Director heterogeneity and its impact on board effectiveness

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Abstract

In this study, I examine whether boards that are heterogeneous along five dimensions—age, gender, tenure, rank, and function—perform their most critical tasks better than boards that are more homogeneous. I find that boards with more heterogeneity in director tenure and rank exhibit significantly higher CEO performance-turnover sensitivity and lower excess compensation. Firms with boards that are high in functional heterogeneity perform better on tasks requiring skill-set diversity, such as M&A transactions. However, the study shows that imposing regulatory pressures on firms to increase the level of diversity may not make boards more effective. I show that director heterogeneity improves board effectiveness for the subset of firms that committed to diversity prior to regulatory pressures, but not for the subset of firms that changed the director mix in response to external calls for diversity. This suggests that although director heterogeneity can improve board effectiveness, such improvement may not be achieved if heterogeneity is adopted in response to regulatory pressures rather than voluntarily.

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1. Introduction

In December 2009, the U.S. Securities and Exchange Commission (SEC) approved a rule requiring firms to improve their proxy disclosures. Chief among the new requirements was the disclosure of information regarding board diversity.[1] In a speech following the enactment of the rule, SEC Commissioner Luis Aguilar emphasized the importance of director diversity referring to studies conducted by CalPERs and diversity-centered international reforms as proof that pursuit of board diversity is beneficial to a firm. Such evidence, however, is largely descriptive and does not account for the endogenous nature of board composition. With an increased focus on director diversity disclosures and mandates regarding board diversification, it is essential to understand how director heterogeneity along the dimensions suggested by the regulators affects boards' effectiveness.

Prior studies have examined the role of board diversity in the context of gender, finding mixed results (Erhardt et al., 2003; Carter et al., 2003; Farrell and Hersch, 2005; Adams and Ferreira, 2009). However, recent disclosure requirements and governance initiatives have expanded the scope of diversity. Though the SEC is agnostic on the type of diversity that firms choose to concentrate on, it provides some suggestions about the types of diversity warranting consideration. Following the SEC recommendations as well as prior research on diversity (Milliken and Martins, 1996; Williams and O'Reilly, 1998), I explore age, gender, tenure, rank, and function heterogeneity. In addition to examining each type of diversity individually, I aggregate the diversity measures into an index. The goal of this study is to provide evidence on whether board diversification along the dimensions proposed by the regulators, alone or in

[1] The final rule on the proxy disclosure enhancements can be accessed at www.sec.gov/rules/final/2009/33-9089.pdf.

aggregate, increases boards' ability to effectively monitor management, and if so, to identify conditions under which such diversification is important.

The benefits of diversity can be realized through two mechanisms: greater access to information and resources and increased board independence via perspective diversification. Heterogeneous groups have better access to information. As a result, board heterogeneity ensures that directors are able to be effective, as such ability depends directly on the quantity and nature of information directors hold (Adams and Ferreira, 2007; Bebchuk and Weisbach, 2010). In addition to improving access to information, diversity increases independence. By allowing their members to voice their opinions more freely, diverse groups are less likely to succumb to management pressures. Consistent with this argument, prior management literature shows that perspective diversity leads heterogeneous groups to perform better at deliberations and tough discussions, leading to improved outcomes (Bantel and Jackson, 1989; Jehn et al., 1999; Goll et al., 2001) and making heterogeneous boards the "ultimate outsiders" (Carter et al., 2003).

Despite the proposed benefits of diversity, there is evidence that decisions made by heterogeneous groups may not result in better outcomes (Wagner et al., 1984; Simons and Peterson, 2000; Jackson et al., 1991). Prior research suggests that heterogeneity can adversely impact boards' effectiveness through increased internal conflict and divisiveness (Simons and Peterson, 2000), coordination and communications costs (Van den Steen, 2010), and failure to reach agreement, leading to animosity and dissatisfaction (Wall and Nolan, 1986). The mixed evidence on the benefits of heterogeneity in work teams raises the question as to the optimal level of board heterogeneity. Hermalin and Weisbach (1998) argue that a board structure imposed by regulators is likely to be less effective than an endogenously chosen one, occurring in the absence of such regulation. If a board is diversified to conform to external pressures, such

diversity may be irrelevant or value-destroying. Consequently, director heterogeneity may produce no effects, or effects opposite to those advocated by the regulators. Ultimately, it is unclear whether adopting a suggested increase in director heterogeneity should have a positive effect on boards' effectiveness.

While endogeneity in board composition is a concern in empirical studies, it is less likely to be an issue when examining the impact of board composition on the outcome of a particular task (Hermalin and Weisbach, 2003). To isolate the effects of board composition, I focus on three major observable tasks performed by boards: CEO replacement, CEO compensation, and merger and acquisition (M&A) deals. Weisbach (1988) and Hermalin (2005) posit that CEO replacement is one of the most important tasks of the board. Therefore, I investigate the incremental effect of board diversity on CEO performance-turnover sensitivity. Conditional on having replaced the CEO, I examine subsequent improvement in stock market performance as a function of board heterogeneity. Next, I explore the role of diversity in reducing excess compensation and adding value to M&A transactions, as measured by M&A announcement returns.

Since I focus on the role of heterogeneity in the context of specific tasks, endogeneity is less likely to pose a severe concern. Nonetheless, to minimize any remaining doubt associated with drawing causal inferences, I select the research design to address the main type of endogeneity of concern: the correlated omitted variable bias. To address time-invariant correlated omitted variable bias, I employ firm fixed-effect specification. Due to the nature of the tasks examined and the period over which the variables are measured, other types of endogeneity, such as reverse causality and simultaneity, do not pose a serious threat to the inferences in the CEO performance-turnover sensitivity analysis. However, I further discuss the choice of specifications

employed and consideration of all three types of endogeneity in the results section. Furthermore, I employee instrumental variable approach in the robustness section to validate results related to the role of compensation committee heterogeneity in CEO compensation decisions.

I find that heterogeneous boards are more likely to remove the CEO after poor performance. Conditional on replacing the CEO, firms with heterogeneous boards experience a greater increase in stock market performance. Similarly, heterogeneous compensation committees are less likely to award excess compensation to their chief executives. Results further suggest that functionally-diverse boards perform better on strategic tasks. Since prior studies show that board structure may be more important in firms with weak governance (Adams and Ferreira, 2009; Gul et al., 2011), I separately examine the impact of heterogeneity in weak and strong governance firm subsamples. Results of the cross-sectional analysis indicate that the pooled results are driven by the subset of firms with weaker governance, consistent with the argument that board composition can be a substitute for other governance mechanisms.

Although overall heterogeneity has a positive impact on board effectiveness, not all dimensions of heterogeneity seem to improve the quality of board decisions. Tenure and rank heterogeneity are most strongly related to board effectiveness in turnover and compensation decisions, and functional heterogeneity plays an important role in circumstances requiring skill-set diversity, such as strategic M&A deals. Gender and age heterogeneity have insignificant effects on improvement in boards' effectiveness. The results on gender diversity are inconsistent with prior studies, which show that gender diversity improves boards' effectiveness. Attempts to reconcile these findings generate an important insight. While gender-diverse boards of firms that commit to diversity early, and presumably voluntarily, are significantly more effective at monitoring, gender-diverse boards of firms adding diversity later, and presumably as a response

to external pressures, show no benefit of such a strategy. It suggests that increasing diversity can improve boards' effectiveness if firms diversify their boards to take advantage of the benefits of diversity, rather than to engage in window-dressing.

My study contributes to the literature on board composition in the following three ways. First, the study shows whether board heterogeneity along the dimensions emphasized by the SEC improves boards' governance outcomes and demonstrates which dimensions of heterogeneity are more important. By introducing other dimensions of heterogeneity currently targeted by regulators, I extend the current literature on board composition and board diversity, most of which focuses exclusively on gender, and provide insight into the relative importance of various sources of diversity advocated.

Second, I distinguish between board heterogeneity that was voluntary adopted and heterogeneity which was arguably imposed as a response to external demands. By focusing on a period starting two years after the Sarbanes-Oxley Act and its accompanying governance reforms, I capture a shift in director heterogeneity that is less likely to be endogenous. During this period, many firms presumably increased diversity as a response to external pressures. Using pre-SOX data to identify firms with a pre-regulatory commitment to diversity, I focus on the post-SOX period to assess the effect of heterogeneity on the subset of firms with a pre-regulatory versus post-regulatory commitment to diversity. The findings indicate that regulatory efforts to require firms to increase diversity may not be effective absent firms' commitment to reaping the benefits of diversity. Board diversity for window-dressing purposes is unlikely to be effective in improving governance. This finding seems to support Hermalin and Weisbach's (1998) claim that directors imposed on a firm by regulators are likely to be less effective than those picked through an endogenous selection process.

Finally, I introduce a way to measure heterogeneity that is new in this research context. Heterogeneity can be treated as a generalized concept or each dimension can be treated as a distinct theoretical construct (Pelled, 1996). For each construct of diversity, I use a measure that assesses not only the variety but also the balance of director characteristics. Although this method of measuring the individual constructs of heterogeneity has been used in management literature, it has not been previously used in this setting. In addition to the individual constructs of diversity, I create a heterogeneity index. This index measures boards' diversity along multiple dimensions simultaneously, providing a method for assessing the role of multi-dimensional diversity.

The remainder of the study is organized as follows. Section 2 discusses relevant literature and the motivation for the study, and develops the hypotheses. Section 3 describes the sample used in the study, along with the source of the data. Section 4 covers the research design and empirical results. Section 5 discusses the findings and an additional analysis. Section 6 concludes the paper with a brief summary of the findings.

2. Prior literature and hypothesis development

2.1. Diversity and team performance

There are many dimensions along which individuals within a group can differ. While some of these differences are observable, others are not. The SEC, in its final ruling, noted that each company was given flexibility to define diversity. The goal of diversity was to reflect "perspective diversity" and increase access to resources and the talent pool. It gave the flexibility to determine the type of observable characteristics that would bring about such diversity.

There are two major mechanisms through which diversity is believed to impact group performance: perspective diversity and better access to information and resources. The benefit of the first mechanism, perspective diversity, is that it generates better discussions and deliberations (Jehn et al., 1999), and creates a culture of communication and questioning (van Knippenberg et al., 2004). As a result, diverse groups achieve better outcomes than homogeneous groups that do not engage in such debates. Perspective diversity also increases independence: heterogeneous directors are likely to ask questions that would not come from a homogeneous group. Diverse boards are considered the "ultimate outsiders" (Carter et al., 2003).

The benefit of the second mechanism, better access to information and resources, improves boards' ability to carry out their duties. The amount and nature of information that directors have has great impact on their effectiveness (Bebchuk and Weisbach, 2010). Boards are a primary linkage mechanism between the firm and its external sources of dependency (Hillman et al., 2007). By bringing a group of diverse individuals together, boards gain access to broader sets of information, knowledge, skills, and talent (Zald, 1969; Pfeffer, 1973; Pfeffer and Salancik, 1978). The source of the benefit is directors' human capital and relationship capital (Hillman and Dalziel, 2003).

Despite the purported benefits of diversity, heterogeneous groups face several well-known obstacles to effective functioning. These include: lack of cohesiveness (Jackson et al., 1991); inability to reach satisfactory agreement, leading to excessive conflict and animosity (Simons and Peterson, 2000); coordination issues (Van den Steen, 2010); and diversion of time toward persuasion and fighting (Baranchuk and Dybvig, 2009). The same factors that can make a board more effective can also prove to be its downfall. For this reason, diversity is often deemed a double-edged sword (Milliken and Martins, 1996).

