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► **To cite this version:**

Sterling Huang, Gilles Hilary. Zombie Board: Board Tenure and Firm Performance. 2018. hal-01736889

**HAL Id: hal-01736889**

**<https://hal.science/hal-01736889>**

Preprint submitted on 18 Mar 2018

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# Zombie Board: Board Tenure and Firm Performance

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<sup>1</sup>Accepted by Christian Leuz. We thank an anonymous referee and our editor for their insightful and constructive comments that helped significantly improve this paper. Special thanks go to Hannes Wagner for generously sharing his data on director deaths. We wish to acknowledge the helpful input of Renee Adams, Morten Bennedsen, Daniel Bens, Lily Brooks, Robert Bushman, Guoli Chen, Lily Fang, Maria Guadalupe, Denis Gromb, Melissa Lewis, Angie Low, Brian Miller, Amine Ouazad, Urs Peyer, Anil Shivdasani, and workshop and conference participants at INSEAD, Singapore Management University, the 4th INSEAD-London Conference, the 25th Australasian Banking and Finance Conference, the 2013 Financial Accounting and Reporting Section Mid-year Conference, the 2013 European Accounting Association Annual conference, the 2013 European Financial Management Association Annual meeting, the 2013 American Accounting Association Annual Meeting, and the 2013 Financial Management Association Annual Meeting. Huang gratefully acknowledges funding from the School of Accountancy Research Center (SOAR) at Singapore Management University. Send correspondence to Sterling Huang, Singapore Management University, 60 Stamford Road, Singapore 528716; telephone: +65 68087929. E-mail: [shuang@smu.edu.sg](mailto:shuang@smu.edu.sg). An Online Appendix to this paper can be downloaded at <http://research.chicagobooth.edu/arc/journal-of-accounting-research/online-supplements>.

# **Zombie Board: Board Tenure and Firm Performance**

## **Abstract**

We show that board tenure exhibits an inverted U-shaped relation with firm value and accounting performance. The quality of corporate decisions, such as M&A, financial reporting quality, and CEO compensation, also has a quadratic relation with board tenure. Our results are consistent with the interpretation that directors' on-the-job learning improves firm value up to a threshold, at which point entrenchment dominates and firm performance suffers. To address endogeneity concerns, we use a sample of firms in which an outside director suffered a sudden death, and find that sudden deaths that move board tenure away from (toward) the empirically observed optimum level in the cross-section are associated with negative (positive) announcement returns. The quality of corporate decisions also follows an inverted U-shaped pattern in a sample of firms affected by the death of a director.

**JEL Classification:** G30, G32, G34, G38, J33, J44, M41

**Keywords:** Board Tenure, Firm Value, Corporate Policies, Learning, Entrenchment

## **1. Introduction**

The issue of director tenure has gained considerable attention both in the US and abroad. On the one hand, some governance experts and market participants express concerns about long-tenured directors. They argue that boards with many long-serving directors are entrenched and indifferent to shareholder concerns (e.g., ISS 2013-14 Policy Survey). Extended board service can create a culture of undue deference to management. On the other hand, inexperienced directors may also be ineffective in their role. A short-tenured board may face less significant governance problems than a long-tenured board, but may have a less complete understanding of the firm's business and history, which may diminish the effectiveness of its monitoring and advising (Pozen and Hamacher [2015]). Thus, the optimal tenure for directors remains an unresolved issue among practitioners.

Despite its practical importance, the academic literature on board effectiveness provides little insight into how the tenure of board members affects the board's monitoring and advising abilities. Instead, it mainly focuses on compositional differences across boards (e.g., Chhaochharia and Grinstein [2007]; Yermack [1996]). In contrast, we examine how board tenure reflects the trade-off between a board's independence and knowledge accumulation. More specifically, we examine how board tenure relates to firm performance and corporate decisions. We operationalize this tenure by considering the average number of years on the board of different outside directors. This approach allows us to examine how the knowledge-independence trade-off is integrated in group decision. As noted in the literature (e.g., Szulanski and Jensen [2006]; van Knippenberg and Schippers [2007]), the consequences of aggregation at the board level of these individual trade-offs through group dynamics are not fully understood at this point.

Our analysis consists of two main parts. First, we examine the relation between board tenure and firm value. We find evidence of an inverted U-shaped relation between board tenure

and firm value. Firm value reaches a maximum when the average tenure of outside directors is approximately 10 years. This finding is robust to the inclusion of controls for an array of 38 corporate governance, CEO, and firm characteristics previously shown as correlated with firm value, and to the inclusion of firm and year fixed effects. The economic magnitude is such that an increase in board tenure from 5 to 7 years is associated with an increase in firm value of 2.7% of the in-sample standard deviation of firm value, while a decrease in board tenure from 13 to 11 years is associated with an increase of 1.3% of this standard deviation. We find these estimates both plausible and economically significant, particularly when compared with the effects of other variables (capital expenditures, for example). We reach a similar conclusion when we use the return on assets (ROA) to measure a firm's performance. The economic magnitude is such that an increase in board tenure from 5 to 7 years is associated with an increase in ROA of 4.3% of the variable standard deviation, while a decrease in board tenure from 13 to 11 years is associated with an increase of 1.2% of the standard deviation. To mitigate the concern that our results may simply reflect the effect of tenure diversity on firm performance, we control for the dispersion in individual director tenures in our specifications. Our results remain unaffected when we consider other measures of tenure diversity, such as the range and the Herfindahl index of board tenure, instead of the dispersion, and other aspects of board diversity, such as ethnic, gender, and age diversity. In addition, we find that the tenure-performance relation is conditional on CEO power and on information complexity. Specifically, long tenure has a more severe negative effect on the board when the CEO is more entrenched, for example, when she has a long tenure as CEO, or is the board chairperson or founder of the firm. Conversely, the negative effect of a short tenure is exacerbated when the information environment is more complex. For example, with low analyst coverage, analyst forecasts are more disperse and less accurate.

Second, we examine the relation between board tenure and various corporate decisions to explain the inverted U-shaped relation between board tenure and firm value. We find that the accumulation of firm-specific knowledge is associated with improvements in the quality of acquisition decisions, corporate disclosure, and CEO compensation practices. However, these results hold only up to a certain threshold. As tenure advances beyond this point, additional years are associated with a decline in board oversight quality and an increase in value-destroying activities. These findings suggest that for each additional year of tenure, the benefits of learning dominate for “younger” boards, whereas the costs of entrenchment dominate for “older” boards. This phenomenon is reminiscent of the effect of audit tenure. Using a quadratic form similar to ours, prior studies (e.g., Chi and Huang [2005]; Davis, Soos and Trompeter [2009]; Bell, Causholli, and Knechel [2015]) find that auditor tenure is associated with an increase in audit quality in the initial years, but only up to a turning point, after which it decreases.<sup>2</sup>

Although we control for many potentially confounding effects, endogeneity problems may still obfuscate the interpretation of these results. First, causality may operate in the reverse direction: poorly performing firms may have trouble attracting new directors, and existing board members may thus stay longer than optimal. Second, if shareholders can (and do) adjust board tenure at no cost, each firm should choose the level of board tenure that maximizes its firm value. In equilibrium, a cross-sectional regression of firm value on board characteristics will not be informative if this is the case (e.g., Demsetz and Lehn [1985]; Chenhall and Moers [2007]). However, it has been argued (e.g., Larcker [2003], p. 94) that this assumption “is an extreme view of the world that is not a useful framework for structuring accounting research.” Instead, some researchers (e.g., Milgrom and Roberts [1992]) suggest that there should be cross-sectional

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<sup>2</sup> However, older studies find either consistent negative (e.g., Carey and Simmet [2006]; Mansi et al. [2004]) or positive (e.g., Myers et al. [2003]; Ghosh and Moon [2005]) effects.

variation around the optimal choice. The cross-sectional regression can be informative if this is the case (the concern about reverse-causality remains a related but separate issue). Consistent with the view articulated by Milgrom and Roberts [1992], Ittner and Larcker [2001] indicate (p. 398) that they find it “difficult to believe that the statement ‘everybody optimizes all the time’ characterizes actual managerial accounting practice.” Rather, they suggest that “all organizations may be dynamically learning and moving toward the optimal level, but a cross-sectional sample will consist of observations that are distributed around the optimal choice.”

The issue of learning will be relevant in our setting if the optimal board tenure differs across firms. In addition, if the transaction costs and other frictions are significant, firms could deviate from their optimal level of board tenure. For example, it is not physically possible to immediately add new directors with company-specific experience if a director leaves. This experience can only be acquired with time. Conversely, it may not be practical, or even feasible, to terminate directors when their tenure is too long.

To further mitigate these concerns, we examine stock market reactions to announcements of the sudden death of an outside director, which represents an unexpected exogenous shock to board tenure. Sudden death announcements that move board tenure away from (closer to) the level of tenure empirically associated with the maximum Tobin’s Q are associated with a three-day abnormal announcement return of -1.4% (1%). These results support a causal interpretation of the relation between board tenure and firm value: firm value changes non-linearly in response to a change in board tenure. We obtain a similar result when we consider the effect of an outside director’s death (sudden or not) on firm value and on the quality of corporate decisions (i.e., acquisitions, corporate disclosure, and CEO compensation) in the following year. Sudden deaths

that move board tenure toward 10 years are associated with a mean abnormal announcement return of 1%, whereas the corresponding effect of those that move board tenure away from 10 years is 1.4%. These findings further strengthen the causal interpretation of our result, as this sample is composed of firms that suffer from a significant shock to board tenure, which is reasonably uncorrelated with firm performance itself.

Our study expands the literature on corporate governance in at least three ways. First, it complements the growing body of literature that relates board characteristics to firm performance. The study contributes to this body of literature by showing that board tenure plays a significant role in firm performance and corporate decisions. However, identifying the effect of tenure on firm valuation is empirically challenging because of the endogenous relation between governance structure and corporate outcome. We address this endogeneity concern by examining director deaths, particularly sudden deaths, which arguably represent an exogenous shock to board tenure and hence provide a more causal interpretation of our results.

Second, this study contributes to our understanding of how directors are valued. Prior studies show that directors' skills and experience are linked with firm performance and corporate decisions (e.g., Celikyurt, Sevilir, and Shivdasani [2012]; Malmendier, Tate, and Yan [2011]). This study adds to this body of literature by showing that the contribution of individual directors to firm value is assessed not only at the individual level, but also in relation to other directors. More specifically, we show that the effect of a director's contribution to firm performance depends in part on her effect on the board's average tenure. As such, the death of an outside director can increase or decrease the firm's value depending on the structure of the board.

Finally, this study contributes to the debate on whether there should be legal limits on the tenure of board members. Given that many proposals for board governance reform explicitly stress



the importance of limiting board tenure, this study shows that board tenure has an inverted U-shaped relation with both corporate decisions and firm value. We also show that factors such as managerial entrenchment and the information environment influence the shape of this relation.

The remainder of the paper proceeds as follows. Section 2 provides information on the institutional background, and develops our hypotheses. Section 3 describes the sample. Section 4 presents the empirical results regarding the effect of board tenure on firm value, followed by a series of tests to address endogeneity concerns. Section 5 examines the relation between board tenure and various corporate decisions. Section 6 provides additional robustness tests for the relation between firm value and board tenure. Section 7 concludes the study.

## **2. Hypothesis Development**

### *2.1. Tenure Length and Firm Performance*

Public companies generally do not have specific term limits on director service (Spencer and Stuart [2011]), the rationale being that long-serving outside directors are valued because of their experience and organizational memory. In recent years, some governance experts and market participants have challenged this view. For example, 74% of investors indicate that long director tenure is problematic (ISS 2013-14 Policy Survey). The Council of Institutional Investors, which manages over US\$3 billion in pension assets, announced a new policy in 2013, calling for boards to evaluate director tenure when assessing director independence, and beginning in the 2014 proxy season, Institutional Shareholder Services (ISS) started to include director tenure in their company governance ratings. ISS views “*tenure of more than nine years as excessive by virtue of potentially compromising a director’s independence.*”<sup>3</sup>

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<sup>3</sup> <http://www.issgovernance.com/file/files/ISSGovernanceQuickScore2.0.pdf>

Outside the US, a growing number of countries have adopted tenure-related guidelines or restrictions on outside directors. With very few exceptions, the “comply and explain” model prevails, and the recommended maximum tenure for a corporate director is between 9 and 12 years. For example, the UK corporate governance code states that a board should explain why a director who has served for more than nine years qualifies as independent. The European Commission recommends that outside directors serve a maximum of three terms, or 12 years. In Hong Kong, an outside director is limited to a nine-year tenure, unless voted otherwise by shareholders. In France, a director is deemed to lose independence after 12 years.<sup>4</sup>

Aside from practical interest, board tenure captures the trade-off between knowledge accumulation and board independence. A board acquires more firm-specific knowledge as board tenure increases, which is associated with an increase in firm value. However, increased familiarity between the board and management can undermine board independence (Fracassi and Tate [2012]; Hwang and Kim [2009]), which can be associated with a decrease in firm value. Although anecdotal evidence suggests that long board tenure is negatively associated with firm performance, empirical evidence on the effect of board tenure on corporate decisions and firm performance remains scarce.

It is important to note that our focus is not on the effect of the tenure of individual directors. Although this question may be important, board members make decisions jointly as a group. Even if each individual director faces the knowledge-independence trade-off, how these director-specific trade-offs aggregate at the board level through group dynamics is less clear (Szulanski and Jensen [2006]). A single long-serving director may be sufficient to share firm-specific knowledge with the rest of the board members, but communication and coordination difficulties

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<sup>4</sup> <http://www.theglobeandmail.com/report-on-business/careers/management/board-games-2013/countries-set-out-rules-on-directors-tenure/article15574442/>

may hinder this knowledge diffusion. For example, von Hippel [1994] and Walton [1975] find that the nature of transferred knowledge changes the effectiveness of knowledge transfers. Conversely, a single outside director may be sufficient to enforce board independence, but that director is equally likely to be captured by more senior and powerful directors or CEOs (Coles, Daniel, and Naveen [2013]; Hermalin and Weisbach [1998]).

We use the average board tenure among all outside directors as a starting point to measure the aggregate balance needed between independence and knowledge at the board level. Arguably, there are other candidate measures, such as the standard deviation or the range of tenure. However, the choice of metric is largely an empirical question, as decision science theory provides limited guidance on the optimal judgment aggregation procedure. For example, Pauly and van Hees [2006] show that there is no non-dictatorial decision method for aggregating sets of judgments in a logically consistent way if the decision method only depends on individual judgments on the proposition under consideration. List [2005] proposes a review of the different theoretical issues associated with judgment aggregation. In the organizational behavior literature, van Knippenberg and Schippers [2007] (p. 533) note that theoretical frameworks to understand the effects of group diversity suffer from “too little development.” Given this theoretical uncertainty, we start our analysis with the first moment of the distribution. However, we revisit this issue in Section 6.1 when we consider the effect of different distributional parameters on our main findings.

We also note that our focus on the first rather than the second moment of the distribution is consistent with the findings in the organizational behavior literature. For example, in their literature review, Williams and O’Reilly [1998] show that the effect of tenure diversity on team performance is inconsistent across studies, with some positive and some negative results (and presumably some insignificant unpublished studies). Wahid [2012] uses the coefficient of

dispersion as her key metric to consider the effect of tenure heterogeneity. We define this coefficient as the ratio of the standard deviation to the mean. In principle, the effect may come from either the numerator or the denominator. Our analysis complements Wahid's [2012] by largely focusing on and establishing a non-linear pattern of the effect of the latter. Our results suggest that the effect of the former is more limited in our context.

### **3. Data and Specifications**

#### *3.1 Pooled Sample*

We use an initial panel of US firms from the WRDS Investor Responsibility Research Center (IRRC) database, which covers S&P 1,500 firms in the US for the 1998-2010 period. We apply two filters to the IRRC data. First, each company must have information on the starting year of the directorship (IRRC variable *dirsince*) for all board members in a given year. We supplement missing tenure information by searching the original proxy filings and 10-K filings, which are available from Capital IQ and the online Edgar data retrieval system. Second, financial information must be available from Compustat, and CEO information must be available from Execucomp. We manually match the company identifier from the IRRC database to Compustat by company name and CEO information, to ensure the correct company identification.

We define “*Board Tenure*” as the average tenure (in years) of all outside directors. We provide detailed definitions of other variables in the Appendix. Our pooled sample comprises 2,222 firms with 12,846 firm-year observations.<sup>5</sup>

Panel A of Table 1 presents the summary statistics for the sample. Board tenure ranges between 0 and 31 years. Consistent with Spencer and Stuart [2011], the average board tenure is

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<sup>5</sup> Our sample includes utility and financial firms, although excluding them does not affect our conclusions.

8.2 and the median is 7.7. The average age of a CEO is 55 years old, with an average tenure of 8 years and shareholding of 2%. We also note that the majority of our sample firms have independent boards, with an average of nine board members. We then calculate the standard deviation of board tenure for each firm and average across all firms. We find that this average is 1.73 (untabulated result), suggesting that there are significant variations in board tenure across time.

