in corporate investment oversight. We assess suboptimal investment by measuring how much firms deviate from the expected level of capital expenditures, R &D expenses, and acquisition spending within their industry. Using a sample of 15,125 firm-year across 1898 firms from 1998 to 2014, we find that task-oriented diversity attributes, such as tenure and expertise, are negatively associated with suboptimal investment, suggesting that diverse boards in terms of firm specific experience and functional expertise are more effective in overseeing corporate investment activities than homogeneous boards. Our results shed light on the recent regulatory requirements on board diversity and recommend greater task-oriented diversity in corporate boardrooms.

1. Introduction

Research on corporate boards has studied board composition, such as the presence of independent directors serving on corporate boards, and suggested that independent directors enhance monitoring function. However, an important but mostly overlooked factor that affects a board's ability to perform its monitoring and advisory roles is the heterogeneity (diversity) of directors. In recent years, investors and regulators worldwide have called for a more diverse board composition. On December 16, 2009, the U.S. Securities and Exchange Commission (SEC) approved a set of rules requiring public companies to disclose in proxy statements whether and how they consider diversity in evaluating director candidates (Securities and Exchange Commission (SEC), 2009). Under these rules, companies are allowed to define diversity in ways they consider appropriate,[1] with some companies emphasize *functional* attributes, such as tenure and expertise, and others focus on *surface-level* attributes, such as race, gender and age.

While diversity has been widely recognized as a desirable board characteristic, research findings on the effects of board diversity on firm performance are inconclusive because of the differences in how diversity is measured and conceptualized.[2] Some researchers turned to examine the impact of board diversity on boards' advising and monitoring functions (e.g., Adams & Ferreira, 2002, 2009, Farrell & Hersch, 2005). However, most studies on board diversity have a narrow focus on single attribute, such as gender, race, or expertise and results from these studies are difficult to generalize without taking other dimensions of diversity into account (Rhode & Packel, 2010). In this study, we examine the impact of board diversity on board performance in overseeing corporate investment activities. Unlike other studies examining only one diversity attribute, we measure diversity in both relation-oriented dimension, which consists of “surface-level” differences such as gender, race, and age, and task-oriented dimension, which consists of “deep-level” or job-related differences such as tenure and expertise.

Corporate investment oversight provides an interesting setting to examine board performance and effectiveness. While firms have to take risky investments to run business, both over-investment (i.e., excessive risk taking) and under-investment (i.e., excessive risk avoidance) could damage firm value and endanger their survival. In the wake of the major financial crisis in the late 2000s, regulators and the investing public have broadened boards' role to include risk oversight (e.g.,

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[1] This is a marked contrast with the quotas implemented at the national level for women directors on public company boards in several European countries, including Norway, France, Italy, Spain, and the Netherlands. For example, since 2008 Norway has required public companies to include at least 40% of the minority gender on their boards by the year 2020, with noncompliance leading to delisting from the exchange and dissolution.

[2] See Carter, Simkins, and Simpson (2003), Adam and Ferreira (2009), Carter, D'Souza, Simkins, and Simpson (2010), Farrell and Hersch (2005), and Kim and Lim (2010).

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COSO, 2009). Board responsibilities for overseeing corporate risk taking activities, including corporate investments, come from state law fiduciary duties, federal law and regulations, stock exchange listing requirements, and general best practices (Brancato, Tonello, Hexter, & Newman, 2006; Lipton et al., 2011). In general, board responsibilities include reviewing the company's investment guideline, strategy, and performance, and overseeing the company's investment-related risks. Boards of large public companies could establish an investment committee or a finance committee to assist in performing these highly specialized and complex tasks.[3] Despite the increased significance of boards' role in investment oversight, corporate governance research has not provided much guidance on what board characteristics are associated with board performance in overseeing corporate investment.

Drawn from theories in group diversity and group performance, especially social categorization (Turner, 1987), similarity/attraction (Berscheid & Walster, 1978), intergroup contract (Allport, 1954), and cognitive diversity theories, this study examines the association between board diversity and board investment oversight. The expectations model of diversity (McGrath, Berdahl, & Arrow, 1995) offers the mechanisms through which the social categorization process in a diverse team results in differential impacts of relation-oriented dimension (i.e., gender, race, and age) and task-oriented dimension (i.e., tenure and expertise) on board monitoring performance.

We measure suboptimal investment (i.e., under- and over-investment) by each firm's deviation from its expected level of investment, estimated using the firm's growth opportunities within the industry in each year. We find that task-oriented board diversity attributes, such as tenure and expertise, are negatively associated with suboptimal investment. Results suggest that diverse boards in terms of firm specific experience and functional expertise are more effective in monitoring corporate investment activities than homogeneous boards. We did not find an association between board relation-oriented diversity measured by gender, race, and age, and board performance in investment oversight.

Understanding the effect of board diversity on corporate investment activities is important for shareholders, corporate executives, and board nominating and governance committees in forming the best practices for board composition. It is also essential in evaluating the outcome of recent legal and disclosure requirements to increase board diversity in the U.S. and several European countries, such as Sweden, Norway, and Spain. For example, the Chairman of the SEC indicated that board diversity is a priority of the agency in 2016, and that the agency is likely to require publicly traded companies to provide more detailed disclosure on board diversity.[4] This study can inform such discussions on board diversity through discovering whether and which type of diversity influence investment and risk governance.