Consistent with the lack of clear expectations for the effect of diversity in board settings, prior studies have found mixed results. Adams and Ferreira (2009), one of the first comprehensive studies of the effect of board diversity, focused on gender diversity. They found that diverse boards are better at disciplining the CEO. Erhardt et al. (2003) and Carter et al. (2003) focused on gender and racial diversity, and found that firms with diverse boards had higher stock valuations. More recently, Gul et al. (2011) documented that gender-diverse boards improved stock-price informativeness, mainly in firms with weak governance. However, results of a study by Farrell and Hersch (2005) suggested that adding women to the board does not affect firm value. Consistent with their findings, Adams and Ferreira (2009) show that, after accounting for endogeneity, gender does not affect accounting profits or firm value.

Prior evidence is therefore unclear on whether diversity improves boards' ability to perform their duties effectively. One of the limitations of some of the earlier studies is they focus on the impact of diversity on firm performance. In this study, I examine the role of board diversity in the context of major tasks performed by boards: CEO replacement, compensation granting practices and M&A transactions.

2.2. CEO turnover and board heterogeneity

One of a board's most important tasks is selecting and replacing the CEO (Hermalin, 2005). Prior research has shown that firms with boards that are better monitors are more likely to replace the CEO following poor stock performance (Weisbach, 1988; Yermack, 1996). Weisbach (1988) also shows that performance-turnover sensitivity is heightened for boards with more independent directors. Performance-turnover sensitivity is explored as a function of other board characteristics, such as gender (Adams and Ferreira, 2009), monitoring intensity (Faleye et al., 2011), and the presence of founders on the board (Li and Srinivasan, 2011).

If diverse boards engage in better dialogues and tougher discussions, as asserted by the literature, their ability to monitor the CEO is likely to be higher. Since perspective diversity is believed to increase the true independence of the board, heterogeneous boards should be more willing to replace the CEO when firm performance is poor. However, prior findings indicate that diversity can have a counter-effect by leading to disagreement and lack of coordination. To the extent that a board is unsure whether to replace its CEO, perspective heterogeneity can lead to prolonged indecisiveness and disagreement about the best course of action. This, in turn, can lead to a decreased sensitivity of the board to firm performance. The board's indecisiveness can result in slower reactions to performance signals. Since benefits and costs of board diversity may exist, my hypothesis is non-directional: Firms with heterogeneous boards are equally effective compared to firms with less heterogeneous boards. Therefore, I hypothesize that:

H1: Heterogeneous board is no more likely to replace the firm's CEO following weak performance than a more homogeneous board.

2.3. Excess compensation and compensation committee heterogeneity

Another context in which boards' monitoring ability is often examined is that of CEO compensation. Boards considered better monitors are found to award less excess compensation to their CEOs. Adams and Ferreira (2009) examine compensation practices of gender-diverse boards, but find no evidence that such boards award less overall compensation to the CEO. Their findings are attributed to the infrequent appointment of women to the compensation committees and the complexity of CEO contracts.

I use CEO compensation as another setting in which to examine the role of director heterogeneity. If heterogeneous compensation committees engage in better discussions regarding appropriate CEO compensation and if such committees are more independent, the CEOs of such firms would be less overcompensated. However, if perspective diversity makes the committee

indecisive regarding the appropriate level of compensation, I would not expect the heterogeneous compensation committee to be any more effective at setting appropriate level of compensation compared to a homogeneous committee. Specifically, I hypothesize that:

H2: A heterogeneous compensation committee is no more likely to award excess compensation to the CEO than a more homogeneous compensation committee.

2.4. Board heterogeneity and post-CEO replacement firm performance

Forced CEO turnover is only one aspect of the CEO replacement process. In addition to removing underperforming CEOs, boards have the task to select a new CEO. To assess whether heterogeneous boards are better at selecting the right candidate, I examine change in firm's market performance conditional on CEO turnover. Using the percentage change in market value from the end of the year before the CEO's departure to the end of the year following the incoming CEO's arrival as the measure of the increase in firm market performance, I examine the role of heterogeneity in such performance change.

If a board's diversity increases its independence, I would expect a heterogeneous board to have a more open approach to the candidate search and to reach out to a broader pool of candidates. Furthermore, if a heterogeneous board has greater access to information, resources, and talent, I expect it to select a better candidate to fill the position. The possible costs of diversity, though still a concern, are expected to be less relevant in this setting. A scenario where the board does not agree on the right candidate is plausible, but it is difficult to imagine that such disagreement would result in selecting a worse candidate. Unlike the board's effectiveness in removing the underperforming CEO, which could be negatively affected by conflict if the board delays its decision and under-reacts to public signals of performance, its effectiveness on the replacement decision should not be negatively affected by the debate process. Consequently, I expect that firms with heterogeneous boards will be make better CEO replacement decisions,

resulting in a higher increase in firm market value following such replacement. More precisely, I hypothesize:

H3: Firms with heterogeneous boards are more likely to experience a significant increase in market value following CEO replacement relative to firms with more homogeneous boards.

2.5. Board heterogeneity and M&A returns

Another major task of the board is to advise on and evaluate strategic decisions proposed by the management (Jensen, 1993). If heterogeneous boards are more independent, then I expect such boards to better monitor strategic choices, preventing the CEO from undertaking bad projects. Likewise, heterogeneous boards should be better able to evaluate the quality of strategic transactions if their access to information and resources is superior to that of more homogeneous boards. Furthermore, if the benefit of director heterogeneity is derived through diversity of human capital, I expect boards that are diverse, especially along the function dimension, to perform better at identifying, negotiating, and closing strategic deals successfully.

A potential drawback of diversity could come from failure to agree on the quality of the transaction proposed, leading to indecision and underinvestment in such projects. Unfortunately, any cost of diversity arising from underinvestment is difficult to measure. Thus, my study focuses on the role of heterogeneity in the success of the board's strategic transactions, conditional on undertaking such projects in the first place.

Conditional on engaging in M&A transactions, I expect firms with heterogeneous boards to select better projects, as measured by the abnormal returns surrounding the announcement of the deal. More precisely, I hypothesize:

H4: Firms with heterogeneous boards will have higher abnormal returns surrounding the announcement of an M&A deal than firms with homogeneous boards.

3. Data

3.1. Sample selection

A five-year sample, from 2004 to 2008, is selected from the universe of the ExecuComp firms. From this sample, I eliminate firms if they are not covered by BoardEx, do not have required financial information in Compustat, stock price information in CRSP, or demographic director information. The final sample consists of 8,214 firm-year observations and 1,985 unique firms. Since not all variables are available throughout the analyses, my sample forms an unbalanced panel and the number of actual observations differs by test.

The primary source of the director characteristics data is BoardEx. For each director in the sample, I collect employment, education, age, gender, and tenure information from Boardex, financial information from Compustat, and the required compensation data from ExecuComp. Information about CEOs (age, tenure, gender, turnover, role duality) is obtained from ExecuComp and supplemented by data available in RiskMetrics.

3.2. Heterogeneity variables

I construct variables for five dimensions of heterogeneity: age, gender, tenure, rank, and function. Since age and tenure are continuous variables, board heterogeneity along these dimensions is measured as a coefficient of variation. Coefficient of variation is defined as:

$$CV_{it} = \sigma_{it}/\mu_{it}$$

The other three dimensions – gender, rank, and function – are categorical variables and I use the Blau index (Blau, 1977) of diversity to measure their heterogeneity. The blau index is defined as:

$$BI_{it} = 1 - \sum_{j=1}^{S} p_{jit}^2$$

Where BI_{it} is the Blau index for firm *i* in year *t*, *j* is the number of categories an individual can belong to (i.e. gender = 2), and p is the proportion of directors on board *i* that belong to

category *j* at time *t*. The Blau index is the most frequently used approach for measuring diversity in work group heterogeneity studies (Harrison and Klein, 2007). The statistical interpretation of the Blau index, ranging from 0 to 1, is the chance that two randomly selected individuals from a group belong to different categories (Harrison and Klein, 2007). This approach is appropriate for measuring diversity of a group where the variable of interest is categorical (i.e. male/female) and no group member belongs to multiple categories simultaneously.

To measure rank and function heterogeneity, I first classify each director's employment background. BoardEx provides comprehensive director employment history. Using this information supplemented by the hand-collected data where BoardEx information is insufficient to make an appropriate classification[2], I categorize each director's rank into one of six categories. To create a function heterogeneity measure, I classify each director's experience into one of twenty categories. See Appendix A for the classification scheme.[3]

In addition to studying each dimension of heterogeneity independently, I create an aggregate index measure. Two difficulties emerge when trying to combine the individual measures. First, measurement method is not consistent across the five categories. The diversity measure for categorical variables is calculated using the Blau index, and for continuous variables using the coefficient of variation. Second, the Blau index of diversity can theoretically only approach 1 (fully heterogeneous) as the number of categories becomes sufficiently large. For variables such as gender, which has only two categories, the maximum range of the Blau index is from 0 to 0.5.

[2] BoardEx provides employment title and name of the firm at which the position was held. In many instances, it is not clear from the name of the firm what type of experience the director acquired. In such instances, I supplement the BoardEx information with research into the nature of the firm. For example, a director whose title states "Partner" at Jones Associates cannot be classified because the type of business in which the firm operates in unclear. Supplemental research leads to additional information which lets me classify this experience appropriately (in this case, I find out that Jones Associates is a stock-brokerage firm).

[3] To ensure that results are not driven by number of categories constructed, I recreate the measure with smaller number of categories. Results are unaffected by the choice of number of categories. Refer to robustness section for further discussion on alternative measures used.

Therefore, the Blau index is not comparable across dimensions with different number of categories (Harrison and Klein, 2007). Summing up Blau index across variables with an unequal number of categories weighs the variable with greater number of categories more heavily. To tackle these issues, I first scale all individual measures of diversity (age, gender, tenure, rank, and function) by the median of their respective categories, and then combine them into an index variable:

$$\text{Board Diversity Index (BDI)}_{it} = \sum_{j=1}^{5} DiversityCategory_{jit} / \widetilde{DiversityCategory_j}$$

Where diversity categories are CV(Age), CV(Tenure), Blau(Gender), Blau(Rank) and Blau(Function).

The standard approach for aggregating the Blau index across categories, widely used in social networks research, is to scale each category by its theoretical maximum (Marsden, 1990; Harrison and Klein, 2007). Since I add different types of measures together (coefficient of variation and Blau across categories), I opt to scale each dimension by its median so as not to force an assumption of theoretical maximum for coefficient of variation dimensions. An example of the methodology is presented in Appendix A.

3.3. Descriptive statistics

Table 1 presents descriptive statistics of the sample. Panel A shows financial characteristics of the sample firms. The selected firms are large; mean and median market capitalizations for a sample firm are $7.1 billion and $1.7 billion, respectively, reflecting ExecuComp's focus on large firms. The median firm in the sample is a growth firm, with book-to-market ratio of 0.46, and profitable, with return on assets (ROA) of 4.8%. There is a large variation in leverage, with 0.05 and 0.33 at the 25th and 75th percentiles, respectively. Similarly, for the annual stock returns, -18% and 19.4% are the 25th and 75th percentiles.

Since the CEO and incumbent members of the board have a say in nominating incoming directors, the structure of the board and characteristics of the CEO may affect board heterogeneity. For this reason, the study controls for CEO characteristics throughout. Panel B of Table 1 presents descriptive statistics of such variables. Only 2.5% of the firms in the sample have a female CEO. For about half of the sample, the CEO and Chairman role is not separated. Most board members (94%) are independent and the average board has 9 directors. On average, 38% of the compensation awarded to the top five earners is allocated to the CEO.

Panel C of the table shows heterogeneity characteristics. There is little variation in director age diversity, as measured by the coefficient of variation. The 25th percentile of age diversity is 0.08 and the 75th percentile is 0.13. Function heterogeneity is another source of diversity with little cross-sectional variation. The other three dimensions of diversity exhibit more cross-sectional variation, indicating that boards across the largest U.S. firms differ more along the gender, tenure, and rank dimensions, compared to the age and function dimensions.