Our sample is further reduced when we consider corporate decisions, as we need additional information on M&A activity, corporate disclosure, and managerial compensation. We provide further information on these samples in the Appendix.

### *3.2 Deaths Sample*

Arguably, examining the relation between board composition and firm performance raises the issue of endogeneity. For example, despite the large body of literature on board independence, there is surprisingly little evidence of any direct link between board independence and measures of financial performance or shareholder value (Shivdasani and Zenner [2004]). One possible reason for this lack of empirical evidence is the endogeneity of board selection (Rosenstein and Wyatt [1990]). For instance, it may be difficult to estimate the marginal effect of a single board characteristic if multiple aspects are jointly selected.

We start our analysis by considering a broad sample of firms over a multi-year period using a large vector of control variables. To address endogeneity more specifically, we supplement our pooled analysis by studying stock market reactions to announcements of the sudden death of an outside director. These events represent unexpected exogenous shocks to board tenure, thus resulting announcement returns should differ depending on where the board is positioned on the distribution of board tenure. The death of a director is a significant event for the small group of individuals sitting on a board (as the median board size is nine). Consistent with this view, Nguyen

and Nielsen [2011] provide evidence of a significant stock price reaction around the death of an outside director. We also show in Section 4.5 that sudden deaths have both an economically and a statistically significant effect on board tenure.

The market response to a director death provides a precise test for the direction of causality. If the observed tenure-performance relation reflects an optimal level of board tenure, then any departure from that optimal level will lead to negative announcement returns. Accounting and finance has a long tradition of using an event study, perhaps starting with Fama et al. [1969]. We also supplement this analysis by considering the effect of director death (sudden or otherwise) over a longer period.

We compile the sample of director deaths from various sources. We manually search Factiva, Edgar, Capital IQ, and S&P Register of Corporations, Directors, and Executives by keyword for terms related to director (e.g., “director,” “board”) and death (e.g., “passed away,” “deceased”) for the 1998-2010 period. We then read news articles and on-line filings to determine the cause of death, and merge these data with the governance information from the IRRC and Boardex. Our final sample consists of 441 deaths associated with outside directors.<sup>6</sup>

Further examination of the causes of death reveals that 151 of these 441 deaths were “sudden deaths,” defined according to Nguyen and Nielsen [2011]. We exclude from the sample concurrent confounding events, such as merger and acquisition announcements and quarterly earnings announcements, or any other concurrent news events from Factiva (e.g., Chang, Dasgupta and Hilary [2010]).

Panel B of Table 1 tabulates the different causes of sudden death in our sample. Deaths described as “unanticipated” but with no specific cause account for the largest proportion (36%).

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<sup>6</sup> Table A3 in the Appendix provides a comprehensive reconciliation. The most common explanation for the missing data is our inability to obtain a proxy statement for a firm traded over-the-counter (OTC).

The second most common cause is heart attack (30%), followed by acute illnesses, such as pneumonia (12%),<sup>7</sup> stroke (7%), and accidents (8%).

#### 4. Board tenure and firm performance

##### 4.1 Baseline Regression

Our first set of tests involves panel data estimates relating Tobin’s Q to board tenure and other corporate governance, CEO, and firm attributes. More specifically, we test the following specification:

$$Tobin_{i,t} = \alpha_i + \alpha_t + \beta_1 * Tenure_{i,t-1} + \beta_2 * Tenure_{i,t-1}^2 + \Gamma' X_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where  $i$  indexes firms,  $t$  indexes time, and  $\alpha_t$  and  $\alpha_i$  denote year and firm fixed effects, respectively. To alleviate endogeneity concerns, we use lead-lag specifications. We measure the dependent variables at year  $t$ , and all independent variables at year  $t-1$ .<sup>8</sup>  $Tenure_{i,t-1}$  denotes the average board tenure of all outside directors,  $Tenure_{i,t-1}^2$  is the squared term of the average board tenure of all outside directors,  $X_{i,t-1}$  is a vector of controls, and  $\varepsilon_{i,t}$  is the error term.

We include control variables that capture the CEO and board characteristics known to be related to firm value (e.g., Fich and Shivdasani [2006]; Yermac [1996]). We start with a list of 23 variables. We control for a range of CEO characteristics, such as CEO age, CEO tenure, CEO share ownership, CEO founder status, and CEO-chairman duality. For board characteristics, we control for tenure diversity, classified board, board independence, busy board status, interlocked

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<sup>7</sup> Arguably, an acute illness, such as pneumonia, may develop over a short period of time, but the resulting death may be expected to some extent. However, board members meet four to five times per year on average, and the onset of acute health conditions may not be immediately discovered by the firm or the media. Thus, these deaths may still come as a surprise to the market. Another concern is that suicide may be endogenous to firm conditions. We re-run the tests excluding these two categories of death, and the results continue to hold.

<sup>8</sup> Our conclusions are not affected if we do not lag the “stock” control variables. A “stock” variable is measured at a given date rather than over a period. We present the results of this estimation in Panel F of Table A1 of the Online Appendix.

board, and board size. We also consider a set of firm-level control variables that are likely to be associated with firm valuation and performance. We control for sales growth, past accounting performance (ROA) and stock return, firm age, number of acquisitions, goodwill, leverage, operation segment, firm size, capital expenditures, return volatility, and an IPO/spin-off indicator. In addition, we control for variables found to be associated with firm value in the cross-listing literature, such as the liquidity of the firm, the amount of equity issuance, and the amount of debt issuance (e.g., Lang, Raedy and Yetman [2003]). Further details on the variable definitions are available in the Appendix. Furthermore, we include firm and year fixed effects. The primary advantage of these tests is that they help alleviate concerns that our results are attributable to omitted time invariant (or slow moving) firm characteristics (e.g., industry or location), or common macroeconomic shocks and time trends. In other words, our test consists of within-group analysis that relies on comparisons within a given time period and firm.

Column (1) of Table 2 reports the panel regression results for Equation (1). The results show that an inverted U-shaped relation exists between board tenure and firm value. Both coefficients of *Tenure* and *Tenure*<sup>2</sup> are statistically significant at the conventional level. The level of tenure empirically associated with the maximum Tobin's Q is approximately 8 to 11 years (depending on the exact specification). The economic magnitude of the phenomenon is such that a 5- to 7-year increase in board tenure is associated with an average increase of 2.7% of the sample standard deviation of the firm value, and a 13- to 11-year decrease in board tenure is associated with an increase of 1.3% of this standard deviation.<sup>9</sup> We find these estimates both plausible and

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<sup>9</sup> For example, at the five-year tenure, holding all other variables at mean, the predicted Tobin's Q is 1.697, while at the seven-year tenure, the predicted Tobin's Q is 1.720. Therefore, the predicted change in Tobin's Q is 0.022 (i.e. 1.720-1.697). Given that the standard deviation of Tobin's Q is 0.83, a change of 0.022 in Tobin's Q is translated into a 2.69% (0.022/0.83) increase compared with its standard deviation. We follow a similar approach to estimate the effect of decreasing the tenure length.



economically significant, particularly when compared with the effect of other variables. For example, one standard deviation in capital expenditures is associated with a 4.3% average increase in Tobin's Q compared with its standard deviation. The coefficients of control variables are generally consistent with the results of prior studies.<sup>10</sup>

To provide a descriptive graphical interpretation of the results, we regress Tobin's Q on the control variables (excluding *Tenure* and *Tenure Squared*), then plot the residual using locally weighted polynomial curve (i.e. LOWESS) in Figure 1. The value of Q increases fairly quickly until board tenure reaches approximately 8 years, then more moderately until it reaches 10 years. Beyond this tipping point it starts to decrease, moderately up to approximately 11 years, then more quickly up to 20 years. At that point, the curve becomes flat. However, we note that very few firms have an average tenure above 20 years (only 1% of the observations), thus the last plateau may be an artefact of the data.

As Figure 1 presents a relatively flat zone between 8 and 11 years, we create two indicator variables:  $D(Tenure \leq 8)$  takes the value of 1 if the tenure is below eight years, and 0 otherwise, and  $D(Tenure \geq 11)$  takes the value of 1 if tenure is above 11 years, and 0 otherwise. We estimate the following model:

$$Tobin_{i,t} = \alpha_i + \alpha_t + \beta_1 * D(Tenure \leq 8)_{i,t-1} + \beta_2 * D(Tenure \geq 11)_{i,t-1} + \Gamma' X_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

Our benchmark group is firms with tenure between 8 and 11 years. The results in Column (3) indicate that both variables are significantly negative, suggesting that the optimal tenure is in the 8-11-year range. The economic magnitude is such that firms with a board tenure below 8 years

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<sup>10</sup> In contrast to Bebchuk and Cohen [2005], the results indicate that a classified board is positively associated with Tobin's Q. This discrepancy is driven by the post-SOX period and our use of firm fixed effects.

(above 11 years) are associated with an average decline in firm value of 4.3% (9.7%) of one standard deviation compared with firms with tenure between 8 and 11 years.

As discussed in the introduction, a key implicit assumption required to meaningfully estimate Model (1) is that firms do not always optimize their board tenure. This can happen for different reasons. First, as noted by Itner and Larcker [2001], firms may not know what the optimal length is, and it may take some time for the different parties to learn it. This learning process may be relevant in our setting as we show below that the optimal length varies across firms. Second, even if this optimal tenure length is known, it may not be possible to immediately reach it. For example, it is not feasible to increase tenure length if a director leaves (short of letting time pass). Conversely, it may not be practical, or even feasible, to terminate directors when their tenure is too long. Firms may have to trade off different attributes. For example, it may not be difficult to retain directors with specialized knowledge. Firms may have to tradeoff between keeping a director with this expertise and pushing board tenure beyond its optimal point, or optimizing the tenure length by forsaking this experience. Agency problems, stock ownerships, legal considerations, social norms, and other similar factors may also lead firms to retain directors beyond the optimal tenure length. Generally, relationships between board and CEO established through repeated interactions can lead to distortions in director selection (Kuhnen [2007]), CEO retention decisions (Nguyen [2008]), CEO compensation decisions (Hwang and Kim [2009]), and corporate investment decisions (Fracassi and Tate [2012]).

## 4.2. Sensitivity

We conduct multiple robustness tests. First, several studies (e.g., Bebchuk, Cremers and Peyer [2011]) show that industry characteristics may drive commonality in firm valuation. To address this point, we control for firm fixed effects in our main specification. As a robustness check, we control for industry (at the SIC 2-digit level) and year joint fixed effects. Industry\*year joint fixed effects should absorb any time series variations in industry characteristics that may confound our results (e.g., Gormley and Matsa [2014]). The results are presented in Panel A of Table A1 of the Online Appendix. We continue to find a quadratic relation between firm value and performance and board tenure, with coefficients statistically significant at a minimum of 5% level. To mitigate any remaining concerns, we also re-estimate Model (1) using accounting performance (ROA) as a dependent variable (instead of Tobin's Q). The results reported in Column (2) yield the same conclusions. However, contemporaneous ROA is affected by decisions that have been supervised by boards with different characteristics, whereas Q offers a more instantaneous response to new information if markets are reasonably efficient. The economic magnitude is such that an increase in board tenure from 5 to 7 years is associated with an increase in ROA of 4.3% of the variable standard deviation, while a decrease in board tenure from 13 to 11 years is associated with an increase of 1.2%.<sup>11</sup>

The second set of robustness checks concerns our econometric specifications. To alleviate the concern that other unobservable firm-level factors may drive our results, we consider two alternative specifications. First, we consider a vector of 15 additional firm-year controls. We control for other aspects of board diversity, such as gender, ethnicity, age diversity, and director

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<sup>11</sup> For example, holding all other variables at mean, the predicted change in ROA when board tenure changes from 5 to 7 years is 0.298. Given that the standard deviation of ROA is 6.90, a change of 0.298 in ROA is translated into a 4.3% (0.298/6.90) increase in average ROA compared with its standard deviation. We follow a similar approach to measure the reduction of the average tenure length.

shareholding (we provide details on these variables in the Appendix). Fama [1980] argues that an efficient labor market provides implicit incentives for directors. We measure the implicit incentives associated with career concerns using the average age of directors and the percentage of directors who are close to retirement age.<sup>12</sup> Another concern is that the board tenure-performance relation may stem from differences in the experience of board members. We use the proportion of directors who have a concurrent outside executive position as a proxy for functional experience. Malmendier, Tate, and Yan [2011] use a CEO birth cohort as a proxy for life experience, and show that differences in life experience influence CEOs' corporate finance policies. Following their analysis, we use a director birth cohort as a proxy for life experience. To construct a board-level measure of directors' life experience, we calculate the percentage of directors belonging to each birth cohort. In addition, we control for the liquidity of the firm, the amount of equity issuance, and the amount of debt issuance (e.g., Fich and Shivdasani [2006]; Becker and Stromberg [2012]).

The results reported in Columns (5) and (6) of Table 2 indicate that the variables of interest remain significant at the 1% level. However, most of the additional controls are statistically insignificant. In fact, an F-test indicates that the vector of additional controls is jointly statistically insignificant with a p-value of 0.51. To further alleviate the concern that differences in firm performance may be attributable to differences in unobservable CEO qualities, we add CEO fixed effects in addition to firm and year fixed effects. Column (7) and (8) of Table 2 show that we

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<sup>12</sup> The correlation between director age and director tenure is only 45%, which suggests that a significant proportion of the variation in director tenure is not related to director age. There is no consensus on the retirement age of directors, nor is there an age limit on director retirement. We use the retirement age of 70 as the cut-off age, which is consistent with industry practice following a survey by Spencer and Stuart [2011] and prior studies (e.g., Yermack [2004]; Gibbon and Murphy [1992]).

continue to find an inverted U-shaped relation between tenure and performance, and the variables of interest remain significant at the 5% level.

#### 4.3. CEO Power

Overall, our results in Table 2 suggest that an average tenure of approximately 10 years is associated with the highest equity valuation, while it starts to drop beyond that point. However, it is likely that this negative effect is stronger for firms in which the CEO is entrenched. To test this conjecture, we consider three alternative proxies for CEO power: CEO tenure length (Finkelstein and Hambrick [1990]), CEO status as a founder, and CEO status as the chairperson of the board (Fich and Shivdasani [2006]). We estimate Model (2) on subsamples of firms with different attributes (i.e. partitioned by CEO power), and use stacked regressions.<sup>13</sup>

We present the results in Table 3. Panels A and D tabulate the results based on CEO tenure length, Panels B and E tabulate the results based on CEO duality, and Panels C and F tabulate the results based on founder status. Panels A, B, and C tabulate the results using Tobin's Q as the dependent variable, while Panels D, E, and F tabulate the results using ROA as the dependent variable. We estimate the full Model (2) but only tabulate the key statistics.

In five out of six cases,  $D(Tenure \geq 11)$  is statistically larger (in absolute value) in the sample of firms with high CEO power (the difference is insignificant in the last case). In all six cases, we observe no statistically significant difference for  $D(Tenure \leq 8)$  between firms with different levels of CEO entrenchment.  $D(Tenure \geq 11)$  is statistically different from zero in the six subsamples of firms with high CEO power, but only in five out of six subsamples of firms with

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<sup>13</sup> In Table 2, we use both a quadratic specification and one based on indicator variables. In Table 3, we focus on the latter, as this allows us to estimate directly how CEO power or information complexity affects each curve segment. In contrast, estimating the former would require us to interpret the cross-partial derivatives of a non-linear function.

low CEO power. Overall, these results are consistent with the hypothesis that long board tenure has a greater effect when CEO power is high.

#### *4.4. Information Complexity*

It has long been recognized that the effectiveness of outside directors depends on their access to information (e.g., Duchin, Matsusaka and Ozbas [2010]; Adams and Ferreira [2007]). Specifically, when the cost of acquiring firm-specific information is high, outside directors are less effective at monitoring and advising management than when the cost of information is low. Our results in Table 2 suggest that an average tenure of approximately 10 years is associated with the highest equity valuation. Before this point, the equity value drops as the average tenure goes toward zero. However, it is likely that this negative effect is stronger for firms in which the economic situation is more complex. To test this conjecture, we consider three alternative proxies for information complexity: analyst coverage, forecast dispersion, and forecast accuracy (e.g., Duchin, Matsusaka and Ozbas [2010]).<sup>14</sup> We divide the sample based on the median values of the three proxies, and estimate Model (2) using stacked regressions in each subsample. We use both Tobin's Q and ROA as the dependent variables.

The results reported in Table 4 are largely consistent across the three partitions. Panels A and D present the results based on analyst coverage, Panels B and E present the results based on forecast dispersion, and Panels C and F present the results based on forecast errors. Panels A, B, and C tabulate the results using Tobin's Q as the dependent variable, while Panels D, E, and F

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<sup>14</sup> Following Duchin, Matsusaka and Ozbas [2010], we use size-adjusted analyst coverage measure, which is defined as the residual of regressing analyst coverage on firm size. Our conclusions are not affected when we use non-adjusted analyst coverage measure.

tabulate the results using ROA as the dependent variable. We estimate the full Model (2) but only tabulate the key statistics.