2. Theories and hypothesis development

Corporate boards are workgroups with complex monitoring and advising tasks that involve information processing and decision-making. Diversity in workgroups has been viewed as a “double-edged” sword (Milliken & Martins, 1996; Webber & Donahue, 2001), leading to more creative solutions to the group tasks, as well as less cohesion that hinders group decision making process. On the one hand, the cognitive resource perspective proposes that diversity could enhance group performance (Webber & Donahue, 2001) because members on a diverse team bring a greater pool of perspectives, knowledge, skills, and abilities to identify solutions and solve problems. People in diverse groups also have access to information outside their work group (e.g., Gruenfeld, Mannix, Williams, & Neale, 1996; Wittenbaum & Stasser, 1996). Broader information networks, along with greater cognitive resources, increase the ability of individuals in diverse teams to engage in more complex problem solving.

On the other hand, social categorization theory and similarity/attraction paradigm predict detrimental impacts of diversity on group process and performance (Williams & O'Reilly, 1998). Social categorization theory (Turner, 1987) describes the process under which people will classify themselves and others into social categories using salient characteristics such as age and gender. This process allows people to form a social identity and build self-esteem by identifying themselves as members of a particular group and by comparing themselves to members of other groups (Tajfel & Turner, 1986). Categorizing people into groups could create in-group/out-group bias and other cognitive biases. In a work unit, people are likely to favor in-group members and perceive out-group members as less trustworthy, dishonest, and less cooperative than in-group members (Brewer, 1979; Tajfel, 1982). The similarity/attraction theory (e.g., Berscheid & Walster, 1978; Byrne, 1971; Byrne, Clore, & Worchel, 1966) suggests that people are more attracted to those who are similar to themselves along various attributes such as demographic characteristics, attitudes, and values. Like social categorization theory, similarity/attraction paradigm predicts that diversity could harm group process and performance through negative attitudes toward dissimilar individuals and infrequent communication among members of a diverse team (e.g., Jehn, 1997; O'Reilly, Snyder, & Boothe, 1993; Riordan & Shore, 1997).

Pelled (1996) classified workgroup diversity attributes based on the degree to which the attributes capture perspectives, experiences, and skills relevant to the work being performed. Attributes such as functional, education, or industry background are considered more relevant (i.e., highly job-related), while demographic attributes such as age, gender, and race are considered less pertinent (i.e., less job-related) to the task on hand. Joshi and Roh (2009) conducted a meta-analysis of team diversity research and found that combining all types of diversity attributes would lead to a nonsignificant relationship between diversity and performance. Following extant studies (Jackson, May, & Whitney, 1995; Pelled, 1996; Webber & Donahue, 2001), we classify board diversity attributes into relation-oriented (less job-related) categories, such as gender, race, and age, and task-related (highly job-related) categories, such as tenure and expertise.

2.1. Relation-oriented diversity attributes and investment oversight

The expectations model of diversity explains how relation-oriented and task-oriented diversity attributes affect group cohesion and performance (McGrath et al., 1995). Social categorization theory (Turner, 1987) is the underlying theory for the expectations model (Webber & Donahue, 2001). The model suggests that, in a workgroup, one uses the other members' characteristics to place them into different social categories and use these categories to infer their underlying attributes (e.g., knowledge base, skills, abilities, values, and beliefs) and form expectations about the other members' behavior. For example, one may conclude that other members from his/her gender group will share the same values and beliefs, and therefore, are perceived as more cooperative and open to one's ideas.

Social categorization of group members into in-group and out-group categories based on relation-oriented attributes will enhance perceived similarities and differences between groups in terms of these surface-level attributes (Pelled, Eisenhardt, & Xin, 1999; Webber & Donahue, 2001). Based on the similarity/attraction theory, the perception of similarity in values, beliefs, and attitudes with members from the same social categories could result in in-group favoritism and out-group

[3] For example, Coca Cola's finance committee “helps the Board fulfill its responsibilities relating to oversight of the Company's financial affairs, including reviewing and recommending to the Board dividend policy, capital expenditures, debt and other financings, major strategic investments and other transactions.” It “also oversees the Company's policies and procedures on hedging, swaps, risk management and other derivative transactions” (http://www.coca-colacompany.com/investors/committee-charters).

[4] A full transcript of her speech can be found at http://www.sec.gov/news/speech/chair-white-icgn-speech.html

discrimination, which in turn, could decrease group cohesion and hamper the ability of the group to perform. Prior research documents the negative consequences of gender, race, and age diversity on group process and performance (e.g., Fiske, 1993; Perry, 1997; Riordan & Shore, 1997; Tsui, Egan, & O'Reilly, 1992).

Intergroup contact theory suggests that the deleterious effects of diversity on team performance are temporary. The theory proposes that intergroup contacts increase the familiarity with members of different groups and reduce the group stereotypes and conflicts (Pettigrew & Tropp, 2006). Further, contact with out-group members creates counterfactual experiences (Dividio, Gaertner, & Kawakami, 2003) and these experiences force individuals to consider the accuracy of their opinions and make adjustments as needed.