Table 2 provides additional information about differences in firm characteristics between firms with highly homogenous versus highly heterogeneous boards. Homogeneous (heterogeneous) boards are those in the lowest (highest) diversity quartile. Firms with heterogeneous boards are significantly larger and more complex, as measured by the number of geographic and business segments. Compared to firms with homogeneous boards, firms with heterogeneous boards are more likely to have a CEO who is a female, younger and with a shorter tenure at the firm. The accounting performance of such firms is not significantly different from firms with homogeneous boards, but the stock performance is significantly weaker. Finally, heterogeneous boards are larger and relatively less independent.

4. Empirical results

4.1. Board heterogeneity and CEO turnover

To explore performance-turnover sensitivity in the context of more broadly defined diversity, I estimate the following model:

$$CEOTurn_{it} = \beta_0 + \beta_1 StockReturn_{it-1} + \beta_2 Heterogeneity_{it} + \beta_3 StockReturn_{it-1} * Heterogeneity_{it} + \beta_{4-7} GovernanceControls + \beta_{8-12} FirmControls + \beta_{12-16} CEOControls + IndustryDummies_i + YearDummies_{it} + \varepsilon \quad \textbf{(1)}$$

I define CEO turnover (*CEOTurn*) as a dummy variable equal to 1 if the CEO leaves the post involuntarily in year *t.* In addition to including clearly identified involuntary departures, I include all CEO turnovers attributed to retirement if the CEO was no older than 60 years of age at the time of departure.[4] My measure of stock performance (*StockReturn*) is each firm's annual return in *t-1* minus the CRSP value-weighted index during the same period, both compounded monthly.[5] Heterogeneity measures (*Heterogeneity*) are defined in Appendix A. Consistent with prior research, I control for firm performance and CEO characteristics that may affect the likelihood of CEO turnover, such as CEO age (*CEOAge*), gender (*CEOGender*), tenure (*CEOTenure*), CEO power proxied by CEO pay slice (*CEOPaySlice*) (Bebcuck et al, 2011), and the duality of the CEO/Chairman role (*CEODuality*). Additionally, I control for firm characteristics and some governance characteristics, such as board independence (*BoardIndep*), board size (*BoardSize*), and percentage of shares held by the institutional investors, factors previously shown to affect the likelihood of CEO turnover.

[4] Since some prior studies use 65 instead of 60 as the cut-off age prior to which a CEO departure is deemed involuntary, I check the robustness of my findings by using the alternative cut-off. The results are similar and all the heterogeneity variables are significant at the originally reported probability levels.

[5] To examine the possibility that performance-turnover sensitivity is affected by the choice of market index used to adjust firm's raw returns, I recalculate market-adjusted returns using the equally-weighted index and median industry (two-digit sic) returns. Results using the two alternative measures of market-adjusted returns are qualitatively the same and heterogeneity variables are still significant at originally reported levels. Using equally-weighted or median industry returns instead of value-weighted index to adjust raw returns does not affect my results.

Table 3 presents the results for hypothesis 1, which states that a heterogeneous board is no more likely to replace the firm's CEO following weak performance than a homogeneous board. The table shows a multivariate analysis of CEO performance-based turnover as a function of board heterogeneity and other variables hypothesized to affect performance-turnover sensitivity. The variable of primary interest is the interaction term of heterogeneity and stock returns. Boards considered better monitors are expected to have a significantly negative coefficient β_3. The first specification for each dimension of diversity in Table 3 shows logit model estimates while the second specification shows the linear probability model with firm fixed effects. Since it is difficult to interpret coefficients of interaction terms in logit regressions, the coefficients reported in the bottom of the table show Norton Wang Ai (2004) marginal effects with corresponding p-values.

Results show that boards with higher tenure, rank, and overall heterogeneity are more performance sensitive and consequently, more likely to replace the CEO following negative stock performance. The β_3 coefficient estimate for overall heterogeneity is negative and statistically significant at the 5% level (p-value 0.043). For tenure and rank heterogeneity, the β_3 coefficient is negative and statistically significant at the 5% level (p-values of 0.015 and 0.031, respectively).

Among the endogeneity concerns associated with attributing CEO performance-turnover sensitivity to director heterogeneity, omitted variable bias is most relevant. I seek to mitigate this concern by controlling for factors previously shown to affect performance-turnover sensitivity, namely factors that could be correlated with board heterogeneity. To further address the issue of omitted time-invariant variables, I also use a firm fixed-effect specification. To the extent that the correlated omitted variable is time-invariant, firm fixed effect specification should eliminate

any concerns related to this type of endogeneity. Simultaneity and reverse causality are unlikely to be a significant concern in this test, since board composition is observed at the beginning of the year, CEO turnover is observed during the entire year, and stock performance is measured over the prior year. The timing of the variable measurement makes it unlikely that results are driven by those two types of endogeneity.

After accounting for the possibility of an omitted time-invariant variable by estimating the firm-fixed effect model, the results are even stronger. The results from firm fixed effect regressions show that firms with boards that are heterogeneous along tenure (p-value 0.001), rank (p-value 0.004) and overall heterogeneity (p-value 0.019) dimensions exhibit an increase in the likelihood of replacing the CEO compared to more homogeneous boards as the firms' market-adjusted performance for the prior year decreases.

The economic significance of such increased performance-turnover sensitivity is large, given that average CEO turnover in the sample is 6.6%. One standard deviation (0.377) decrease in stock returns increases the likelihood of CEO turnover in a firm whose board's overall heterogeneity index is in the 5^{th} percentile by 2.83% compared to 5.29% in a firm with a heterogeneity index in the 95^{th} percentile. The same decrease in stock performance increases the likelihood of CEO turnover by 1.07% for a board with tenure heterogeneity in the 5^{th} percentile compared to 5.03% for a board with tenure heterogeneity in the 95^{th} percentile. Finally, one standard deviation decrease in stock returns increases the likelihood of CEO turnover by 1.60% for a board with rank heterogeneity in the 5^{th} percentile compared to 4.80% for a board with such heterogeneity in the 95^{th} percentile.

4.2. Board heterogeneity and excess compensation

I examine the role of the five sources of heterogeneity on total excess compensation and the likelihood of awarding excess compensation to the CEO. To derive excess compensation, I first estimate normal compensation using the following model:

$$\ln(CEOTotalComp)_{it} = \beta_0 + \beta_{1-3}GovernanceControls + \beta_{4-11}FirmControls_{it} + \beta_{12-16}CEOControls_{it} + YearDummies_{it} + IndustryDummies_i + \varepsilon \quad \textbf{(2)}$$

I regress the natural log of total compensation (*ln*(*CEOTotalComp*)) on the factors believed to be the determinants of CEO compensation, such as firm characteristics, firm performance, performance volatility, two-digit SIC industry codes, and year-fixed effects. Using coefficient estimates from model (2), I calculate excess compensation as the difference between the actual and predicted total compensation. Since compensation is determined at the committee level, I construct and use compensation committee-level heterogeneity variables for this analysis. Using excess compensation as the dependent variable, I estimate the following model:

$$Excess\_Comp_{it} = \beta_0 + \beta_1 Heterogeneity_{it} + \beta_2 BoardSize_{it} + \beta_3 BoardIndep_{it} + \beta_4 InsiderOwner_{it} + YearDummies_{it} + IndustryDummies_{it} + \varepsilon \quad \textbf{(2a)}$$

Table 4 examines the role of heterogeneity in awarding excess CEO compensation (*Excess_Comp*). Panel A shows results of estimating model (4a). In panel B of the table, I re-estimate the model (4a) above as a logistic regression, replacing the dependent variable with a binary variable equal to 1 when excess compensation is awarded (residual > 0) and 0 otherwise:

$$Excess\_Comp\_Dummy_{it} = \beta_0 + \beta_1 Heterogeneity_{it} + \beta_2 BoardSize_{it} + \beta_3 BoardIndep_{it} + \beta_4 InsiderOwner_{it} + YearDummies_{it} + IndustryDummies_{it} + \varepsilon \quad \textbf{(2b)}$$

The results in table 4 indicate that firms with tenure, rank, and overall-diverse compensation committees award less excess compensation, and are less likely to award any excess compensation. The coefficient on overall heterogeneity is negative in models 2a and 2b and statistically significant at the 5% level (p-values 0.034 and 0.03, respectively). Similarly, tenure heterogeneity is negatively associated with excess compensation (p-value 0.004) and the

likelihood of awarding any excess compensation (p-value 0.005). The coefficient on rank heterogeneity is negative and statistically significant at the 5% level in models 2a and 2b (p-values 0.044 and 0.045, respectively), indicating that boards heterogeneous in rank award less excess compensation, and are less likely to award any excess compensation. Function heterogeneity, however, is associated with increased likelihood of excess compensation (p-value 0.057) and greater overall excess compensation (p-value 0.083). The analysis controls for other board characteristics, such as board size, independence, and percentage of shares held by institutions. As in prior instances, age and gender heterogeneity do not seem to be significant determinants of excess compensation, though coefficients on all of these variables are negative.

In economic terms, compensation committees in the 95^{th} percentile of the aggregate heterogeneity index are 0.848 times as likely to award excess compensation as compensation committees with homogenous index (5^{th} percentile). Equivalently, homogeneous compensation committees are 1.18 times more likely to award excess compensation compared to the more heterogeneous counterparts. Firms with compensation committees homogeneous along the rank and tenure dimensions are 1.28 and 1.22 times more likely, respectively, to award some excess compensation to their CEO compared to the firms with boards heterogeneous along the two dimensions.

4.3. Board heterogeneity post-CEO replacement performance

To examine whether heterogeneous boards are more effective at selecting the new CEO, I estimate change in firm market value post-CEO replacement, as a function of heterogeneity and other hypothesized determinants of firm market value. Specifically, I estimate the following regression:

$$MV\_Increase_{it} = \beta_0 + \beta_1 Heterogeneity_{it} + \beta_{2-4} GovernanceControls_{it} + \beta_{5-11} FirmControls_{it} + \beta_{12-16} CEOControls_{it} + YearDummies_{it} + IndustryDummies_{it} + \varepsilon \quad \textbf{(3)}$$

The dependent variable, *MV_Increase*, is a dummy variable equal to 1 if the % change in market value, as measured from the end of the year before to the end of the year following CEO replacement, is in the top quartile of all firms experiencing CEO transition, and 0 otherwise. A positive coefficient on β_1 would indicate that firms with heterogeneous boards are more likely to experience a significant increase in firm performance following the arrival of the new CEO. To the extent that such an increase in market value is attributable to market perception of the CEO's quality as well as actions undertaken by the CEO during the year, I would conclude that boards of such firms performed better at selecting the right candidate.

Findings suggest this is, indeed, the case. Results in Table 5 show that boards high on overall, tenure, and function diversity measures are significantly more likely (p-values of 0.003, 0.034 and 0.016, respectively) to experience an increase in market value in the top quartile of all firms undergoing leadership change. The findings are consistent with the prediction that heterogeneous boards are more effective in CEO selection due to access to a broader set of resources and greater talent pool, as well as increased independence. Though coefficients on other types of diversity are all positive, they are not significant in the statistical terms.

In economic terms, the results indicate that compared to a board which is in the 5th percentile on heterogeneity measures, a board which is in the 95th percentile would have 2.9 times higher odds of experiencing a significant increase in market value after the appointment of a new CEO, as measured by overall heterogeneity, and 2.9 and 2.3 times higher odds, respectively, as measured by tenure and function heterogeneity.