In all six panels,  $D(\text{Board tenure} \leq 8)$  is larger (in absolute value) in subsamples of firms with high information complexity (i.e., low coverage, high dispersion, and high forecast errors) than in subsamples of firms with low complexity. The difference is statistically significant in all six cases, with p-values ranging from 0.00 to less than 0.09. In none of the six cases do we observe a statistical difference in the coefficients of  $D(\text{Board tenure} \geq 11)$  between the two types of subsamples.  $D(\text{Board tenure} \leq 8)$  is statistically different from zero in the six high information complexity subsamples, but in none of the low information complexity subsamples. Overall, these results are consistent with the hypothesis that short board tenure has a greater effect when information complexity is high.

#### 4.5. Sudden Deaths

To provide further evidence of a causal relation between board tenure and firm value, we consider a largely exogenous shock to the board average tenure: sudden deaths of directors. Although we cannot entirely exclude the possibility that some deaths are at least partially caused by poor firm performance, this situation is likely to be rare and we address this concern in the next section. The shock is indeed economically important. For example, the average board tenure decreases by approximately 15% after the death of an outside director (from 8.25 years before the death to 7.25 afterward). This difference is statistically significant at the 5% level. We hypothesize that when the sudden death of an outside director moves board tenure away from its value-maximizing level, it will be followed by a negative announcement return, and that when a director's death moves board tenure closer to the value-maximizing level, it will be positively received by the market. The "event-study" approach relies on the absence of systematic bias when

market participants process information. Based on Figure 1 and Table 2, we initially choose 10 years as the cut-off value for board tenure.

Panel A of Table 5 reports the results for announcement returns conditional on the direction of the change in board tenure. We compare board tenure immediately before and after the sudden death of a director. We set the indicator variable “Move away from 10 years” to 1 if the sudden death of a director induces board tenure to move away from the optimal level of 10 years. We tabulate unwinsorized announcement returns in Panel A, winsorized returns at the top and bottom one percentile in Panel B, and median returns in Panel C. We obtain consistent results across different panels. The results show that sudden deaths that move board tenure toward 10 years are associated with a mean (median) abnormal announcement return of 1% (0.4%), whereas sudden deaths that move board tenure away from 10 years are associated with a negative mean (median) abnormal announcement return of 1.4% (0.9%). The difference is statistically significant at the 1% level. In Table A5 of the Online Appendix, we consider the returns in three cases: board tenure moves away from the 8-11-year range, tenure moves closer to the 8-11-year range, and tenure remains within the 8-11-year range following a sudden death. The results indicate that the average returns are  $-1\%$  and  $0.8\%$  in the first two cases (with t-statistics of  $-2.5$  and  $1.7$ ), respectively. The average (or median) return is statistically undistinguishable from zero in the third case. The difference in announcement returns is inconsistent with a reverse causality argument that poor firm performance leads to prolonged board tenure.

#### *4.6. All Deaths*

Next, we consider the full death sample (sudden or otherwise) using a long window approach. This sample offers a setting in which the average tenure is subject to a large shock that is reasonably uncorrelated with the pre-existing firm value. The motivation for this test is that firms



cannot physically add additional years of firm-specific board experience when a director dies. This increases the likelihood that frictions will lead to a temporary deviation from the optimal tenure level (at least in the case of lack of experience). It generalizes the approach that we follow in the previous section, and allows us to consider the effect of death over a longer period. We re-estimate Model (1) cross-sectionally in the year following the director's death. We report the results in Table 6. Column (1) uses Tobin's Q as the dependent variable and Column (2) uses ROA as the dependent variable. In both columns, we find the familiar quadratic relation between board tenure and firm performance. Both tenure and tenure squared are statistically significant. The economic magnitude of the phenomenon is such that a 5- to 7-year increase in board tenure is associated with an average increase of 6.9% of the sample standard deviation of the Tobin's Q, and a 13- to 11-year decrease in board tenure is associated with an increase of 10% of this standard deviation. Overall, our results support the causal interpretation that changes in board tenure cause changes in firm valuation.

## **5. Corporate Decisions**

If the relation between board tenure and firm value reflects a trade-off between knowledge and entrenchment, then corporate policies and decisions should reflect the same trade-off. In this section, we investigate whether board tenure has an inverted U-shaped relation with important corporate decisions influenced by the board: 1) M&A performance (Masulis, Wong, and Xie [2007]), 2) financial reporting quality (Farber [2005]), and 3) CEO compensation (Bebchuk, Cremers, and Peyer [2011]). For each type of decision, we analyze our pooled sample and consider

the death sample for disclosure quality and managerial compensation (sample attrition prevents us from performing this analysis for the market reaction around M&A announcements).<sup>15</sup>

### 5.1. M&A Performance

We obtain a sample of acquisitions from the Securities and Data Corporation's (SDC) Merger and Acquisitions database, to empirically test the relation between board tenure and M&A performance. We follow Masulis Wong and Xie [2007] and impose a few additional filters (detailed in the Appendix). Our final sample consists of 2,884 acquisitions made between 1998 and 2010. We measure bidder announcement returns over a two-day window ( $CAR [0,1]$ ), in which day 0 is the acquisition announcement date provided by the SDC. As a robustness check, we also consider  $CAR [-2,2]$ , the market reaction over a five-day announcement window.

In our baseline specification, we consider the 23 standard variables used in Model (1). In addition, we control for three deal characteristics: *Deal Size* and two indicator variables denoting whether the target is a public company (*Public Target*) and whether the deal is executed on an all-cash basis (*All Cash Deal*).

Column (1) in Panel A of Table 7 presents the results for an ordinary least squares (OLS) regression in which two-day announcement returns is the dependent variable. Column (2) reports the results when we consider the five-day window. In both cases, we find the expected inverted U-shaped relation between acquisition announcement returns and board tenure. The results are consistent with the interpretation that boards with shorter tenure make better investment decisions that lead to higher firm valuations, whereas boards with longer tenure are more likely to engage in value destroying acquisitions.

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<sup>15</sup> For completeness, we connect the valuation result of board tenure to these corporate decisions using a structural equation modeling (SEM) approach. We present the results in Section VI of the Online Appendix.

## 5.2. Financial Reporting Quality

Several studies (e.g., Farber [2005]) examining the relation between board characteristics and financial reporting quality show that board structure correlates with financial reporting quality. To capture financial reporting quality, we use four alternative proxies. The first is the accrual quality measure derived from Dechow and Dichev [2002], augmented by the fundamental variables in Jones [1991], which are used extensively in the literature (e.g., McNichols [2002]). Second, we consider the amount of abnormal accruals by calculating the absolute value of the residuals in the McNichols model. We multiply both abnormal accruals and the accrual quality measure by  $-1$ , so that the values increase with financial reporting quality. Third, following Khan and Watts [2009], we use an accounting conservatism measure (*C-Score*). Watts [2003] argues that conservatism constrains opportunistic managerial behavior and offsets managerial biases with its asymmetrical verifiability requirement, and is thus likely to constitute an efficient financial reporting mechanism in the absence of complete contracting. Fourth, we consider restatements (Cheng and Farber [2008]; Armstrong et al. [2013]). However, this last proxy presents some unique characteristics, as restatements are relatively rare and are clustered among firms with unique characteristics. To address these issues, we obtain a list of restatements from *AuditAnalytics*. We then match these observations with non-restating firms using propensity score matching method (we discuss the details of this procedure in Section V of the Online Appendix). Finally, we estimate logit regression using the matched sample.

Panel B of Table 7 reports the results of the pooled sample. In addition to the standard set of 23 control variables, we control for asset tangibility (*Tangibility*), dividend-paying status (*Dividend*), operating cycle (*Operating Cycle*), volatility of operating cash flow (*Vol(CFO)*), volatility of sales (*Vol(Sales)*), and cash-assets ratio (*Cash*), which are demonstrated to affect

reporting quality (e.g., Biddle, Hilary, and Verdi [2009]). We find that financial reporting quality first increases and then decreases with board tenure using all four measures of financial reporting quality. Both the linear and the squared terms of board tenure are statistically significant at conventional levels.

### *5.3. CEO Compensation*

Next, we consider the effect of board tenure on compensation. We examine three aspects of compensation: the level (measured by the overall compensation), the excess compensation, and the sensitivity to performance (measured by the log of the compensation delta). We present the results of the pooled sample in Panel C of Table 7. In both cases, we observe the familiar inverted U-shape. A level of tenure close to the optimal reduces excess compensation and increases the pay-performance sensitivity.

### *5.4. All Death-Corporate Decisions*

Table 8 reports the results of the death sample for financial reporting quality (Column 1 to 3) and for CEO compensation (Column 4 to 6). Following the same intuition as our test for firm performance, we re-estimate Model (1) cross-sectionally in the year following the director's death. Across the three measures of financial reporting quality, we continue to find a quadratic relation between board tenure and financial reporting quality. For CEO compensation analysis, we find that death of directors that moves tenure close to the optimal reduces excess compensation and increases the pay-performance sensitivity. Overall, the results suggest that financial reporting quality and better compensation contracting are channels through which board tenure affects firm valuation.

## 6. Further Analysis

### 6.1. Functional Form

Our analysis so far has focused on the quadratic relation between the mean board tenure and different corporate variables. The arguments presented in Section 2 theoretically support this approach (rather than using a cubic specification, for example). Empirically, the approach is also supported by the non-parametric descriptive statistics in Figure 1, which clearly display a quadratic pattern. The use of the mean (rather than the median, for example) is less clear from a theoretical point of view, but the results in Table A1 (Panels B and C) of the Online Appendix indicate that using the median or mode (instead of the average) tenure results in similar conclusions.

However, the dispersion of tenure may be used as an alternative to the length. Wahid [2012], for example, considers the coefficient of correlation (i.e., the ratio of the volatility to the average length of tenure) as a measure of dispersion. To ensure that our analysis is meaningful, we include the standard deviation of tenure in all of our regressions, and the variables of interest remain significant at the 5% level. We consider alternative measures of tenure diversity, such as the range and the Herfindahl index of tenure. We report these results in Panels D and E of Table A1 of the Online Appendix. We continue to find an inverted U-shape relation between firm value and board tenure with these alternative measures. Similarly, including or excluding the range or the Herfindahl index does not affect our conclusion. We note that the volatility, range, and Herfindahl index are statistically insignificant in most of the specifications when controlling for the tenure length (i.e. the denominator of the coefficient of correlation). In addition, Columns (5) and (6) of Table 2 further control for other forms of board diversity that are studied in the literature, such as diversity in gender, ethnicity, and age. As reported, these additional controls do not affect our analysis. This lack of robust significance is broadly consistent with the findings in the organizational literature. For example, in their literature review, Williams and O'Reilly [1998]

find that tenure diversity can be associated with both positive and negative effects on team performance, depending on the study.

Nevertheless, it is possible that dispersion conditionally affects our results. In fact, van Knippenberg and Schippers [2007], in another review of the organizational literature, call for greater attention to the interaction effect between group diversity and mediators or moderators on firm performance. To explore this, we re-estimate Model (2) and partition the sample based on the median value of two tenure diversity measures: the tenure standard deviation and the Herfindahl index of tenure. We present the results in Table A2 of the Online Appendix. When we focus on low board tenure observations, we observe no difference across cells (i.e., board tenure dispersion is not relevant to explain differences across cells). This is true irrespective of whether we use Tobin's Q or ROA as the dependent variable. However, when we consider high tenure dispersion, we observe that the negative effect of long tenure is more pronounced when tenure dispersion is low (measured by the volatility or the Herfindahl index). The difference is statistically significant at the 1% and 7% levels, respectively, when Tobin's Q is the dependent variable. This result supports the idea that high dispersion in tenure length mitigates the under-monitoring problem. We observe a qualitatively similar pattern when we consider the effect on ROA. The point estimates of the coefficients are more negative in the low dispersion samples (but these differences are not statistically significant).

## *6.2. Specialized Committees*

Finally, it is possible that a shock to tenure from the death of a director may have a greater effect if the deceased is the Chairperson of the board (when the Chairperson is not the CEO) or a committee chair. However, examining one type of director at a time yields extremely noisy coefficient estimates. We further investigate this aspect by grouping directors who are Chairperson

of the board or chair of a committee. We also reproduce the analysis for audit committee members, but focus on financial reporting in that case. The results are largely inconclusive. Across the different specifications, we find that the basic inverted U-shape is present in the different subsamples. However, we do not observe a pattern that is qualitatively different in these subsamples from the one that we observe in the overall sample (based on the entire board). One possible explanation for this finding is that the full board takes the important decisions. Another issue is that this test does not benefit from substantial statistical power. A typical board in our sample has approximately seven outside directors, while a typical committee has about four outside directors. In this context, it is difficult to distinguish between the effect of director tenure on the full board and on different committees.

## **7. Conclusion**

We investigate the relation between average board tenure and both firm performance and corporate decisions, while holding other firm, CEO, and board characteristics constant. We find that average board tenure has an inverted U-shaped relation with firm value, and that this relation is also reflected in M&A performance, financial reporting quality, and CEO compensation. The results indicate that for firms with short-tenured boards, the marginal effect of board learning dominates the entrenchment effect, whereas for firms with long-tenured boards, the entrenchment effect dominates the learning effect. We further show that the marginal benefit of learning depends on firms' governance and information environment. Specifically, we find that information complexity exacerbates the cost of short board tenure, and that CEO entrenchment exacerbates the cost of long board tenure.

Our results hold for a pooled sample using specifications that control for a large number of potentially confounding effects. They also hold when we examine stock market reactions to

announcements of the sudden death of an outside director (an unexpected exogenous shock to board tenure) in short windows, and when we consider a longer window immediately following the death of an external director. The results of these tests are consistent with a causal interpretation that board tenure drives changes in firm value.

We note that our conclusions are subject to different caveats. For example, the results based on the pooled sample rely on the premise that adjustment costs or frictions prevent firms from optimizing board tenure all the time. In addition, the results based on market reactions rely on the fact that prices can aggregate information in an unbiased way.



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## **Appendix: Variable Definition and Sample Construction**

### **Firm Performance Measures**

1. Tobin: Market value of equity plus book value of assets minus the sum of book value of common equity and deferred taxes, all divided by the book value of assets.
2. ROA: Log of one plus ROA, where ROA is the net income plus extraordinary items and discontinued operations, all divided by lagged total assets.

### **Merger and Acquisition Measures**

#### 1. Sample Construction

We obtain a sample of acquisitions from the Securities and Data Corporation's (SDC) Merger and Acquisitions database from 1998 to 2010. We follow Masulis, Wong and Xie [2007] and impose a few additional filters: the acquisition must be completed.

1. The acquirer must control less than 50% of the target's shares prior to the announcement, and must own 100% of the target's shares after the transaction.
2. The deal value must be disclosed in SDC, and must exceed US\$1 million.
3. The acquirer must be included in the IRRC database with valid tenure information.
4. The relevant financial information and share price information are available from Compustat and CRSP.

#### 2. Announcement Returns

We measure bidder announcement returns over a two-day window ( $CAR [0,1]$ ), in which day 0 is the acquisition announcement date provided by the SDC. As a robustness check, we also consider  $CAR [-2,2]$ , the market reaction over a five-day announcement window. We use the CRSP value-weighted return as the market return, and estimate market model parameters over the 200-day period from event day-210 to event day-11. The choices of model and parameters are similar to those used in prior studies, such as Masulis, Wong and Xie [2007].

### **Financial Reporting Quality Measures**

#### 1. Abnormal Accrual

We examine abnormal accruals (*Abn\_Accruals*), which are widely used to study earnings management (Dechow and Dichev [2002]; McNichols, 2002; Kothari, Leone, and Wasley [2005]). Following Dechow and Dichev [2002] and McNichols [2002], we estimate the following model by year for each of the 48 Fama-French industries, requiring at least 20 observations for each estimation:

$$TA_{i,t} = \alpha_0 + \alpha_1 CFO_{i,t-1} + \alpha_2 CFO_{i,t} + \alpha_3 CFO_{i,t+1} + \alpha_4 \Delta Sales_{i,t} + \alpha_5 PPE_{i,t} + \epsilon_{i,t} \quad (A1)$$

where  $CFO$  is the operating cash flow, measured as the sum of net income, depreciation and amortization, and changes in current liabilities, minus changes in current assets, scaled by average

total assets.  $\Delta Sales$  refers to the change in sales revenue, and  $PPE$  denotes property, plants, and equipment. The absolute value of the residuals from the above regression serves as our measure of abnormal accruals. We further multiply the absolute value of the residuals by -1 to arrive at a measure that increases with financial reporting quality.

## 2. Accrual Quality

*Accrual Quality* at year  $t$  is calculated as the standard deviation of the residuals from Model (A1) during the years  $t-5$  to  $t-1$ . We multiply the accrual quality measure by -1 so that the value increases with financial reporting quality.