Although relation-oriented attributes are less informative about how group members could contribute to the task on hand, several experimental studies have found that these attributes, including gender, ethnicity, and national origin, could have positive effects on group performance (e.g., Cox, Lobel, & McLeod, 1991; Watson, Kumar, & Michaelsen, 1993). Boards with high levels of relation-oriented heterogeneity may bring many out-group contacts and experience, and therefore, could benefit from a diverse pool of resources. With respect to the board monitoring task to oversee investment activities, relation-oriented attributes could improve the diversity of risk taking propensity in the board.

Research has provided empirical evidence on the relationship between each relation-oriented attribute (i.e., gender, race/ethnicity, and age) and risk taking propensity. Women are usually considered more risk averse than men, but the relationship between gender and risk taking is not straightforward. Performing a meta-analysis of 150 psychology studies, Byrnes, Miller, and Schafer (1999) concluded that men are more likely to take risks than women, but the gender-related difference grows smaller with the age level. Two studies examining gender differences in investing behavior find that women are more risk averse than men in making mutual fund investment decisions (Dwyer, Gilkeson, and List (2002), and that women invest less, and therefore, are seen to be more risk averse than men (Charness & Gneezy, 2012). Examining gender diversity in corporate boards, Levi, Li, and Zhang (2014) show that boards with female directors pursue less aggressive acquisition strategies, suggesting that gender diverse boards are more risk averse.

The empirical evidence on the impact of race (ethnicity) on risk taking propensity is limited. Two recent experimental studies document that ethnic minority individuals are more risk averse than individuals from an ethnic majority group.[5] Potential explanations for the difference in risk preference are that ethnic minority participants perceive more severe negative consequence from loss (Sansani, 2018) and are more sensitive to loss (penalty) associated with risk taking than those from the ethnic majority group (Collado, Risco, & Banducci, 2017). Research has generally shown that older people are more risk averse, but the relationship between age and risk taking is complex (Josef, Samanez-Larkin, Hertwig, Richter, Wagner, & Mata, 2016; Best & Charness, 2015). Risk taking tendencies of individuals are relatively stable over time, but risk taking propensity could decrease due to decreasing learning ability (i.e., ability to process information) as people age (Mata, Josef, Samanez-Larkin, Hertwig, 2011) and experiencing major life events, such as marriage and retirement, that affect the willingness to take risk (Josef et al., 2016).

Taken together, the preceding discussion suggests that being a member of certain gender, ethnic, or age group could affect one's risk preference. If directors from diverse background could overcome their in-group/out-group biases, the board could benefit from the diverse perspectives and inputs to make more informed decisions. As such, increasing relation-oriented diversity through inclusion of women, ethnic minority, and younger[6] directors serving on corporate boards could change the boards' risk taking tendencies, and thus, their benchmark of acceptable level of risk taking and investment. Female and ethnic minority directors may have lower level of risk tolerance and their preference toward risk could serve as a balancing control mechanism to avoid excessive investment and risk taking. Younger directors could be more aggressive in setting the investment target level than older directors. The presence of younger directors, in turn, could also serve as a balancing control mechanism to prevent too much risk avoidance.

In summary, there are two competing arguments on the relationship between relation-oriented diversity and board performance in investment oversight. On the one hand, relation-oriented diverse boards may have more challenges in reaching a consensus due to cognitive biases toward out-group members, and in turn, affecting monitoring performance. This argument suggests a negative association between relation-oriented diversity and board performance in investment oversight. On the other hand, if the detrimental effects of relation-oriented attributes on performance is temporary as directors, through multiple contacts, become familiar with other board members and overcome the in-group/out-group biases, diversity in risk taking propensity among directors could provide a balancing control mechanism to avoid excessive risk taking and risk avoidance. This argument suggests a positive association between relation-oriented diversity and board performance in investment oversight. Since we could not predict which of the two forces would dominate, our hypothesis, stated in an alternative form, is non-directional:

H1. Board relation-oriented diversity attributes are associated with board performance in investment oversight.

2.2. Task-oriented diversity attributes and investment oversight

Task-oriented diversity is more associated with elaboration-based processes or the exchange, processing, and integration of information and perspective among group members than relation-oriented diversity (Jackson, May, Whitney, 1995; Pelled, Eisenhardt, and Xin, 1999). Tasked-oriented attributes, such as expertise, function, and tenure diversity expand a team's cognitive resource base and collective knowledge, skills, and abilities. Prior research has documented that the presence of expert directors on corporate boards is associated with better board monitoring performance. The presence of independent directors with legal and industry expertise is associated with lower earning management, higher financial reporting quality (Krishnan, Wen, & Zhao, 2011; Cohen, Hoitash, Krishnamoorthy, & Wright, 2014; Wang, Xie, & Zhu, 2015) and increased strategic change (Oechmichen, Schrapp, & Wolff, 2017).

The expectations model of diversity (McGrath et al., 1995) shows how the social categorization process using task-oriented diversity attributes could enhance team performance (Webber & Donahue, 2001). Within the context of the task being performed (e.g., investment oversight), board members use the social categorization process to place other members into groups based on their task-oriented attributes (e.g., functional background, tenure/experience). For example, one may consider a particular board member with a finance/accounting degree as a finance expert. The correct identification of board members with relevant expertise and experience will facilitate the inferences about their underlying knowledge, skills, and abilities. Appropriate inferences about members' cognitive resources will improve board process as the

[5] These studies do not suggest that individuals from a certain race or ethnic group are more risk-averse (risk-seeking) than those from other races (ethnic groups). Instead, the studies compare the risk taking property of individuals from a more dominant ethnic group with those from a minority (less dominant) ethnic group in a society.

[6] The average and median age of directors in our sample is 61 years old. Less than 10% of them are younger than 55 years old.

group could locate the relevant expertise within the board and utilize the diverse pool of cognitive resources to enhance the board's problem solving ability.

Using computer simulations and an experimental methodology, West and Dellana (2009) examined the effect of cognitive diversity on the accuracy of multi-agent group decision processes. They showed that cognitive diversity (i.e., having group members that think differently) provides the most effective approach to lower decision errors. Their result is consistent with the expectations model showing that task-oriented diversity attributes enhance group performance (Webber & Donahue, 2001).

The preceding discussion suggests that task-oriented attributes (i.e., expertise and experience) are positively associated with board performance in investment oversight. Effective investment oversight requires a corporate board to determine the appropriate level of investment and risk. Task-oriented board diversity not only increases the pool of cognitive resources to perform the board's monitoring task, but also triggers the social categorization process to identify directors' expertise and utilize the underlying cognitive resources to process complex information. Thus, we hypothesize a positive association between board diversity and board performance in investment oversight. Our hypothesis, stated in an alternative form, is as follows:

H2. Board task-oriented diversity attributes are positively associated with board performance in investment oversight.

3. Research design

3.1. Data sources and sample selection

Our initial sample consists of firms with director data available in RiskMetrics (Institutional Shareholder Services or ISS) for the period of 1998–2014.[7] We used the director data to construct our diversity indexes (discussed in the next section). We then combined the director data with financial data from Compustat, stock market data from the Center for Research in Securities Prices (CRSP), and executive compensation data from Execucomp. We exclude financial institutions (SIC codes in the 6000 s) because they are subject to specific regulations and have fundamentally different investment approaches than nonfinancial institutions. Our final sample after merging the data, excluding financial institutions and deleting observations with missing values, contains 15,125 firm-year observations across 1898 firms.

3.2. Dependent variables

Our proxy for board performance in investment oversight is the firm-specific deviation from the expected level of investment. We measure corporate investment using capital expenditures (CAPEX), R& D expenses (RDEX), and acquisition spending (ACQEX). Each investment variable is scaled by the average assets for the observation year. Following Biddle, Hilary, & Verdi, (2009), we model a firm's investment as a function of growth opportunities and use the residuals from the model to measure the abnormal level of investment.[8] More specifically, we determine the predicted value of investment for each company within the industry it belongs (based on the Fama-French 48 industry classification) during each year using the following model:

$$INVESTMENT_{i,t} = \alpha_0 + \alpha_1 SALEGROWTH_{i,t-1} + u_{i,t} \quad (1)$$

where INVESTMENT represents each of the investment expenditures (i.e., CAPEX, RDEX, ACQEX); SALE_GROWTH is the percentage change in sales from year $t-2$ to $t-1$. Eq. (1) is estimated for each industry and each year.

We obtain the residuals (i.e., deviations from the expected level of investment) by subtracting the actual values of investment from the predicted values of investment from the regression results of Eq. (1). These residuals measure each firm's deviation from its expected investment level in each year given its growth opportunities. We construct three dependent variables (ABSR_CAPEX, ABSR_RDEX, and ABSR_ACQEX) by taking the absolute value of these residuals. A low value of ABSR_CAPEX, ABSR_RDEX, or ABSR_ACQEX indicates a small deviation from the expected level of investment, suggesting better board performance in corporate investment oversight.

3.3. Independent variables

We measure board diversity using the index of diversity (D), a commonly used measure in demographic research, created by Gibbs and Martin (1962) and later referred to by Blau (2000):

$$D = 1 - \sum p_i^2 \quad (2)$$

where p is the proportion of individuals in a category, and i is the number of categories. An index of diversity of 1 (0) indicates that the population is perfectly heterogeneous (homogeneous). As the number of categories increases, the maximum value of D also increases. For example, the maximum value of D is 0.75 if the population has four categories (with equal representation in each category)[9]; it increases to 0.8 if there are five categories in the population.

We use the index of diversity (D) to measure board diversity in directors' gender, race, age, tenure, and expertise (i.e., GENDER_D, RACE_D, AGE_D, TENURE_D, and EXPERT_D). RELATION_D is our measure of relation-oriented diversity attributes, defined as the sum of GENDER_D, RACE_D and AGE_D. TASK_D is our measure of task-oriented diversity attributes, defined as the sum of TENURE_D and EXPERT_D. See Table 1 for more information about the construction of these indexes.

3.4. Regressions

To formally test our hypothesis, we estimate the following model:

$$ABSRINVESTMENT\,(u - hat_{i,t}) = \beta_0 + \beta_1 DIVERSITY_{i,t} + \sum \beta_i CONTROL\ VARIABLES_{i,t} + \varepsilon_{i,t\ldots} \quad (3)$$

ABSR_INVESTMENT represents the absolute values of the investment residuals ($u\text{-}hat_{i,t}$) (i.e., ABSR_CAPEX, ABSR_RDEX, and ABSR_ACQEX) from Eq. (1); DIVERSITY represents the board diversity variables (RELATION_D and TASK_D). We also include a set of control variables that potentially affect investment and risk taking (see Table 1). We conduct the Hausman's (1978) specification test to determine whether we should use random effect or fixed effect models. The test guides us to use and report the fixed effect models.

4. Results

4.1. Descriptive statistics and univariate tests

Table 2 provides the summary statistics of the dependent and main independent variables in the regression models. On average, the sample firms' capital expenditures, R&D expenses, and acquisition spending account for 5.6%, 3.1%, and 3.1% of their assets, respectively. At least 25% of the sample firms do not invest in R&D and 50% do not have

[7] We did not use the RiskMetrics data from 1996 to 1997 due to missing director data on gender, race, tenure, and other directorship positions.

[8] Prior literature has used CAPEX, RDEX, and ACQEX as measures of risk taking (e.g., Bargeron, Lehn, & Zutter, 2010) and investment (e.g., Biddle et al., 2009) interchangeably.

[9] D = 1 - (0.25^2 + 0.25^2 + 0.25^2 + 0.25^2) = 0.75.

Table 1
Variable definitions.

Dependent variables	
CAPEX	The capital expenditures for year t divided by the average assets for year t.
RDEX	The R&D expenditures for year t divided by the average assets for year t. RDEX is set to zero if R&D is missing.
ACQEX	The acquisition spending for year t divided by the average assets for year t.
ABSR_INVESTMENT (ABSR_CAPEX, ABSR_RDEX, ABSR_ACQEX)	Absolute value of investment residuals estimated from the Biddle et al. (2009) model.
Independent variables	
The board diversity variables are based on Blau's (2000) index of diversity (calculated as $1 - \Sigma Pi^2$, where P is the proportion of individuals (directors) in a category and i is the number of categories).	
GENDER_D	Index of diversity for gender with two categories: males and females.
RACE_D	Index of diversity for race with five categories: Asian, Black, Caucasian, Hispanic, and Native Americans
AGE_D	Index of diversity for age with five categories: 40 and younger, 40–49, 50–59, 60–69, 70 years old and older
TENURE_D	Index of diversity for director tenure, measured by the number of terms served on the board. On average, a director serves a term of 3 years. This variable contains six categories: 1 (i.e., 3 years or less), 2, 3, 4, 5, and more than 5 (i.e., more than 15 years) terms.
EXPERT_D	Index of diversity for director expertise with five categories: financial, consulting, legal, management (executives), and other expertise (i.e. research, technology, medical, etc.)
RELATION_D	The sum of GENDER_D, RACE_D and AGE_D
TASK_D	The sum of EXPERIENCE_D and TENURE_D
Control variables	
INDEPENDENCE	Percent of independent directors for year t.
AFTERCEO	Percent of directors appointed after the current CEO took office for year t.
AVG_EXPERIENCE	Average number of outside directorships held by directors for year t.
G-INDEX	The index provides the number of shareholder rights-decreasing provisions a firm has (Gompers, Ishii, & Metrick, 2003). The index ranges from a feasible low of 0 to a high of 24; a high score is associated with weak shareholder rights.
CEO_AGE	CEO's age (in years) in year t.
CEO_FEMALE	A dummy variable that equals to 1 if the CEO is a female, 0 otherwise.
CEO_CHAIR	A dummy variable that equals to 1 if the CEO is also the Chairman of the board.
CEO_TENURE	The number of years the current CEO has served as the CEO of the firm in year t.
BONUS	The annual bonus compensation for year t, measured as a proportion of total compensation received by the CEO.
EXOPTION	Exercisable options defined as the number of unexercised options held by the CEO that have vested at the end of year t, scaled by total outstanding shares of the firm.
UNEXOPTION	Unexercisable options defined as the number of unexercised options (including option grants in the current period) held by the CEO that have not vested at the end of year t, scaled by total outstanding shares of the firm.
SHARES_OWNED	The number of restricted stocks that have not vested and the aggregate number of shares held by the CEO at the end of year t (excluding stock options), scaled by total outstanding shares of the firm.
SIZE	Natural log of total assets (in $ million) for year t
CASH	The log of cash and cash equivalents to total sales for year t − 1.

Table 2
Descriptive statistics.

Variable	N	Mean	Std. Dev	1%	10%	25%	Median	75%	90%	99%
CAPEX	15,125	0.056	0.057	0.003	0.013	0.022	0.039	0.069	0.114	0.286
RDEX	15,125	0.031	0.055	0.000	0.000	0.000	0.001	0.039	0.104	0.238
ACQEX	15,125	0.031	0.078	−0.001	0.000	0.000	0.000	0.023	0.094	0.379
ABSR_CAPEX	15,125	0.028	0.033	0.000	0.004	0.009	0.019	0.033	0.060	0.171
ABSR_RDEX	15,125	0.031	0.043	0.000	0.001	0.003	0.011	0.046	0.091	0.200
ABSR_ACQEX	15,125	0.034	0.053	0.001	0.006	0.011	0.018	0.029	0.070	0.309
RELATION_D	15,125	0.876	0.259	0.278	0.568	0.689	0.874	1.056	1.223	1.486
TASK_D	15,125	1.160	0.325	0.320	0.711	0.960	1.191	1.361	1.594	1.735
GENDER_D	15,125	0.182	0.140	0.000	0.000	0.000	0.198	0.298	0.375	0.469
RACE_D	15,125	0.119	0.156	0.000	0.000	0.000	0.000	0.219	0.370	0.500
AGE_D	15,125	0.575	0.112	0.219	0.430	0.500	0.594	0.656	0.698	0.741
TENURE_D	15,125	0.665	0.147	0.000	0.494	0.625	0.711	0.760	0.781	0.820
EXPERT_D	15,125	0.495	0.273	0.000	0.000	0.346	0.500	0.653	0.880	0.963
INDEPENDENCE	15,125	87.337	54.714	25.000	57.143	70.000	81.818	88.889	100.000	350.000
AFTERCEO	15,125	27.084	29.127	0.000	0.000	0.000	16.667	50.000	75.000	100.000
AVG_EXPERIENCE	15,125	0.894	0.545	0.000	0.250	0.500	0.833	1.222	1.600	2.455
G-INDEX	15,125	7.623	2.038	3.000	5.000	6.000	8.000	9.000	10.000	13.000
CEO_AGE	15,125	55.249	7.609	39.000	46.000	50.000	55.000	60.000	65.000	76.000
CEO_FEMALE	15,125	0.031	0.174	0.000	0.000	0.000	0.000	0.000	0.000	1.000
CEO_CHAIR	15,125	0.668	0.471	0.000	0.000	0.000	1.000	1.000	1.000	1.000
CEO_TENURE	15,125	6.393	7.740	0.000	0.000	1.000	4.000	9.000	16.000	35.000
BONUS	15,125	9.791	15.961	0.000	0.000	0.000	0.000	15.613	34.797	63.273
EXOPTION	15,125	0.632	1.014	0.000	0.000	0.047	0.284	0.822	1.625	4.606
UNEXOPTION	15,125	0.325	0.538	0.000	0.000	0.010	0.161	0.425	0.839	2.299
SHR_OWNED	15,125	1.131	3.971	0.000	0.000	0.000	0.004	0.506	2.378	21.007
SIZE	15,125	7.730	1.532	4.805	5.865	6.597	7.572	8.724	9.885	11.641
CASH	15,125	0.141	0.161	0.001	0.008	0.024	0.077	0.205	0.375	0.692

Table 3
Fixed effect regressions of abnormal level of investment on board diversity.

	ABSR_CAPEX	ABSR_RDEX	ABSR_ACQEX
RELATION_D	−0.00120	−0.00057	−0.00409
	(0.91)	(0.64)	(1.47)
TASK_D	−0.00821	−0.00206	−0.02240
	(9.04)***	(3.33)***	(11.65)***
INDEPENDENCE	−0.00002	−0.00002	−0.00001
	(1.26)	(1.56)	(0.24)
AFTERCEO	0.00001	−0.00001	−0.00001
	(0.63)	(0.82)	(0.48)
AVG_EXPERIENCE	−0.00267	0.00107	−0.00203
	(3.82)***	(2.24)**	(1.37)
GINDEX	−0.00043	−0.00002	−0.00094
	(2.77)***	(0.22)	(2.84)***
CEO_AGE	0.00002	0.00004	−0.00011
	(0.41)	(1.33)	(1.13)
CEO_FEMALE	0.00212	−0.00010	0.00295
	(1.15)	(0.08)	(0.75)
CEO_CHAIR	0.00063	0.00023	0.00011
	(1.03)	(0.56)	(0.08)
CEO_TENURE	0.00005	−0.00003	0.00008
	(0.85)	(0.92)	(0.69)
BONUS	0.00001	−0.00001	0.00018
	(0.58)	(1.27)	(5.62)***
EXOPTION	−0.00027	−0.00013	0.00154
	(0.83)	(0.59)	(2.23)**
UNEXOPTION	0.00082	−0.00075	0.00087
	(1.59)	(2.13)**	(0.80)
SHR_OWNED	−0.00004	−0.00008	−0.00006
	(0.50)	(1.29)	(0.34)
SIZE	−0.00061	0.00115	0.02159
	(1.02)	(2.84)***	(17.15)***
CASH	0.00635	0.00354	0.12627
	(2.27)**	(1.86)*	(21.27)***
Constant	0.04780	0.46130	−0.10884
	(9.19)***	(130.40)***	(9.89)***
R-squared	0.0153	0.0073	0.0528

Absolute values of t-statistics are in parentheses.
*** Indicates statistical significance at 1% level.
** Indicates statistical significance at 5% level.
* Indicates statistical significance at 10% level.

acquisition expenditures during the sample period.[10] The average GENDER_D and RACE_D are much lower than the average AGE_D, TENURE_D, and EXPERT_D. In addition, the 25th percentile of GENDER_D (median RACE_D) equals to zero indicates that at least 25% (50%) of the boards are populated with directors of the same gender (ethnicity). These indicate that the average board is relatively homogeneous in gender and race, but more diverse in age, tenure, and expertise.

4.2. Regression results

We formally test our hypothesis by estimating the fixed effect regression of each measure of board performance in investment oversight (i.e., ABSR_CAPEX, ABSR_RDEX, and ABSR_ACQEX) on two separate diversity measures (RELATION_D and TASK_D) and control variables. Table 3 reports the results. The coefficient estimate of RELATION_D is insignificant across the investment regressions, suggesting that board relation-oriented diversity is not associated with board performance in investment oversight. Our empirical results on relation-oriented diversity do not provide support for our first hypothesis (H1). These results may suggest that the positive effect of relation-oriented diversity on board performance, as predicted by contact theory and cognitive resource perspective, and the negative effect on performance, as predicted by social categorization and similarity/attraction theory, cancel themselves out. In contrast, the coefficient estimate of TASK_D is significant and negatively associated with the abnormal investment levels in all three regressions at the 1% level. Specifically, one-unit increase in TASK_D reduces ABSR_CAPEX by 0.00821, which represents 29% of the average ABSR_CAPEX. Similarly, one-unit increase in TASK_D reduces ABSR_RDEX by 0.00206 (i.e., 6.6% of the average ABSR_RDEX) and ABSR_ACQEX by 0.0224 (i.e., 66% of the average ABSR_ACQEX). Our results support our second hypothesis (H2) that board task-oriented diversity is positively associated with investment oversight.

4.3. Robustness tests

We performed several analyses to check the robustness of our findings, including using alternative dependent and independent variables, an alternative investment estimation model, standardized indexes of board diversity, different regression estimation methods, and subsamples from various industries. We discuss some of the robustness tests as follows. First, we estimated our dependent variables, the deviations (error terms) from the expected level of investment, using the Bargeron, Lehn, and Zutter (2010) model instead of the Biddle et al. (2009) model.[11] The results (available upon request) are consistent with those in Table 3, suggesting that our findings are not driven by the model used to estimate the deviations from the expected level of investment.

Second, to address the potential sample selection bias, we utilized the Heckman's two-stage correction model (Heckman, 1979). Our initial sample from Riskmetrics is likely to comprise of larger firms with a more diverse board than the population. In the first-stage probit regression, the dependent variable TREATMENT equals one if RELATION_D is greater than the median of RELATION_D and TASK_D is greater than the median of TASK_D, or zero otherwise. We used the independent variables from Gul, Srinidhi, and Ng (2011) and Srinidhi et al. (2011).[12] The results (not tabulated) are consistent with those of the fixed effect regressions in Table 3. The coefficient estimate of TASK_D is negative, statistically significant, and consistent across the three investment regressions. The coefficient estimate of RELATION_D is not statistically significant.

Third, to address the potential endogeneity issue (i.e., board relation and task oriented diversity measures are endogenously determined by omitted variables that are potentially correlated with the firm's investment oversight), we conducted two-stage least squares (2SLS) regressions. In the first stage, we used the instrumental variables from Gul et al. (2011) and Srinidhi et al. (2011) to predict RELATION_D and TASK_D separately. We then used the fitted value of RELATION_D and TASK_D from the first stage regression in the second stage regression to examine the impact of board diversity on firms' deviation from the expected level of investment. The second stage results of the 2SLS regression (not tabulated) are similar to the fixed effect regression results presented in Table 3.

Finally, we check the validity of our investment oversight measures (i.e., ABSR_CAPEX, ABSR_RDEX, and ABSR_ACQEX) by examining the association between these measures and firm value (Tobin's Q). Since both under- and over-investment could hurt a firm's survival, we expect the deviations from the expected level of investment to be *negatively* associated with future firm value. Table 4 reports the regressions of the

[10] We performed additional analyses (not reported in the paper) by excluding firms with zero R&D and acquisition expenditures and found that our main results hold with the exclusion of such firms.

[11] Our estimation model, modified from Bargeron et al. (2010) is described below:
$INVESTMENT_{i,t} = \alpha_0 + \alpha_1 POSTSOX_{i,t} + \alpha_2 S\&P500\ index\ returns_{i,t} + \alpha_3 US\ GDP\ growth_{i,t} + \alpha_4 Earnings\ before\ interests\ and\ taxes_{i,t-1} + \alpha_5 Market\text{-}to\text{-}book\ ratio_{i,t-1} + \alpha_6 Debt_{i,t-1} + \alpha_7 Cash_{i,t-1} + \alpha_8 Sales\ growth_{i,t-1} + u_{i,t}$.
Since our sample consists of U.S. firms, we used a dummy variable for SOX (instead of two dummy variables for US and non-US), S&P500 index returns, and U.S. GDP growth in the regression in our model. In addition, we added two control variables (Cash and Sales growth) documented as having strong association with risk taking in the estimation model (Harford, Mansi, & Maxwell, 2008; Biddle et al., 2009).

[12] Gul et al. (2011) and Srinidhi et al. (2011) used these variables in a model to predict whether a firm has a gender diverse board and a female CEO, respectively.

Table 4
The impact of deviation from expected level of investment on future firm performance and firm value: average three-year ahead TOBIN'S Q.

	AVGTOBINQ	AVGTOBINQ	AVGTOBINQ
ABSR_CAPEX	−0.6422		
	(2.47)**		
ABSR_RDEX		−1.9459	
		(2.81)***	
ABSR_ACQEX			−1.1664
			(7.68)***
INDEPENDENCE	−0.0011	−0.0012	−0.0011
	(1.79)*	(1.90)*	(1.79)*
AFTERCEO	−0.0013	−0.0013	−0.0013
	(3.37)***	(3.44)***	(3.23)***
AVG_EXPERIENCE	0.1410	0.1383	0.1342
	(7.05)***	(6.93)***	(6.70)***
GINDEX	−0.0365	−0.0364	−0.0362
	(7.48)***	(7.52)***	(7.43)***
CEO_AGE	−0.0096	−0.0097	−0.0098
	(6.13)***	(6.19)***	(6.27)***
CEO_FEMALE	−0.1872	−0.1848	−0.1911
	(3.77)***	(3.70)***	(3.85)***
CEO_CHAIR	−0.0461	−0.0455	−0.0450
	(2.19)**	(2.16)**	(2.13)**
CEO_TENURE	0.0124	0.0125	0.0124
	(6.92)***	(6.98)***	(6.92)***
BONUS	0.0036	0.0035	0.0036
	(5.55)***	(5.43)***	(5.62)***
EXOPTION	−0.0900	−0.0904	−0.0906
	(7.00)***	(6.98)***	(6.89)***
UNEXOPTION	−0.0587	−0.0602	−0.0576
	(2.69)***	(2.73)***	(2.62)***
SHR_OWNED	−0.0016	−0.0017	−0.0016
	(0.65)	(0.70)	(0.67)
SIZE	−0.0257	−0.0246	−0.0272
	(3.09)***	(3.02)***	(3.28)***
CASH	2.2826	2.1659	2.2884
	(22.25)***	(19.89)***	(22.32)***
Constant	3.5427	3.8169	2.9749
	(11.55)***	(9.99)***	(16.66)***
R-squared	0.2402	0.2413	0.2422
Observations	13,729	13,729	13,729

Absolute values of t-statistics are in parentheses.
*** Indicates statistical significance at 1% level.
** Indicates statistical significance at 5% level.
* Indicates statistical significance at 10% level.

average three-year ahead Tobin's Q on the abnormal level of investment. Results indicate that the deviations from the expected level of investment (ABSR_CAPEX, ABSR_RDEX, and ABSR_ACQEX) are negatively associated with future Tobin's Q in all regressions, significant at the 0.05 level or better. These results provide support to validate our measures of board performance in corporate investment oversight. In a separate analysis, we replaced the dependent variable with future financial performance (ROA) and our untabulated results indicate that the abnormal level of investment is associated with lower future ROA, validating our measures of board investment oversight.

5. Conclusion and discussion

This study examines the impact of board diversity on board performance in investment oversight. We categorize diversity attributes into two dimensions: relation-oriented diversity (i.e., gender, race, and age) and task-oriented diversity (i.e., tenure and expertise). We did not find an association between board relation-oriented diversity and board performance in investment oversight. However, we found that board task-related diversity is negatively associated with the deviation from the expected level of investment, suggesting that diverse experiential boards make better investment decisions than homogeneous ones. Our results are robust to the use of several alternative dependent and independent variables, standardized diversity indexes, different regression methods, and different subsamples.

Theories on the benefits of diversity are mixed. Some argue that workgroup diversity reduces groupthink and brings healthy debates and disagreements to decision making (Gruenfeld et al., 1996; Wittenbaum & Stasser, 1996), while others contend that workgroup heterogeneity makes reaching consensus difficult and damage group performance (Jehn, 1997; Riordan & Shore, 1997; Tsui et al., 1992). Our study highlights the importance of examining related-oriented and task-oriented diversity attributes separately as both types of diversity have different influence on group performance. Researchers are unlikely to find the impact of diversity on team performance when combining all types of diversity (Joshi & Roh, 2009). The reason that we did not find an association between board relation-oriented diversity and board performance in investment oversight is possibly because the beneficial and harmful effects of relation-oriented diversity cancel themselves out.

Our sample suggests that the average corporate board is relatively homogeneous in gender and race, but is diverse in other dimensions, such as age, tenure, and expertise. Therefore, studies measuring board diversity based on only relation-oriented dimension (e.g., gender and race) could potentially underestimate the importance of different dimensions of diversity in boardrooms. In addition, compared to task-oriented attributes, relation-oriented diversity is less relevant to the task being examined, and therefore, the impact of these surface-level attributes on group performance is not clear.

Our study provides evidence supporting the calls for a more diverse board composition by regulators. More specifically, our results provide insights into the role of different types of board diversity in overseeing corporate investment and curtailing suboptimal investment. We show that experiential diversity could benefit corporate boards in performing their monitoring duties. More specifically, we show that a diverse experiential board, particularly one that consists of directors with different professional backgrounds (expertise) and tenure (length of services), makes better decisions. Our study also provides some implications for organizations promoting diversity in workplace. Although the purpose of increasing diversity at workplace is to achieve better representation and inclusion, understanding the impact of different types of diversity on a diverse group's performance and decision making can help corporate boards and managers to better allocate resources in managing the unique challenges, tension, and conflicts that diversity creates.

By nature, our study, similar to other archival-based studies, could observe only outcome, not process. As such, we only observe the equilibrium stage of firms' investment and board diversity. Our study suggests that in equilibrium, task-related diversity attributes reduce deviations from the expected investment level. However, we acknowledge that our study could not capture the dynamic of board decision-making process. Future research should study boards' decision-making process and observe this process to identify whether board diversity enhances the effectiveness of board investment oversight. Future research could also examine other measures of board performance, such as the effectiveness of a board in shaping and sustaining its firm's ethical standards and corporate culture. Our results also suggest that in overseeing corporate investment, cognitive resources of directors (i.e., task-oriented diversity) matter more than directors' innate surface-level differences (i.e., relation-oriented diversity). Future research should explore whether similar phenomenon occurs among other leaders and employees at different organizational levels and different contexts.

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