4.4. Board heterogeneity and M&A announcement returns

To examine the impact of director heterogeneity on the abnormal returns surrounding the announcement of M&A transactions, I estimate the following model:

$$CAR_i = \beta_0 + \beta_1 Heterogeneity + \beta_{2-6} DealCharacteristics_{it} + \beta_{7-13} FirmControls_{it} + \beta_{14-16} GovernanceControls_{it} + \beta_{17-21} CEOControls_{it} + YearDummies_{it} + IndustryDummies_i + \varepsilon \quad \textbf{(4)}$$

I define CAR_i as the five-day, market-adjusted cumulative abnormal return surrounding the announcement day of the M&A transaction, centered on the day of the announcement. Consistent with prior studies, I control for deal characteristics, such as percent paid by cash (*%_Cash*), percentage of the target firm acquired in the deal (*%_Acquired*), transaction value (*Transaction_Value*), value of the transaction relative to firm size (*Relative_Value*), and dummy for whether the target is a private firm (*Private_Target*). In addition, I control for firm, governance and CEO characteristics. Since most firms are serial acquirers with multiple merger deals within the five year period, I include firm fixed effects in the estimation. This mitigates the risk that findings are attributable to an unobserved firm-specific ability or skill to identify the right deal that is correlated with the measures of heterogeneity.

Results in Table 6 suggest that firms with function-heterogeneous boards earn significantly higher abnormal returns (coefficient 0.071, p-value 0.037) around the transaction announcement date. This indicates that function heterogeneity increases boards' ability to select value-enhancing projects. Since function heterogeneity captures diversity of directors' skill and information set, and since merger transactions are usually complex and require a board range of capabilities, it is plausible that functional board heterogeneity is important for firms that engage in M&A transactions. Aside from function diversity, no other source of diversity seems to significantly impact firms' ability to engage in value-enhancing M&A transactions. Coefficients on age, gender, tenure and rank heterogeneity are all insignificant, in statistical terms.

In economic terms, the results suggest that compared to a board which is in the 5th percentile on functional heterogeneity, a board in the 95th percentile on the same dimension experiences 2% higher abnormal returns around the announcement date of an M&A transaction. The magnitude is large, given that the median five-day abnormal return surrounding a deal announcement is under 0.5%. The results indicate that skill-diverse boards exhibit superior ability to identify and close value-enhancing deals.

5. Discussion of results and additional analyses

5.1. Summary of findings

Rank heterogeneity plays an important role in tasks involving CEO disciplining: it increases the sensitivity of forced turnover to performance and decreases the likelihood of the compensation committee awarding excess CEO pay. Function heterogeneity affects boards' ability on tasks relying on relationship and human capital. Such heterogeneity increases boards' effectiveness when selecting a new CEO and identifying good M&A transactions. Of all the dimensions of heterogeneity, tenure heterogeneity has the strongest impact on boards' effectiveness in performing its major tasks. Tenure diverse boards are more performance-sensitive in replacing their CEO, less likely to overcompensate and, on average, provide less excess compensation overall. Furthermore, such boards exhibit significantly more improvement in firm performance following CEO replacement, indicating the success of their CEO selection process. Firms with tenure-diverse boards experience positive, albeit not statistically significant, abnormal returns on the announcement of an M&A transaction.

The two dimensions of diversity that seem to have no impact on a board's ability to perform any of the tasks are age and gender heterogeneity. Firms with boards diverse along these two

dimensions do not exhibit greater differences in CEO performance-turnover sensitivity, compensation practices, ability to select the new CEO or add value to strategic transactions.

5.2. Additional analysis of gender diversity

The findings on gender diversity are not fully consistent with prior research. Adams and Ferreira (2009) show that gender diverse boards are, on average, better at monitoring: their performance-turnover sensitivity is stronger. I do not find such results. One possible explanation for the difference in results is the different time period over which the analysis is performed. While their sample covers 1998 through 2003, my sample starts in 2004 and ends in 2008. The debate on the benefits of including women in governance has gathered steam in recent years. A possible explanation for the difference in results may be that firms recently have added diversity as a window-dressing measure. Rather than to reap the benefits of increasing diversity, firms may be doing so to conform to external expectations. If the female directorships are given as a token without expectation or encouragement of meaningful dialogue, increasing gender diversity may not produce the desired results.

To explore this possibility, I identify firms in my sample that had a long-standing commitment to diversity. Long before organizations such as Catalyst set out to promote benefits of the diversity around 2003, there were firms with women board directors. In my sample, I identify all firms that had more than one female director by 2001 and label those firms "committed." All other firms are labeled as "non-committed." Using the early year data to identify firm types and current data to estimate the impact of diversity for the two firm subsamples, I compare the impact of director gender diversity on board effectiveness (CEO performance-turnover sensitivity and excess compensation) of committed versus non-committed firms.

Results of the analysis are shown in Table 7. In the committed group, there is significant association between gender diversity and increased CEO performance-turnover sensitivity as well as decreased likelihood of excess compensation. No such results are found in the non-committed group. Using the Chow-test of difference in coefficients, I find that such difference in the impact of gender between the two subsamples is statistically significant (chi-squared 5.11, p-value 0.024 for performance-turnover sensitivity and chi-squared 3.23, p-value 0.073 for excess compensation).

To address the concern that findings are driven by other differences between committed and non-committed firms that are correlated with gender diversity, I re-estimate the model with firm a fixed-effect. Holding the firm constant yields same results. Committed firms benefit from the increase in gender diversity even in the recent years, while non-committed firms seem to derive no benefit from such increase in diversity.

The results suggest that gender diversity has a significant impact on firms that seek not to merely comply with external demands for diversity, but to reap the benefits of diverse boards. This finding provides partial explanation for the mixed evidence on the role of gender diversity. Adams and Ferreira (2009) and Carter et al. (2003) use a sample period before external pressures to increase gender diversity were in effect. At that time, firms increased diversity "voluntarily": the choice to add women to the board was largely endogenous and likely driven by internal needs. The results in this study using the pooled sample show no benefit of gender diversity. Since the sample of firms used in the study spans 2004 to 2008, a period after gender initiatives became more prominent, it is likely that firms added diversity during this period to respond to external pressures. This result is also largely consistent with Farrell and Hersch's (2005) view that additions of women to the board are mere window-dressing, and with findings by Ahern and

Dittmar (2011), which show that mandated gender quota in Norway resulted in value reductions for affected firms.

5.3. Impact of racial diversity

Another dimension of heterogeneity frequently advocated is race diversity. Due to limited availability of data, race diversity is omitted from this study. Of the 8,214 firm-year observations, only 12% (984) have full racial profile of the board. Including race diversity would have limited my ability to construct heterogeneity index for most firms in the sample. Using the limited sample in an untabulated analysis, I do not find statistically significant evidence that racial diversity has any impact on board effectiveness in terms of CEO performance-turnover sensitivity or compensation. However, these results are interpreted with caution due to the small sample size.

5.4. The role of governance

As firms differ on many important dimensions, their governance needs differ as well. Firms with weak governance mechanisms benefit more from intense board monitoring (Adams and Ferreira, 2009). Also, the boards of such firms may be more likely to succumb to groupthink mentality as the CEO and top management's power often goes unchecked (i.e., staggered boards, golden parachutes, employment contracts). Combination of high homogeneity and dominant leadership is the main characteristic of passive groups often falling prey to a groupthink mentality (Janis, 1982). Consequently, I explore whether the benefits of heterogeneous boards are realized primarily in the subsample of poorly governed firms.

To examine the incremental monitoring benefit of diverse boards under weak versus strong governance conditions, I replicate the earlier analyses after splitting the sample into two groups: firms with strong and firms with weak governance. To define quality of firm governance, I use

two measures: the Gompers, Ishii, Metrick (2003) index of governance (G-Index) and the Audit Integrity accounting and governance risk (AGR) score. Daines et al. (2010) show that different governance ratings are not highly correlated and have poor predictive power of governance-related outcomes. The study shows that among the ratings, AGR performs marginally better relative to other measures. However, since G-index is perhaps most commonly used, I combine the two to rate the firms as good versus poorly governed. I assign a firm to the weak group if it is below median on either measure and to the strong group if it is above median on both metrics.

In an untabulated analysis, I show that consistent with the idea that diversity may act as the substitute governance mechanism, well-governed firms gain little from monitoring by diverse boards. Though the β_3 coefficient is still negative for tenure, rank, and overall heterogeneity, it is no longer statistically significant in the case of rank and overall heterogeneity. Firms without very strong governance mechanisms in place seem to benefit from boards' tenure, rank, and overall diversity significantly, in terms of their effectiveness in monitoring the CEO. One has to be cautious about drawing comparative inferences between the strong and weak governance samples. The difference in β_3 coefficients across the two subsamples is significant only for the overall heterogeneity measure (p-value 0.075), and not for any of the dimensions examined individually. The Chow test of the coefficient equality between the two samples indicates that while firms with weak governance mechanism benefit more from overall diversity compared to firms with strong governance, in terms of CEO performance-turnover sensitivity, the same cannot be said of other individual forms of heterogeneity. The results from the subsample analysis indicate that the findings are primarily driven by the weak governance subset of firms even though the comparative importance of heterogeneity for the two subsamples cannot be inferred from the results with respect to tenure and rank heterogeneity. The finding that the

impact of heterogeneity is more pronounced in firms without strong governance is consistent with Adams and Ferreira's study (2009), which concludes that mandated gender quotas for firms with otherwise good governance can lead to a reduction in firm value.

5.5. Alternative heterogeneity measures

Due to the concern that results may be driven by the measurement of the diversity, I construct alternative diversity measures. Since age and tenure diversity is originally measured as the coefficient of variation, which is sensitive to large group outliers, I recreate these two measures using the Blau index. First, I transform the continuous variables into categorical variables. For alternative measures of age heterogeneity, I assign each director into one of six age categories. To ensure that results are not driven by the arbitrary choice of age categories, I repeat the exercise again with three categories only.[6] Regardless of the variable choice, the results of the analyses are virtually unchanged. The finding that age diversity does not seem to improve boards' effectiveness in a statistically significant way is robust to multiple methods of measuring diversity and does not seem to be an artifact of the measurement methodology.

I follow similar approach to examine robustness of tenure heterogeneity measure. First, I transform the continuous tenure variable into a categorical variable with six tenure categories.[7] Analysis using the Blau measure yields very similar results: tenure diversity has a positive effect on boards' effectiveness, which is both statistically and economically significant.

For gender diversity, I create three alternative measures: 1) percentage of women on the board, 2) indicator variable equal to 1 if the board has a female director and 0 otherwise, and 3) indicator variable equal to 1 if the board has multiple (more than 1) women on the board, and 0

[6] The six age categories are under 40, 40-49, 50-59, 60-69, 70-79, and 80 and over and the three age categories are under 50, 50-69 and 70 and older.
[7] The six tenure categories are less than 1 year, 1-5 years, 5-10, 10-15, 15-20, 20-30 and more than 30 years.

otherwise. Regardless of the variable used in the analysis, the results are qualitatively the same. There is no evidence that gender diversity improves boards' effectiveness, other than for committed firms.

To test robustness of the rank diversity measure, I recreate the variable by collapsing the six original categories into three: c-level executive, non-executive upper management and lower-management/non-management. Using the blau measure of rank diversity with three categories instead of six generates very similar results and leads to the same inferences as the original analysis. The findings indicate that rank diversity is associated with better governance outcomes, and that such result is robust to alternative measurements of rank heterogeneity.

Finally, I examine the robustness of the findings regarding the impact of functional diversity on governance quality. The initial functional diversity construct was obtained by classifying each director's primary work experience into one of twenty functional areas, described in Appendix A. Since the Blau index is highly sensitive to the number of categories, I recreate the variable three more times by collapsing the number of function categories first into fourteen, ten, and six. Though coefficients vary depending on the specification used, the direction of the coefficients and the statistical significance do not. In each instance, function diversity is not related to quality of governance outcomes in a statistically meaningful way. The robustness tests indicate that initially reported findings are not driven by the nature of the variable measurement.