## 3. C-score

The C-score is constructed based on Basu's (1997) model as follows:

$$X_i = \beta_1 + \beta_2 D_i + \beta_3 R_i + \beta_4 D_i * R_i + e_i,$$

where  $X$  is the earnings over the market value of equity at the prior fiscal year end,  $R$  is the annual stock return, and  $D$  is an indicator variable that equals 1 if  $R < 0$ , and 0 otherwise. The coefficient  $\beta_4$  captures the incremental timeliness of bad news over good news, that is, accounting conservatism. Khan and Watts (2009) assume that  $\beta_3$  and  $\beta_4$  are linear functions of firm-specific characteristics each year, as follows:

$$\begin{aligned}\beta_3 &= \mu_1 + \mu_2 Size_i + \mu_3 MB_i + \mu_4 Lev_i \\ CScore &= \beta_4 = \lambda_1 + \lambda_2 Size_i + \lambda_3 MB_i + \lambda_4 Lev_i,\end{aligned}$$

where  $Size$  is the log of the market value of equity,  $MB$  is the ratio of the market value of equity to the book value of equity, and  $Lev$  is the total debt divided by the market value of equity. Thus, the annual cross-sectional regression model that is used to estimate C-score can be written as follows:

$$\begin{aligned}X_i &= \beta_1 + \beta_2 D_i + R_i(\mu_1 + \mu_2 Size_i + \mu_3 MB_i + \mu_4 Lev_i) + D_i R_i(\lambda_1 + \lambda_2 Size_i + \lambda_3 MB_i + \lambda_4 Lev_i) \\ &\quad + (\delta_1 Size_i + \delta_2 MB_i + \delta_3 Lev_i + \delta_4 D_i Size_i + \delta_5 D_i MB_i + \delta_6 D_i Lev_i) + \varepsilon_i,\end{aligned}$$

where the coefficients  $\delta_1$  to  $\delta_6$  capture the independent effects of firm-specific variables and their interactions with  $D$  on earnings, while the coefficients  $\lambda_1$  to  $\lambda_4$  are used to construct the C-score. We estimate the above equation cross-sectionally for each industry with at least 20 observations in a given year based on the Fama-French 48 industry classification.

## 4. Restatement

We collect data on accounting restatements from *Audit Analytics*. To be included in our sample, each restatement must have a start and an end date. We use these dates to determine the fiscal year to which the restatement applies. A firm is classified as restating its results for a given year if any financial results (quarterly, annual, or otherwise) are subsequently restated. This classification tracks the year(s) to which the restatement applies, rather than the year during which the restatement is announced. (Armstrong et al. [2013]).

## CEO Compensation Measures

We obtain CEO compensation data from the Execucomp database.

1. Total Compensation: Log of CEO total compensation.
2. Delta: Log of compensation delta. Delta measures the dollar change in wealth associated with a 1% change in the firm's stock price, and originates from Coles Daniel and Naveen [2006, 2013] and Core and Guay [2002].
3. Excess Compensation: Excess compensation received by CEO. It is calculated as the residual of regressing log total compensation on past stock return, stock volatility, firm size, and year and industry fixed effects.

### **Independent Variables**

1. Board Tenure is the average tenure of all outside directors, where a director's tenure is calculated as the year of the annual meeting (IRRC variable *meetingdate*) minus the start year of directorship (variable *dirsince*) minus any breaks in the directorship service (indicated by the variable *priorserv*).<sup>16</sup> We base the classification of directors on the IRRC classification (variable *classification*).<sup>17</sup> There are four cases in which conflicting starting year information may be recorded for the same director in the same company. 1) The same director ID is assigned to two different individuals. We resolve this issue by checking the original SEC filing. 2) Directors appointed between two annual meetings are usually ratified by shareholders in the next shareholder meeting. If an appointment and the subsequent annual meeting occur in different years, conflicting starting year information will be recorded on the SEC filing (and in the IRRC). In this case, we use the appointment year. 3) Some directors are re-appointed to the board after a break in service, and the IRRC may record the year of the most recent appointment. Instead, we use the year of the first appointment and adjust for breaks in service when calculating a director's tenure. 4) An inconsistent starting year may be recorded before and after a corporate transformation (e.g., incorporation, M&A, re-organization). We use the starting year of the predecessor firm.
2. D(Board Tenure<=8): An indicator variable that equals 1 if the board tenure is equal to or less than 8 years, and 0 otherwise.
3. D(Board Tenure>=11): An indicator variable that equals 1 if the board tenure is equal to or more than 11 years, and 0 otherwise.
4. Std Dev of Board Tenure: Standard deviation of board tenure.

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<sup>16</sup> The IRRC stopped collecting the *priorserv* indicator variable in 2003. We manually collect this variable for subsequent years by searching proxy statements for each director. For each director identified as having prior service with the board, we manually collect the period of prior service on the board.

<sup>17</sup> As noted in Chhaochharia and Grinstein (2009), the IRRC uses a more stringent definition of independence to classify directors than stock exchange listing rules. For example, under stock exchange listing rules, a past employee of the company may qualify as an independent director as long as the employment relationship ends more than three years before the board appointment. However, the IRRC treats such a director as a non-independent director. Guthrie, Sokolowsky, and Wan (2011) show that the re-classification of a director's independence may introduce systematic bias. In this study, we focus on the tenure of non-executive directors.

5. CEO Age: Age of CEO.
6. CEO Tenure: Tenure of CEO.
7. CEO Shareholding: Percentage of outstanding shares owned by the CEO.
8. CEO-Founder: An indicator variable that equals 1 if the CEO is the founder of the firm, and 0 otherwise. We identify founder information from two sources: 1) the CEO has the title of “Founder” or “Co-Founder” disclosed in the IRRC, Execucomp, or Boardex, and 2) the CEO joined the firm before an IPO.
9. CEO-Chair: An indicator variable that equals 1 if the CEO is also the Chairman of the board, and 0 otherwise.
10. Classified Board: An indicator variable that equals 1 if the board is staggered, and 0 otherwise.
11. Independent Board: An indicator variable that equals 1 if the board has a majority of independent directors, and 0 otherwise.
12. Busy Board: An indicator variable that equals 1 if a majority of directors hold more than three directorships, and 0 otherwise.
13. Interlocked Board: An indicator variable that equals 1 if the board is interlocked with another company as defined by Execucomp, and 0 otherwise.
14. Board Size: Number of directors on the board.
15. Sales Growth: Growth in sales.
16. LagROA: One year lagged ROA, where ROA is the net income plus extraordinary items and discontinued operations, all divided by lagged total assets.
17. Stock Return: Log of one plus the stock return over the last year.
18. Firm Age: Log of firm age. We calculate firm age from the year a firm was founded. We estimate the founding year from three sources: we first collect firm age data from Jay Ritter’s website, in which he collects the age of firms from the founding year. Second, we manually search for the remaining firms in Capital IQ and Hoover. If neither of these two sources provides the necessary information, we use the first year when the stock appears in the CRSP database as the founding year.
19. Num Acq: Number of acquisitions.
20. Goodwill: Goodwill scaled by total assets.
21. Leverage: Short-term debt plus long-term debt, all divided by total assets.
22. Num Seg: Number of business segment disclosed under Compustat Segment files.
23. Firm Size: Log of total assets.
24. Capex: Capital expenditures over total assets.
25. Risk: Log of the standard deviation of the daily stock return over the last year.
26. IPO: An indicator variable that equals 1 if a firm is spun off or listed in that year.
27. Gender Diversity: Blau index of directors’ gender. The Blau Index is calculated as  $1 - \sum_{i=1}^s p^2$ , where s is the number of categories, and p is the fraction of directors belonging to category i. Gender is measured over two groups: female and male.
28. Ethnic Diversity: Blau index of directors’ ethnicity. The Blau Index is calculated as  $1 - \sum_{i=1}^s p^2$ , where s is the number of categories, and p is the fraction of directors belonging to



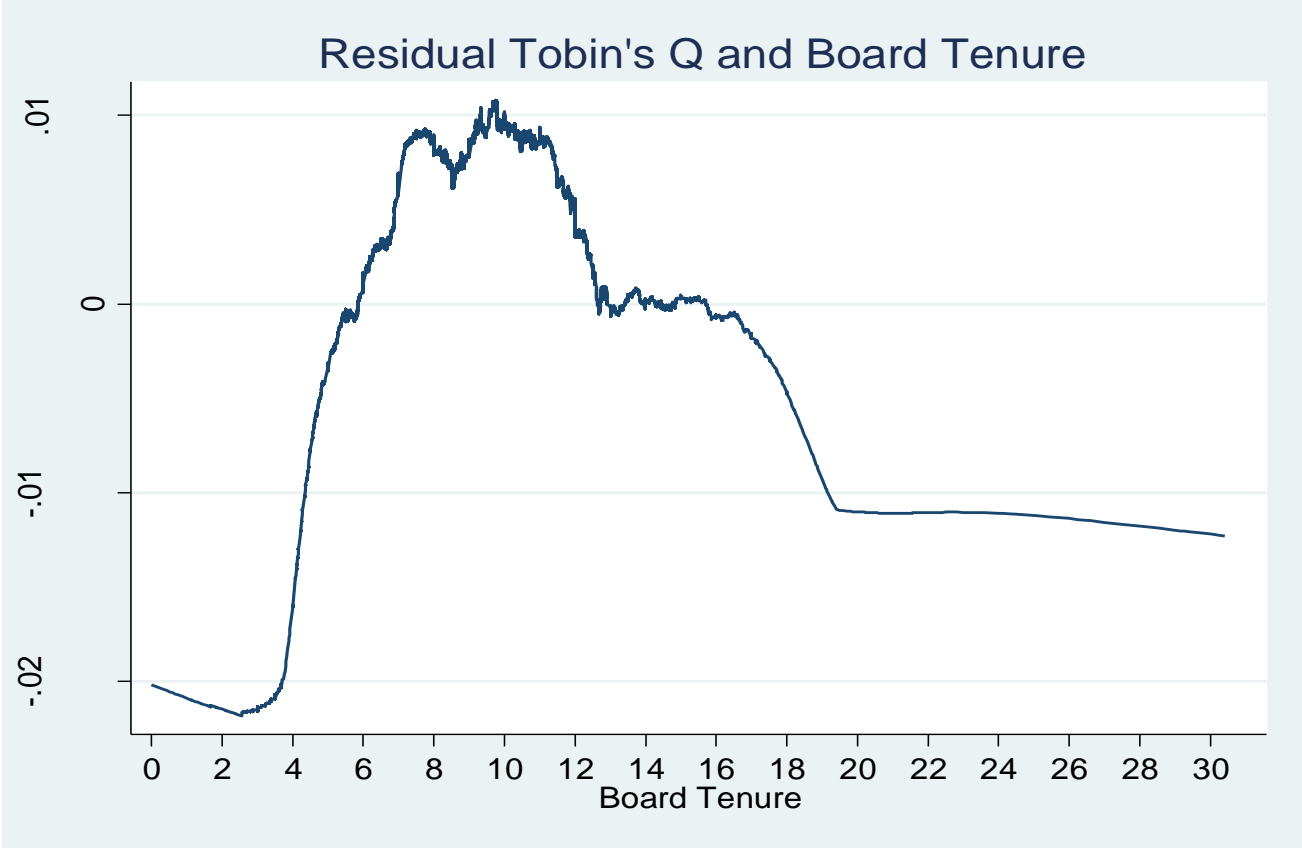
category *i*. Ethnicity is measured over six groups: Caucasian, Indian American, Asian, Hispanic, Black, and Other.

29. Age Diversity: Blau index of directors' age cohort. The Blau Index is calculated as  $1 - \sum_{i=1}^s p^2$ , where *s* is the number of categories, and *p* is the fraction of directors belonging to category *i*. Age is measured in terms of birth cohorts, which are 10-year periods starting in 1920, 1930, 1940, 1950, 1960, and 1970.
30. Director Shareholding: Average share ownership of directors.
31. % Retirement Age Directors: Percentage of directors that are over 70 years of age.
32. Director Age: Average age of directors.
33. % Outside Executives: Percentage of directors that work as executives.
34. % Born in XXX Cohort: Percentage of directors born in XXX birth cohort, where XXX are 10-year periods starting in 1920, 1930, 1940, 1950, 1960, and 1970. We use the percentage of directors born in 1970 as the holdout group in the regression.
35. Equity Issuance: Following Baker, Stein, and Wrugler [2003], we calculate the amount of equity issuance as the change in common equity plus the change in deferred taxes minus the change in retained earnings, all scaled by total assets.
36. Debt Issuance: Percentage change in total liabilities.
37. Liquidity: Current assets over current liabilities.
38. Analyst Coverage: Following Duchin, Matsusaka and Ozbas [2010], we calculate size-adjusted analyst coverage, which is the residual from a regression of the number of analysts on firm size.
39. Forecast Errors: Absolute value of the difference between analyst forecasts and actual EPS, scaled by total assets.
40. Forecast Dispersion: Standard deviation of forecast errors, scaled by total assets.
41. Public Target: An indicator variable that equals 1 if the acquisition target is a public firm, and 0 otherwise.
42. All Cash Deal: An indicator variable that equals 1 if the acquisition is conducted using all cash, and 0 otherwise.
43. Deal Size: Total value of the transaction over market value.
44. Tangibility: Net PPE over assets.
45. Dividend: An indicator variable that equals 1 if the firm pays dividend in year *t*, and 0 otherwise.
46. Operating Cycle: Log of 360 times the sum of receivables over sales and inventory over COGS.
47. Vol (CFO): Volatility of operating cash flow over the last 5 years, where *CFO* is the operating cash flow, measured as the sum of net income, depreciation and amortization, and changes in current liabilities, minus changes in current assets, scaled by average total assets.
48. Vol (Sales): Volatility of sales over the last 5 years, where we scale sales by the average total assets.
49. Cash: Cash over total assets.
50. Tenure Median: Median tenure of all outside directors.
51. Tenure Mode: Mode tenure of all outside directors.

52. Board Tenure HHI: The Herfindahl index is defined as the sum of the squared percentage, where the percentage is the tenure of outside director  $i$  over the sum of the tenure of all outside directors.
53. Board Tenure Range: Maximum director tenure minus minimum director tenure.

**Figure 1 Descriptive Plot - Residual Tobin's Q and Board Tenure**

This figure plots the residual Tobin's Q on board tenure using a locally weighted polynomial curve (LOWESS). Residual Tobin's Q is the residual of regressing Tobin's Q on the control variables (excluding Tenure and Tenure Squared).



## Table 1 Summary Statistics

The sample period is from 1998 to 2010. We define all variables in the Appendix. We multiply ROA by 100. Panel A reports summary statistics of our pooled sample. Panel B reports the causes of sudden death.

Panel A Pooled Sample						
	N	Mean	Median	Std	P25	P75
<i>Tobin</i>	12034	1.73	1.46	0.83	1.14	2.05
<i>ROA</i>	11604	5.06	5.22	6.90	2.09	8.96
<i>Board tenure</i>	12034	8.22	7.71	3.64	5.71	10.00
<i>Std dev of board tenure</i>	12034	6.07	5.51	3.38	3.67	7.84
<i>CEO age</i>	12034	55.58	56.00	6.98	51.00	60.00
<i>CEO tenure</i>	12034	8.23	6.00	7.13	3.00	11.00
<i>CEO shareholding</i>	12034	2.00	0.29	4.96	0.08	1.06
<i>CEO-Founder</i>	12034	0.20	0.00	0.40	0.00	0.00
<i>CEO-Chair</i>	12034	0.61	1.00	0.49	0.00	1.00
<i>Classified board</i>	12034	0.38	0.00	0.48	0.00	1.00
<i>Independent board</i>	12034	0.85	1.00	0.35	1.00	1.00
<i>Busy board</i>	12034	2.26	2.00	2.09	1.00	3.00
<i>Interlocked board</i>	12034	0.05	0.00	0.21	0.00	0.00
<i>Board size</i>	12034	9.27	9.00	2.34	8.00	11.00
<i>Sale growth</i>	12034	0.11	0.08	0.23	0.00	0.18
<i>LagROA</i>	12034	5.10	5.40	8.32	2.22	9.37
<i>Stock return</i>	12034	0.04	0.08	0.43	-0.17	0.30
<i>Firm age</i>	12034	3.75	3.71	0.75	3.18	4.41
<i>Num acq</i>	12034	0.14	0.00	0.49	0.00	0.00
<i>Goodwill</i>	12034	0.11	0.05	0.14	0.00	0.18
<i>Leverage</i>	12034	0.23	0.22	0.17	0.07	0.34
<i>Num seg</i>	12034	1.77	1.00	1.32	1.00	2.00
<i>Firm size</i>	12034	7.43	7.31	1.47	6.41	8.38
<i>Capex</i>	12034	0.06	0.04	0.05	0.02	0.07
<i>Risk</i>	12034	-2.30	-2.30	0.50	-2.64	-1.96
<i>IPO</i>	12034	0.00	0.00	0.06	0.00	0.00
<i>Gender Diversity</i>	12034	0.16	0.18	0.14	0.00	0.28
<i>Ethnic Diversity</i>	12034	0.29	0.31	0.19	0.17	0.46
<i>Age Diversity</i>	12034	0.58	0.60	0.11	0.52	0.66
<i>Director shareholding</i>	12034	0.38	0.00	1.15	0.00	0.16
<i>% Retirement age directors</i>	12034	0.13	0.11	0.14	0.00	0.20
<i>Director age</i>	12034	61.00	61.14	4.18	58.44	63.71
<i>% Outside executives</i>	12034	0.16	0.13	0.14	0.00	0.25
<i>% born in 1930 cohort</i>	12034	0.04	0.00	0.09	0.00	0.07
<i>% born in 1940 cohort</i>	12034	0.25	0.23	0.18	0.11	0.38
<i>% born in 1950 cohort</i>	12034	0.43	0.43	0.19	0.30	0.56
<i>% born in 1960 cohort</i>	12034	0.22	0.20	0.17	0.10	0.33
<i>% born in 1970 cohort</i>	12034	0.04	0.00	0.08	0.00	0.08
<i>Equity Issuance</i>	10990	0.02	0.01	0.08	-0.01	0.03
<i>Debt Issuance</i>	12011	0.17	0.06	0.46	-0.04	0.21
<i>Liquidity</i>	12034	2.21	1.77	1.60	1.21	2.63