5.6. Endogeneity concerns

Endogeneity is often considered a treat to results related to the impact of board composition on its effectiveness. The three types of endogeneity to consider include omitted variable bias, simultaneity and reverse causality. I use a three-step approach to mitigate endogeneity concerns. First, I examine heterogeneity in the context of specific tasks entrusted to the board: CEO

replacement, compensation decisions and M&A activity. Hermalin and Weisbach (2003) argue that endogeneity is less of a concern when examining the role of board composition in the context of specific tasks. Therefore, instead of focusing on the role of board heterogeneity in the context of firm value or accounting performance, I focus my analysis on the three major tasks facing boards periodically.

The second way to deal with endogeneity is to employ research design to mitigate the risk of specific forms of endogeneity in each analysis. First type of endogeneity posing a threat to my results is time-invariant omitted variable bias. I mitigate the risk of such bias driving my results by utilizing firm-fixed effect approach in the analysis of CEO performance-turnover sensitivity and M&A returns. I am unable to use similar approach in the CEO compensation test as the composition of the compensation committee tends to be rather stable over the period examined in my study. Lack of variation in the compensation committee composition makes it difficult to employee firm fixed effect approach in the test of the role of compensation committee heterogeneity in awarding excess compensation to the CEO. I address this issue using instrumental variable approach, discussed subsequently in this section.

The second type of endogeneity, which could pose a threat to the validity of the results, is reverse causality. Fortunately, this type of endogeneity is not likely to be a concern in this setting due to the timing of variable measurement. In each one of my tests, the composition of the board is measured prior to the board's undertaking of the task in question. Hence, the task outcome cannot be the determinant of board's composition in any of the tests.

The third type of endogeneity is simultaneity. Similar to time-invariant omitted variable bias, simultaneity resulting from firm-specific factors, which do not vary over the time of the sample

period, affecting board composition and its effectiveness simultaneously is mitigated through firm-fixed effect specification.

To the extent that endogeneity is caused by factors within the firm which vary over the sample period, endogeneity may still pose a credible threat to the results. In order to address some of the concerns resulting from time-variant omitted variables, I re-estimate results using instrumental variable approach discussed below.

5.6.1. Endogeneity concern

The third approach to mitigating the risk to result validity stemming from endogeneity is to re-estimate the results using two-stage instrumental variable approach. Finding good instruments in this setting poses a credible challenge. Informed by the argument in Zald (1969), who argues that the location of organization determines board composition due to the available director supply, I use local demographics in the zip code of a firm's headquarters as instruments for its board composition. Using local demographics to instrument for board composition is also consistent with the resource dependency view of the board: the board serves as a way of connecting the firm with the resources it needs to operate effectively (Pfeffer, 1973; Pfeffer and Salancik, 1978). To the extent that the board needs to understand the local environment, a firm's choice of director should be representative of the locality in which it operates. Local demographic structure has been used previously as an instrument in a related setting. Becker et al. (2010), for example, use local demographics as an instrument in examining the impact of large shareholders on corporate performance.

I use various variables or mix of such variables capturing local demographics and geography (such as number of business establishments, concentration of businesses per population, ratio of water to the land area, median household size, median female per household, female per

employee ratio, ratio of household size to number of businesses, population density, etc.) to instrument for the board or committee heterogeneity dimension examined. Throughout the analysis, I ensure that the instruments selected are valid and relevant. Specifically, I test for weak instruments and instrument relevance, over-identification and joint significance. I have no ex-ante reason to believe that any of the instruments selected fails the instrument exogeneity criteria.

Using the two-stage instrumental variable approach, I re-estimate my analyses. All the dimensions of heterogeneity previously found to be significant determinants of board effectiveness continue to be significant at the similar levels as previously documented. In addition, gender seems to be more significant determinants of board's ability to compensate the CEO appropriately after taking into account the types of endogeneity not addressed in the CEO compensation analysis (p-value of 0.06). I take these results to indicate that my analyses are robust to the main types of endogeneity that could threaten the findings in this setting.

6. Conclusion

The results of this study are consistent with the assertion that diversity affects boards' effectiveness. Overall, heterogeneous boards are more effective at completing major tasks than homogeneous boards. This performance differential is most stark in firms with weak governance. Among the sources of diversity, tenure, rank, and function seem to be more important than age or gender. Tenure heterogeneity has the strongest effect on boards' effectiveness, suggesting that true independence may be best achieved through a mix of old and new perspectives.

This study has implications for firms and standard-setters alike. It suggests that board diversity can be beneficial, but it should not be viewed as a one-size-fits-all approach. While some firms can benefit from diversifying their board, firms with very strong alternative

governance mechanisms in place stand to gain less from such strategy. While the study does not provide any evidence that diversity has negative consequences on boards' effectiveness, it does suggest that the "advertised" benefits may be more limited in scope than previously believed. It challenges the notion that the observed director heterogeneity unconditionally improves firm performance, and suggests that board renewal (tenure heterogeneity) may be a productive avenue for introducing meaningful board diversity.

The broader implication of the results is that while opinion diversity, which can come in many forms, improves boards' effectiveness, its positive impact may be limited to the group of firms willing and able to take it seriously. This finding has implications for governance-related debates putting pressure on firms to comply with the expanding list of best practices. It provides some support for assertions that regulatory-imposed board structures may not be more effective than those that are endogenously-chosen (Weisbach, 1988) and that governance regulations resulting in "window-dressing" behavior by firms will be ineffective (Westphal and Zajac, 1998). While this study provides no evidence that diversity is value-destructive, even when adopted due to external pressures, it does suggest that the benefits of diversity can be derived only if diversity policies are implemented for the right reasons.

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Appendix A

Panel A: Variable Definition - Heterogeneity Variables

Heterogeneity	Definition	Source of Data
Age Heterogeneity	Coefficient of variation (standard diviation / mean) of director's age for the $board_i$, during period t.	*BoardEx*
Gender Heterogeneity	Blau index of diversity (see below), where the two categories are male and female.	*BoardEx*
Tenure Heterogeneity	Coefficient of variation (standard diviation / mean) of director's tenure for the $board_i$, during period t.	*BoardEx*
Rank Heterogeneity	Blau index of diversity (see below), where the six categories are 1) CEO, 2) Other C-suit executives, 3) Upper management, 4) Mid-management, 5) Lower management and 6) Non-management	*BoardEx; Proxy statements; Internet search*
Function Heterogeneity	Blau index of diversity (see below) where the twenty categories are 1) Academic 2) Accounting & Audit, 3) Consulting 4) Creative Arts 5) Science, Engineering, Manufacturing, and R&D 6) General Management 7) Human Resources 8) Investing, Finance and Banking 9) Legal, Compliance and Ethics 10) Medical & Health 11) Politics, Goverment & Defense 12) Public/Investor Relations & Corporate Responsibility 13) Purchasing & Supply Chain Management 14) Risk Management, Quality Control and Regulation 15) Sales, Marketing and Customer Service 16) Strategy and Operations 17) Technology 18) Publishing and Media 19) Corporate Oversight 20) Other	*BoardEx; Proxy statements; Internet search;*
Heterogeneity Index	Each individual measure is scaled by the sample median to make the measures comparable and ensure that each construct is equally represented in the aggregate measure. The standardized measures are added together to create the heterogeneity index.	*BoardEx; Proxy statements; Internet search*

Panel B: Example

Blau Index $1 - \sum_{i=1}^{s} p_i^2$ where p is proportion of directors in category *i* and *s* is the number of categories

Company Name	Directors	Age	Gender	Tenure	Position	Experience
Affiliated Comp Svcs	Joseph O'Neill	63	M	9.6	CEO	Strategy & Operations
	Dennis McCuistion	67	M	0.8	Other C-Suit Exec	Academic
	Darwin Deason	70	M	16.2	CEO	Technology
	Frank Rossi	72	M	9.6	Other C-Suit Exec	Accounting & Audit
	J Kosberg	73	M	3.8	CEO	Consulting

Age Heterogeneity: Standard Deviation / Mean = 4.06/69 =0.06	[Sample median is 0.105]
Gender Heterogeneity: 1 - $((0/5)^2+(5/5)^2) = 0$	[Sample median is 0.198]
Tenure Heterogeneity: Standard Deviation / Mean = 5.96/8 = 0.744	[Sample median is 0.638]
Rank Heterogeneity: 1 - $((3/5)^2 + (2/5)^2) = 0.48$	[Sample median is 0.541]
Function Heterogeneity: 1 -$((1/5)^2+(1/5)^2+(1/5)^2+(1/5)^2+(1/5)^2) = 0.8$	[Sample median is 0.765]
Heterogeneity Index: 0.06/0.105 + 0/.198 + 0.744/0.638 + 0.48/0.541 + 0.8/0.765 = 3.671	[Sample median is 2.482]

Affiliated Computer Services is less diverse than a median firm along age, gender and rank dimensions, but more diverse along tenure and function dimensions. On aggregate, it is more diverse than a median board.

Appendix B

Variable Definition - Other Variables

Dependent Variables	Definition	Source of Data
CEO Turnover	Indicator variable equal to 1 if CEO is replaced in year t, 0 otherwise. The departures classified as "retirements" where CEO is above the age of 60 are not considered CEO replacements.	*ExecuComp*
Excess_Comp	Residuals from regression of total compensation (see specification description in table 4) on the hypothesized determinants of CEO pay.	*N/A*
Excess_Comp_Dummy	Indicator variable equal to 1 for observations where the residual (defined above) is greater than 0 (when some excess compensation is awarded), and 0 otherwise.	*N/A*
Market_Value_Improve	Indicator variable equal to 1 for observations where the % change in market value, measured from the end of period t-1 to end of the period t+1 (where t= year of CEO turnover) is in the top quartile of all firms undergoing CEO transition, and 0 otherwise.	*CRSP*
CAR	Cumulative abnormal market-adjusted 5-day returns centered on the event announcement date.	*CRSP*

Control Variables	Definition	
Stock Returns	Market-adjusted (CRSP value-weigted) returns for year t-1, compounded monthly.	*CRSP*
Firm Size	Natural log of total assets in year t.	*Compustat*
Log(Sales)	Natural log of total revenue in year t.	*Compustat*
Book to Market	Ratio of book value (total assets - total liabilities) to market value of equity in year t.	*Compustat*
ROA	Net income excluding extraordinary items divided by average total assets in period t.	*Compustat*
Leverage	Sum of long and short-term debt divided by average total assets in year t.	*Compustat*
ROA Volatility	Standard deviation of annual ROA over the three year period preceeding year t.	*Compustat*
Stock Volatility	Standard deviation of monthly stock returns over three years prior to t.	*CRSP*
Market Value	Market value of equity at the end of the period t.	*Compustat*
CEO Age	Age of the CEO at the end of the period t.	*ExecuComp*
CEO Gender	Indicator variable equal to 1 if CEO is female, 0 otherwise.	*ExecuComp*
CEO Tenure	Number of years, measured at the end of year t, that the CEO has been at the position.	*ExecuComp*
CEO's Pay Slice	% of Total compensation paid to the top five earners claimed by the CEO.	*ExecuComp*
CEO Duality	Indicator variable equal to 1 if CEO is also company's Chairman, 0 otherwise.	*ExecuComp*
Institutional Ownership	Percentage of float shares held by the institutional investors in year t.	*Thomson Financial*
Board Size	Natural log of the number of directors on the board at the end of period t.	*BoardEx*
Board Independence	Percentage of the board directors considered unaffiliated in year t.	*BoardEx*
# of Bus.Segments	Number of reporting business segments measured in year t.	*Compustat*
%_Cash	Percentage of the transaction paid for by cash.	*SDC Platinum*
%_Acquired	Percentage of the target firm acquired.	*SDC Platinum*
Transaction_Value	Total dollar value of the transaction.	*SDC Platinum*
Relative_Value	Total dollar value of the transaction scaled by firm's total market value of equity.	*SDC Platinum*
Private_Target	Indicator variable equal to 1 if the target firm is private, 0 otherwise.	*SDC Platinum*
# of Geo. Segments	Number of reporting geographic segments measured in year t.	*Compustat*
Weak Governance	Indicator variable equal to 1 if firm's governance is rated as below median on either G-Index (Gompers, Ishii, Metrick, 2003) or Audit Integrity AGR score, and 0 otherwise.	*Risk Metrics & Audit Integrity*

Table 1

Sample summary statistics

The sample consists of an unbalanced panel of 1,985 unique firms over the five year period from 2004 to 2008, for a total of 8,214 firm-years. In order to be includd in the sample, each firm had to be in BoardEx and Execucomp, and meet the minimum data requirement. Financial data is from Compustat, stock returns from CRSP, governance from Risk Metrics, compensation and CEO characteristics from ExecuComp, board characteristics from BoardEx. Variable definitions are as follows: firm size is natural log of assets, book to market is ratio of (total assets-total liabilities) to market value of equity, return on assets is net income before extraordinary items divided by average total assets, leverage is (long + short term debt) divided by total assets, ROA and stock volatility is standard dividation of the two variables over the prior 3 years, market value is market value of equity and annual returns are CRSP value-weighted portfolio adjusted returns over the prior year, compounded monthly. CEO gender is indicator variable set to 1 if CEO is female, CEO tenure is number of years at the CEO post, CEO's Pay Slice is % of total compensation earned by top five disclosed earners attributed to the CEO, CEO duality is indicator variable set to 1 if CEO is also company's Chairman, board size is natural log of the number of board directors, board independence is the percentage of directors considered outsiders (independent). All diversity variables are described in Appendix A.

Panel A - Firm Characteristics

Variable	n	Mean	Median	25th percentile	75th percentile
Firm Size	8,214	7.689	7.556	6.490	8.745
Log(Sales)	8,214	7.312	7.196	6.223	8.335
Book to Market	8,129	0.537	0.455	0.284	0.670
Return on Assets	8,214	0.044	0.048	0.016	0.087
Leverage	8,186	0.212	0.191	0.047	0.326
ROA Volatility	8,195	0.047	0.050	0.016	0.093
Stock Volatility	8,214	0.112	0.098	0.073	0.135
Market Value	8,211	7,066	1,726	699	5,001
Annual Returns	8,214	0.039	(0.004)	(0.184)	0.194

Panel B - Board & CEO Characteristics

	n	Mean	Median	25th percentile	75th percentile
CEO Age	8,203	55.188	55.000	50.000	60.000
CEO Gender	8,214	0.025	0.000	0.000	0.000
CEO Tenure	8,007	6.981	5.000	2.000	9.000
CEO's Pay Slice	8,107	0.375	0.377	0.301	0.445
CEO Duality	8,214	0.528	1.000	0.000	1.000
Insider Ownership	8,102	0.759	0.798	0.647	0.914
Board Size	8,214	2.206	2.197	2.079	2.398
Board Independence	8,214	0.938	1.000	0.889	1.000

Panel C - Diversity Characteristics

	n	Mean	Median	25th percentile	75th percentile
Age Heterogeneity	8,214	0.109	0.105	0.083	0.131
Gender Heterogeneity	8,214	0.179	0.198	0.000	0.298
Tenure Heterogeneity	8,214	0.644	0.638	0.481	0.798
Rank Heterogeneity	8,214	0.510	0.541	0.444	0.612
Function Heterogeneity	8,214	0.739	0.765	0.716	0.810
Heterogeneity Index	8,214	2.447	2.482	2.147	2.769

Table 2

Summary statistics - high verus low heterogeneity

This table shows differences in firm and governance characteristics between low heterogeneity and high heterogeneity firms. The low heterogeneity firms are those which are in the lowest quartile and the high heterogeneity are the firms in the top quartile on each of the dimensions of heterogeneity, as well as the overall heterogeneity index. Heterogeneity is defined in Appendix A. Market adjested returns are monthly-compounded returns for the firm less those for the value-weighted CRSP portfolio. Firm age is number of years since the firm became public. All other variables were previously defined in table 1 and in Appendix B.

	Heterogeneity Index			Age Heterogeneity			Gender Heterogeneity			Tenure Heterogeneity			Rank Heterogeneity			Function Heterogeneity		
Variable	Low	High	Diff	Low	High	Diff	Low	High	Diff	Low	High	Diff	Low	High	Diff	Low	High	Diff
Firm Characteristics																		
Firm Size	7.06	7.95	0.00 ***	7.82	7.32	0.00 ***	6.83	8.17	0.00 ***	7.54	7.72	0.00 ***	8.12	7.36	0.00 ***	7.26	8.29	0.00 ***
Log(Sales)	6.67	7.69	0.00 ***	7.44	6.95	0.00 ***	6.47	7.86	0.00 ***	7.07	7.44	0.00 ***	7.78	6.95	0.00 ***	6.77	7.93	0.00 ***
Book to Market	0.52	0.53	0.42	0.53	0.56	0.02 **	0.55	0.53	0.10	0.54	0.55	0.63	0.49	0.55	0.00 ***	0.56	0.53	0.02 **
Leverage	0.19	0.23	0.00 ***	0.21	0.20	0.70	0.18	0.23	0.00 ***	0.21	0.21	0.84	0.22	0.20	0.01 ***	0.21	0.23	0.00 ***
Business Segments	2.58	3.36	0.00 ***	3.18	2.70	0.00 ***	2.51	3.47	0.00 ***	2.77	3.33	0.00 ***	3.45	2.92	0.00 ***	2.60	3.70	0.00 ***
Geographic Segments	2.58	2.49	0.29	2.52	2.32	0.01 ***	2.58	2.45	0.10	2.16	2.69	0.00 ***	2.59	2.47	0.15	2.29	2.64	0.00 ***
Firm Age	18.54	25.78	0.00 ***	26.07	17.90	0.00 ***	16.94	26.34	0.00 ***	15.85	26.76	0.00 ***	28.11	20.07	0.00 ***	18.62	28.71	0.00 ***
Firm Performance																		
ROA	0.05	0.04	0.74	0.05	0.04	0.01 ***	0.04	0.05	0.13	0.05	0.04	0.29	0.05	0.05	0.53	0.04	0.04	0.65
ROA Volatility	0.05	0.05	0.66	0.05	0.05	0.14	0.04	0.05	0.15	0.05	0.05	0.22	0.05	0.05	0.07 *	0.04	0.04	0.81
Stock Volatility	0.13	0.10	0.00 ***	0.11	0.12	0.00 ***	0.13	0.10	0.00 ***	0.11	0.11	0.94	0.11	0.11	0.00 ***	0.12	0.10	0.00 ***
Market Value	4032	8925	0.00 ***	8102	4726	0.00 ***	2359	10407	0.00 ***	6259	7384	0.04 **	11658	4410	0.00 ***	3524	11865	0.00 ***
Returns - 1 year	0.06	0.02	0.00 ***	0.06	0.04	0.09 *	0.06	0.03	0.00 ***	0.06	0.03	0.04 **	0.04	0.04	0.68	0.04	0.03	0.56
Returns - 2 year	0.27	0.09	0.00 ***	0.18	0.14	0.15	0.25	0.11	0.00 ***	0.22	0.13	0.00 ***	0.16	0.17	0.72	0.17	0.09	0.00 ***
CEO Characteristics																		
CEO Age	55.70	54.48	0.00 ***	56.47	53.66	0.00 ***	55.41	54.66	0.00 ***	54.75	55.42	0.00 ***	55.60	55.17	0.06*	55.15	55.42	0.22
CEO Gender	0.02	0.04	0.00 ***	0.02	0.02	0.57	0.02	0.05	0.00 ***	0.02	0.03	0.50	0.03	0.03	0.57	0.03	0.02	0.09 *
CEO Tenure	8.34	6.31	0.00 ***	7.20	7.17	0.92	8.55	5.83	0.00 ***	6.80	6.67	0.56	6.36	7.69	0.00 ***	7.59	6.06	0.00 ***
CEO's Pay Slice	0.37	0.37	0.77	0.38	0.37	0.00 ***	0.37	0.37	0.44	0.37	0.37	0.90	0.38	0.37	0.35	0.37	0.39	0.00 ***
CEO Duality	0.51	0.54	0.05*	0.58	0.44	0.00 ***	0.46	0.59	0.00 ***	0.52	0.49	0.10	0.59	0.49	0.00 ***	0.49	0.58	0.00 ***
Governance Characteristics																		
Institutional Ownership	0.77	0.76	0.41	0.75	0.77	0.00 ***	0.77	0.76	0.34	0.77	0.74	0.00 ***	0.75	0.77	0.09*	0.76	0.75	0.47
Board Size	2.05	2.29	0.00 ***	2.20	2.17	0.00 ***	2.04	2.26	0.00 ***	2.13	2.24	0.00 ***	2.23	2.18	0.00 ***	2.09	2.34	0.00 ***
Board Independence	0.95	0.93	0.00 ***	0.95	0.93	0.00 ***	0.94	0.95	0.03 **	0.95	0.93	0.00 ***	0.94	0.94	0.72	0.95	0.92	0.00 ***

Table 3

CEO performance-turnover sensitivity and board heterogeneity

This table shows logistic and linear probability model with firm fixed effects regressions of CEO turnover on firm performance, governance characteristics, CEO characteristics and board hetergeneity. Return is market adjusted return for the year using CRSP value-weighted index, compounded mothly. Board independence is the percentage of directors considered unaffiliated. Heterogeneity is defined in the Appendix A. Board size is natural log of number of directors on the board. Closely held shares is the percentage of shares held by the top management, CEO gender is indicator variable equal to 1 when CEO is a female, 0 otherwise. CEO tenure is number of years the current CEO has been at the position. CEO pay slice is % of total pay earned by the disclosed earners captured by the CEO. CEO duality is indicator variable equal to 1 if CEO is also the Chairman. Firm size is natural log of total assets. Business and geographic segments are number of reporting business and geographic segments, respectively. Return volatility is standard diviation of stock returns over the proceeding three year period. Standard errors for the regressions without firm fixed effects are clustered at the firm level. Number in parentheses are two-sides p-values. Significance is denoted by ***, **, and * for 1%, 5% and 10%, respectively. Marginal effects of heterogeneity for the logit specification are calculated using Norton Wang Ai (2004) method and reported in the lower section of the table.

	Dependent Variable = 1 if CEO replaced, 0 otherwise											
	(1) Heterogeneity Index		(2) Age Heterogeneity		(3) Gender Heterogeneity		(4) Tenure Heterogeneity		(5) Rank Heterogeneity		(6) Function Heterogeneity	
CEO Turnover	Logit	LPM FFE	Logit	LPM FFE	Logit	LPM FFE	Logit	LPM FFE	Logit	LPM FFE	Logit	LPM FFE
Returns	-0.919***	-0.029***	-0.907***	-0.026***	-0.889***	-0.026***	-0.914***	-0.028***	-0.922***	-0.023***	-0.917***	-0.026***
	[0.000]	[0.001]	[0.000]	[0.003]	[0.000]	[0.004]	[0.000]	[0.001]	[0.000]	[0.009]	[0.000]	[0.002]
Heterogeneity	0.189	-0.002	-2.743**	-0.030	1.112***	-0.038	0.227	0.028	-0.408	0.009	0.423	0.001
	[0.112]	[0.907]	[0.049]	[0.864]	[0.001]	[0.432]	[0.294]	[0.195]	[0.213]	[0.846]	[0.460]	[0.988]
Returns * Heterogeneity	-0.589	-0.046**	-4.616	-0.047	1.092	-0.002	-1.842**	-0.115***	-3.219**	-0.174***	-1.038	-0.049
	[0.160]	[0.019]	[0.313]	[0.826]	[0.324]	[0.975]	[0.026]	[0.001]	[0.013]	[0.004]	[0.614]	[0.546]
Board_Independence	0.741	-0.001	0.488	-0.002	0.517	0.005	0.778	-0.005	0.612	-0.001	0.737	-0.001
	[0.212]	[0.995]	[0.419]	[0.979]	[0.384]	[0.953]	[0.189]	[0.953]	[0.303]	[0.986]	[0.217]	[0.991]
Returns * Board_Indep	-4.001***	-0.262***	-4.121***	-0.242**	-4.139***	-0.241**	-4.050***	-0.286***	-4.441***	-0.264***	-4.118***	-0.252**
	[0.004]	[0.007]	[0.004]	[0.013]	[0.006]	[0.013]	[0.003]	[0.004]	[0.004]	[0.007]	[0.005]	[0.011]
Board_Size	-0.032	0.042	0.149	0.043	0.001	0.043	0.046	0.030	0.142	0.041	0.029	0.041
	[0.895]	[0.213]	[0.517]	[0.192]	[0.995]	[0.177]	[0.849]	[0.360]	[0.537]	[0.207]	[0.907]	[0.219]
Institutional_Ownership	-0.274	-0.028	-0.258	-0.028	-0.273	-0.028	-0.223	-0.031	-0.243	-0.028	-0.265	-0.028
	[0.163]	[0.303]	[0.192]	[0.303]	[0.164]	[0.307]	[0.260]	[0.253]	[0.213]	[0.299]	[0.179]	[0.303]
Firm_Size	0.016	-0.020	0.009	-0.021	-0.001	-0.020	0.022	-0.018	0.011	-0.021	0.016	-0.021
	[0.683]	[0.169]	[0.828]	[0.146]	[0.988]	[0.153]	[0.570]	[0.197]	[0.773]	[0.134]	[0.690]	[0.151]
Return_Volatility	2.351**	0.170	2.320**	0.173	2.479***	0.173	2.250**	0.163	2.213**	0.169	2.265**	0.173
	[0.011]	[0.174]	[0.011]	[0.166]	[0.007]	[0.167]	[0.015]	[0.194]	[0.015]	[0.177]	[0.014]	[0.167]
Business_Segments	0.041**	0.008**	0.044**	0.008**	0.044**	0.008**	0.043**	0.008**	0.043**	0.008**	0.044**	0.008**
	[0.023]	[0.018]	[0.016]	[0.018]	[0.016]	[0.018]	[0.020]	[0.017]	[0.019]	[0.018]	[0.018]	[0.018]
Geographic_Segments	0.023	0.007	0.023	0.007	0.022	0.007	0.023	0.007	0.024	0.006	0.023	0.007
	[0.231]	[0.108]	[0.230]	[0.108]	[0.254]	[0.109]	[0.251]	[0.105]	[0.222]	[0.126]	[0.235]	[0.107]
CEO_Age	-0.047***	-0.011***	-0.050***	-0.011***	-0.047***	-0.011***	-0.049***	-0.011***	-0.048***	-0.011***	-0.048***	-0.011***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

(Table 3 - Con't)

CEO_Gender	-0.347	-0.159***	-0.345	-0.158***	-0.388	-0.156***	-0.331	-0.164***	-0.334	-0.158***	-0.326	-0.158***
	[0.288]	[0.000]	[0.291]	[0.000]	[0.234]	[0.000]	[0.302]	[0.000]	[0.310]	[0.000]	[0.314]	[0.000]
CEO_Tenure	-0.012	0.018***	-0.012	0.018***	-0.010	0.018***	-0.013	0.018***	-0.012	0.018***	-0.012	0.018***
	[0.126]	[0.000]	[0.139]	[0.000]	[0.212]	[0.000]	[0.117]	[0.000]	[0.128]	[0.000]	[0.134]	[0.000]
CEO_Pay_Slice	-4.153***	-0.253***	-4.163***	-0.252***	-4.152***	-0.252***	-4.138***	-0.251***	-4.150***	-0.254***	-4.150***	-0.252***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
CEO_Duality	0.147	0.025**	0.148	0.025**	0.129	0.025**	0.163	0.026**	0.150	0.025**	0.146	0.025**
	[0.149]	[0.038]	[0.147]	[0.044]	[0.208]	[0.042]	[0.114]	[0.035]	[0.141]	[0.044]	[0.152]	[0.044]
Constant	0.779	0.664***	0.599	0.671***	0.874	0.666***	0.577	0.682***	0.475	0.681***	0.683	0.671***
	[0.272]	[0.000]	[0.400]	[0.000]	[0.217]	[0.000]	[0.419]	[0.000]	[0.498]	[0.000]	[0.344]	[0.000]
Year/Industry/Firm FE	Y/Y/N	Y/-/Y	Y/Y/N	Y/-/Y	Y/Y/N	Y/-/Y	Y/Y/N	Y/-/Y	Y/Y/N	Y/-/Y	Y/Y/N	Y/-/Y
Number of Observations	7,856	7,856	7,856	7,856	7,856	7,856	7,856	7,856	7,856	7,856	7,856	7,856
(Pseudo) R-squared	0.0785	0.067	0.0776	0.067	0.0791	0.067	0.0804	0.069	0.0794	0.068	0.0769	0.067

	Heterogeneity Index		Age Heterogeneity		Gender Heterogeneity		Tenure Heterogeneity		Rank Heterogeneity		Function Heterogeneity	
	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value	Coeff	p-value
Marginal Effects of Heterogeneity * Returns	-0.045**	0.043	-0.170	0.318	0.022	0.537	-0.124**	0.015	-0.184**	0.031	-0.082	0.235

Table 4

Excess compensation and compensation committee heterogeneity

This table presents regression of excess compensation on board characteristics and compensation committee heterogeneity. Excess compensation is obtained from the residuals of the first regression. First stage regression model is specified as follows:

$$\ln(CEOTotalComp)_{it} = \beta_0 + \beta_1 FirmSize_{it} + \beta_2 FirmGrowth_{it} + \beta_3 ROA_{it} + \beta_4 ROAVolatility_{it} + \beta_5 StockReturn_{it} + \beta_6 StockRetVolatility_{it} + \beta_7 BusinessSegment_{it} + \beta_8 GeographicSegment_{it} + \beta_9 CEOAge_{it} + \beta_{10} CEOGender_{it} + \beta_{11} CEOTenure_{it} + \beta_{12} CEODuality_{it} + \beta_{13} CEOTitleLength_{it} + YearDummies_{it} + IndustryDummies_i + LocationDummies_i + \varepsilon$$

Panel A shows OLS regressions where excess compensation is the residual amount from regression 1. Panel B shows logistic regressions, where excess compensation is defined as an indicator variable set to 1 for residual from first regression greater than 0, and 0 otherwise. First stage regression (1) includes two digit industry SIC codes, year dummies and firm location dummies. Heterogeneity is defined in Appendix A. Board size is natural log of the total number of board directors. Board independence is the percentage of directors considred unaffiliated. Institutional ownership is the percentage of shares held by institutional investors.Two-sided p-values are in parentheses. Robust standard errors are clustered at the firm and year level. Significance level is denoted by ***, **, and * for 1%, 5% and 10%, respectively.

	Dependent variable (Excess_Comp) = total excess compensation					
	(1)	(2)	(3)	(4)	(5)	(6)
	Heterogeneity	Age	Gender	Tenure	Rank	Function
PANEL A	Index	Heterogeneity	Heterogeneity	Heterogeneity	Heterogeneity	Heterogeneity
Heterogeneity	-0.011**	-0.395	-0.005	-0.120***	-0.087**	0.118*
	[0.034]	[0.116]	[0.914]	[0.004]	[0.044]	[0.057]
Board_Size	0.052	0.044	0.039	0.061	0.041	0.029
	[0.343]	[0.429]	[0.466]	[0.266]	[0.444]	[0.591]
Board_Independence	-0.013	-0.016	-0.015	-0.021	-0.013	-0.014
	[0.932]	[0.918]	[0.924]	[0.891]	[0.930]	[0.927]
Institutional_Ownership	0.317***	0.315***	0.318***	0.316***	0.315***	0.319***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Constant	-0.168	-0.160	-0.267	-0.210	-0.207	-0.314
	[0.514]	[0.531]	[0.314]	[0.428]	[0.425]	[0.232]
Year/ Industry FE	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Observations	7,421	7,421	7,421	7,421	7,421	7,421
R-Squared	0.031	0.031	0.030	0.032	0.030	0.031
PANEL B	Dependent variable (Excess_Comp_Dummy) = 1 if excess compansation awarded, 0 otherwise					
Heterogeneity	-0.030**	-0.735	-0.045	-0.265***	-0.303**	0.289*
	[0.030]	[0.196]	[0.769]	[0.005]	[0.045]	[0.083]
Board_Size	-0.125	-0.151	-0.156	-0.111	-0.152	-0.185
	[0.453]	[0.359]	[0.350]	[0.495]	[0.355]	[0.261]
Board_Independence	0.157	0.150	0.154	0.138	0.158	0.155
	[0.636]	[0.652]	[0.641]	[0.677]	[0.631]	[0.638]
Institutional_Ownership	0.997***	0.995***	1.000***	0.997***	0.990***	1.004***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Constant	-0.197	-0.275	-0.342	-0.380	-0.095	-0.533
	[0.866]	[0.815]	[0.772]	[0.748]	[0.933]	[0.666]
Year/ Industry FE	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes	Yes/Yes
Observations	7,420	7,420	7,420	7,420	7,420	7,420
Pseudo R-Squared	0.033	0.033	0.033	0.034	0.034	0.033

Table 5

Board heterogeneity and change in performance following CEO replacement

This table presents estimation of the likelihood of large improvement in firm performance (market value) following CEO replacement, as a function of board heterogeneity and other hypothesized determinants of performance change surrounding CEO departure. Dependent variable is 1 if firm's % increase in market value is in the top quartile for all firms replacing CEO, and 0 otherwise. Percentage increase in market value is measured starting at the beginning of the year during which CEO is replaced (t) to the end of the year following CEO replacement (t+1). Heterogeneity is defined in the Appendix A. Board size is natural log of the number of board directors. Board independence is the percentage of directors considered unaffiliated. Institutional ownership is the % of float shares held by institutions. Firm size is natural log of total assets. Book to market is the ratio of book value to market value of equity. ROA and stock volatility is standard dividation of the two variables over the prior 3 years. Returns are CRSP value-weighted portfolio adjusted returns over the year before CEO replacement, compounded monthly. CEO gender is sn indicator variable equal to 1 when CEO is a female, 0 otherwise. CEO tenure is number of years the current CEO has been at the position. CEO title length is character length of CEO's full title. CEO duality is indicator variable equal to 1 if CEO is also the Chairman. Business and geographic segments are number of reporting business and geographic segments, respectively. Regression includes year and industry fixed effects. Number in parentheses are two-sided p-values. Robust standard errors are clustered at the firm and year level. Significance is denoted by ***, **, and * for 1%, 5% and 10%, respectively.

	Dependent Variable = Market_Value_ Improvement					
	(1)	(2)	(3)	(4)	(5)	(6)
Heterogeneity	Heterogeneity Index	Age Heterogeneity	Gender Heterogeneity	Tenure Heterogeneity	Rank Heterogeneity	Function Heterogeneity
Heterogeneity	0.741***	4.732	0.418	1.257**	0.606	2.975**
	[0.003]	[0.169]	[0.514]	[0.034]	[0.180]	[0.016]
Board_Size	-0.108	0.300	0.367	0.157	0.352	-0.038
	[0.767]	[0.504]	[0.426]	[0.696]	[0.430]	[0.949]
Board_Independence	1.152	1.386	0.969	1.386	0.997	1.196
	[0.420]	[0.319]	[0.487]	[0.314]	[0.485]	[0.375]
Institutional_Ownership	0.304	0.304	0.275	0.322	0.280	0.290
	[0.707]	[0.702]	[0.736]	[0.701]	[0.729]	[0.740]
Firm_Size	-0.022	-0.005	-0.030	-0.001	-0.006	-0.039
	[0.898]	[0.977]	[0.872]	[0.996]	[0.974]	[0.831]
Book_to_Market	0.990*	0.970*	1.055*	0.952*	1.011*	1.054*
	[0.081]	[0.067]	[0.071]	[0.061]	[0.078]	[0.059]
ROA_Volatility	-1.088**	-0.979	-0.977	-0.945	-1.086*	-0.820
	[0.047]	[0.117]	[0.123]	[0.106]	[0.088]	[0.190]
$Returns_{t-1}$	5.284***	5.212***	5.181***	5.313***	5.201***	5.185***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Return_Volatility	8.485***	7.939**	8.143**	8.527***	8.072**	8.233**
	[0.009]	[0.020]	[0.016]	[0.010]	[0.017]	[0.023]
Business_Segments	0.086***	0.085***	0.084***	0.081***	0.085***	0.077***
	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]	[0.001]
Geographic_Segments	0.036	0.037	0.041	0.018	0.040	0.045
	[0.431]	[0.404]	[0.385]	[0.590]	[0.386]	[0.365]
CEO_Age	0.010	0.006	0.006	0.006	0.005	0.006
	[0.770]	[0.860]	[0.870]	[0.856]	[0.881]	[0.855]
CEO_Gender	-3.163***	-2.835***	-2.775***	-3.036***	-2.748***	-2.879***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
CEO_Tenure	-0.019	-0.019	-0.018	-0.023	-0.020	-0.018
	[0.280]	[0.296]	[0.318]	[0.191]	[0.269]	[0.337]
CEO_Duality	-0.453	-0.442	-0.442	-0.399	-0.430	-0.444
	[0.357]	[0.362]	[0.354]	[0.416]	[0.372]	[0.358]
CEO_TitleLength	0.013	0.011	0.011	0.009	0.010	0.011
	[0.384]	[0.433]	[0.462]	[0.533]	[0.496]	[0.474]
Constant	-7.860	0.559	-1.353	-9.902	-2.111	-1.904
	[0.821]	[0.986]	[0.967]	[0.789]	[0.949]	[0.953]
Year + Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	687	687	687	687	687	687
R-squared	0.392	0.389	0.387	0.394	0.387	0.390

Table 6

Board heterogeneity and M&A announcement returns

This table presents OLS regression of five-day abnormal returns surrounding the M&A announcement date on board heterogeneity and other hypothesized determinants of announcement returns. Dependent variable is the cumulative abnormal returns surrounding the meger announcement, centered around the announcement date and market-adjusted. Heterogeneity is defined in the Appendix A. Percentage (%) cash is percentage of the M&A transaction paid by cash. Percentage acquired is the percentage of the target firm acquired in the transaction. Transaction value is dollar value of the transaction, in $ mill. Relative value is transaction value scaled by firm's total market value of equity. Private target is an indicator variable equal to 1 if the target is a private firm and 0 otherwise. Firm size is natural log of total assets. Leverage is total short-term and long-term debt scaled by average total assets. ROA is net inicome excluding extraordinary items scaled by average total assets. Firm age is the number of years firm has been public. Board independence is the percentage of directors considered unaffiliated. Board size is natural log of the number of board directors. Instituational ownership is the % of float shares held by institutions. CEO gender is an indicator variable equal to 1 when CEO is a female, 0 otherwise. CEO tenure is the number of years the current CEO has been at the position. CEO pay slice is the percentage of total pay earned by the disclosed earners captured by the CEO. CEO duality is an indicator variable equal to 1 if CEO is also the Chairman. Business and geographic segments are number of reporting business and geographic segments, respectively. Regression includes firm and year fixed effects. Number in parentheses are two-sided p-values. Significance is denoted by ***, **, and * for 1%, 5% and 10%, respectively.

	Dependent Variable = CAR					
	(1)	(2)	(3)	(4)	(5)	(6)
Heterogeneity	Heterogeneity Index	Age Heterogeneity	Gender Heterogeneity	Tenure Heterogeneity	Rank Heterogeneity	Function Heterogeneity
Heterogeneity	0.004	-0.003	0.005	0.013	-0.031	0.071**
	[0.642]	[0.977]	[0.845]	[0.217]	[0.170]	[0.037]
%_Cash	0.000	0.000	0.000	0.000	0.000	0.000
	[0.164]	[0.168]	[0.168]	[0.176]	[0.176]	[0.142]
%_Acquired	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*
	[0.090]	[0.094]	[0.093]	[0.091]	[0.098]	[0.090]
Transaction_Value	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	[0.006]	[0.006]	[0.006]	[0.006]	[0.005]	[0.006]
Relative_Value	-0.023***	-0.023***	-0.023***	-0.023***	-0.023***	-0.023***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Private_Target	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
	[0.253]	[0.259]	[0.256]	[0.259]	[0.251]	[0.252]
Firm_Size	0.004	0.004	0.004	0.005	0.003	0.004
	[0.556]	[0.582]	[0.577]	[0.482]	[0.609]	[0.551]
Leverage	0.003	0.004	0.003	-0.000	0.003	0.000
	[0.899]	[0.880]	[0.882]	[0.997]	[0.914]	[0.984]
ROA	-0.022	-0.022	-0.022	-0.022	-0.023	-0.025
	[0.418]	[0.428]	[0.425]	[0.418]	[0.414]	[0.368]
Returns	0.027***	0.027***	0.027***	0.027***	0.027***	0.028***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Firm_Age	-0.003*	-0.003*	-0.003*	-0.003*	-0.003*	-0.003**
	[0.057]	[0.063]	[0.062]	[0.051]	[0.060]	[0.040]
Board_Size	-0.045**	-0.043**	-0.043**	-0.049***	-0.039**	-0.052***
	[0.011]	[0.014]	[0.012]	[0.006]	[0.025]	[0.003]
Board_Independence	0.014	0.015	0.014	0.014	0.017	0.028
	[0.715]	[0.703]	[0.716]	[0.722]	[0.653]	[0.474]
Institutional_Ownership	0.016	0.016	0.016	0.016	0.016	0.015
	[0.377]	[0.379]	[0.378]	[0.369]	[0.385]	[0.413]
CEO_Age	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	[0.248]	[0.250]	[0.252]	[0.208]	[0.266]	[0.267]
CEO_Gender	0.004	0.005	0.005	-0.002	0.008	0.004
	[0.846]	[0.775]	[0.782]	[0.913]	[0.678]	[0.814]
CEO_Tenure	0.000	-0.000	-0.000	0.000	-0.000	0.000
	[0.967]	[0.988]	[0.989]	[0.809]	[0.931]	[0.883]
CEO_Pay_Slice	0.005	0.005	0.006	0.005	0.008	0.005
	[0.712]	[0.700]	[0.696]	[0.702]	[0.590]	[0.725]
CEO_Duality	0.005	0.005	0.005	0.005	0.005	0.004
	[0.411]	[0.405]	[0.406]	[0.446]	[0.447]	[0.524]
Business_Segments	0.002	0.002	0.002	0.002	0.002	0.002
	[0.124]	[0.126]	[0.127]	[0.129]	[0.149]	[0.109]
Geographic_Segments	0.003*	0.003*	0.003*	0.003*	0.003*	0.004*
	[0.078]	[0.075]	[0.076]	[0.070]	[0.066]	[0.060]
Constant	0.132*	0.134*	0.135*	0.138*	0.140**	0.092
	[0.064]	[0.059]	[0.058]	[0.051]	[0.048]	[0.209]
Year + Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	2,694	2,694	2,694	2,694	2,694	2,694
R-squared	0.052	0.052	0.052	0.053	0.053	0.055

Table 7

Gender diversity: committed versus non-committed firm and the impact on monitoring effectiveness

This table shows seemingly unrelated estimates of two outcomes (CEO turnover and excess compensation) as a function of gender diversity estimated across two samples: firms with early committement to gender diversity ("committed") and firms with late committement ("non-committed"). Committed firms are those firms which had more than one female on board by 2001, and non-committed firms are those firms which did not have more than one female on board at that time. Coefficients on gender diversity are compared across the two firm types. The chow test represents the difference between those coefficients. Return is market adjusted return for the year using CRSP value-weighted index, compounded mothly. Heterogeneity is defined in Appendix A. Board size is natural log of number of directors on the board, board independence is the % of directors considered unaffiliated with the firm and institutional owership is the % of firms' float-adjusted shares held by institutional investors. All other control variables shown in prior tables are included here, but not shown for brevity. Numbers in parentheses are two-sided p-values. Standard errors in models without firm fixed effects are clustered at the firm level. Significance is denoted by ***, **, and * for 1%, 5% and 10%, respectively.

	Dependent Variable							
	(1) CEO_turnover				(2) Excess_Comp_Dummy			
	Logit		LPM Firm Fixed Effect		Logit		LPM Firm Fixed Effect	
	Non-commited	Committed	Non-commited	Committed	Non-commited	Committed	Non-commited	Committed
Returns	-0.867***	0.167	-0.042***	0.023				
	[0.000]	[0.785]	[0.000]	[0.589]				
Gender_Heterogeneity	1.051***	-0.755	0.044*	-0.080	0.049	-0.972*	0.010	-0.186*
	[0.006]	[0.492]	[0.054]	[0.196]	[0.812]	[0.067]	[0.832]	[0.060]
Returns * Gender_Heterogeneity	1.402	-8.676**	0.032	-0.609**				
	[0.247]	[0.043]	[0.603]	[0.044]				
Board_Independence	0.601	1.624	0.046	0.091	0.164	1.718	0.040	0.339
	[0.366]	[0.335]	[0.177]	[0.406]	[0.715]	[0.238]	[0.706]	[0.238]
Returns * Board_Independence	-4.776***	3.144	-0.244***	0.095				
	[0.001]	[0.545]	[0.003]	[0.769]				
Board_Size	-0.006	-0.009	-0.005	-0.036	-0.299	0.408	-0.072	0.092
	[0.983]	[0.987]	[0.746]	[0.345]	[0.133]	[0.466]	[0.130]	[0.392]
Institutional_Ownership	-0.277	0.413	-0.028*	0.021	0.971***	1.252***	0.231***	0.250***
	[0.208]	[0.349]	[0.059]	[0.515]	[0.000]	[0.001]	[0.000]	[0.001]
Early_Commitement vs. Late_Commitment [Prob > χ2]	**χ2 (1) =5.11 [0.024]**		**χ2 (1) =4.33 [0.038]**		**χ2 (1) =3.23 [0.073]**		**χ2 (1) =3.18 [0.074]**	
Controls	Included	Included	Included	Included	Included	Included	Included	Included
Year/Industry/Firm FE	Yes/Yes/No	Yes/Yes/No	Yes/-/Yes	Yes/-/Yes	Yes/Yes/No	Yes/Yes/No	Yes/-/Yes	Yes/-/Yes
Observations	6,502	1,349	6,502	1,349	7,424	7,424	6,129	1,292
Pseudo R-squared	0.096	0.071	0.044	0.042	0.021	0.022	0.055	0.254