**Table 1 Summary Statistics, Continued**

<b>Panel B Death Sample</b>		
Cause of sudden death	N	%
Accidents	13	8.61
Heart attack	46	30.46
Murder	1	0.66
Stroke	11	7.28
Sudden death undisclosed causes	55	36.42
Acute illness	18	11.92
Suicide	7	4.64
Total sudden death	151	
Deaths other than sudden	290	
Total deaths	441	

**Table 2 Board Tenure and Firm Value**

The sample period is from 1998 to 2010. We define all variables in the Appendix. We multiply the coefficient associated with ROA by 100. Constants are included but not displayed in all regressions. We measure all monetary items in 2002 dollars, and present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively. We correct standard errors for heteroscedasticity and clustering of observations at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>Tobin</i>	<i>ROA</i>	<i>Tobin</i>	<i>ROA</i>	<i>Tobin</i>	<i>ROA</i>	<i>Tobin</i>	<i>ROA</i>
<i>Board tenure</i>	0.028 (2.76)***	0.341 (3.69)***			0.039 (3.46)***	0.353 (3.43)***	0.021 (1.88)*	0.246 (2.21)**
<i>Board tenure squared</i>	-0.0014 (-3.39)***	-0.016 (-4.18)***			-0.002 (-3.18)***	-0.015 (-3.73)***	-0.001 (-2.96)***	-0.012 (-2.71)***
<i>D(Board tenure&lt;=8)</i>			-0.036 (-1.88)*	-0.275 (-2.35)**				
<i>D(Board tenure&gt;=11)</i>			-0.081 (-3.76)***	-0.267 (-2.70)***				
<i>Std dev of board tenure</i>	0.000 (0.10)	-0.021 (-0.58)	0.003 (0.76)	0.003 (0.09)	-0.002 (-0.44)	-0.031 (-0.78)	0.004 (0.78)	-0.076 (-1.70)*
<i>CEO age</i>	-0.003 (-1.62)	-0.053 (-2.77)***	-0.003 (-1.63)	-0.055 (-2.83)***	-0.002 (-0.99)	-0.054 (-2.67)***	-0.009 (-0.90)	0.004 (0.04)
<i>CEO tenure</i>	0.006 (2.56)**	0.068 (3.29)***	0.006 (2.60)***	0.071 (3.38)***	0.006 (2.42)**	0.076 (3.59)***	0.020 (0.72)	0.471 (1.57)
<i>CEO shareholding</i>	0.000 (0.04)	0.005 (0.21)	-0.000 (-0.04)	0.003 (0.14)	0.001 (0.28)	0.002 (0.07)	-0.004 (-1.36)	0.010 (0.38)
<i>CEO-Founder</i>	0.006 (0.13)	-0.170 (-0.41)	0.007 (0.16)	-0.148 (-0.36)	0.023 (0.47)	-0.050 (-0.12)	0.273 (0.08)	0.100 (0.05)
<i>CEO-Chair</i>	-0.002 (-0.11)	0.188 (1.04)	-0.000 (-0.01)	0.204 (1.13)	-0.010 (-0.49)	0.281 (1.51)	-0.032 (-1.43)	-0.020 (-0.09)
<i>Classified board</i>	0.055 (2.99)***	-0.070 (-0.38)	0.056 (3.05)***	-0.054 (-0.30)	0.059 (3.12)***	0.005 (0.03)	0.034 (1.96)**	-0.105 (-0.57)
<i>Independent board</i>	0.001 (0.05)	0.015 (0.07)	0.001 (0.03)	0.015 (0.07)	0.011 (0.42)	0.001 (0.01)	-0.005 (-0.17)	-0.034 (-0.14)
<i>Busy board</i>	0.008 (1.24)	-0.030 (-0.52)	0.008 (1.24)	-0.026 (-0.45)	0.009 (1.27)	-0.037 (-0.62)	0.004 (0.60)	-0.069 (-1.00)
<i>Interlocked board</i>	-0.095 (-2.42)**	-0.605 (-1.85)*	-0.090 (-2.32)**	-0.563 (-1.71)*	-0.105 (-2.60)***	-0.677 (-2.00)**	-0.103 (-2.45)**	-0.676 (-2.05)**
<i>Board size</i>	-0.013 (-2.08)**	-0.029 (-0.54)	-0.014 (-2.25)**	-0.040 (-0.74)	-0.009 (-1.39)	-0.000 (-0.00)	-0.011 (-1.76)*	-0.012 (-0.18)
<i>Sale growth</i>	0.076 (2.59)***	1.302 (3.57)***	0.076 (2.60)***	1.299 (3.56)***	0.066 (2.05)**	1.882 (4.92)***	0.068 (2.24)**	1.337 (3.18)***
<i>LagROA</i>	0.005 (4.41)***	0.096 (6.95)***	0.005 (4.46)***	0.097 (7.03)***	0.005 (4.31)***	0.090 (6.18)***	0.002 (2.10)**	0.039 (2.47)**
<i>Stock return</i>	0.193 (13.17)***	2.948 (17.24)***	0.193 (13.17)***	2.953 (17.25)***	0.195 (12.74)***	3.020 (16.97)***	0.151 (10.13)***	2.884 (16.52)***
<i>Firm age</i>	-0.212 (-1.77)*	0.183 (0.17)	-0.191 (-1.60)	0.529 (0.51)	-0.229 (-1.85)*	-0.552 (-0.51)	-0.141 (-1.01)	1.974 (1.27)
<i>Num acq</i>	0.031 (2.13)**	0.508 (3.73)***	0.031 (2.15)**	0.505 (3.70)***	0.031 (2.07)**	0.511 (3.59)***	0.032 (2.22)**	0.564 (3.91)***
<i>Goodwill</i>	-0.776 (-7.02)***	-5.656 (-5.45)***	-0.767 (-6.94)***	-5.601 (-5.36)***	-0.798 (-6.94)***	-6.393 (-6.16)***	-0.584 (-4.50)***	-6.688 (-4.86)***
<i>Leverage</i>	-0.596 (-6.90)***	-3.876 (-4.43)***	-0.589 (-6.82)***	-3.825 (-4.36)***	-0.706 (-7.28)***	-4.538 (-4.77)***	-0.531 (-5.29)***	-2.794 (-2.67)***
<i>Num seg</i>	-0.008 (-0.97)	-0.086 (-0.98)	-0.009 (-1.06)	-0.090 (-1.02)	-0.008 (-0.95)	-0.164 (-1.84)*	-0.010 (-1.04)	-0.124 (-1.17)

**Table 2 Board Tenure and Firm Value, Continued**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>Tobin</i>	<i>ROA</i>	<i>Tobin</i>	<i>ROA</i>	<i>Tobin</i>	<i>ROA</i>	<i>Tobin</i>	<i>ROA</i>
<i>Firm size</i>	-0.138 (-5.22)***	-0.234 (-0.77)	-0.140 (-5.30)***	-0.241 (-0.79)	-0.138 (-4.85)***	-0.516 (-1.66)*	-0.159 (-5.31)***	-0.499 (-1.06)
<i>Capex</i>	0.840 (3.41)***	3.818 (1.70)*	0.859 (3.49)***	4.007 (1.78)*	0.725 (2.91)***	1.654 (0.72)	0.284 (1.08)	2.450 (0.96)
<i>Risk</i>	0.039 (2.31)**	-0.460 (-2.47)**	0.040 (2.39)**	-0.456 (-2.45)**	0.039 (2.19)**	-0.372 (-1.91)*	0.012 (0.71)	-0.137 (-0.67)
<i>IPO</i>	0.092 (0.97)	-0.638 (-0.60)	0.087 (0.91)	-0.711 (-0.66)	0.074 (0.70)	-1.035 (-0.81)	0.103 (0.89)	-0.564 (-0.57)
<i>Gender diversity</i>					-0.154 (-1.54)	-1.097 (-1.18)		
<i>Ethnic diversity</i>					-0.000 (-0.00)	0.275 (0.67)		
<i>Age diversity</i>					-0.157 (-1.42)	-0.826 (-0.76)		
<i>Director shareholding</i>					0.000 (0.04)	-0.035 (-0.39)		
<i>% Retirement age directors</i>					-0.036 (-0.39)	0.091 (0.11)		
<i>Director age</i>					-0.001 (-0.15)	0.028 (0.51)		
<i>% Outside executives</i>					-0.001 (-0.02)	0.315 (0.50)		
<i>% born in 1930 cohort</i>					0.075 (0.23)	1.846 (0.58)		
<i>% born in 1940 cohort</i>					0.261 (1.00)	2.471 (0.94)		
<i>% born in 1950 cohort</i>					0.344 (1.35)	1.976 (0.75)		
<i>% born in 1960 cohort</i>					0.576 (2.16)**	4.010 (1.48)		
<i>% born in 1970 cohort</i>					0.562 (1.81)*	3.312 (1.07)		
<i>Equity Issuance</i>					-0.036 (-0.37)	-3.798 (-3.60)***		
<i>Debt Issuance</i>					0.014 (0.93)	-0.338 (-2.08)**		
<i>Liquidity</i>					-0.021 (-2.00)**	-0.367 (-3.57)***		
Observations	12,034	12,846	12,034	12,846	10,314	10,593	12,034	12,846
R-squared	0.708	0.569	0.709	0.568	0.713	0.579	0.774	0.652
Firm fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEO fixed effect	No	No	No	No	No	No	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

**Table 3 CEO Power**

The sample period is from 1998 to 2010. We estimate the following regressions for each subsample:  $FirmVal_{i,t} = \alpha_i + \alpha_t + \beta_1 D(Tenure \leq 8)_{i,t-1} + \beta_2 D(Tenure \geq 11)_{i,t-1} + \Gamma X_{i,t-1} + \varepsilon_{i,t}$ , where i indexes firm, and t indexes year.  $\alpha_i$  and  $\alpha_t$  are firm and year fixed effects, respectively.  $FirmVal_{i,t}$  is measured by Tobin's Q (Panel A to Panel C) or ROA (Panel D to Panel F). *High (Low) CEO Tenure* is an indicator variable equal to 1 if the CEO tenure is above (below) median, and 0 otherwise. *CEO-Chair (No CEO-Chair)* is an indicator variable equal to 1 if a CEO is also (is not) the chairman of the board. *CEO-Founder (No CEO-Founder)* is an indicator equal to 1 if a CEO is also (is not) the founder of the firm. We define all other variables in the Appendix. For Panel A and D, we include all control variables under Column (1) of Table 2 other than *CEO-Founder*. For Panel B and E, we include all control variables under Column (1) of Table 2 other than *CEO-Chair Duality*. For Panel C and F, we include all control variables under Column (1) of Table 2 other than *CEO-Founder* status. The last column of each panel compares the difference in coefficients across two subsamples using seemingly unrelated estimations, and we report the p-value of two-sided t-tests. We measure all monetary items in 2002 dollars. We multiply the coefficient associated with ROA by 100. We present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively. We correct standard errors for heteroscedasticity and clustering of observations at the firm level.

<b>Tobin's Q as a measure of firm performance</b>				<b>ROA as a measure of firm performance</b>			
<b>Panel A CEO Tenure</b>				<b>Panel D CEO Tenure</b>			
	High CEO Tenure	Low CEO Tenure	test of difference	High CEO Tenure	Low CEO Tenure	test of difference	
	(1)	(2)	in coefficients	(3)	(4)	in coefficients	
	<i>Tobin</i>	<i>Tobin</i>	<i>p-value</i>	<i>ROA</i>	<i>ROA</i>	<i>p-value</i>	
<i>D(Board tenure&lt;=8)</i>	-0.080 (-2.91)***	-0.048 (-1.77)*	0.399	<i>D(Board tenure&lt;=8)</i>	-0.546 (-1.83)*	-0.487 (-1.71)*	0.887
<i>D(Board tenure&gt;=11)</i>	-0.163 (-5.15)***	-0.068 (-2.21)**	0.032	<i>D(Board tenure&gt;=11)</i>	-0.959 (-3.58)***	-0.140 (-1.69)*	0.036
Controls	Yes	Yes		Controls	Yes	Yes	
Observations	6,590	5,650		Observations	7,048	6,039	
R-squared	0.711	0.705		R-squared	0.546	0.582	
Firm fixed effect	Yes	Yes		Firm fixed effect	Yes	Yes	
Year fixed effect	Yes	Yes		Year fixed effect	Yes	Yes	
<b>Panel B CEO-Chair Duality</b>				<b>Panel E CEO-Chair Duality</b>			
	CEO-Chair	No CEO-Chair	test of difference	CEO-Chair	No CEO-Chair	test of difference	
	(1)	(2)	in coefficients	(3)	(4)	in coefficients	
	<i>Tobin</i>	<i>Tobin</i>	<i>p-value</i>	<i>ROA</i>	<i>ROA</i>	<i>p-value</i>	
<i>D(Board tenure&lt;=8)</i>	-0.048 (-1.98)**	-0.098 (-2.87)***	0.226	<i>D(Board tenure&lt;=8)</i>	-0.318 (-1.53)	-1.028 (-2.22)**	0.161
<i>D(Board tenure&gt;=11)</i>	-0.110 (-3.40)***	-0.100 (-2.99)***	0.828	<i>D(Board tenure&gt;=11)</i>	-0.752 (-3.10)***	-0.109 (-0.37)	0.087
Controls	Yes	Yes		Controls	Yes	Yes	
Observations	7,281	4,753		Observations	7,697	5,149	
R-squared	0.741	0.753		R-squared	0.663	0.592	
Firm fixed effect	Yes	Yes		Firm fixed effect	Yes	Yes	
Year fixed effect	Yes	Yes		Year fixed effect	Yes	Yes	



**Table 3 CEO Power, Continued**

<b>Panel C CEO-Founder</b>				<b>Panel F CEO-Founder</b>			
	CEO-Founder	No CEO-Founder	test of difference	CEO-Founder	No CEO-Founder	test of difference	
	(1)	(2)	in coefficients	(3)	(4)	in coefficients	
	<i>Tobin</i>	<i>Tobin</i>	<i>p-value</i>	<i>ROA</i>	<i>ROA</i>	<i>p-value</i>	
<i>D(Board tenure&lt;=8)</i>	-0.090 (-1.88)*	-0.058 (-2.69)***	0.548	<i>D(Board tenure&lt;=8)</i>	-0.739 (-1.47)	-0.377 (-1.65)*	0.511
<i>D(Board tenure&gt;=11)</i>	-0.205 (-2.90)***	-0.094 (-4.16)***	0.093	<i>D(Board tenure&gt;=11)</i>	-1.126 (-2.25)**	-0.517 (-2.34)**	0.098
Controls	Yes	Yes		Controls	Yes	Yes	
Observations	2,437	9,597		Observations	2,624	10,222	
R-squared	0.739	0.715		R-squared	0.621	0.575	
Firm fixed effect	Yes	Yes		Firm fixed effect	Yes	Yes	
Year fixed effect	Yes	Yes		Year fixed effect	Yes	Yes	

**Table 4 Information Complexity**

The sample period is from 1998 to 2010. We estimate the following regressions for each subsample:  $FirmVal_{i,t} = \alpha_i + \alpha_t + \beta_1 D(Tenure \leq 8)_{i,t-1} + \beta_2 D(Tenure \geq 11)_{i,t-1} + \Gamma X_{i,t-1} + \varepsilon_{i,t}$ , where  $i$  indexes firm, and  $t$  indexes year.  $\alpha_i$  and  $\alpha_t$  are firm and year fixed effects, respectively.  $FirmVal_{i,t}$  is measured by Tobin's Q (Panel A to Panel C) or ROA (Panel D to Panel F). *High (Low) Coverage* is an indicator variable equal to 1 if the size-adjusted analyst coverage is above (below) median, and 0 otherwise. Size-adjusted analyst coverage is the residual from a regression of analyst coverage on firm size. *High (Low) Forecast Dispersion* is an indicator variable equal to 1 if the forecast dispersion is above (below) median, and 0 otherwise. *High (Low) Forecast Error* is an indicator variable equal to 1 if the analyst forecast error is above (below) median, and 0 otherwise. We define all other variables in the Appendix. We include all control variables in Column (1) of Table 2. The last column of every panel compares the difference in coefficients across two subsamples using seemingly unrelated estimations, and we report the p-value of two-sided t-tests. We multiply the coefficient associated with ROA by 100. We measure all monetary items in 2002 dollars, and present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively. We correct standard errors for heteroscedasticity and clustering of observations at the firm level.

<b>Tobin's Q as a measure of firm performance</b>				<b>ROA as a measure of firm performance</b>			
<b>Panel A Analyst Coverage</b>				<b>Panel D Analyst Coverage</b>			
	High Coverage	Low Coverage	test of difference		High Coverage	Low Coverage	test of difference
	(1)	(2)	in coefficients		(3)	(4)	in coefficients
	<i>Tobin</i>	<i>Tobin</i>	<i>p-value</i>		<i>ROA</i>	<i>ROA</i>	<i>p-value</i>
<i>D(Board tenure&lt;=8)</i>	-0.020 (-0.75)	-0.141 (-5.23)***	0.001	<i>D(Board tenure&lt;=8)</i>	-0.024 (-0.10)	-1.312 (-3.43)***	0.004
<i>D(Board tenure&gt;=11)</i>	-0.128 (-4.01)***	-0.079 (-2.71)***	0.240	<i>D(Board tenure&gt;=11)</i>	-0.378 (-1.54)	-0.796 (-2.58)**	0.243
Controls	Yes	Yes		Controls	Yes	Yes	
Observations	6,475	5,559		Observations	6,881	5,965	
R-squared	0.759	0.663		R-squared	0.597	0.608	
Firm fixed effect	Yes	Yes		Firm fixed effect	Yes	Yes	
Year fixed effect	Yes	Yes		Year fixed effect	Yes	Yes	
<b>Panel B Forecast Dispersion</b>				<b>Panel E Forecast Dispersion</b>			
	High Forecast Dispersion	Low Forecast Dispersion	test of difference		High Forecast Dispersion	Low Forecast Dispersion	test of difference
	(1)	(2)	in coefficients		(3)	(4)	in coefficients
	<i>Tobin</i>	<i>Tobin</i>	<i>p-value</i>		<i>ROA</i>	<i>ROA</i>	<i>p-value</i>
<i>D(Board tenure&lt;=8)</i>	-0.121 (-3.53)***	-0.026 (-0.95)	0.013	<i>D(Board tenure&lt;=8)</i>	-1.006 (-2.50)**	-0.247 (-1.08)	0.089
<i>D(Board tenure&gt;=11)</i>	-0.131 (-3.28)***	-0.090 (-2.94)***	0.323	<i>D(Board tenure&gt;=11)</i>	-0.932 (-2.75)***	-0.364 (-1.44)	0.166
Controls	Yes	Yes		Controls	Yes	Yes	
Observations	6,123	5,911		Observations	6,470	6,376	
R-squared	0.716	0.773		R-squared	0.618	0.604	
Firm fixed effect	Yes	Yes		Firm fixed effect	Yes	Yes	
Year fixed effect	Yes	Yes		Year fixed effect	Yes	Yes	

**Table 4 Information Complexity, Continued**

<b>Panel C Forecast Errors</b>			
	High Forecast Error	Low Forecast Error	test of difference in coefficients
	(1)	(2)	
	<i>Tobin</i>	<i>Tobin</i>	<i>p-value</i>
<i>D(Board tenure&lt;=8)</i>	-0.091 (-3.06)***	-0.040 (-1.51)	0.097
<i>D(Board tenure&gt;=11)</i>	-0.126 (-3.75)***	-0.107 (-3.61)***	0.669
Controls	Yes	Yes	
Observations	5,889	6,145	
R-squared	0.695	0.783	
Firm fixed effect	Yes	Yes	
Year fixed effect	Yes	Yes	

<b>Panel F Forecast Errors</b>			
	High Forecast Error	Low Forecast Error	test of difference in coefficients
	(3)	(4)	
	<i>ROA</i>	<i>ROA</i>	<i>p-value</i>
<i>D(Board tenure&lt;=8)</i>	-0.743 (-1.97)**	-0.022 (-0.10)	0.095
<i>D(Board tenure&gt;=11)</i>	-0.734 (-2.60)***	-0.428 (-1.76)*	0.420
Controls	Yes	Yes	
Observations	6,152	6,694	
R-squared	0.616	0.636	
Firm fixed effect	Yes	Yes	
Year fixed effect	Yes	Yes	

## Table 5 Event Study-Sudden Death

This table reports the three-day announcement returns for a sample of outside directors who died suddenly between 1998 and 2010. Panel A reports unwinsorized announcement returns. Panel B reports results using winsorized announcement returns at top and bottom one percentile. Panel C reports median announcement returns. We define all variables in the Appendix. We present t-statistics in parentheses for Panel A and B, and Wilcoxon z-statistics in parentheses for Panel C. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

<b>Panel A Event Study-Sudden Death (Unwinsorized)</b>			
	Move away from 10 years	Move closer toward 10 years	P-value of test of mean difference
N	73	78	
Mean	-1.429%	1.038%	
t-stat	(-3.218)***	(2.428)***	0.00
<b>Panel B Event Study-Sudden Death (Winsorized)</b>			
	Move away from 10 years	Move closer toward 10 years	P-value of test of mean difference
N	73	78	
Mean	-1.36%	0.97%	
t-stat	(-3.42)***	(2.37)***	0.00
<b>Panel C Event Study-Sudden Death (Median Return)</b>			
	Move away from 10 years	Move closer toward 10 years	P-value of test of median difference
N	73	78	
Median	-0.93%	0.40%	
Wilcoxon z-stat	(-2.94)***	( 1.93)*	0.00

## Table 6 Regression-Death Sample

The sample period is from 1998 to 2010. The table reports the regression results for a sample of outside directors who died between 1998 and 2010. We define all variables in the Appendix. We multiply the coefficient associated with ROA by 100. Constants are included but not displayed in all regressions. We measure all monetary items in 2002 dollars, and present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively. We correct standard errors for heteroscedasticity and clustering of observations at the firm level.

	(1) <i>Tobin</i>	(2) <i>ROA</i>
<i>Board tenure</i>	0.102 (1.66)*	1.021 (1.71)*
<i>Board tenure squared</i>	-0.0061 (-2.62)***	-0.047 (-2.31)**
<i>Std dev of board tenure</i>	0.040 (1.12)	0.113 (0.40)
<i>CEO age</i>	0.009 (0.70)	-0.055 (-0.65)
<i>CEO tenure</i>	0.010 (0.87)	0.137 (1.45)
<i>CEO shareholding</i>	-0.006 (-0.29)	-0.017 (-0.12)
<i>CEO-Founder</i>	-0.095 (-0.39)	-0.426 (-0.22)
<i>CEO-Chair</i>	-0.032 (-0.17)	0.666 (0.42)
<i>Classified board</i>	0.082 (0.64)	0.620 (0.47)
<i>Independent board</i>	-1.560 (-1.34)	-2.796 (-0.34)
<i>Busy board</i>	0.037 (1.45)	-0.127 (-0.46)
<i>Interlocked board</i>	-0.997 (-1.39)	-7.872 (-1.06)
<i>Board size</i>	-0.058 (-1.99)**	-0.764 (-2.26)**
<i>Sale growth</i>	0.488 (1.29)	-1.049 (-0.14)
<i>LagROA</i>	-0.350 (-0.82)	0.165 (2.56)**
<i>Stock return</i>	0.254 (1.71)*	3.698 (2.15)**
<i>Firm age</i>	-0.030 (-0.21)	-0.265 (-0.13)
<i>Num acq</i>	0.351 (1.21)	-0.422 (-0.31)
<i>Goodwill</i>	-1.037 (-1.96)*	3.098 (0.51)
<i>Leverage</i>	-1.595 (-4.50)***	-2.587 (-0.66)

**Table 6 Regression-Death Sample, Continued**

<i>Num seg</i>	-0.040 (-0.76)	-0.168 (-0.26)
<i>Firm size</i>	-0.055 (-1.27)	2.076 (2.47)**
<i>Capex</i>	-0.210 (-0.14)	59.517 (2.67)***
<i>Risk</i>	1.314 (1.22)	-19.218 (-1.40)
<i>IPO</i>	0.900 (1.38)	-0.741 (-0.15)
Observations	441	439
R-squared	0.193	0.370
Industry fixed effect	Yes	Yes

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**Table 7 Corporate Policies-Pooled Sample**

The sample period is from 1998 to 2010. We define all variables in the Appendix. All regressions contain the same set of control variables as in Column (1) of Table 2. Panel A further controls for *Public target*, *All cash deal*, and *Deal Size*. Panel B further controls for *Tangibility*, *Dividend paying*, *Operating cycle*, *Cash*, *Vol(CFO)*, and *Vol(Sale)*. We measure all monetary items in 2002 dollars, and present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively. We correct standard errors for heteroscedasticity and clustering of observations at the firm level.

<b>Panel A M&amp;A Announcement Returns</b>				
	(1)	(2)		
	<i>CAR</i> [0,1]	<i>CAR</i> [-2,2]		
<i>Board tenure</i>	0.0019 (2.29)**	0.0026 (2.13)**		
<i>Board tenure squared</i>	-0.0001 (-2.80)***	-0.0001 (-2.12)**		
Controls	Yes	Yes		
Observations	2,884	2,884		
R-squared	0.070	0.053		
Industry fixed effect	Yes	Yes		
Year fixed effect	Yes	Yes		
<b>Panel B Financial Reporting Quality</b>				
	(1)	(2)	(3)	(4)
	<i>AQ</i>	<i>Abn Acc</i>	<i>Cscore</i>	<i>Restate</i>
<i>Board tenure</i>	0.003 (2.00)**	0.002 (2.56)**	0.014 (2.49)**	-0.102* (-1.96)
<i>Board tenure squared</i>	-0.00012 (-1.82)*	-0.0001 (-2.21)**	-0.00056 (-2.49)**	0.005** (2.34)
Controls	Yes	Yes	Yes	Yes
Observations	10,976	10,612	11,232	3,632
R-squared	0.386	0.388	0.220	0.01
Firm fixed effect	Yes	Yes	Yes	No
Industry fixed effect	No	No	No	Yes
Year fixed effect	Yes	Yes	Yes	Yes
<b>Panel C CEO Compensation</b>				
	(1)	(2)	(3)	
	<i>Tot Comp</i>	<i>Excess Comp</i>	<i>Log Delta</i>	
<i>Board tenure</i>	-0.033 (-2.89)***	-0.032 (-2.82)*	0.033 (1.92)*	
<i>Board tenure squared</i>	0.001 (1.86)*	0.001 (1.75)*	-0.0014 (-1.88)*	
Controls	Yes	Yes	Yes	
Observations	11,499	11,499	10,698	
R-squared	0.764	0.580	0.837	
Firm fixed effect	Yes	Yes	Yes	
Year fixed effect	Yes	Yes	Yes	

**Table 8 Corporate Policies-Death Sample**

The sample period is from 1998 to 2010. The table reports the regression results for a sample of outside directors who died between 1998 and 2010. We define all variables in the Appendix. Constants are included but not displayed in all regressions. We measure all monetary items in 2002 dollars, and present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively. We correct standard errors for heteroscedasticity and clustering of observations at the firm level.

	(1) <i>AQ</i>	(2) <i>Abn Acc</i>	(3) <i>Cscore</i>	(4) <i>Tot Comp</i>	(5) <i>Excess Comp</i>	(6) <i>Log Delta</i>
<i>Board tenure</i>	0.004 (1.95)*	0.021 (1.77)*	0.750 (2.67)***	-0.172 (-2.36)**	-0.086 (-1.77)*	0.302 (2.00)**
<i>Board tenure squared</i>	-0.0002 (-1.82)*	-0.001 (-2.09)**	-0.028 (-2.33)**	0.0053 (1.98)**	0.0048 (3.18)***	-0.014 (-1.94)*
<i>Std dev of board tenure</i>	0.002 (1.65)	0.000 (0.00)	0.093 (0.73)	-0.012 (-0.35)	-0.028 (-0.99)	0.046 (0.62)
<i>CEO age</i>	0.000 (0.47)	0.002 (1.38)	-0.015 (-0.24)	-0.021 (-1.87)*	-0.007 (-0.93)	-0.005 (-0.18)
<i>CEO tenure</i>	-0.000 (-0.24)	0.001 (0.56)	-0.120 (-1.13)	0.004 (0.28)	0.008 (0.78)	-0.013 (-0.38)
<i>CEO shareholding</i>	0.001 (1.48)	-0.003 (-1.06)	0.132 (1.06)	0.006 (0.25)	-0.004 (-0.28)	0.119 (1.40)
<i>CEO-Founder</i>	-0.005 (-0.61)	-0.006 (-0.22)	2.274 (1.55)	0.316 (1.13)	-0.104 (-0.48)	-0.146 (-0.25)
<i>CEO-Chair</i>	-0.004 (-0.77)	0.016 (0.50)	-1.963 (-1.82)*	0.006 (0.04)	0.098 (0.81)	0.569 (1.28)
<i>Classified board</i>	0.006 (1.07)	-0.027 (-1.41)	2.107 (1.03)	0.116 (0.70)	0.374 (3.14)***	-0.000 (-0.00)
<i>Independent board</i>	-0.022 (-3.42)***	-0.011 (-0.14)	0.953 (0.86)	0.083 (0.19)	0.056 (0.24)	-1.086 (-1.06)
<i>Busy board</i>	-0.000 (-0.20)	-0.005 (-1.38)	-0.089 (-0.51)	0.079 (2.60)**	0.042 (1.77)*	0.067 (0.79)
<i>Interlocked board</i>	0.068 (2.05)**	0.156 (1.15)	-1.871 (-0.41)	-2.311 (-1.57)	-2.604 (-3.44)***	2.605 (1.47)
<i>Board size</i>	0.001 (0.66)	0.006 (0.81)	-0.164 (-1.16)	0.010 (0.28)	-0.050 (-2.04)**	-0.071 (-0.66)
<i>Sale growth</i>	0.006 (1.36)	0.014 (0.57)	-0.645 (-1.16)	0.165 (0.47)	-0.129 (-0.35)	0.315 (0.41)
<i>LagROA</i>	-0.011 (-1.84)*	-0.140 (-1.77)*	0.856 (0.79)	0.709 (1.14)	-0.336 (-0.83)	1.822 (2.34)**
<i>Stock return</i>	-0.007 (-1.30)	0.011 (0.37)	-1.823 (-1.74)*	-0.217 (-1.35)	0.309 (2.06)**	0.553 (1.54)
<i>Firm age</i>	-0.013 (-1.73)*	-0.024 (-0.88)	1.137 (1.43)	-0.063 (-0.36)	0.059 (0.49)	0.256 (0.64)
<i>Num acq</i>	0.008 (2.01)**	0.036 (1.87)*	-2.106 (-2.64)***	0.047 (0.36)	0.004 (0.04)	0.168 (0.71)
<i>Goodwill</i>	0.024 (1.26)	0.015 (0.18)	1.454 (0.48)	-0.356 (-0.56)	0.197 (0.47)	-0.113 (-0.10)
<i>Leverage</i>	-0.007 (-0.63)	-0.161 (-1.71)*	3.846 (1.90)*	0.953 (1.97)*	0.250 (0.70)	1.258 (1.37)
<i>Num seg</i>	-0.005 (-1.49)	-0.019 (-1.34)	0.248 (0.61)	0.114 (1.65)	-0.033 (-0.69)	-0.088 (-0.67)
<i>Firm size</i>	0.003 (2.03)**	0.022 (1.22)	0.229 (0.82)	0.015 (0.20)	0.040 (0.77)	0.156 (0.80)



**Table 8 Corporate Policies-Death Sample, Continued**

<i>Capex</i>	0.043 (1.04)	-0.314 (-0.84)	-6.606 (-0.41)	-0.218 (-0.12)	-3.090 (-2.08)**	1.347 (0.38)
<i>Risk</i>	-0.074 (-1.71)*	0.203 (1.26)	8.219 (1.79)*	-0.357 (-0.31)	0.947 (0.93)	-5.962 (-1.88)*
<i>IPO</i>	-0.030 (-1.92)*	0.022 (0.44)	2.140 (1.55)	-0.615 (-1.13)	0.817 (2.27)**	-0.046 (-0.07)
Observations	415	415	415	194	193	194
R-squared	0.135	0.096	0.107	0.293	0.345	0.291
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

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**Online Appendix of “Zombie Board: Board Tenure  
and Firm Performance”**

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## **I. Introduction**

This Online Supplemental Material complements and extends the analysis carried out in “Zombie Board: Board Tenure and Firm Performance” in several ways. First, it complements the main study by considering a battery of robustness checks to ensure that our findings are not sensitive to alternative definitions and model specifications. Second, we examine how tenure diversity mediates the relation between board tenure and firm values. Third, we carry out additional robustness tests related to the event study. In particular, we provide additional information on the death sample (as mentioned in Footnote 5 of the published study). Second, we consider how departing from a 10-year tenure affects the stock price in the case of a sudden death. We revisit this analysis by examining the effect of moving away from an optimal tenure range of 8 to 11 years. Fourth, we conduct robustness tests related to our corporate policy analyses to mitigate any potential confounding effects of omitted correlated variables. Lastly, we conduct a structural equation estimation (SEM) linking various corporate decisions with firm performance.

## **II. Robustness Tests**

We consider a battery of additional robustness checks to ensure that our findings are not sensitive to alternative definitions and model specifications. We tabulate these results in Table A1. We include the full set of control variables listed in Column (1) of Table 2 unless otherwise noted. For brevity, we only tabulate the main variable of interest. First, to mitigate the concern that our results are attributable to time series variation in industry characteristics, we control for industry and year joint fixed effects. Industry\*Year joint fixed effects should absorb any time series variations in industry characteristics that may confound our results. Panel A of Table A1 shows that our results are not caused by unobservable characteristics at the industry-year level.

Our next set of robustness tests considers alternative measures of board tenure. We use average board tenure as the main summary statistics of the tenure profile of the board. However, the diversity of tenure among board members may affect firm performance and corporate decisions. To explore this issue, we use two alternative measures of board tenure that are less affected by board tenure diversity: we use the median in Panel B and the mode in Panel C. We define *Board Tenure Median (Mode)* as the median (mode) of tenure among outside directors. We continue to find an inverted U-shape relation between firm value and board tenure using either tenure measure. Both linear and quadratic tenure terms are significant at the conventional level. We then consider alternative measures of tenure diversity. Panel D uses the range of board tenure (*Board Tenure Range*) and Panel E uses the Herfindahl index of board tenure (*Board Tenure HHI*). Our conclusions are not affected. *Board Tenure Range* and *Board Tenure HHI* are both insignificant. Next, we consider alternative regression specifications. Our main regression uses lead-lag specification to mitigate endogeneity concerns. Panel F re-estimates the regression measuring all variables simultaneously (i.e., both dependent variables and independent variables are measured at year  $t$ ), and our conclusions are not affected. Lastly, we incorporate firm fixed effects to mitigate concerns that our results may be confounded by time-invariant unobservable firm characteristics. The specification relies on within-firm variation in board tenure to identify the valuation effect. Panel G considers alternative specification in which we do not include firm fixed effects. We continue to find an inverted U-shaped relation between board tenure and firm valuation.

### **III. Cross-sectional Analysis of Tenure Diversity**

Next, we consider how tenure dispersion mediates the effects of tenure length. To this end, we re-estimate Model (3) and partition the sample based on the median value of tenure diversity (using either the standard deviation of tenure or the Herfindahl index as proxy). We present the

results in Table A2. When we focus on short tenure cases, we observe no difference across cells using Tobin's Q measure (i.e., board tenure dispersion is not relevant to explain differences across cells). However, we observe that a low dispersion in director tenure exacerbates the negative effect of long tenure. The difference is statistically significant at the 1% and 7% levels (using the standard deviation or tenure Herfindahl index as proxy) when Tobin's Q is the dependent variable. Although we do not find an average effect of tenure diversity on firm performance, the results in Table A2 suggest that greater diversity helps mitigate the oversight problem when the average tenure is high (at least when Q is the dependent variable). This finding is consistent with prior studies, such as Williams and O'Reilly [1998], which find that the effect of diversity on team performance varies across studies. Our results are consistent with the idea that diversity has a positive effect when groups are too jaded.

#### **IV. Additional Tests Related to Event Studies**

##### **Reconciliation of Death Sample**

Our initial sample of 565 deaths covers the 1998-2010 period and is not restricted to S&P 1500 firms, on which the IRRC provides board information. We manually collect board information from proxy statements in various databases, such as Capital IQ, Boardex, and the Edgar Archive. The following table reconciles the reduction from the initial sample of 565 to the final sample of 441 used in the analysis in Table A3. We provide further details and examples for each category below.

- a. Corporate Event. If the death happened in a year during which the company experienced a corporate event, such as M&A, liquidation, or IPO, we remove the confounding event. For example, Robert Palmer, who was an independent director of Epixtar Corp, died on June

21, 2005. Epixtar Corp filed a voluntary petition for reorganization under Chapter 11 of the United States Bankruptcy code in October 2005.

- b. Private firm-public debt or private equity. The SEC requires companies with more than US\$10 million in assets and a class of equity securities held by more than 500 owners to file annual and other periodic reports, regardless of whether the securities are publicly or privately traded. For example, David Anacker, who was an independent director of Grubb & Ellis Co., died on May 23, 2007. Capital IQ classifies the firm as a private firm with public debt. As we cannot obtain pricing information for these companies, we exclude them from the analysis.
- c. Private firm-operating subsidiary. Our initial search identifies these events to be associated with parent-listed companies. Thus, we remove them to avoid misidentification. For example, Jeffrey A Timmons, who was an independent director of National Mentor Holdings, Inc., died on April 8, 2008. National Mentor Holdings, Inc. is a non-listed operating subsidiary of a NYSE listed firm, Civitas Solutions, Inc. (NYSE ticker: CIVI).
- d. 20-F Firms. We identify two non-US firms that are listed in the US. For example, Akira Chiaya, who was an independent director of Hitachi, Ltd. (a Japanese firm), died on January 22, 2007. We remove these two observations as the nature of boards in Japan is different from that of boards in the US.
- e. Missing Controls. Missing controls are mainly associated with the non-disclosure of information on director tenure or director age from proxy statements or directors' profile pages from Capital IQ. Many of these firms are OTC. For example, Jeff Scheive, who was an independent director of Golden Star Enterprises Ltd., died on June 3, 2008. The

company is traded in the over-the-counter market. We are unable to hand-collect the information for these cases.

### **Event Study-truncated Returns**

To mitigate the concern that our event studies may be driven by outliers, we present the analyses sequentially using unwinsorized, winsorized, and median announcement returns in Table 5. To further address this issue, we exclude nine observations that generate large negative abnormal returns. Table A4 shows that our conclusions are not affected.

### **Optimal Tenure Range**

The empirical observations in both Figure 1 and Table 2 suggest that 10 years is the optimal length of tenure. Consequently, we use this as the cut-off value in our announcement return tests in Table 5. We acknowledge that the optimal tenure point may vary across different specifications. To explore this possibility, we use this section to consider board tenure between 8 and 11 years as the optimal tenure range. To this end, we partition our samples based on whether board tenure moves toward or away from this optimal range, and repeat our announcement return tests. Specifically, we consider the mean and median returns in three cases (board tenure moves away from, tenure moves closer to, and tenure remains within the 8-11-year range), and report the results in Table A5. We reach a similar conclusion to that in Table 5. The average returns are -1% and 0.8% in the first two cases, with t-statistics of -2.5 and 1.7, respectively. The average (or median) return is statistically undistinguishable from zero in the third case.



## **V. Additional Tests Related to Corporate Policies Analyses**

### **Restatements**

We examine whether board tenure affects likelihood of restatement. To account for the fact that firms that restate their financial statements are substantially different from typical firms, we use a propensity score matching specification. Specifically, propensity scores are created every year based on Probit regressions that include all of the characteristics tabulated in Panel B of Table 7 and industry fixed effects (Fama and French 48 industry level), which allow us to select, for each restatement firm, a non-restatement firm that has similar characteristics to function as its control group. After matching, the difference in propensity scores between restatement firms and control firms is statistically insignificant across two samples (p-value = 0.80). We then estimate logit regression using the matched sample. Table A6 below shows that the likelihood of restatement has a U-shaped relation with board tenure.

### **Additional Firm-year Controls**

We include a vector of 15 additional firm-year controls under valuation analysis in Table 2, and show that most variables are insignificant. To mitigate the concern that a correlated omitted variable may explain our results on corporate policies, we control for these 15 variables in addition to the set of control variables and fixed effects that are already included in Table 7. Results are reported in Table A7. They show that including these additional controls does not change our conclusions.

Second, there may be a concern that our choice of control variables may bias our results. More specifically, *AQ* and *AbsAcc* are obtained by transforming the residuals of a first stage regression (we use the standard deviation in the first case and the absolute value in the second). There may be a concern that there could be a correlation between the noise in the estimated

residuals and the variables in the second regression. To ensure that our financial transparency results are not driven by the inclusion of specific covariates, we first re-estimate our baseline regression omitting all control variables. If our results are driven by the correlation structure between the control variables and the estimated residuals from the first stage, excluding these control variables will materially affect them. Results reported in Table A8 indicate that our conclusions are not affected. In addition, we randomly select a set of control variables among the 29 variables used in Panel B of Table 7, and re-estimate our baseline model with this alternative set of controls. We repeat the procedure 1,000 times with both *AQ* and *AbnAcc* as dependent variables. We find that the two variables of interest (*Tenure* and *Tenure*<sup>2</sup>) are always significant when *AQ* is the dependent variable. When *AbnAcc* is the dependent variable, *Tenure* is always significant, *Tenure*<sup>2</sup> is significant in 984 specifications out of 1,000 draws.

## VI. Structural Equation Modeling

Overall, our analysis of corporate policies and decisions shows that the trade-off driving the quadratic relation between board tenure and firm value is also evident among corporate decisions determining the quality of investment, financial reporting, and executive compensation. For completeness, we connect the valuation result of board tenure to the channel analyses. We use a SEM approach to examine if these decisions moderates (in a statistical sense) the relation between tenure and firm value. We focus on financial reporting quality and compensation, as the relation between M&A announcement returns and tenure is largely cross-sectional, and inclusion of this relation will lead to severe sample attrition. Specifically, we estimate the following SEM equations simultaneously:

$$FRQ_{it} = \alpha_i + \alpha_t + \beta_1 Tenure_{i,t-1} + \beta_2 Tenure_{i,t-1}^2 + \Gamma' X_{i,t-1} + \varepsilon_{i,t} \quad (A1a)$$

$$Comp_{it} = \alpha_i + \alpha_t + \beta_1 Tenure_{i,t-1} + \beta_2 Tenure_{i,t-1}^2 + \Gamma' X_{i,t-1} + \varepsilon_{i,t} \quad (A1b)$$

$$Tobin_{it} = \alpha_i + \alpha_t + \beta_1 Tenure_{i,t-1} + \beta_2 Tenure_{i,t-1}^2 + \beta_3 FRQ_{i,t} + \beta_2 Comp_{i,t} + \Gamma' X_{i,t-1} + \varepsilon_{i,t} \quad (A1c)$$

Results in Table A9 should be treated with caution. For example, Kline [2012, p.113] in his review of structural models, stresses that “interpretation of statistical estimates of direct effects as indicating causality assumes that the researcher’s model is correct”. This requires multiple assumptions (e.g., the form of the data distribution is known) are not empirically testable. These assumptions may be violated in our setting.

These results confirm the curvilinear relationship between both tenure and policies and tenure and Tobin’s Q. Panel A reports the direct effect of board tenure on firm performance, holding other endogenous variables (i.e., financial reporting quality and compensation) constant. Panel B shows the indirect effect of board tenure on firm performance, mediated through financial reporting quality and compensation measures. Panel B shows that the overall indirect effect of tenure is also curvilinear and statistically significant at the 10% level, consistent with our findings that board tenure has a quadratic relation with financial reporting quality and compensation. Consistent with the idea that the effect of *Tenure* and *Tenure*<sup>2</sup> partially flows through *FRQ* and *Comp*, we observe that the coefficients of interest have the expected signs in Panel B. The standardized coefficients (0.020 and -0.019) indicate that the effects of *Tenure* and of its square term are economically equivalent, but in opposite directions. Finally, Panel A of Table A9 shows the direct effect of board tenure on firm performance. We find that there is a curvilinear and significant effect of tenure on Tobin’s Q, after controlling for *FRQ* and *Comp*.

## References

WILLIAMS K. Y. AND C.A. O'REILLY. "Diversity in Organizations: A Review of 40 Years of Research." *Research in Organizational Behavior* 20 (1998): 77-140.

## Table A1 Robustness Tests

The sample period is from 1998 to 2010. We define all variables in the Appendix. All panels contain all of the control variables reported in Column (1) of Table 2, except for Panel D and E. Panel D and Panel E contain all control variables other than the standard deviation of board tenure reported in Column (1) of Table 2. We measure all monetary items in 2002 dollars. We present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels. We correct standard errors for heteroscedasticity and clustering of observations at the firm level.

<b>Panel A Industry*year Joint Fixed Effects</b>		
	(1)	(2)
	<i>Tobin</i>	<i>ROA</i>
<i>Board tenure</i>	0.022 (2.28)**	0.429 (3.00)***
<i>Board tenure squared</i>	-0.001 (-2.82)***	-0.019 (-3.25)***
Controls	Yes	Yes
Observations	12,010	12,821
R-squared	0.752	0.610
Firm fixed effect	Yes	Yes
Industry*year joint fixed effect	Yes	Yes
<b>Panel B Tenure Median</b>		
	(1)	(2)
	<i>Tobin</i>	<i>ROA</i>
<i>Board tenure median</i>	0.009 (1.79)*	0.231 (2.56)**
<i>Board tenure median squared</i>	-0.001 (-2.62)***	-0.011 (-2.63)***
Controls	Yes	Yes
Observations	12,034	12,846
R-squared	0.707	0.569
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
<b>Panel C Tenure Mode</b>		
	(1)	(2)
	<i>Tobin</i>	<i>ROA</i>
<i>Board tenure mode</i>	0.005 (1.83)*	0.077 (2.61)***
<i>Board tenure mode squared</i>	-0.000 (-2.49)**	-0.002 (-2.94)***
Controls	Yes	Yes
Observations	12,034	12,846
R-squared	0.707	0.568
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes

**Table A1 Robustness Tests, Continued**

<b>Panel D Control for Tenure Range</b>		
	(1)	(2)
	<i>Tobin</i>	<i>ROA</i>
<i>Board tenure</i>	0.030 (2.85)***	0.503 (3.58)***
<i>Board tenure squared</i>	-0.002 (-3.30)***	-0.022 (-3.96)***
<i>Board tenure range</i>	-0.001 (-0.47)	-0.016 (-1.07)
Controls	Yes	Yes
Observations	12,034	12,846
R-squared	0.708	0.569
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
<b>Panel E Control for Tenure HHI</b>		
	(1)	(2)
	<i>Tobin</i>	<i>ROA</i>
<i>Board tenure</i>	0.029 (2.94)***	0.472 (3.64)***
<i>Board tenure squared</i>	-0.001 (-3.29)***	-0.021 (-3.95)***
<i>Board tenure HHI</i>	0.063 (0.43)	0.001 (0.06)
Controls	Yes	Yes
Observations	12,034	12,846
R-squared	0.708	0.569
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
<b>Panel F Measured at Year t</b>		
	(1)	(2)
	<i>Tobin</i>	<i>ROA</i>
<i>Board tenure</i>	0.029 (2.81)***	0.510 (3.71)***
<i>Board tenure squared</i>	-0.002 (-3.42)***	-0.024 (-4.37)***
Controls	Yes	Yes
Observations	12,034	12,846
R-squared	0.719	0.580
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes

**Table A1 Robustness Tests, Continued**

<b>Panel G No Firm Fixed Effects</b>		
	(1)	(2)
	<i>Tobin</i>	<i>ROA</i>
<i>Board tenure</i>	0.051 (4.53)***	0.711 (6.61)***
<i>Board tenure squared</i>	-0.002 (-4.48)***	-0.025 (-5.69)***
Controls	Yes	Yes
Observations	12,034	12,846
R-squared	0.190	0.200
Firm fixed effect	No	No
Year fixed effect	Yes	Yes

**Table A2 Tenure Diversity**

The sample period is from 1998 to 2010. We estimate the following regressions for each subsample:  $FirmVal_{i,t} = \alpha_i + \alpha_t + \beta_1 D(Tenure \leq 8)_{i,t-1} + \beta_2 D(Tenure \geq 11)_{i,t-1} + \Gamma X_{i,t-1} + \varepsilon_{i,t}$ , where  $i$  indexes firm, and  $t$  indexes year.  $\alpha_i$  and  $\alpha_t$  are firm and year fixed effects, respectively.  $FirmVal_{i,t}$  is measured by Tobin's Q (Panel A to Panel B) or ROA (Panel C to Panel D). *High (Low) Tenure Std* is an indicator variable equal to 1 if the standard deviation of board tenure is above (below) the median, and 0 otherwise. *High (Low) Tenure HHI* is an indicator variable equal to 1 if the board tenure HHI is above (below) the median, and 0 otherwise. We define all other variables in the Appendix. For all panels, we include all control variables under Column (1) of Table 2 other than the standard deviation of board tenure. The last column of each panel compares the difference in coefficients across two subsamples using seemingly unrelated estimations, and we report the p-value of two-sided t-tests. We measure all monetary items in 2002 dollars. We present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively. We correct standard errors for heteroscedasticity and clustering of observations at the firm level.

<b>Tobin's Q as a measure of firm performance</b>				<b>ROA as a measure of firm performance</b>			
<b>Panel A Tenure Std</b>				<b>Panel C Tenure Std</b>			
	High Tenure Std	Low Tenure Std	test of difference in coefficients	High Tenure Std	Low Tenure Std	test of difference in coefficients	
	(1)	(2)		(3)	(4)		
	<i>Tobin</i>	<i>Tobin</i>	<i>p-value</i>	<i>ROA</i>	<i>ROA</i>	<i>p-value</i>	
<i>D(Board tenure &lt;= 8)</i>	-0.049 (-1.15)	-0.055 (-2.47)**	0.89	<i>D(Board tenure &lt;= 8)</i>	-0.663 (-1.02)	-0.244 (-1.08)	0.43
<i>D(Board tenure &gt;= 11)</i>	-0.057 (-2.10)**	-0.155 (-3.91)***	0.01	<i>D(Board tenure &gt;= 11)</i>	-0.539 (-2.17)**	-0.648 (-1.86)*	0.80
Controls	Yes	Yes		Controls	Yes	Yes	
Observations	6,113	5,921		Observations	6,423	6,423	
R-squared	0.746	0.737		R-squared	0.648	0.588	
Firm fixed effect	Yes	Yes		Firm fixed effect	Yes	Yes	
Year fixed effect	Yes	Yes		Year fixed effect	Yes	Yes	
<b>Panel B Tenure HHI</b>				<b>Panel D Tenure HHI</b>			
	High Tenure HHI	Low Tenure HHI	test of difference in coefficients	High Tenure HHI	Low Tenure HHI	test of difference in coefficients	
	(1)	(2)		(3)	(4)		
	<i>Tobin</i>	<i>Tobin</i>	<i>p-value</i>	<i>ROA</i>	<i>ROA</i>	<i>p-value</i>	
<i>D(Board tenure &lt;= 8)</i>	-0.079 (-2.93)***	-0.052 (-2.06)**	0.35	<i>D(Board tenure &lt;= 8)</i>	-0.709 (-2.25)**	-0.131 (-0.50)	0.10
<i>D(Board tenure &gt;= 11)</i>	-0.136 (-4.18)***	-0.074 (-2.47)**	0.07	<i>D(Board tenure &gt;= 11)</i>	-0.657 (-2.50)**	-0.506 (-1.59)	0.72
Controls	Yes	Yes		Controls	Yes	Yes	
Observations	5,952	6,082		Observations	6,339	6,507	
R-squared	0.709	0.776		R-squared	0.618	0.645	
Firm fixed effect	Yes	Yes		Firm fixed effect	Yes	Yes	
Year fixed effect	Yes	Yes		Year fixed effect	Yes	Yes	



### Table A3 Death Sample Reconciliation

This table provides a reconciliation of death events from the initial sample to the final sample used in the analysis.

	<b>Sample Attrition</b>
Total Events 1998-2010	565
Corporate Events (e.g., IPO, M&A, Bankruptcy)	12
Private Firm–Public Debt or Private Equity	30
Private Firm–Operating Subsidiary of Listed Firms	17
20-F Firms	2
Missing Controls	63
Total in the sample	441

## Table A4 Sudden Death-Truncated Returns

This table reports the three-day announcement returns for a sample of outside directors who died suddenly between 1998 and 2010. Panel A reports results using truncated announcement returns in which we exclude nine observations that generate large negative announcement returns. We present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

<b>Panel A Event Study-sudden Death (Truncated)</b>			
	Move away from 10 years	Move closer toward 10 years	P-value of test of mean difference
N	69	73	
Mean	-1.22%	0.85%	
t-stat	(-3.07)***	(2.01)***	0.00

## Table A5 Sudden Death-Optimal Tenure Range

The table reports the three-day announcement returns for a sample of outside directors who died suddenly between 1998 and 2010. The panel splits the sample into three groups: a) those that move away from the tenure range of 8-11 years, b) those that stay within 8-11 years of tenure, c) those that move toward 8-11 years of tenure. We define all variables in the Appendix, and present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively.

	Event Study-optimal Range			
	Move away from 8-11 years	Stay within 8-11 years	Move closer toward 8-11 years	P-value of test of mean (median) difference
N	61	30	60	
Mean	-1.04%	-0.24%	0.78%	
t-stat	(-2.47)***	(-0.31)	(1.67)*	0.00
Median	-0.63%	-0.62%	0.50%	
Wilcoxon z-stat	(-2.18)**	(-0.67)	(1.67)*	0.013

## Table A6 Restatement-Matched Sample

The sample period is from 1998 to 2010. The table reports results from logit regression using propensity score matched sample. We include the same set of control variables as in Panel B of Table 7. *Restate* is an indicator variable that equals 1 if the restatement occurred in year  $t+1$ . All independent variables are measured at year  $t$ . We define all other variables in the Appendix. We measure all monetary items in 2002 dollars, and present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively. We correct standard errors for heteroscedasticity and clustering of observations at the firm level.

PSM Sample	
	(1)
	Restate
<i>Board tenure</i>	-0.102 (-1.96)*
<i>Board tenure squared</i>	0.005 (2.34)**
Controls	Yes
Observations	3,632
R-squared	0.0109
Industry fixed effect	Yes
Year fixed effect	Yes
<i>PSM Score</i>	
<i>Restating Sample</i>	0.265
<i>Control sample</i>	0.266
<i>P-value</i>	0.80
Ai and Norton (2003) Corrected Statistics	
<i>Board tenure squared</i>	0.001 (2.18)**

**Table A7 Corporate Policies-Additional Controls**

The sample period is from 1998 to 2010. We define all variables in the Appendix. Constants are included but not displayed in all regressions. We measure all monetary items in 2002 dollars, and present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively. We correct standard errors for heteroscedasticity and clustering of observations at the firm level.

	(1) <i>CAR[0,1]</i>	(2) <i>AQ</i>	(3) <i>Abn Acc</i>	(4) <i>Cscore</i>	(5) <i>Tot Comp</i>	(6) <i>Excess Comp</i>	(7) <i>Log Delta</i>
<i>Board tenure</i>	0.002 (2.01)**	0.002 (2.21)**	0.0036 (2.16)**	0.012 (1.98)**	-0.041 (-3.00)***	-0.041 (-2.88)***	0.033 (2.55)**
<i>Board tenure squared</i>	-0.0001 (-2.30)**	-0.0001 (-1.89)*	-0.00013 (-2.01)**	-0.0005 (-2.00)**	0.0011 (1.96)*	0.001 (1.77)*	-0.0013 (-2.02)**
<i>Std dev of board tenure</i>	0.000 (0.30)	0.000 (0.29)	-0.000 (-0.48)	-0.003 (-1.13)	0.003 (0.60)	0.002 (0.44)	0.006 (1.19)
<i>CEO age</i>	-0.000 (-0.99)	0.000 (0.63)	-0.000 (-0.66)	-0.001 (-0.95)	-0.000 (-0.12)	-0.000 (-0.01)	0.005 (1.92)*
<i>CEO tenure</i>	0.000 (0.92)	0.000 (0.33)	0.000 (1.09)	0.001 (0.93)	0.002 (0.56)	0.001 (0.29)	0.042 (12.55)***
<i>CEO shareholding</i>	-0.000 (-0.07)	-0.000 (-0.07)	-0.000 (-1.40)	-0.000 (-0.03)	-0.011 (-2.68)***	-0.011 (-2.40)**	0.105 (22.25)***
<i>CEO-Founder</i>	0.004 (1.58)	0.001 (0.22)	0.001 (0.08)	-0.001 (-0.03)	-0.110 (-1.95)*	-0.114 (-2.01)**	0.044 (0.73)
<i>CEO-Chair</i>	0.001 (0.62)	-0.002 (-1.53)	-0.001 (-0.48)	-0.015 (-1.11)	0.063 (2.50)**	0.057 (2.32)**	0.157 (6.77)***
<i>Classified board</i>	-0.001 (-0.41)	-0.001 (-0.20)	-0.001 (-0.21)	0.019 (0.58)	0.034 (0.63)	0.033 (0.62)	0.222 (4.26)***
<i>Independent board</i>	-0.004 (-1.18)	0.002 (0.82)	0.000 (0.01)	-0.005 (-0.32)	0.006 (0.20)	0.011 (0.39)	-0.006 (-0.21)
<i>Busy board</i>	-0.000 (-0.15)	0.001 (0.92)	0.001 (0.72)	0.002 (0.47)	-0.001 (-0.09)	-0.002 (-0.26)	-0.007 (-0.92)
<i>Interlocked board</i>	0.006 (1.07)	0.003 (1.12)	0.001 (0.26)	-0.009 (-0.35)	-0.078 (-1.73)*	-0.077 (-1.72)*	-0.079 (-1.83)*
<i>Board size</i>	-0.001 (-2.01)**	0.000 (1.02)	-0.000 (-0.11)	0.003 (0.59)	-0.011 (-1.42)	-0.016 (-2.02)**	-0.017 (-2.12)**
<i>Sale growth</i>	-0.004 (-1.84)*	-0.007 (-1.97)**	-0.009 (-1.62)	0.026 (1.83)*	0.027 (1.03)	0.042 (1.66)*	0.049 (1.98)**
<i>LagROA</i>	0.004 (0.54)	-0.003 (-0.20)	-0.016 (-0.96)	-0.032 (-1.16)	0.131 (1.72)*	0.115 (1.55)	0.349 (5.83)***
<i>Stock return</i>	0.004 (1.73)*	0.001 (0.51)	-0.000 (-0.07)	0.006 (0.57)	0.187 (11.03)***	-0.023 (-1.36)	0.255 (13.72)***
<i>Firm age</i>	0.003 (1.83)*	0.022 (2.14)**	0.032 (1.81)*	-0.032 (-0.40)	-0.150 (-1.05)	-0.170 (-1.19)	-0.214 (-1.57)
<i>Num acq</i>	0.001 (1.26)	0.001 (1.23)	0.002 (0.70)	0.001 (0.13)	0.008 (0.51)	0.006 (0.41)	0.053 (3.64)***
<i>Goodwill</i>	0.004 (0.53)	0.009 (1.08)	0.019 (1.13)	-0.135 (-1.76)*	0.016 (0.15)	0.012 (0.11)	-0.095 (-0.93)
<i>Leverage</i>	0.002 (0.38)	0.012 (1.20)	-0.007 (-0.41)	0.092 (1.42)	-0.330 (-3.48)***	-0.323 (-3.43)***	-0.566 (-6.27)***
<i>Num seg</i>	0.000 (0.33)	-0.001 (-0.68)	-0.000 (-0.30)	0.004 (0.61)	0.005 (0.40)	0.001 (0.09)	0.000 (0.01)
<i>Firm size</i>	-0.001 (-0.76)	-0.006 (-1.52)	-0.013 (-2.22)**	-0.057 (-3.59)***	0.255 (7.51)***	-0.076 (-2.28)**	0.268 (9.25)***
<i>Capex</i>	-0.002 (-0.07)	0.000 (0.00)	-0.018 (-0.59)	0.227 (1.85)*	0.122 (0.50)	0.066 (0.28)	0.452 (1.93)*
<i>Risk</i>	0.005 (1.27)	-0.008 (-3.59)***	-0.001 (-0.13)	0.097 (3.75)***	0.023 (0.65)	0.041 (1.14)	0.052 (1.39)
<i>IPO</i>	-0.002 (-0.23)	-0.009 (-1.27)	-0.015 (-1.19)	0.006 (0.10)	-0.124 (-1.03)	-0.122 (-1.01)	0.002 (0.03)

**Table A7 Corporate Policies-Additional Controls, Continued**

<i>Additional Controls</i>							
<i>Gender diversity</i>	0.006 (0.70)	-0.008 (-1.02)	-0.008 (-0.62)	-0.048 (-0.75)	0.035 (0.33)	0.043 (0.42)	0.082 (0.74)
<i>Ethnic diversity</i>	-0.003 (-0.49)	0.002 (0.51)	-0.001 (-0.22)	-0.003 (-0.11)	-0.079 (-1.51)	-0.095 (-1.83)*	0.007 (0.12)
<i>Age diversity</i>	0.001 (0.11)	0.003 (0.32)	-0.008 (-0.57)	-0.012 (-0.16)	0.086 (0.67)	0.077 (0.60)	0.153 (1.15)
<i>Director shareholding</i>	-0.001 (-0.51)	-0.002 (-1.17)	-0.003 (-1.37)	0.001 (0.16)	-0.004 (-0.36)	-0.002 (-0.19)	0.024 (1.81)*
<i>% Retirement age directors</i>	0.023 (2.00)**	-0.010 (-1.51)	-0.015 (-1.36)	0.040 (0.61)	0.031 (0.31)	0.031 (0.30)	0.025 (0.24)
<i>Director age</i>	-0.000 (-0.29)	0.000 (0.13)	0.001 (0.93)	-0.006 (-1.82)*	0.007 (0.90)	0.007 (1.00)	-0.016 (-2.31)**
<i>% Outside executives</i>	0.022 (2.79)***	0.005 (0.94)	0.005 (0.53)	-0.049 (-1.10)	0.063 (0.86)	0.048 (0.67)	0.206 (2.69)***
<i>% born in 1930 cohort</i>	0.037 (1.00)	0.002 (0.11)	0.014 (0.37)	0.046 (0.23)	0.063 (0.14)	0.003 (0.01)	0.452 (1.22)
<i>% born in 1940 cohort</i>	0.033 (1.04)	-0.001 (-0.04)	0.016 (0.48)	0.032 (0.17)	-0.010 (-0.03)	-0.123 (-0.32)	0.139 (0.41)
<i>% born in 1950 cohort</i>	0.041 (1.28)	-0.006 (-0.36)	0.007 (0.20)	-0.012 (-0.06)	-0.045 (-0.12)	-0.147 (-0.38)	0.109 (0.32)
<i>% born in 1960 cohort</i>	0.039 (1.12)	-0.008 (-0.37)	0.020 (0.52)	0.022 (0.11)	-0.031 (-0.08)	-0.125 (-0.31)	0.067 (0.18)
<i>% born in 1970 cohort</i>	0.017 (0.45)	-0.001 (-0.03)	0.023 (0.48)	-0.170 (-0.73)	-0.127 (-0.26)	-0.223 (-0.46)	-0.074 (-0.18)
<i>Equity Issuance</i>	-0.018 (-1.75)*	-0.043 (-3.11)***	-0.123 (-4.12)***	-0.073 (-1.22)	0.484 (4.46)***	0.337 (3.09)***	0.782 (7.82)***
<i>Debt Issuance</i>	0.000 (0.01)	-0.004 (-2.46)**	-0.024 (-5.34)***	-0.001 (-0.19)	0.068 (3.79)***	0.030 (1.70)*	0.059 (3.40)***
<i>Liquidity</i>	0.001 (0.82)	0.001 (2.25)**	0.001 (1.14)	-0.002 (-0.84)	0.006 (0.99)	0.011 (1.99)**	-0.000 (-0.01)
Observations	2,414	9,231	9,542	9,769	9,862	9,862	9,132
R-squared	0.070	0.411	0.416	0.226	0.771	0.589	0.849
Firm fixed effect	No	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	No	No	No	No	No	No
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes

## Table A8 Financial Reporting Quality-No Control

The sample period is from 1998 to 2010. We define all variables in the Appendix. Constants are included but not displayed in all regressions. We measure all monetary items in 2002 dollars, and present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively. We correct standard errors for heteroscedasticity and clustering of observations at the firm level.

	(1)	(2)
	<i>AQ</i>	<i>Abn Acc</i>
<i>Board tenure</i>	0.003 (2.94)***	0.004 (2.59)***
<i>Board tenure squared</i>	-0.000 (-2.54)**	-0.000 (-2.35)**
Controls	No	No
Observations	10,976	10,612
R-squared	0.373	0.377
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes

## Table A9 Structural Equation Modeling

The sample period is from 1998 to 2010. The table estimates Structural Equation Model (SEM) of Eq. (A1a)-(A1c). All regressions contain the same set of control variables as in Column (1) of Table 2. We define all variables in the Appendix. We multiply the coefficient associated with ROA by 100. We measure all monetary items in 2002 dollars, and present t-statistics in parentheses. \*\*\*, \*\*, and \* denote significance of coefficients at the 1%, 5%, and 10% levels, respectively. We correct standard errors for heteroscedasticity and clustering of observations at the firm level.

<b>Panel A Direct Effect</b>				
	(1)	(2)	(3)	(4)
	<i>AQ</i>	<i>Log Delta</i>	<i>Tobin</i>	<i>ROA</i>
<i>Board tenure</i>	0.158 (4.92)***	0.051 (2.02)**	0.065 (2.54)**	0.778 (4.51)***
<i>Board tenure squared</i>	-0.116 (-4.28)***	-0.047 (-2.09)**	-0.089 (-3.82)***	-0.032 (-4.53)***
<i>AQ</i>			-0.019 (-1.55)	7.503 (1.32)
<i>Log Delta</i>			0.447 (5.90)***	2.215 (12.89)***
Controls	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
<b>Panel B Indirect Effect</b>				
	(1)	(2)	(3)	(4)
	<i>AQ</i>	<i>Log Delta</i>	<i>Tobin</i>	<i>ROA</i>
<i>Board tenure</i>			0.020 (1.73)*	0.051 (2.12)**
<i>Board tenure squared</i>			-0.019 (-1.85)*	-0.002 (-2.14)**
Controls	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes