

CEO-BOARD DYNAMICS*

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August 2018

Abstract

We examine CEO-board dynamics using a new panel dataset that spans 1918 to 2011. This dataset allows us to perform within-firm tests over a long horizon, many for the first time in the governance literature. We find that substantial director turnover occurs when a new CEO is hired, but despite this turnover, board structure is persistent. The changes in board structure that do occur are consistent with predictions from bargaining and dynamic agency theories: Monitoring and the sensitivity of CEO turnover to performance both decrease, and pay increases, over the tenures of successful CEOs. Regulations implemented in 2003 alter the relation between CEO tenure and board independence, but our evidence suggests that more CEOs were appointed as board chairs in substitution. Finally, event studies document a positive market reaction when powerful CEOs die in office, in contrast to no market reaction to typical CEO deaths, consistent with powerful CEOs becoming entrenched.

Key Words: Governance, Chief Executive, Board of Directors, Dynamic Contracting, Bargaining, Compensation, Monitoring

JEL Codes: G3, J3, B26, M12

* We appreciate comments from Ofer Eldar, Yaniv Grinstein (Drexel discussant), Byoung-Hyoun Hwang, Dirk Jenter (AFA discussant), Andrew Karolyi, Stephen Karolyi, Peter Limbach, Roni Michaely, Felipe Varas, Neng Wang, and seminar and conference participants at AFA, Binghamton University, Columbia University, Cornell University, Drexel Corporate Governance Conference, Duke University, Federal Reserve Bank of Richmond (Charlotte), IDC Summer Finance Conference, Tuck, Purdue University, Rome Junior Finance Conference (EIEF), SMU, University of Kentucky, University of Rochester, USC, University of Utah, Vanderbilt University, Washington University in St. Louis, and the WSJ CEO Forum, excellent research assistance from Penghao Chen, Hyungjin Choi, David Hong, Dawoon Kim, Jason Lee, Boyao Li, Song Ma, Pradeep Muthukrishnan, Youngjun Song, Curtis Wang, Daniel Woo, Hyun Gu Yeo, Gang Zhang, and data support from the librarians at Cornell, Duke, Harvard, and MIT. We thank William Goetzmann for sharing data on historical stock prices and Charlie Hadlock, Jesus Salas, and Timothy Quigley for sharing data on CEO deaths. This paper was previously titled “CEO Power and Board Dynamics”.

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1. Introduction

In recent years, regulators and investors have shown increasing interest in the composition of corporate boards of directors.¹ Academic research suggests there is no universally optimal board composition. While prior empirical research has focused largely on how board structure varies in the cross-section with characteristics of the firm or CEO, theory suggests that boards may also optimally change dynamically within the tenure of a CEO. For example, while a key role of the board is overseeing and monitoring managers, excessive monitoring may impose costs on the board or CEO, or over-constrain management. These tradeoffs are likely to evolve through time as more is known about the ability of the CEO and the scope for agency conflicts changes. As a result, a firm might optimally shift to a board structure that supports more or less intensive monitoring over time. In this paper, we use a unique longitudinal dataset to study the within-firm dynamics of corporate boards and how they relate to the tenure, turnover and performance of the CEO.

We organize our paper around the rich set of predictions emanating from bargaining and dynamic agency models. In bargaining models, CEOs negotiate with the board over compensation and private benefits of control (e.g., Hermalin and Weisbach, 1998; HW). Successful CEOs gain bargaining power as their perceived ability (or match quality) and tenure increase and as uncertainty about their ability declines. Among other things, successful CEOs negotiate for less monitoring, which is also optimal from the board's perspective. A similar outcome can occur in dynamic contracting models (e.g., DeMarzo and Fishman, 2007a, b).² As a CEO performs well over time, both compensation and continuation value (i.e., the CEO's "stake" in the firm) increase,

¹ For example, in the early 2000s the NYSE and NASDAQ implemented listing requirements that boards be majority independent; more recently, activist investors often focus on board structure and composition.

² See also Zwiebel (1996), DeMarzo and Sannikov (2006, 2017), Bolton et al. (2011), DeMarzo et al. (2012) and Piskorski and Westerfield (2016).

which reduces agency problems and the need for monitoring and the threat of termination. Note that less intense monitoring could occur via declining board independence or by appointing the CEO board chair. In addition to less monitoring, successful CEOs are expected to be paid more and experience turnover that is less sensitive to performance. All of this occurs in a setting of endogenous, optimal governance in which the CEO's perceived ability or agency problems evolve dynamically. (The theory is described in more detail in Section 4.)

It is important to highlight that these theories make *dynamic* predictions about board structure, which by nature occur within firms or within CEOs. Yet due to data limitations, prior empirical tests have largely been conducted using repeated cross-sections. Thus, Adams, Hermalin, and Weisbach (2010, p. 69) emphasize the need for studies that “shed more direct empirical light on the dynamic nature of the CEO-board relationship *within-firms*” (emphasis added). Moreover, we note that some theoretical predictions are *within-CEO*. To conduct these dynamic tests, and especially to isolate within-CEO and within-firm effects from other dynamic outcomes, one needs a long time-series of data that includes multiple CEOs per firm. To achieve this, we construct a new officer and director database with over 87,000 firm-year observations from 1918 to 2011, allowing us to study board dynamics over many regulatory and economic environments, and within the careers of over 15,000 CEOs.

We begin our exploration of CEO-board dynamics by documenting that, on average, one-third of the board is replaced when a new CEO is appointed. Interestingly, even with this amount of director turnover, board composition is persistent in that exiting dependent (independent) directors are replaced with a very similar number of dependent (independent) directors. Given our large sample, we conduct rigorous tests of board persistence for the first time in the literature. We document that initial board independence is by far the strongest predictor of board independence

decades later: firms that initially have independent (or dependent) boards on average still have relatively independent (dependent) director-dominated boards 30 years later. This contrasts with the findings of Cicero et al. (2013), who argue that during 1993–2013 firms quickly adjusted their board structures as firm characteristics changed, generating frequent changes in board size and independence. Likewise, Denis and Sarin (1999) conclude that changes in board structure are not uncommon during 1983–1992.

While board structure is sticky, it is not fixed. Our near-century of data provides power to test whether the changes that do occur are consistent with economic theory. To benchmark to the existing literature, we first perform regressions using repeated cross-sections without firm fixed effects and find a negative relation between CEO tenure and board independence over the last 15 years of our sample.³ However, we show that there is *no within-firm relation* when we include firm fixed effects as suggested by theory. When we examine the first seven decades of the sample, though, we do find a within-firm negative relation between CEO tenure and board independence. Similarly, we also find a positive within-firm relation between CEO tenure and the CEO being appointed board chair. Thus, ours is the first paper to document the predicted theoretical relations using within-firm tests.⁴

The timing of the non-relation in modern data is notable because the NYSE and NASDAQ implemented regulations requiring listed firms to have majority independent boards after 2002, altering CEO-board dynamics. In our empirical tests, we confirm that the negative within-firm relation between board independence and CEO tenure dissipates following the 2002 listing

³ See, for example, Baker and Gompers (2003), Boone et al. (2007), and Dikolli et al. (2014).

⁴ Using a sample of 142 firms from 1971-1983, Hermalin and Weisbach (1988) employ specifications both with and without firm fixed effects to examine the relation between CEO tenure and additions/departures of insider and outsider directors. However, their results with fixed effects are generally weaker than or inconsistent with those without fixed effects, which the authors attribute to limited within-firm variation in their sample.

regulations. While the regulations increased board independence as intended, HW (p. 111) argue that “As long as the bargaining process [between the CEO and board] itself is unaffected by reforms, the equilibrium will be little affected.” Building on this logic, we argue that if regulation changes the equilibrium by increasing monitoring via board independence, the bargaining model would predict less monitoring via other channels. Specifically, we explore whether the regulations led to an increase in successful, long-tenured CEOs being appointed dual board chair, again within-firm. We find evidence consistent with this prediction: the within-firm relation between CEO tenure and the likelihood of the CEO being appointed chair of the board became *more* pronounced after the 2002 board independence regulations were implemented. Thus, looking over the century, the evidence is consistent with monitoring declining over the career of a successful CEO at a given firm. This substitution to dual chair is new to the literature and seems to be a fruitful area for future research.

On average, the magnitude of the decline in board independence through a CEO’s tenure is modest. However, we document substantial heterogeneity in this dynamic relation that is consistent with theory. In particular, the magnitude of decline in independence is stronger when there is less uncertainty about CEO ability and following strong corporate performance. Further, the dynamic CEO tenure-board independence relation is weaker when external forces reduce CEO power or reduce agency conflicts, such as when activist investors target a firm.

We confirm that our main results hold at CEO turnover and within-CEO. Thus, there are two sources of the negative CEO tenure-board independence relation. First, there is a jump in board independence at the time a new CEO is appointed. This makes sense because both uncertainty about the CEO’s ability and the change in CEO tenure are greatest at this moment (tenure drops from an average of six years for departing CEOs to one year for incoming CEOs).

Additional tests imply that these patterns are above and beyond effects that may occur due to a CEO succession tournament (see Hermalin and Weisbach, 1988). Second, there is a gradual reduction in board independence over a CEO's tenure – the magnitude of this reduction is economically modest, which is what we expect given the strong persistence mentioned above.

In addition to board structure changing in ways that decrease monitoring over a successful CEO's career, we document that compensation increases and CEO turnover becomes less sensitive to performance (details below). Finally, we explore how the market reacts when successful (and thus “powerful”) CEOs depart their firms. Because of endogeneity concerns, we examine this issue on a sample of turnover events tied to the CEO's death or serious health issues.⁵ We find that the announcement of the departure of a powerful CEO (relatively long job tenure, dual board chair, or founder of the firm) is associated with about a 3% higher abnormal return, relative to departures of less powerful CEOs. This finding is somewhat surprising because in bargaining models, CEO power emanates from perceived superior ability (or match quality) relative to a replacement. Rather, our results seem more consistent with ex-post entrenchment resulting from a weaker board. The positive market reaction may also be consistent with dynamic agency models if promised future rents revert back to shareholders following a sudden departure, or if shareholders tolerate some degree of ex-post entrenchment to preserve incentives ex ante.

In summary, despite relatively persistent board structure, we find that dynamics of board structure are consistent with dynamic bargaining and contracting theory: As their tenure increases, CEOs who are successful earn more pay, are more likely to serve as dual board chair, and interact with boards that grow less independent; and the magnitudes of these relations vary conditionally

⁵ See also Fee, Hadlock, and Pierce (2013), Quigley, Crossland, and Campbell (2017) and Jenter, Matveyev, and Roth (2016).

as expected. Powerful CEOs are also less likely to be replaced upon poor corporate performance, and when they do finally leave office, the market reacts positively.

While earlier studies have explored elements of board dynamics and the interaction between CEOs and board structure, ours is the first to study these dynamics strictly within-firm and within-CEO, using a comprehensive panel of data covering thousands of firms and over 90 years. This has several important advantages. First, prior empirical studies of board dynamics and CEO-board bargaining rely primarily on small samples or short time horizons. While these studies provide helpful insights, this approach has limitations for testing *within-firm, dynamic* predictions. In particular, studies relying on cross-sectional or short panel data often have insufficient within-firm variation to control for firm fixed effects. Further, unless one observes multiple CEOs within a given firm, it is difficult to distinguish between CEO-tenure-related changes in board composition and an overall time trend, while controlling for firm fixed effects.

Second, reliably detecting the degree of persistence in board structure requires studying a long database like the one we use. We document a greater degree of board persistence than has been suggested by earlier studies (e.g., Denis and Sarin, 1999; Cicero et al., 2013). Third, our long time series enables us to document long-term trends in board structure and CEO turnover. Lehn et al. (2009) also study average board structure over a long horizon, but use a survivorship sample including only 82 of the largest firms. We find substantially different trends using our more comprehensive sample.

Fourth, we are able to test the numerous predictions from bargaining and dynamic agency theory on a consistent set of firms, versus the extant empirical evidence that is based on a collection of studies, each of which typically focuses on a subset of issues and studies different time periods and samples of firms. We also examine how these relations have changed over time, for example,

before and after the governance reforms of the early 2000s. Moreover, our paper is one of the few that empirically tests the predictions of dynamic agency models.

2. Sample construction and long-term trends

2.1. Data on corporate boards of directors and officers

We construct a comprehensive database of corporate officers and directors, such as the Chief Executive Officer (CEO), Chief Financial Officer (CFO),⁶ various corporate vice presidents, and others, at public U.S. companies from 1918 to 2011. We combine information from a number of sources. First, we hand-collect names of corporate officers and directors, as well as financial data on their firms, from Moody's Industrial Manual ('Moody's') from 1918 to 1988, and also the year 1998.⁷ Second, we collect names of corporate directors and officers from Compact Disclosure during 1985-2005. Compact Disclosure derives information from firms' public disclosure such as 10-Ks, 10-Qs, and Proxy Statements. Third, we supplement these two primary board and officer databases using Mergent (which took over the Industrial Manual from Moody's; 2002-2009) and Board Analyst (2002-2011) for more recent years. We gather stock price and return data from CRSP and financial statement data from Compustat or Moody's Industrial Manuals (for firm-years not covered by Compustat).⁸ Like most corporate finance research, we do not include firms in the financial (SIC 6000-6999), transportation (4000-4599), and utility (4900-4999) sectors.

⁶ The 'CEO' includes corporate officers with various titles depending on the era, including 'President' and 'Chief Executive Officer'. The 'CFO' is the finance chief and includes corporate officers in various titles depending on the era, including 'Treasurer' and 'Chief Financial Officer'.

⁷ See Graham, Leary, and Roberts (2015) for a description of coverage and available financial statement information in Moody's. Papers that analyze smaller samples of Moody's financial and board information include Lehn, Patro, and Zhao (2009), Frydman, Hilt, and Zhou (2015) and Avedian, Cronqvist, and Weidenmier (2015).

⁸ We obtain stock price data from 1920 to 1925 from William Goetzmann.

To maintain comparability across the various databases and years, we focus on U.S. firms listed on the NYSE or AMEX.⁹ Our main results are similar if we include ADRs and NASDAQ firms, or if we use NYSE firms only (see Appendix Table 1, Panel D). We have CEO and board information for nearly 80% of the NYSE/AMEX firms in the CRSP database over the 1918-2011 period. All total, our database contains 87,734 firm-year observations and more than 10,000 CEO turnover events.

2.2. Descriptive statistics

Table 1 presents descriptive statistics on firm-year observations in the full database and by decade. CEO turnover averages 11.8% per year for the full sample, increasing from the first to the second half of the sample. The average CEO, CFO, and board chair tenures are 6.3, 5.1, and 5.9 years, respectively. The CEO holds the title of board chair ('CEO-Chair duality') for 41.6% of observations, with substantial time-series variation over the century. The average board has about 10 directors (including the chair) for a typical sample firm, and boards have gotten somewhat smaller over the past century. The ratio of the number of outside directors (i.e., directors who are not current officers of the firm) to the total number of directors is 0.65, and the proportion of independent directors (i.e., directors who are (i) neither current nor previous officers of the firm, nor (ii) family members of the CEO, proxied by having the same last name) is 0.58.¹⁰ Both ratios were stable until the 1980s, then increased in recent decades.

Panel B presents descriptive statistics on firm-level financial data (exclusively from Moody's before 1951; mostly from Compustat starting in 1951, though we fix the Compustat backfill problem during 1951-1962). The average firm has \$2.31 billion of real book assets in 2000

⁹ We identify and delete non-U.S. firms (i.e., ADRs) using the approach in Marosi and Massoud (2008).

¹⁰ We do not consider whether a director has business relations with the firm (e.g., lawyers and bankers), given that Moody's and Compact Disclosure do not provide such information on directors.

constant dollars (CPI-adjusted) and has been in the sample about 21 years (“firm age”). Other characteristics are generally similar to those in modern Compustat analysis.

2.3. Long-term trends in CEO turnover, CEO appointment, and board structure

Fig. 1 presents the long-term evolution of various U.S. CEO and board trends. Panel A shows that CEO turnover rates for NYSE and AMEX firms were relatively low from 1922¹¹ to 1950 before increasing in the middle portion of the sample (1950-1970), then decreasing starting around 1970. The rate of CEO turnover for the later period is comparable with those documented in Kaplan and Minton (2012), who find an average 15.8% turnover rate from 1992 to 2007. In addition, we find a negative (-29.0%, t -stat = -2.87) time-series correlation between average CEO turnover rates and ROA, suggesting that CEO turnover is counter-cyclical.

Panel B shows 3-year moving averages of the fraction of “outside CEO” (i.e., neither a current nor previous officer of the firm) appointments from 1933 to 2011. We exclude years prior to 1933 to allow a start-up period to accumulate information on previous corporate officers. The frequency of outside CEO appointments declined from the 1930s to the 1940s, then stabilized until the 1970s. Beginning in the late 1980s, outside CEOs became increasingly common, reaching around 41% by the mid-2000s. This upward trend from the 1970s to the 2010s is consistent with evidence in Huson, Parrino, and Starks (2001) and Murphy and Zbojnik (2007) on the frequency of outside CEO appointments. Moreover, the trend is consistent with the argument by the latter that there has been a shift in the importance of managerial skills for CEOs from firm-specific knowledge to general (or portable) managerial ability, such as MBA education. Our evidence from the long time-series highlights this recent trend by placing it in the context of a much longer horizon and highlights that external hires were also common in the 1930s and 1960s.

¹¹ The first CEO turnover in our database occurs in 1920.

Panel C presents the ratio of the number of independent directors to the total number of directors from 1933 to 2011. Board independence was stable at about 50% for four decades starting in the 1930s; the cross-sectional standard deviation (not in graph) was also very steady at about 0.19 over these four decades. From the late-1970s to mid-1990s, average board independence increased to around 60%. Following imposition of the 2003 NYSE and NASDAQ amendments that require majority independent boards (and 2002's Sarbanes-Oxley),¹² average board independence increased to 75% by 2011 (and the post-2003 standard deviation declined below 0.13). We later examine whether this mandated increase in board independence affects other dynamic outcomes between the CEO and board.

Panel D presents the proportion of firms that have CEOs who are also board chairs from 1918 to 2011. The titles of the CEO and chair were largely separate before the 1960s, at which time the frequency of the dual title increased to a peak of 73% in the mid-1980s.¹³ Shortly thereafter, duality began to decrease, possibly due to “governance activists” such as the National Association of Corporate Directors (NACD) which supported separating the two roles (see, e.g., Wangler, 1994; NACD, 1996). The downward trend is also consistent with Dahya, McConnell, and Travlos (2002) who show that the duality of the titles began to disappear in the U.K. in 1992 when the Cadbury Committee recommended separation of chair and CEO titles.

¹² SOX was signed into law in July 2002 and the SEC approved the NYSE and NASDAQ's new corporate governance requirements in November 2003. See Chhaochharia and Grinstein (2007) for a detailed timeline.

¹³ The dual chair analysis does not include the one-fifth of the observations for which the chair title is not clearly denoted in data sources (such as Moody's). If we include these observations under the assumption that the CEO is always chair, the hump-shaped trend is similar to that in Panel D from 1950 onward, also peaking in the mid-1980s. Also, the conclusions we draw below based on our dual chair regression analyses are unchanged whether or not we exclude the ambiguous observations.

3. Persistence of board structure

Fig. 1, Panel C suggests that board independence is slow-moving at the aggregate level. In this section we examine the extent to which this is true at the firm level and if so, whether it occurs because directors rarely change or whether director rotation occurs in ways that keep board structure stable. We first document changes in board members in the years following CEO turnover. In Table 2, we sort observations in event time, where year 0 is the year of a change in CEO, and report the average additions and departures of independent and dependent directors in each year. Panels A and B show these turnovers for internal and external CEOs, respectively. In both panels, addition and departure rates increase in the year of CEO turnover, then revert to relatively stable rates. When a new internal CEO is appointed (Panel A), on average 0.99 new independent directors join the board and 0.96 leave, a bit higher than the average addition (departure) rate of 0.81 (0.75) in non-CEO-turnover years. The increase in board turnover is more pronounced for dependent directors. On average, 2.6 dependent directors leave the board in the year of CEO change and 2.46 dependent directors are added. While in most cases one of the 2.6 (2.46) is the outgoing (incoming) CEO, this still represents a meaningful level of board turnover relative to the average board size of about 10 members.

Even though roughly 35% of the board turns over in the year of CEO turnover (see also Cicero et al., 2013), because the addition rates are similar to the departure rates, the independence ratio changes little, leading to slow-moving board structure. The movement we do see in year 0 in Panel A, though, is toward more independence. In the years following CEO turnover, the addition and departure rates are similar to each other within a given type of director, with the rates generally declining slightly over the CEO's tenure. Panel B shows that for external CEO appointments the addition and departure rates are also similar to each other within each of the independent and

dependent director categories, and decrease over the CEO's tenure, again suggesting slow-moving board structure. One difference, though, is that in year 0 when an external CEO is appointed, more independent directors leave and dependent directors are added on net. This is potentially consistent with the importance of an advisory role for internal directors when an external CEO is appointed.

We now more formally explore board persistence after netting the effects of director rotation. Hermalin and Weisbach (1998) argue that board independence should exhibit persistence or path-dependence over time: "Strong, independent boards will beget stronger, more independent boards than will weak boards" (p.107). Persistence of board structure can also be interpreted as being consistent with dynamic contracting. For example, DeMarzo and Fishman (2007a) argue "the agent's continuation payoff at any stage is weakly increasing in the agent's continuation payoff at an earlier stage" (p. 171).¹⁴ Thus, we expect (i) board independence to persist, and (ii) initial board independence will explain subsequent independence within firms.

First, we visually examine persistence. In each calendar year from 1918 to 1992, we sort all firms into four equal-sized groups based on their board independence ratio, and compute the groups' average independence ratios for the next 30 years. We repeat this process for all calendar years from 1918 to 1992 and then average across the calendar years. Fig. 2 shows that while there is some convergence, differences in board independence ratios on average persist over 30 years. For comparison, we note that the patterns we document here for board independence are similar to those documented for corporate leverage by Lemmon, Roberts, and Zender (2008), both in terms of the dispersion of initial ratios and the degree of convergence of average ratios over the subsequent 20 years.

¹⁴ While this prediction describes dynamics within a given manager's tenure, we would expect persistence to extend across a firm's CEOs if there are frictions that prevent a complete board re-set at CEO turnover.

Second, we follow Lemmon et al.'s (2008) capital structure analysis and test whether initial board independence is a significant determinant of future independence by estimating the following equation:

$$Independence_{it} = \alpha_t + \beta_1 Independence_{i0} + \beta_2 CEO\ tenure_{it} + \beta_3 Firm\ age_{it} + X_{it}'\gamma + \varepsilon_{it}, \quad (1)$$

where $Independence_{it}$ is defined as the ratio of the number of independent directors to total directors; α_t represents year fixed effects; $Independence_{i0}$ is the first observed board independence ratio for firm i ; $CEO\ tenure_{it}$ is the number of years for which the CEO has been chief executive in firm i as of year t ; $Firm\ age_{it}$ represents the number of years since firm i first appears in our database; X_{it} represents a vector of firm-level control variables including log board size, log number of officers, log book assets, Tobin's q , two-digit SIC industry-adjusted return on assets, and asset tangibility; and ε_{it} represents random errors clustered at the firm level.

Table 3, Panels A and B use the full sample (excluding the first year for each firm) and subsamples consisting of the cross-section of firms that survive five, 10, and 20 years, respectively. Panel C repeats the analysis in regressions that include initial board independence as the only independent variable. To facilitate comparisons across variables, in this table only we scale each independent variable by its standard deviation. Thus, each coefficient estimate represents the change in board independence (in percentage points) corresponding to a one-standard deviation (SD) change in an independent variable. In all three panels, the coefficient on initial independence is positive and highly significant (at better than a 1% level). In fact, its statistical and economic significance is substantially higher than that of any of the other included variables shown in Panel A. In terms of economic magnitude, column 3 of Panel A, which controls for firm-level characteristics, shows that a one-SD increase in the initial independence (19.7 percentage points) is associated with a 7.9 percentage point increase in board independence. In addition, the R^2 's in

Panel C show that initial board independence explains 38.3% (27.6%) of the variation in board independence 10 (20) years later.

Persistence is also evident in Table 3, Panel D, which shows the probability of transition from one quartile of board independence to another. In each year, we sort firms into quartiles based on board independence and follow them for ten years. Board independence is most persistent in the two extreme quartiles. For example, 82.5% of firms in the lowest quartile in year 0 are still in the quartile the following year; and the probability of remaining in this same quartile is 58.5% ten years after the initial sorting. Similarly, 77.7% (46.0%) of firms in the highest quartile in year 0 remain in the same quartile one year (10 years) later. We note that these transition probabilities are similar to those documented by DeAngelo and Roll (2015) for leverage. For example, after 10 years, we find that the probabilities of being in the initial quartile of board independence are 58.5%, 33.3%, 33.0%, and 46.0%, respectively, for quartiles 1 through 4. The same probabilities reported by DeAngelo and Roll (2015) are 52.9%, 33.2%, 34.4%, and 50.7%.

While persistence is evident, it is not complete. Panel E shows results from regressing board independence on firm and year fixed effects. Firm effects that are constant for the entire time a firm exists in our sample explain 57% of the variation in independence over the century-long panel. Allowing firm effects to change each three decades (e.g., two FEs for a firm that exists between 31 and 60 years in our sample), or including firm-decade FEs, increases the R^2 's to 71% and 82%, respectively. Thus, over a long enough horizon, there are significant changes in board structure within the life of a given firm.

Overall, our descriptive evidence on changes in board composition reveals four main findings. First, there is substantial turnover of board members, especially when there is a change in CEO. Second, changes in board structure, as measured by the independence ratio, are modest

relative to the changes in individual board members. Third, as a result, board structure is fairly persistent, of a degree comparable to that of corporate leverage. Fourth, despite this persistence, over longer horizons there are significant within-firm changes in board structure. In the next section, we explore the economic underpinnings of these changes.

4. Dynamics of CEO tenure, pay and board structure

4.1. Conceptual links between performance, CEO tenure, and board structure

Hermalin and Weisbach (1998) argue that board structure is an endogenous outcome of a bargaining process between the board and the CEO, conditional on firm performance and underlying CEO ability. While CEOs are assumed to prefer less monitoring, when there is uncertainty about the CEO's ability or her perceived ability is low, monitoring is valuable to the board. However, performance observations partially resolve this uncertainty and strong performance increases the board's perception of the CEO's ability, reducing the value of further monitoring. Therefore, when a firm performs well, the CEO is retained and is better able to bargain for reduced monitoring (fewer independent directors on the board and/or the CEO becoming board chair) in addition to higher compensation.

Dynamic agency theory produces similar predictions.¹⁵ In this class of models, the principal (board in our context) controls agency problems by tying the agent's (CEO in our context) current and future payoffs to performance and by maintaining a threat of monitoring or termination. In particular, following good performance, the CEO receives a higher continuation value (higher expected future payoff) in the firm. Since this higher future share of firm value helps align incentives, the termination threat is optimally eased, for example via less intense monitoring

¹⁵ E.g., Zwiebel (1996), DeMarzo and Sannikov (2006, 2017), DeMarzo and Fishman (2007a, 2007b), Bolton et al. (2011), DeMarzo et al. (2012) and Piskorski and Westerfield (2016).

by the board. After a history of success, further incentive alignment becomes less important and thus, the strength of board monitoring decreases and cash compensation increases.

Likewise, continuation value falls after poor performance and the CEO is terminated if it hits a lower bound. DeMarzo and Fishman (2007b) note that termination can also be interpreted as the introduction of a monitoring technology. Piskorski and Westerfield (2016) generate a similar prediction by directly incorporating a monitoring mechanism into the optimal contract: if bad behavior is detected, the CEO is fired and loses her continuation value. Because this penalty is more severe the larger the CEO's stake in the firm, the intensity of monitoring required to maintain incentives (and hence board independence) declines following a history of strong performance.

Thus, bargaining and dynamic agency theories produce many predictions, including (1) board independence declines over a CEO's tenure within a given firm (with board independence increasing at the time of CEO turnover, then decreasing over the CEO's tenure); (2) the reduction in board independence over the CEO's tenure primarily occurs among CEOs who perform well; (3) this relation should become more pronounced when there is less uncertainty about CEO ability; (4) external shocks that reduce CEO power or agency problems attenuate the negative within-firm tenure-independence relation; (5) positive within-firm relations exist between tenure and both chair duality and compensation; (6) regulation that does not directly alter the contracting or bargaining environment may little affect overall board-CEO dynamics; (7) board structure is persistent under reasonable assumptions; (8) CEO turnover is less sensitive to performance when the CEO has a stronger history of performance (and thus is more 'powerful'). Note that many of these are *dynamic, within-firm* predictions, although in the past they have almost exclusively been tested in repeated cross-sections [a point emphasized in the Adams, Hermalin, and Weisbach

(2010) review]. Thanks to our long panel of data, we are able to conduct powerful within-firm tests.

4.2. Empirical analysis of CEO tenure, pay, and board structure

In Fig. 3, we explore the first prediction in a univariate fashion by showing average board independence as a function of CEO tenure at a given firm: Panel A shows that board independence decreases almost monotonically in CEO tenure, by 0.3 percentage points per year. In particular, the independence ratio is about 58% for new CEOs and 51% for those with 25 or more years of tenure. Panel B shows that CEOs with longer tenure are more likely to be board chairs as well. In particular, a one-year increase in tenure is associated with a 1.8 percentage-point increase in the probability that the CEO is a board chair (Prediction 5).

While the univariate results are consistent with the theoretical predictions discussed above, it is not clear whether they truly reflect within-firm (or within-CEO) changes in board structure or whether the types of CEOs that tend to have longer tenures are matched with firms that tend to have less independent boards. We test for a dynamic within-firm relation by estimating the following equation:

$$Board\ outcome_{it} = \alpha_i + \alpha_t + \beta_1 CEO\ tenure_{it} + \beta_2 Firm\ age_{it} + X_{it}'\gamma + \varepsilon_{it}, \quad (2)$$

where $Board\ outcome_{it}$ is either board independence, defined as the ratio of the number of independent directors to total directors, CEO-chair duality, or compensation (defined below); α_i and α_t represent firm and year fixed effects; the other variables are defined in Eq. (1).

To benchmark to the prior literature, in column 1 of Table 4, Panel A we estimate Eq. (2) excluding firm fixed effects and focusing on the most recent 16 years of our sample period (1996 – 2011). The negative coefficient on CEO tenure (-0.317; t -stat = -7.44) is consistent with prior findings (see Baker and Gompers, 2003; Boone et al., 2007; Dikolli et al., 2014 for evidence in

repeated cross-sections of firms, without firm fixed effects) and has been interpreted as providing support for models such as HW. However, when we add firm fixed effects in column 2, the relation between CEO tenure and board independence is insignificant within firms. This contrast demonstrates the importance of controlling for firm effects to isolate within-firm variation in measuring this relation.

In columns 3–5 of Table 4, Panel A, we extend the estimation to our full sample horizon of 1918–2011. Column 3 shows the basic relation between CEO tenure and board independence within firms, including firm fixed effects and firm age (time trend) but without firm-level controls or year-fixed effects. We find that board independence decreases by 0.14 percentage points per additional year of CEO tenure. The effect is statistically significant at the 1% level, and is the first robust evidence of a *within-firm, dynamic* relation between CEO tenure and board independence as opposed to across-firm relations (see footnote 4). The economic magnitude indicates that ten years of CEO tenure would lead to a 1.4 percentage-point ($= 0.14 \times 10$) decrease in the independence ratio, which is about 11% of a within-firm standard deviation of board independence (12.6 percentage points). Thus, despite the persistence in board structure documented above, we show dynamic changes in board structure consistent with theory. These effects are modest in magnitude, which is to be expected given the persistence (Section 3). However, as we highlight below, this average effect masks considerable heterogeneity across firms and time in the relation between CEO tenure and board independence. We show below that the magnitude is larger when theory predicts that it should be.

Column 4 controls for board size and number of officers, as well as additional firm characteristics such as log assets, Tobin's q , and industry-adjusted ROA, and column 5 adds year-fixed effects to control for year-specific variation (including any time trends) in board

independence (and as a result, firm age drops out). These controls have little effect on the coefficient on CEO tenure and its significance level. The positive, significant coefficients on firm age, assets and board size are consistent with the cross-sectional findings in Boone et al. (2007) that board independence is positively associated with firm size and age. Importantly, the negative coefficient on industry-adjusted ROA suggests that CEOs who perform well (relative to industry peers) are more likely to have a less independent board within the same firm. In terms of economic magnitude, from column 5, a one-SD increase in ROA is associated with a 0.217 percentage-point ($= 0.087 \times -2.496$) reduction in the independence ratio.

Though firm fixed effects control for time-invariant firm-level omitted variables, the negative coefficient on CEO tenure could reflect a correlation between average tenure and board independence across CEOs within a firm, rather than a decline in board independence through the tenure of a given CEO. It is not feasible to estimate Eq. (2) with firm-CEO fixed effects, however, because tenure and firm age (or a time trend) are perfectly correlated within each firm-CEO pair. As an alternative, in column 6, we use variation in tenure within a firm-CEO pair as an instrument, following Altonji and Shakotko (1987). Specifically, define \overline{T}_{ij} and $\max T_{ij}$ as the average and maximum tenure for a given firm-CEO pair (indexed by i and j , respectively). We then use $(T_{ijt} - \overline{T}_{ij})/\max T_{ij}$ as an instrument for tenure. Intuitively, this transformation removes any differences in average tenure across firm-CEO pairs and measures the proportion of a given CEO's ultimate tenure that has been realized at each point in time. In this sense, this is a within-CEO measure.

Not surprisingly, the first stage (unreported) finds a very strong relation between the instrument and CEO tenure. The second stage results (shown in column 6) are similar to those in columns 4 and 5. The coefficient on instrumented CEO tenure is significantly negative and slightly

larger in magnitude and statistical significance than the previous estimates. This suggests our previous results reflect within-CEO dynamics and are not simply driven by a cross-CEO relation between average tenure and board independence.

Column 7 estimates Eq. (2) *without* firm-fixed effects over the full sample period, which gives an idea of potential bias in such estimates. Compared to the coefficient in the other columns, the coefficient in column 7 (-0.243) suggests that not isolating within-firm variation may lead to an estimate that is inflated by two-thirds. This significant difference in economic magnitude illustrates another important reason to test the theory within firms.

Our data allow us to identify the within-firm relation between board independence and CEO tenure separately from that of firm age or a time trend because the data span the careers of multiple CEOs per firm. However, the importance of CEO turnovers for our identifying variation raises the question of whether our estimated tenure-independence relation may reflect a CEO turnover effect on board independence that is unrelated to the change in CEO tenure. To control for any turnover-specific effects, in Panel B we include the cumulative number of CEO turnovers per firm as an additional independent variable. The magnitude of the estimated coefficient on CEO tenure is smaller, but still highly statistically significant in this specification.

Dual Chairs and CEO Compensation: Another dimension of board structure that may effectively reduce the monitoring of the CEO is tied to whether the CEO is also board chair. Therefore, in the first column of Panel C of Table 4 we examine whether CEO tenure is related to CEO-chair duality. Column 1 shows results from estimating Eq. (2) with a dependent variable dummy equal to one if the CEO also holds the title of board chair, and zero otherwise. The positive coefficient estimate for *CEO tenure* is the first within-firm evidence consistent with CEOs with long tenure receiving the dual chair role. [Dikolli et al. (2014) find a similar relation in the cross-

section.] In terms of economic magnitude, an additional year of tenure in the same firm is associated with an increase of 2.2 percentage points (significant at the 1% level) in the probability that the CEO becomes board chair.

Dynamic bargaining and agency models also predict that CEO compensation will increase following a history of strong performance. Column 2 shows results from estimating Eq. (2) with a dependent variable of the log of the CEO's total current compensation (salary and bonus). The sample consists of 3,326 firm-years from the combined database of corporate officers and directors merged with CEO compensation data drawn from Frydman and Saks (2010) from 1935 to 1991 and ExecuComp from 1992 to 2011.¹⁶ The significantly positive coefficient on *CEO tenure* indicates that CEOs are rewarded with higher compensation as their tenures increase. In terms of economic magnitude, each additional year of CEO tenure leads to 2.4% higher pay (significant at the 1% level), beyond that associated with year and firm fixed effects and other included controls. In an unreported analysis we confirm a significantly positive within-firm effect of CEO tenure on pay (a 1.2% increase per additional year of tenure) using the full sample of firm-years matched to ExecuComp from 1992 to 2009 (N = 11,715). Thus, consistent with theory, compensation is path-dependent, increasing after a history of strong performance.

4.3. Dynamics of board independence and variation in the CEO tenure effect

Section 3 shows that board structure is persistent, while the previous subsection provides within-firm evidence that board independence declines moderately through a CEO's career on average. The rest of this section explores whether the CEO tenure-board independence relation varies in ways consistent with economic theory. In particular, we examine the relation conditional

¹⁶ We thank Carola Frydman for making the dataset of executive compensation from 1935 to 1991 available. For consistency across the sample, Panel C only analyzes 1992-2011 data for firms that appear in the Frydman and Saks database at least once.

on firm performance, uncertainty about CEO ability, and regulatory changes, in response to shocks to CEO power, and in subsamples of arguably exogenous CEO turnover. We begin by examining board structure year-by-year as a CEO’s tenure increases.

The board is more likely to agree to a weaker monitoring structure when the marginal benefit of monitoring the CEO is lower. In bargaining models, monitoring becomes less valuable as the board’s assessment of the CEO’s ability increases or uncertainty about that ability decreases. Uncertainty about the CEO’s ability is likely to be highest when the CEO is new to the job and declines after the board has time to evaluate her performance (Pan, Wang, and Weisbach, 2015). In dynamic agency models, monitoring is less valuable when the agent has performed well and as a result accumulated large promised pay, which mitigates agency problems.

We therefore examine how board independence changes upon CEO turnover and how it evolves thereafter. Because the level of the CEO’s perceived ability and promised pay should depend on the history of performance, we also study how the dynamics of board independence vary with firm performance. We explore these issues by estimating the following equation:

$$Independence_{it} = \alpha_i + \alpha_t + \sum_{k=0}^{12} \gamma_k d_{it}[k] + X_{it}'\delta + \varepsilon_{it}. \quad (3)$$

The key independent variables in Eq. (3) are a set of dummy variables, $d[0], \dots, d[12]$, corresponding to the firm-year observations from the year of CEO turnover to 12 years after the turnover. “Year -1” observations are also included in this analysis, serving as the baseline level. As before, this specification includes firm fixed effects, and thus examines within-firm dynamics following CEO turnover. We exclude CEO changes after 2002 from the sample because the analysis requires a post-turnover period. We also require that the previous CEO had at least two years of tenure, and that we have data for the firm in year 1.

1. Board dynamics conditional on firm performance. In this subsection, we explore how the dynamics of board independence vary with proxies for perceived CEO ability or uncertainty about that ability, using a sample of 3,843 turnovers from 1920 to 2002 for which the new CEO is a corporate insider.¹⁷ We focus on new insider CEOs because appointment of outsiders could affect board structure for reasons different than those related to the board's monitoring, which is our primary focus. In Appendix B, we separately examine the effect of CEO turnover on board independence when the new CEO is an outsider.

Fig. 4 presents coefficients estimated from Eq. (3). Panel A presents the percentage of board members who are independent, relative to the firm-level average and after controlling for year fixed effects and firm characteristics. The y-intercept indicates that among firms appointing an insider CEO following the departure of the previous chief executive, board independence jumps in the year of turnover by about 0.58 percentage points (red dashed line).¹⁸ The increase is statistically significant at the 1% level and is about four times the average annual change estimated in Table 4 (Panel A).¹⁹ This finding is consistent with greater value of board monitoring following a discrete jump in uncertainty about CEO ability or a smaller continuation value for the new CEO.²⁰

The blue solid line in Panel A represents the subset of new internal CEOs who are ultimately employed by their firms for at least 12 years. Hence, this analysis avoids possible changes in sample composition and focuses on CEOs who are successful enough to achieve long

¹⁷ There are about twice as many insider- than outsider-appointed CEOs in our sample over the 1918-2011 period.

¹⁸ In Eq. (3) and Figure 4 only, we start our analysis of a given CEO at $t-1$ in order to observe the jump in board independence that occurs at CEO turnover.

¹⁹ Dikolli, Mayew, and Nanda (2014) document an increase in board independence following CEO turnover among ExecuComp firms during 1996-2005. Denis and Sarin (1999) document that changes in board structure are stronger around executive turnover.

²⁰ By contrast, results discussed in Appendix B show a significant decline in board independence when a new external CEO is hired. This is consistent with the initial importance of the advisory role of an insider board to an external CEO, as opposed to the bargaining power and incentive effects that appear to dominate for internal CEO appointments.

tenure. The blue solid line shows that board independence increases in the year of turnover (insignificant) and decreases afterward. The decreases from year t to years $t+10$ and $t+12$ are -1.63 (t -stat = -1.88) and -2.37 (t -stat = -2.38). The decline in board independence is more pronounced than for the full sample, which may be because these CEOs survive longer as a reflection of superior performance early in their careers (hence less monitoring is needed). We examine this superior performance conjecture in Panel B. The decrease in board independence that occurs over time is also consistent with less intense monitoring occurring as uncertainty about CEO ability is resolved.

In Panel B, we compare less successful CEOs (those with below-median industry-adjusted ROA averaged over the first three years in office) in the red dashed line to more successful CEOs (above median) in the blue solid line. Despite similar increases in the year of turnover, board independence decreases faster for CEOs with better operating performance (ROA) in the early years of tenure. As in Panel A, this finding is consistent with economic theory in that the value of monitoring declines as the CEO accumulates a history of strong performance. By contrast, there is little, if any, reduction in board independence for CEOs who fail to send a positive signal through good initial performance.

In column 8 of Table 4, Panel A, we further test the impact of performance on the tenure-independence relation by modifying Eq. (2) to include an interaction between CEO tenure and the firm's industry-adjusted ROA over the first three years of the CEO's tenure. The estimated interaction term is negative and significant at the 10% level. For example, a one-SD increase in ROA (0.079) would decrease the tenure-independence relation by 0.047 ($= -0.597 \times 0.079$), which is about a 32% change relative to the baseline (-0.148). These findings are again consistent with performance history driving the decline in monitoring intensity over the CEO's tenure.

We note that the CEO succession process (e.g., Vancil, 1987; Hermalin and Weisbach, 1988) is potentially an alternative explanation of the documented change in board independence. In particular, toward the end of a CEO's tenure the board may add additional directors who are candidates to become the next CEO. If these succession candidates are primarily insiders, this would push down board independence pre-turnover; and if the losing candidates leave the board right after the CEO change, this would increase board independence following CEO turnover.

We empirically examine whether such a CEO succession process can account for the board dynamics we find by re-estimating Eq. (3) after excluding potential CEO candidates from our calculation of the board independence measure. Specifically, we exclude directors who were added to the board within two years before a CEO turnover (i.e., years $t-2$ and $t-1$) and subsequently depart at turnover (Hermalin and Weisbach, 1988).²¹ Results are very similar to those in Panel A of Fig. 4 (unreported), suggesting that director turnover related to the CEO succession process does not drive the negative within-CEO relation between tenure and independence.²²

2. Death- and health-related CEO turnover and board dynamics. Assigning a causal interpretation to the dynamics of board structure is difficult because unobserved changes at the firm (e.g., variation in investment opportunities or strategy) may drive both CEO turnover and board independence (e.g., Casamatta and Guembel, 2010). To address this challenge, we study a subsample of CEOs for which turnover occurs for plausibly exogenous reasons due to death or serious health issues of the previous CEO.²³ This analysis also highlights how the CEO tenure effect on board independence varies with perceived CEO ability and related uncertainty. First,

²¹ We find qualitatively similar results when we exclude directors who joined the board within three years before CEO turnover then depart.

²² When we exclude only dependent directors who join just prior to CEO turnover and leave in the year of turnover, we find little increase in board independence in the year of turnover, but a similar decline in independence through the CEO's tenure. Thus, while departure of losing CEO candidates may account for some of the jump in board independence at turnover, succession planning does not fully account for within-firm dynamics after turnover.

²³ See Appendix C for details about how we form this sample.

CEOs appointed in sudden death/health transitions are likely to have less power than their predecessors, relative to new CEOs in the typical insider transition depicted in Panel A of Fig. 4. (Consistent with this conjecture, we find that the CEOs who died in office had longer tenure, and were much more likely to have been board chair, relative to typical CEOs who leave office.) Additionally, these firms will have had less opportunity for succession planning and grooming the new CEO, increasing uncertainty about her ability in the job.

We estimate Eq. (3) using the 96 death and health CEO turnover events that we are able to match to our CEO and board database in which the new CEO is an insider. Estimates in Panel C of Fig. 4 are consistent with the results for the full sample: These CEO turnovers lead to an immediate increase in board independence of 1.62 percentage points in the year of turnover (significant at the 10% level). After this relatively sharp increase in board independence, a modest decrease occurs in year 6, and the decrease sharply accelerates in year 10.²⁴

We also re-estimate Eq. (2) using these CEO death and health events as an instrument for CEO tenure. For this estimation, we limit the sample to only the year before and the year of the CEO turnover and use turnover events through 2011. Thus, the only source of variation in CEO tenure in this sample is the death or health-driven departure of the prior CEO. The results (untabulated) from the first stage indicate that an exogenous CEO turnover is associated with an average reduction in CEO tenure of about 8 years. The second stage shows an additional year of tenure is associated with a reduction in board independence of 0.21 percentage points (significant at the 10% level), which is slightly larger than our baseline estimates in Table 4.

3. Hedge fund activist shock. External shocks to CEO power can potentially limit the ability of the chief executive to negotiate for reduced board independence as tenure increases. Additionally,

²⁴ We note that the similarity between results for unexpected departures and those for the full sample further indicates that our results are not driven by succession planning.

external monitoring (for example, by large active shareholders) can substitute for internal monitoring, weakening the relation between internal monitoring and performance history. We investigate how hedge fund activism affects the CEO tenure-board independence relation (see, e.g., Brav et al., 2008). Large active shareholders can limit the influence of CEOs (and management in general) on operations and governance of the firm, including selecting directors (Shleifer and Vishny, 1986). We draw events of activist hedge funds targeting public firms from an extended version of the sample used in Brav et al. (2009) from 1994-2008, matched to our database of directors and officers. We estimate the following equation to study whether activist investor events affect the relation between CEO tenure and board independence within firms:

$$\begin{aligned}
 Independence_{it} = & \alpha_i + \alpha_t + \beta_1 CEO\ tenure_{it} + \beta_2 CEO\ tenure_{it} \times Target_{it} + \\
 & \beta_3 CEO\ tenure_{it} \times Target_{it} \times After_{it} + X_{it}'\gamma + \varepsilon_{it},
 \end{aligned} \tag{4}$$

where dummy variable *Target* is equal to one for firm-years that are targeted by an activist hedge fund²⁵ plus or minus 10 years relative to year *t*, and zero otherwise; and *After* equals one for the 11 firm-years in and after the targeting year, and is zero otherwise. In addition to these targeted firms, we include non-targeted firms from 1984 to 2011, resulting in a sample of 34,279 firm-years.

Table 5 shows estimation results for Eq. (4). The significantly negative coefficient on *CEO tenure* confirms that long-tenured CEOs face less independent boards in this subsample, consistent with the baseline result. The negative coefficient on *CEO tenure* × *Target* (-0.127) suggests that prior to actual targeting, the ultimately targeted firms exhibited a stronger effect of tenure on board independence, although this interaction effect is insignificant. The key coefficient of interest, *CEO*

²⁵ We follow Brav et al. (2009) and define activist investor targeting as when the fund files Schedule 13D filings indicating that it owns at least 5% of any class of a company's shares and intends to influence corporate control. They supplement this sample using news searches to identify activism events at large companies in which the activist holds an ownership stake between 2% and 5%.

tenure × *Target* × *After* (0.326, *t*-stat = 2.18), shows that relative to years before activism, the effect of CEO tenure on board independence is significantly reduced after targeting. As a result, the effect of CEO tenure on board independence turns positive ($0.118 = -0.081 - 0.127 + 0.326$) and statistically insignificant (*p*-value = 0.34). Our evidence is consistent with activist investors disrupting the influence of powerful CEOs on boards and/or external monitoring by activists substituting for internal monitoring. In untabulated analyses, we find that the effect of activist investors is significant up to seven years post-targeting, consistent with a long-term effect on governance. We also find that the coefficient on *CEO tenure* × *Target* × *After* is significantly positive when governance (e.g., seeking board seats, ousting the CEO) is a stated objective of the activist and insignificant when governance is not one of the listed objectives.

4. *CEO tenure and governance outcomes following 2002-2003 regulations.* Table 6 examines the association between CEO tenure and board independence, chair duality, and CEO compensation for years before and after 2002. During 2002-2003, new regulations and laws (e.g., imposed by SOX, NYSE, and NASDAQ) began to require that the majority of directors be independent (Chhaochharia and Grinstein, 2007; Linck et al., 2008; Duchin et al., 2010). These regulations therefore might attenuate the relation between CEO tenure and board independence. Consistent with this conjecture, the coefficient on *CEO tenure* × *Post 2002* is 0.100, suggesting that after 2002, CEO tenure has essentially no impact on board independence ($-0.147 + 0.100 = -0.047$; *t*-stat = -0.86). This result is consistent with the new regulations ending the effect of CEO tenure on board independence. This may explain the lack of a relation between CEO tenure and board structure in Coles et al. (2014), given their 1996 – 2010 sample period (and in our results over that same horizon in column 2 of Table 4, Panel A).

While the regulations increased board independence as intended, Hermalin and Weisbach (1998, p. 111) argue that “As long as the bargaining process [between the CEO and board] itself is unaffected by reforms, the equilibrium will be little affected.” Thus, we might expect to find that successful CEOs receive greater rewards in other dimensions. In a dynamic contracting context, if regulation forces a firm away from the efficient level of monitoring, they may use other dimensions to restore the optimal contract. Consistent with these implications, the coefficient on *CEO tenure* × *Post 2002* is 0.005 (*t*-stat = 2.58) in column 2, indicating that the years after the 2002 regulations saw increased chair duality for long-tenured CEOs. This result is consistent with a substitution towards a dual chair role (and thus less monitoring) due to higher board independence (and thus more monitoring) following the implementation of Sarbanes-Oxley and related regulations. More generally, in Appendix Table 1, Panels A and B, we find evidence for this substitution effect between board independence and chair duality over the past century. Specifically, across the century, in sub-periods when the within-firm relation between CEO tenure and board independence is weaker, the within-firm relation between tenure and the CEO being appointed board chair is stronger. Column 3 in Table 6 explores whether the regulations affected compensation. The coefficient on *CEO tenure* × *Post 2002* is 0.014, suggesting somewhat higher compensation post-2002, although this coefficient is insignificant.

5. Effect of CEO power on CEO turnover-performance sensitivity

The evidence above is largely consistent with CEOs being monitored less intensely and gaining power over their tenure. Does this imply that the jobs of successful and powerful CEOs are relatively protected, and if so, do long-tenure CEOs eventually become entrenched and adversely affect firm value? To investigate these questions, we start by examining CEO

replacement conditional on performance.²⁶ Bargaining models like HW, in which the board learns CEO ability from realized performance, predict that previously successful CEOs would be optimally fired less often conditional on poor current performance. Likewise, in dynamic contracting models, a history of good performance results in continuation values well above the termination threshold, making termination less sensitive to current performance.

We begin by estimating a linear probability model with firm fixed effects to predict CEO turnover from 1918 to 2011, conditional on firm performance and CEO power (for analysis on modern data, see Weisbach, 1988; Warner and Watts, 1988; Jenter and Lewellen, 2014). Specifically, we estimate the following equation using Ordinary Least Squares:²⁷

$$\begin{aligned}
 CEO\ turnover_{it} = & \alpha_i + \alpha_t + \beta_1 \Delta ROA_{it} + \beta_2 \Delta ROA_{it} \times Power_{it} + \beta_3 Excess\ return_{it} \\
 & + \beta_4 Excess\ return_{it} \times Power_{it} + \beta_5 Power_{it} + X_{it}' \delta + \varepsilon_{it},
 \end{aligned} \tag{5}$$

where $CEO\ turnover_{it}$ is a dummy variable equal to one if the current CEO is different from the previous year's CEO, and zero otherwise; ΔROA_{it} is the change in return on assets; $Excess\ return_{it}$ is the stock return minus value-weighted market return from CRSP; $Power$ is one of four proxies that measure bargaining power or superior past performance: Board independence, CEO-chair duality, ROA or stock returns over the past three years, and CEO tenure (Adams, Almeida, and Ferreira, 2006; Morse, Nanda, and Seru, 2011);²⁸ X_{it} is a vector of firm-level controls including CEO tenure, log book assets, and Tobin's q for firm i in year t ; and standard errors are clustered at the firm level.²⁹ We are the first to enhance the specification in Weisbach (1988) and Warner

²⁶ We proxy for the decision to fire the CEO using a CEO turnover dummy equal to one if the current CEO is different from the previous year's CEO, and equal to zero otherwise (see, e.g., Jenter and Lewellen, 2014).

²⁷ We find qualitatively similar results using logit models with firm fixed effects (i.e., conditional logit).

²⁸ In the presented analysis, we use a dummy variable for the top (ROA, stock return, and tenure) or bottom quartile (independence) of the full sample to define powerful CEOs (except for the dual chair dummy). Our results are robust to alternative specifications that use other percentiles of distributions (e.g., the median) or continuous variables to measure CEO power.

²⁹ CEO age is not available in Moody's or Mergent; thus, we do not include it as a control variable.

and Watts (1988) by including firm fixed effects to account for unobserved firm-level heterogeneity in the propensity to replace the CEO. We also estimate on many more decades of data, many of which are out of sample relative to previous research. When stock returns are included in the equation, we confine the estimation to the years after 1925 to align with the availability of CRSP data.

We first benchmark that CEO turnover is significantly negatively associated with performance, as measured either by ROA or excess stock returns, consistent with prior research (see Appendix Table 2).³⁰ Our focus is on the effects of CEO power on CEO turnover-performance sensitivity. We start with the classic proxy for monitoring intensity of the board: the board independence ratio. Column 1 of Table 7 shows that less independent boards are associated with significantly lower operating performance sensitivity of CEO turnover. Our result is based on within-firm variation and is consistent with Weisbach's (1988) cross-sectional finding. Column 2 uses a dummy variable for CEO-chair dual title as a proxy for CEO power and shows that dual chair-CEOs face a significantly lower sensitivity of turnover to performance measured by either changes in ROA or excess stock returns (see Goyal and Park, 2002 for cross-sectional evidence).

Next, we directly examine whether CEOs who have performed well in the past three years face different turnover decisions conditional on current performance. Column 3 (4) defines power based on firms with ROA (stock returns) in the past three years in the top quartile. Consistent with good past performance reducing turnover sensitivity, we find that current performance has little effect on turnover propensity for CEOs who performed well over the past three years. Lastly, column 5 measures CEO power with a "long tenure" dummy which is equal to one if CEO tenure is larger than its third quartile (nine years) and shows that longer tenured CEOs face little more

³⁰ See, for example, Warner and Watts (1988), Weisbach (1988), Murphy and Zimmerman (1993) and Jenter and Lewellen (2014).

than half the stock return-turnover sensitivity of less tenured CEOs.³¹ Overall, these results are consistent with powerful CEOs being somewhat shielded from board monitoring and, in particular, the risk of being fired due to poor firm performance.

6. Market reaction to sudden departures of CEOs

The results in the previous sections are consistent with bargaining or dynamic contracting affecting board structure and chief executive retention decisions. These findings beg an important question: Do CEOs who have gained power through a history of superior performance in a given firm continue to add value to the firm (consistent with them having “high ability” or a larger stake in the firm), or do they become entrenched and potentially reduce value *ex post*? To address this question, we examine market reactions to CEO turnover, conditional on the power or past success of the departing CEO. To examine plausibly exogenous CEO turnover, we use events of death and health-related CEO turnover from 1950 to 2011 (see, e.g., Bennedsen, Perez-Gonzalez, and Wolfenzon, 2010; Jäger, 2016).³² We first estimate excess daily stock returns using a market model:

$$\varepsilon_{it} = R_{it} - R_{mt} \tag{6}$$

from day -2 to day +2, where R_{it} is the rate of stock return for firm i on day t , and R_{mt} is the rate of return for the market portfolio (“vwretd” from CRSP). We compute cumulative excess returns during the [-2, +2] window around the announcement of CEO turnover by compounding the daily excess returns.³³

³¹ Dikolli et al. (2014) show that performance-related CEO turnover declines in CEO tenure for Execucomp firms. As mentioned above, our analysis includes firm fixed effects and hence tests the within-firm theoretical prediction.

³² Previous research finds generally weak *average* announcement returns around CEO turnover due to death of the CEO (see, e.g., Johnson et al., 1985; Jenter et al., 2016).

³³ The results are robust to alternative event windows such as [-3, +3], [-2, +3], and [-1, +2].

See Appendix C for details on how we gather data on CEO death and health events. To increase sample size, in this section we include NASDAQ firms in addition to NYSE/AMEX firms. This sample selection process results in 336 events with matched information on directors and officers. The average cumulative abnormal return for death and health events is 0.82%, which is similar to the 0.66% average buy-and-hold-abnormal return during the month of death announcement documented by Jenter, Matveyev, and Roth (2016).

Table 8 shows the results of regressing cumulative excess return in response to plausibly exogenous CEO turnover on various proxies for CEO power: (1) A dummy for CEO tenure above the third quartile, (2) a dummy for whether the CEO is board chair, and (3) a dummy for whether the CEO is the founder of the firm. Across the columns of Panel A, death-related CEO turnover is associated with 3.1% to 3.9% higher announcement returns when the departing CEO was more powerful, and the differences are significant at the 1% to 5% levels. In contrast, departures of CEOs who had relatively little power before leaving office entail insignificant announcement returns ranging -1.3% to 0.2%, as captured by the intercepts.³⁴ Panel B uses data on both death and health-related events and provides similar evidence. These findings are consistent with the argument that powerful CEOs can become entrenched or extract excess pay, and thus removing these CEOs (which presumably would have been costly without a death occurrence) would increase shareholder value. Note that the economic magnitudes of our estimates in Table 8 are

³⁴ Salas (2010) finds that market reactions to deaths of older, longer tenured, and founder CEOs are significantly positive only when their firms performed poorly in the years prior to the death. Johnson et al. (1985) find positive reactions to the deaths of founder CEOs. In a contemporaneous paper, Jenter et al. (2016) find a negative market reaction to the deaths of founder CEOs, which they interpret as reflecting the value of CEO-firm matching. They find positive market reactions to the deaths of old founders and in some specifications, long-tenure CEOs. Our analysis in this section complements these findings by using comprehensive data on CEO death-driven turnovers from 1950 to 2011 and documenting how the market reacts to the death of a CEO conditional on several measures of CEO power. Thus we tie our findings to dynamic bargaining and contracting models that we rely on as a theoretical framework.

similar to those in Taylor (2010), who uses a structural model to estimate that shareholder value would increase by 3% if the perceived cost of removing (entrenched) CEOs was eliminated.

Does entrenchment fit with the bargaining and contracting models we rely on as a framework? On the one hand, in dynamic learning models such as HW, CEOs who achieve long tenures and gain power over the board are those perceived to be of high skill. However, as HW discuss, if insiders prefer to retain the incumbent CEO and the board becomes less independent over time, such a framework could lead to entrenchment ex-post. This finding can also be interpreted as consistent with dynamic contracting in that ex-post entrenchment (as a non-pecuniary benefit) may provide the agent incentives ex ante. The positive market reaction is also consistent with promised future rents to the CEO reverting back to the firm upon the CEO's death. Thus, we might think of these positive market reactions as an ex-post measure of the cost of agency conflicts, even if firms are ex ante optimizing board structure conditional on these frictions.

7. Conclusion

We analyze more than 87,000 firm-year observations over 94 years to explore dynamic interactions between the CEO and board of directors. Our long panel of data allows us to investigate potentially slow-moving governance and contracting processes. We find that board structure is persistent: board independence lagged 10 or 20 years is by far the strongest predictor of current period board independence, suggesting that a board once weakened (or strengthened) may remain so far into the future. Future research should attempt to uncover the frictions or other forces behind this persistence.

Despite persistent board structure, our long sample enables us to examine whether the board changes that do occur are consistent with economic theory. We provide robust within-firm

evidence largely consistent with the rich, within-firm governance predictions of bargaining and dynamic contracting models. Consistent with successful CEOs gaining power or higher continuation value at their firms, we find that board independence decreases as a given CEO's tenure increases. CEOs also are more likely to become board chair and earn higher compensation over their tenures. The within-firm CEO tenure-board independence relation is attenuated in circumstances that plausibly reduce relative CEO power or mitigate agency problems, such as being targeted by activist investors. The relation strengthens when board incentives to monitor weaken, such as following strong corporate performance or a decline in uncertainty about the CEO's ability.

We explore CEO turnover in detail. There is a jump in board independence when a new internal CEO is appointed, consistent with the new CEO being relatively less powerful and lacking a history of good performance. In contrast, boards become less independent when an external CEO is hired, consistent with external CEOs benefiting more from the advice of insider directors than from monitoring. We also find that powerful CEOs and those with a history of strong performance are less likely to be replaced conditional on poor current performance. Given this greater job security, we investigate whether powerful CEOs might become entrenched in the sense that an unexpected departure would increase firm value. We find no market reaction to the typical CEO death, but a positive reaction when powerful (long-tenure, dual board chair, founder) CEOs die in office.

Overall, our evidence is consistent with the life-cycle of powerful CEOs being that they are successful early in their careers and hence gain power within their firms, which leads to job security, dual chair roles and greater pay, and eventually leads to powerful CEOs becoming entrenched (on average). Given that these results are likely to be equilibrium outcomes of a

dynamic bargaining or contracting process, our tests do not always allow us to prove causality of these results, but they do suggest interesting avenues for future research.

Many of our results are consistent with multidimensional contracting and bargaining between CEOs and the board. We find evidence that new regulations succeeded in reducing the relation between board independence and CEO power but did not prevent other outcomes, such as the CEO being appointed board chair, perhaps in substitution for increased board independence post-regulation. Thus, not finding evidence of a negative relation between board independence and CEO tenure post-2002 does not necessarily mean that CEO-board dynamics do not occur – they might still occur in other dimensions.

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Appendix A - Robustness tests for subsamples and firm survival

In this appendix, we describe two robustness tests. First, we split the full sample into subsamples by time period to examine whether the effect of CEO tenure on board structure is robust in various sub-periods. Second, we repeat our estimation using subsamples consisting of firms that survive for more than T years, where T=2, 5, 10, or 15.

Appendix Table 1 presents results for these tests. Columns 1 to 3 of Panels A (board independence) and B (CEO-chair dual title) split the full sample into three non-overlapping time periods (1918-1947, 1948-1977, and 1978-2011) and find that the board independence-CEO tenure effect generally decreases over the century. In Panel C, we estimate Eq. (2) for subsamples consisting of firms that exist in the database more than 15 years (or more than 10 years, etc.). Subsetting in this manner allows us to examine whether our within-firm results hold for firms with a long history and therefore are not driven by sample composition effects (new or short-lived firms entering the full sample). Column 1 shows the baseline estimate from column 5 of Table 4, Panel A as a basis for comparison. Across the columns, the coefficients on CEO tenure are very similar, suggesting that our results are in fact driven by (long) within-firm dynamics.

Appendix B – External CEO appointments

In this appendix, we examine board dynamics when a new, external CEO is appointed (i.e., not a previous officer of the firm). Given that a new outsider CEO likely has less experience or expertise with the firm than does an insider, hiring an outsider may increase the benefit of having inside directors on the board, due to their ability to provide firm-specific advice. (Mace, 1971; Adams and Ferreira, 2007 examine board advice.) In Panel D of Figure 4, the patterns differ from those in the earlier panels. Board independence *decreases* by 2.8 percentage points in the turnover year when the new CEO is an external hire, in stark contrast with results for new internal CEOs. The decrease is significant at the 1% level. Thus, the negative relation at turnover documented above between CEO tenure and board independence reverses when the benefits of an insider board are greater.

Board independence increases rapidly in the first few years of an outsider CEO's tenure, offsetting most of the initial decline by year t+6. The increase from years t to t+6 is significant at the 1% level. This pattern is consistent with the new external CEO gaining more experience within the firm, reducing the need for internal advisor-directors on the board. Board independence eventually shows the familiar decrease after year t+9, with the decrease from t+9 to t+10 significant at the 10% level. Overall, the dynamics of board structure for external CEO appointments seem consistent with the advantage of inside advice playing a dominant role initially, in contrast to the monitoring effects that appear to dominate for internal CEO appointments and later in the tenures of both internal and external CEOs.

Appendix C – Construction of the sample of CEO death and health events

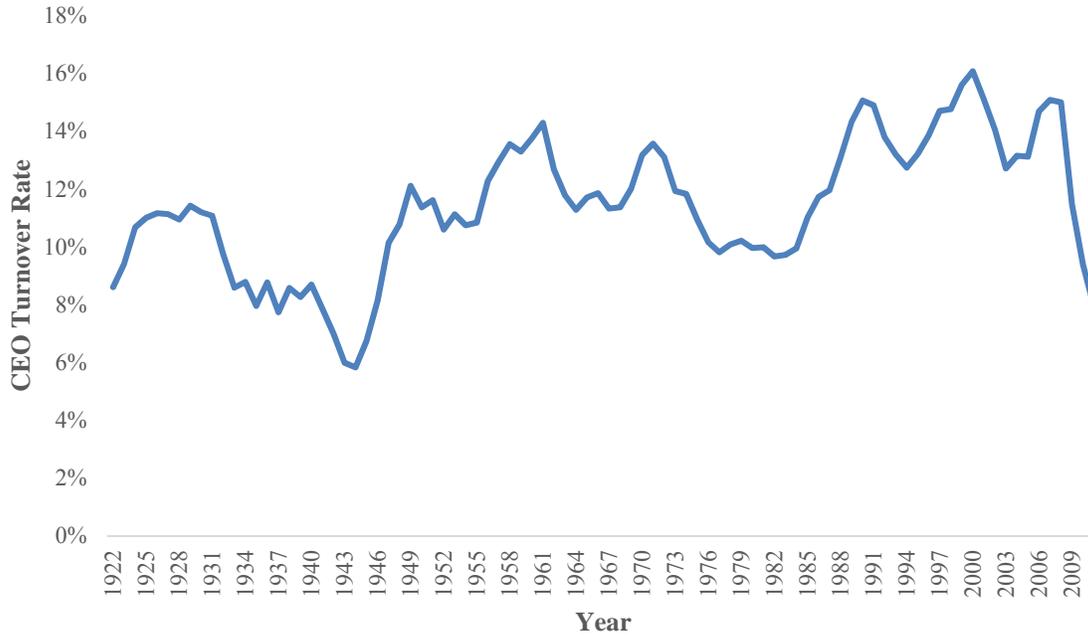
We start with CEO death and health-related events from Salas (2010), Fee, Hadlock, and Pierce (2013) and Quigley, Crossland, and Campbell (2017) from 1972 to 2008, 1989 to 2006, and from 1950 to 2011, respectively. We supplement these data with our own data collection. Specifically, we use the following sources to ascertain whether the previous CEO died or had serious health problems (such as cancer or a heart attack) that forced her to step down. First, we collect names of CEOs who died in office and the dates of death from the obituary section of Standard and Poor's Register of Corporations, Directors, and Executives ('S&P Register') from 1950 to 2011. Second, we use news searches to collect additional CEO changes due to death or health reasons at public firms from 1968 to 2011. Third, we supplement this set of death and health events by examining all CEO turnovers in our database from 1973 to 2011 that are not identified above and determine whether they are due to death or serious health issues of the CEO by searching for news articles using Factiva. (News articles from Factiva are sparse prior to the mid-1970s.)

To determine the announcement date of the event, we first obtain dates (or often year-months) of CEO deaths from the obituary section of S&P Register, as well as from Salas (2010), Fee et al. (2013) and Quigley et al. (2017). Second, we search news articles for these CEO death and health events using Factiva and other sources, to identify the exact announcement date of death or health-related events. If there are multiple news articles, we use the first publication date as the event date. We also collect founder status from the news articles. Lastly, we match each of these events with our officer and director database using firm identifiers, names, and event dates.

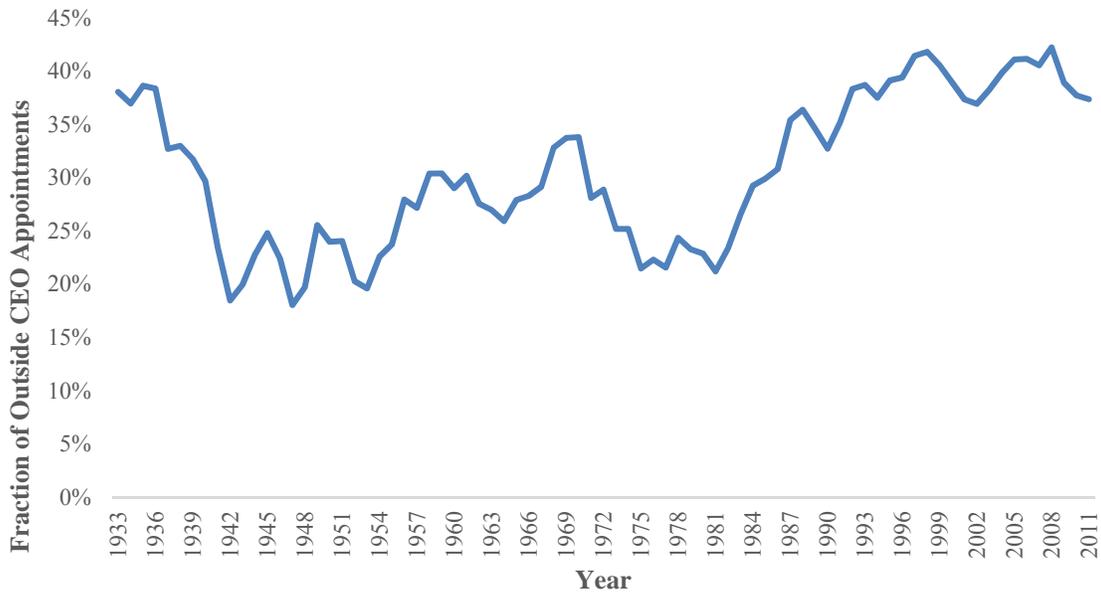
Figure 1: Long-run CEO and board trends

This figure shows annual means of CEO turnover (Panel A), the proportion of non-affiliated CEO appointments (Panel B), board independence (Panel C), and the percentage of CEOs who are also board chairs (Panel D). Panels A and B plot three-year moving averages. For Panel C, the sample begins in 1933 given that identification of dependent directors relies on historical observations for given firms.

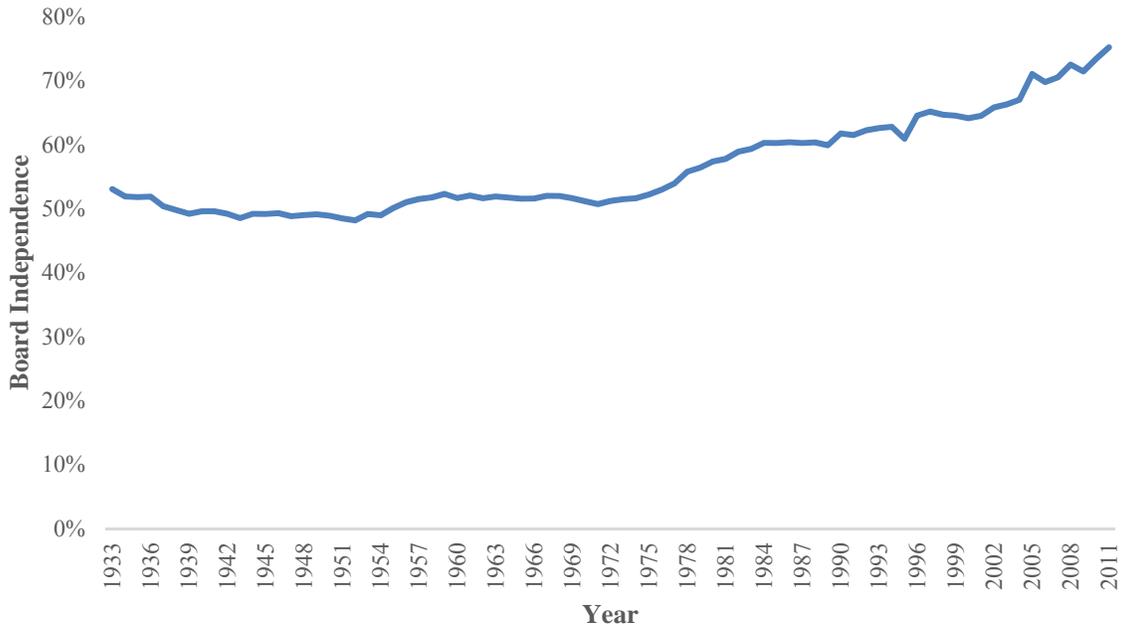
Panel A: CEO turnover (3-year moving average)



Panel B: Outside CEO appointment (3-year moving average)



Panel C: Board independence



Panel D: CEO-chair duality

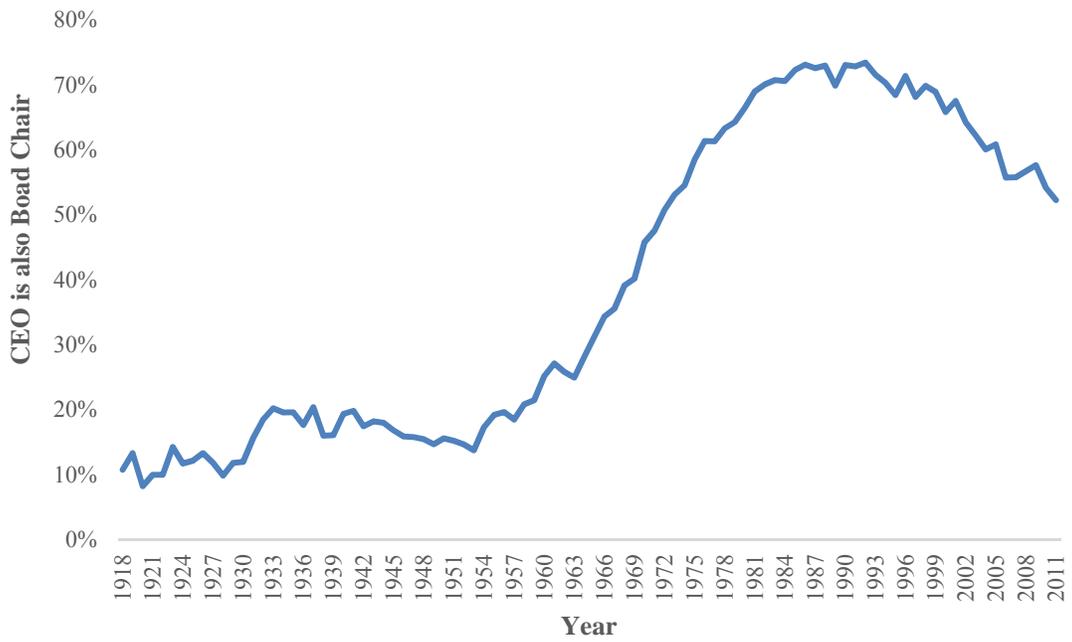


Figure 2: Persistence of board independence

This figure presents the dynamics of board independence for firms sorted into quartiles based on the initial level of the board independence ratio. Specifically, for each calendar year, we form groups by ranking firms based on their independence ratios and compute the groups' average board independences for the next 30 years. We repeat this process for all calendar years and report the average across all the calendar years.

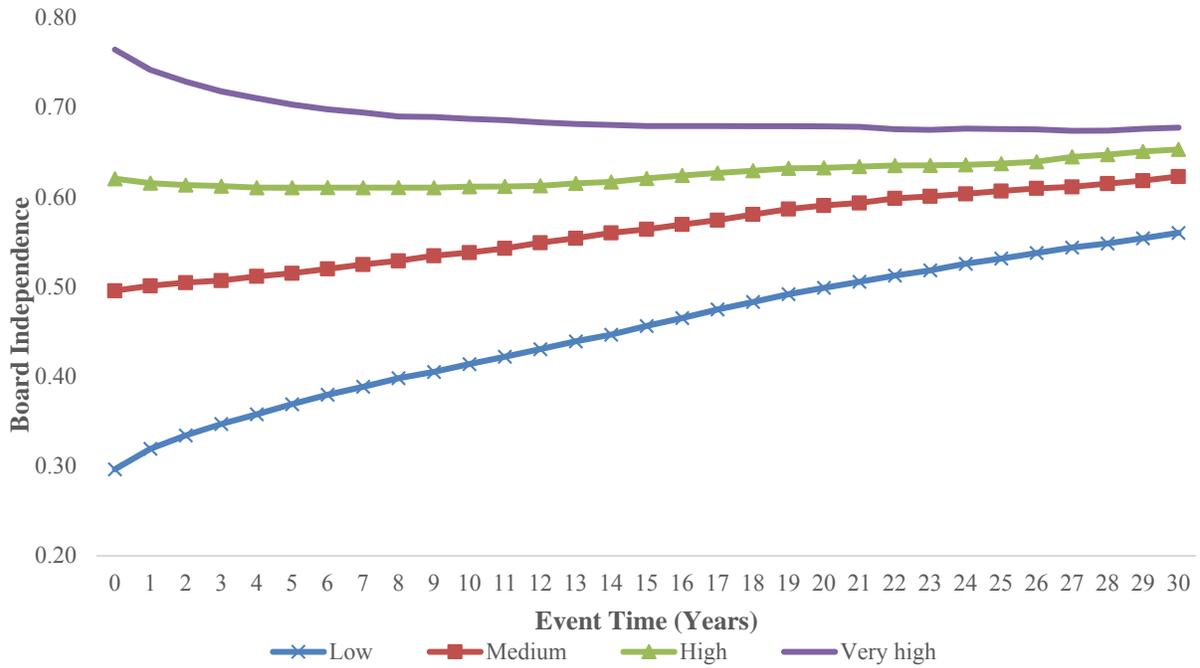
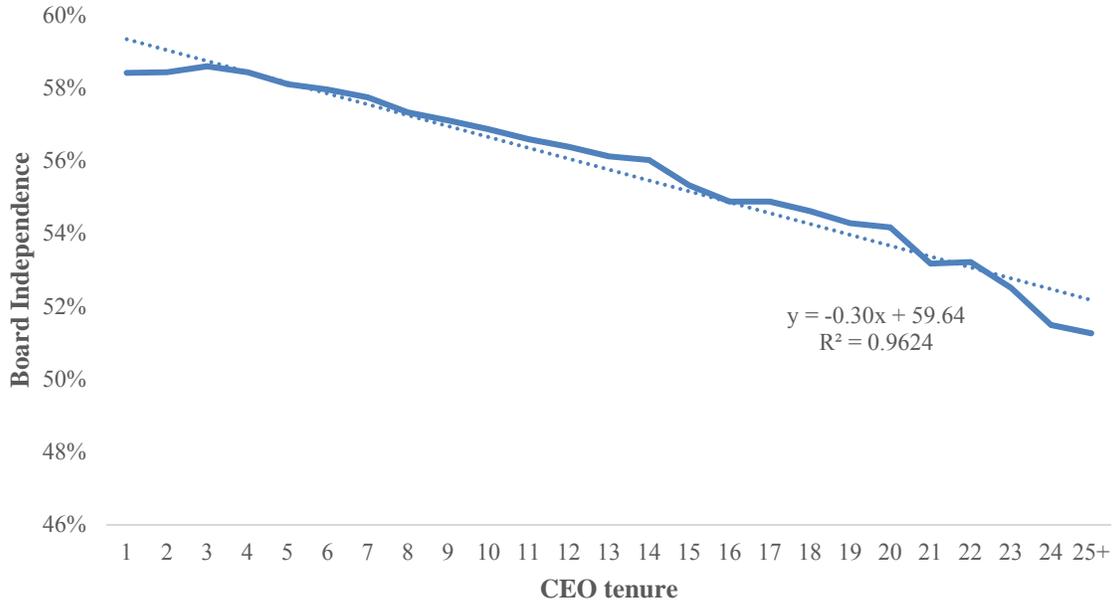


Figure 3: Non-parametric relation between CEO tenure, board independence, and CEO-chair duality

This figure shows the univariate relation between CEO tenure and board independence (Panel A) and CEO-chair duality (Panel B). Board independence is measured by the ratio of the number of independent directors to all directors (see Table 1 for definition). Firm-years with at least two directors are included in the figures. CEOs with 25 or more years of tenure are shown as 25+. The straight line is a linear trend.

Panel A: Board independence ratio



Panel B: CEO-chair duality

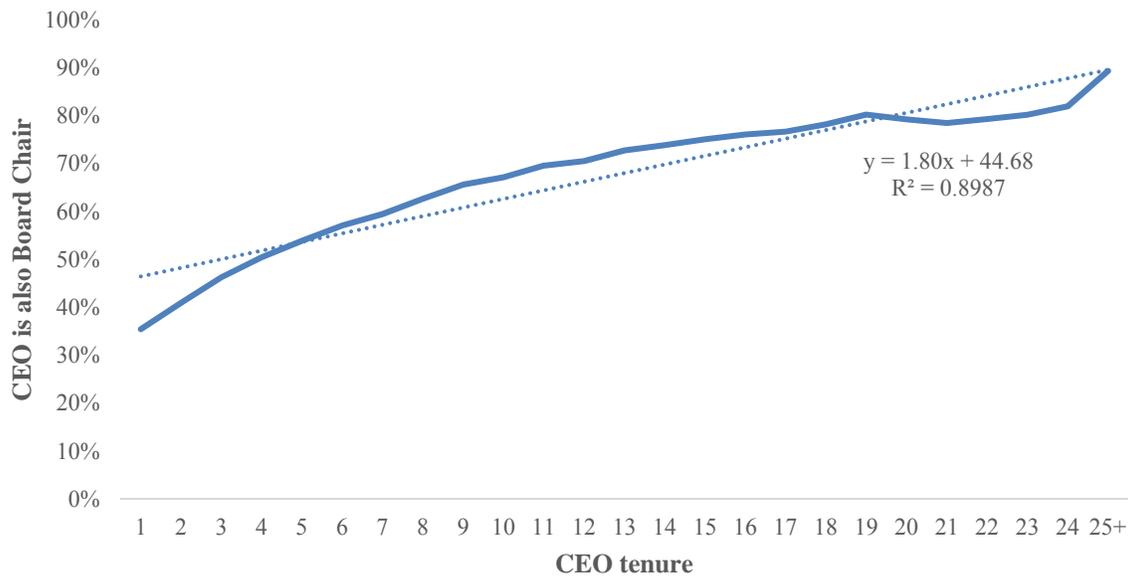
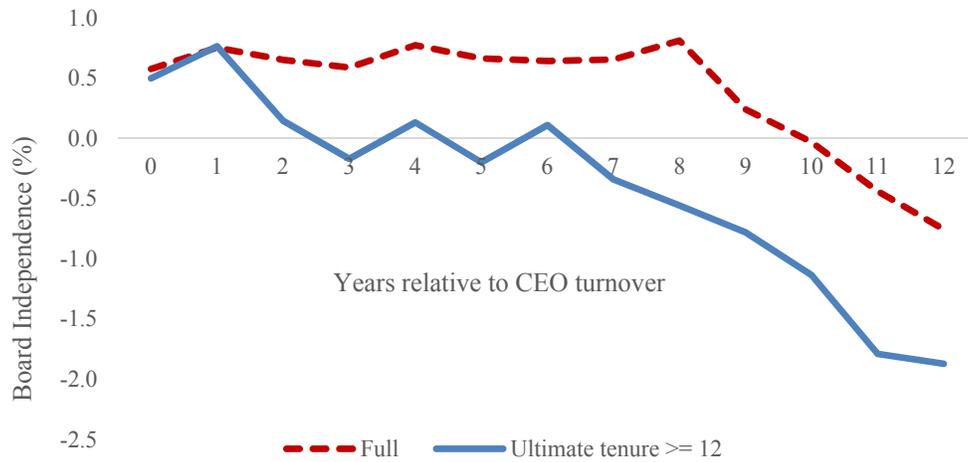


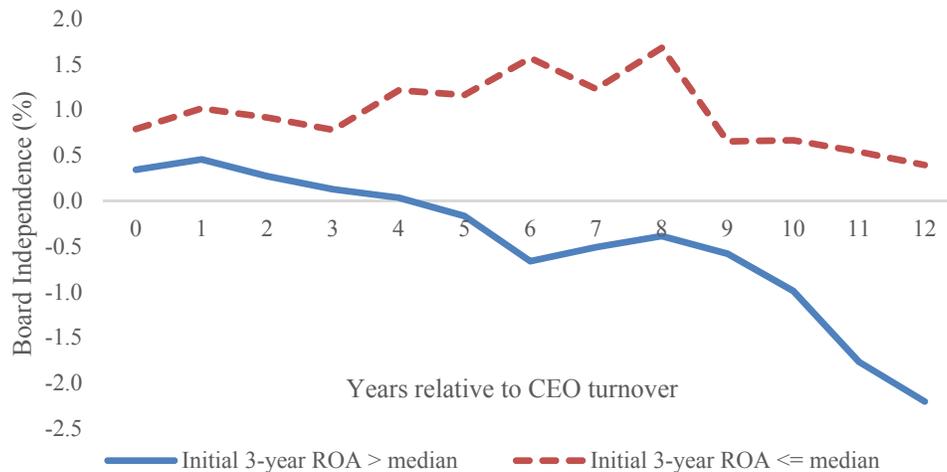
Figure 4: Dynamics of board independence following CEO turnover

This figure presents the dynamics of board independence following CEO turnover in $t=0$ (year $t-1$ serves as baseline). The sample includes firm-years from $t-1$ to $t+12$, although any observations from $t+k$ onward are excluded if there is another CEO turnover in year $t+k$. We exclude observations if the previous CEO has less than two years of tenure or the new CEO is replaced within two years. The presented numbers are net of regression-estimated firm and year fixed effects and firm-level controls as in Table 4. In Panel A, the red dashed line shows dynamics of board independence for average new internal CEOs, and the blue solid line shows dynamics of board independence for new internal CEOs whose ultimate tenure is at least 12 years. In Panel B, the blue solid line shows dynamics of independence for new internal CEOs whose average industry-adjusted ROA in the first three years is above the median, and the red dashed line shows new internal CEOs whose average ROA is below the median. Panel C presents results for CEO turnovers due to death or health issues of the previous CEO. Panel D presents estimates for new external CEOs (see Appendix B).

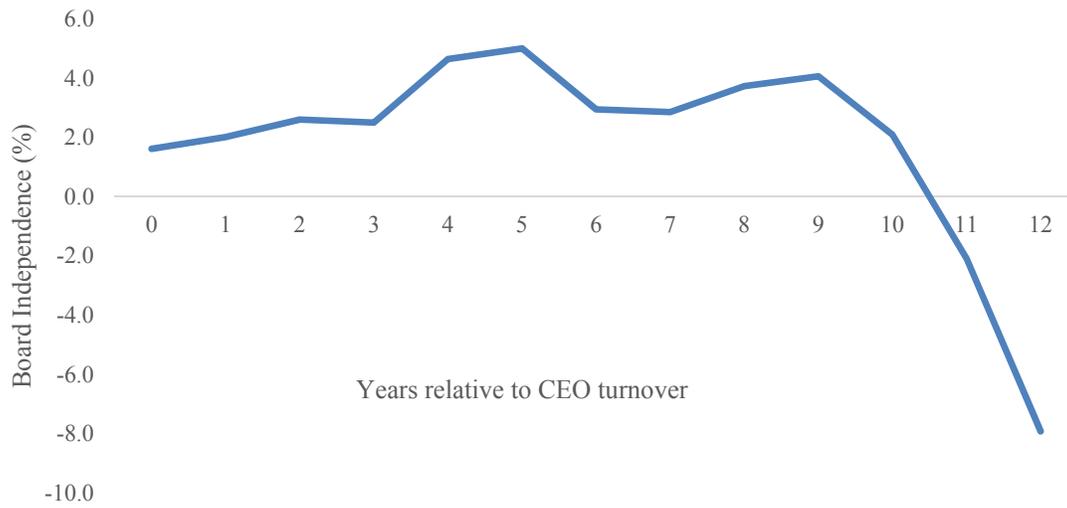
Panel A: New internal CEOs



Panel B: New internal CEOs conditional on average ROA over first 3 years of tenure



Panel C: CEO turnovers due to health issues or death of previous CEO



Panel D: New external CEOs



Table 1: Descriptive statistics on CEOs and corporate boards of directors from 1918 to 2011

This table presents summary statistics on corporate boards and CEOs for U.S. firms from 1918 to 2011. Panel A (B) shows the statistics for board/officer (firm) characteristics. “CEO turnover” equals one if the name of the CEO changes relative to the previous year; “CEO (CFO) [Chair] tenure” is the total number of years during which an individual serves as CEO (CFO) [Chair] of a given firm; “CEO-Chair duality” is a dummy equal to one if the CEO and Chair of the board are the same person; “Board size” is the number of directors; “Outsider ratio” is the number of outsider directors scaled by the total number of directors, where outsiders are all directors other than current officers of the firm. “Indep. ratio” is the number of independent directors scaled by the total number of directors, where independent directors are those who are neither current nor previous officers of the firm nor family members of the CEO (identified using last names); “Outside CEO” is a dummy variable equal to one if the new CEO is not a previous officer of the firm, and zero otherwise. “Total assets” is book assets; “Firm age” is the number of years since a firm appears in our database; “ROA” represents return on assets defined as income before taxes scaled by lagged assets; “Tangibility” is PP&E scaled by assets; “Industry-adj ROA” represents ROA adjusted for the average ROA at the two-digit SIC industry and year level; “Tobin’s q” is book assets minus book equity plus market equity scaled by assets; “Cash/assets” is cash and equivalents scaled by total assets. 1920s* include 1918-1919, and 2000s* include 2010 and 2011.

Panel A: Board and officer characteristics

Variable	N (firm-years)	CEO turnover	CEO tenure	CFO tenure	Chair tenure	CEO-Chair duality	Board size	Outsider ratio	Indep. ratio	Outside CEO (new appt)
Panel A: Full Sample (1918-2011)										
Mean	87,734	0.118	6.27	5.08	5.87	0.416	9.89	0.647	0.577	0.326
Median	-	0.000	5.00	4.00	4.00	0.000	9.00	0.667	0.600	0.000
STD	-	0.323	5.60	4.70	5.32	0.493	3.51	0.189	0.193	0.469
Panel B: By-decade Mean										
1920s*	3,148	0.105	4.54	4.33	3.75	0.051	11.24	0.597	0.560	0.422
1930s	5,125	0.087	6.61	6.33	5.30	0.084	10.81	0.571	0.520	0.365
1940s	6,159	0.091	7.97	7.55	6.75	0.091	10.47	0.544	0.492	0.220
1950s	6,570	0.119	7.14	6.98	6.24	0.112	11.12	0.571	0.502	0.256
1960s	9,679	0.119	5.36	4.81	4.71	0.226	10.81	0.584	0.518	0.292
1970s	15,336	0.112	5.83	4.74	5.37	0.455	10.02	0.601	0.527	0.250
1980s	12,289	0.115	7.42	5.06	6.76	0.621	9.80	0.666	0.594	0.293
1990s	14,548	0.142	5.81	3.88	5.84	0.639	8.70	0.698	0.632	0.397
2000s*	14,880	0.129	6.01	4.41	6.21	0.574	8.99	0.785	0.689	0.398

Panel B: Firm characteristics

Variable	N (firm-years)	Total assets (\$million in 2000)	Firm age	ROA	Industry-adj ROA	Tangibility	Tobin's q	Cash/assets
Panel A: Full Sample (1918-2011)								
Mean	87,734	2,305.93	21.14	0.053	0.000	0.339	1.444	0.073
Median	-	380.76	16.00	0.058	0.002	0.302	1.160	0.045
STD	-	12,011.22	17.72	0.095	0.087	0.204	0.965	0.081
Panel B: By-decade Mean								
1920s*	3,148	681.27	6.43	0.076	-0.001	0.443	1.263	0.062
1930s	5,125	707.69	11.64	0.046	0.001	0.443	1.117	0.092
1940s	6,159	736.48	18.22	0.096	0.000	0.321	1.123	0.138
1950s	6,570	1080.45	24.70	0.079	0.000	0.354	1.184	0.100
1960s	9,679	1373.86	22.30	0.072	0.000	0.341	1.612	0.062
1970s	15,336	1562.01	21.20	0.064	0.000	0.332	1.169	0.038
1980s	12,289	2227.12	24.49	0.050	0.000	0.346	1.349	0.037
1990s	14,548	3026.26	21.61	0.031	0.000	0.329	1.735	0.068
2000s*	14,880	5124.64	23.13	0.022	0.000	0.295	1.813	0.095

Table 2: CEO Tenure, and addition and departure of directors

This table presents the number of additions and departures of independent and dependent directors by a given CEO's tenure for internal (Panel A) and external CEOs (Panel B). A CEO is defined as an 'internal' ('external') CEO if she is (is not) a previous officer of the firm. "N" is the number of firm-year observations for each tenure group.

Panel A: Internal CEOs

Year rel. to turnover	N	Independent directors		Dependent directors	
		# Addition	# Departure	# Addition	# Departure
-1	3882	0.83	0.79	0.68	0.65
0	3882	0.99	0.96	2.46	2.60
1	3651	0.89	0.81	0.66	0.73
2	3139	0.87	0.81	0.63	0.68
3	2764	0.83	0.79	0.63	0.69
4	2349	0.88	0.81	0.58	0.66
5	1988	0.84	0.76	0.58	0.64
6	1722	0.84	0.75	0.56	0.61

Panel B: External CEOs

Year rel. to turnover	N	Independent directors		Dependent directors	
		# Addition	# Departure	# Addition	# Departure
-1	1300	1.03	0.93	0.58	0.64
0	1300	1.65	1.80	2.37	2.06
1	1188	1.04	1.03	0.78	0.91
2	937	1.03	0.90	0.63	0.67
3	751	0.97	0.94	0.55	0.63
4	599	0.94	0.84	0.58	0.59
5	503	0.89	0.88	0.49	0.51
6	417	0.90	0.70	0.46	0.56

Table 3: Persistence of board independence

This table examines persistence of board independence. “Initial independence ratio” is the board independence ratio for the first available observation of each firm. Panel A uses all firm-years (except for the very first year for each firm), and Panels B and C use the cross-section of firms T years after observing initial board independence (T = 5, 10, or 20). Panel D sorts firms into board independence ratio quartiles in a given year, and follows them over the next 10 years. Panel E reports R²s from panel regressions with various layers of fixed effects. *, **, and *** represent results significant at the 10, 5, and 1% levels, respectively.

Dep. Var.:	Independence ratio		
	(1)	(2)	(3)
Panel A: Full sample			
Initial independence ratio	9.383*** (38.93)	8.507*** (36.96)	7.949*** (35.26)
CEO tenure	-1.307*** (-7.80)	-1.195*** (-7.56)	-0.926*** (-6.20)
Firm age	4.055*** (18.13)	3.603*** (16.81)	2.460*** (11.12)
log(board size)	-	-	3.585*** (16.11)
log(N. officers)	-	-	-3.189*** (-14.63)
log(assets)	-	-	1.740*** (5.72)
q	-	-	0.111 (0.76)
ROA	-	-	-0.398*** (-3.84)
Tangibility	-	-	0.468*** (2.76)
Year fixed effects	N	Y	Y
R ²	0.271	0.345	0.379
N	81901	81901	81901
Panel B: Cross-Section			
Timing relative to initial year:	t+5	t+10	t+20
Initial independence ratio	10.956*** (37.83)	8.666*** (26.01)	6.567*** (14.07)
CEO tenure	0.052 (0.13)	-1.253*** (-3.25)	-0.971*** (-2.65)
Firm-level controls	Y	Y	Y
Year fixed effects	Y	Y	Y
R ²	0.491	0.420	0.333
N	3675	2654	1393
Panel C: Cross-section (with no controls or fixed effects)			
Timing relative to initial year:	t+5	t+10	t+20
Initial independence ratio	11.824*** (41.52)	9.503*** (28.48)	7.056*** (14.45)
Firm-level controls	N	N	N
Year fixed effects	N	N	N
R ²	0.458	0.383	0.276
N	3675	2654	1393

Panel D: Transition matrix for board independence

Year	1	2	3	4	5	6	7	8	9	10
Year 0 Quartile = 1										
% quartile 1	82.5%	75.6%	71.0%	68.0%	65.3%	63.2%	61.9%	60.4%	59.4%	58.5%
% quartile 2	14.2%	18.8%	21.0%	22.4%	23.6%	24.1%	24.4%	24.5%	24.3%	24.3%
% quartile 3	2.4%	4.2%	5.9%	7.3%	8.2%	9.3%	10.0%	10.9%	11.9%	12.3%
% quartile 4	0.9%	1.4%	2.0%	2.3%	2.9%	3.4%	3.7%	4.2%	4.4%	4.9%
Year 0 Quartile = 2										
% quartile 1	15.3%	19.7%	22.4%	24.2%	25.4%	26.7%	27.3%	27.7%	28.3%	28.5%
% quartile 2	64.1%	53.2%	47.2%	43.0%	39.8%	37.5%	35.8%	34.7%	34.0%	33.3%
% quartile 3	17.7%	22.0%	23.6%	24.5%	25.3%	25.5%	25.9%	25.9%	25.7%	25.9%
% quartile 4	3.0%	5.1%	6.9%	8.3%	9.4%	10.3%	11.0%	11.7%	12.0%	12.3%
Year 0 Quartile = 3										
% quartile 1	2.5%	4.7%	6.4%	7.9%	9.4%	10.5%	11.7%	12.5%	13.2%	13.9%
% quartile 2	17.1%	21.0%	22.8%	23.7%	24.4%	24.9%	24.8%	25.5%	25.7%	26.2%
% quartile 3	63.8%	52.9%	46.7%	42.7%	39.7%	37.8%	36.3%	34.6%	33.9%	33.0%
% quartile 4	16.6%	21.5%	24.2%	25.8%	26.4%	26.8%	27.2%	27.5%	27.1%	26.9%
Year 0 Quartile = 4										
% quartile 1	0.8%	1.6%	2.5%	3.2%	3.9%	4.5%	5.0%	5.7%	6.3%	7.3%
% quartile 2	3.2%	5.6%	7.5%	9.5%	10.8%	12.0%	13.4%	14.3%	15.2%	15.7%
% quartile 3	18.3%	23.7%	26.9%	28.7%	29.8%	30.3%	30.9%	31.3%	31.0%	31.0%
% quartile 4	77.7%	69.0%	63.1%	58.7%	55.6%	53.2%	50.7%	48.7%	47.5%	46.0%

Panel E: R-squared of fixed-effect regressions

Dep. Var.	Independence ratio						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Full Sample							
Firm-decade fixed effects			Y				Y
Firm-3-decade fixed effects		Y				Y	
Firm fixed effects	Y				Y		
Year fixed effects				Y	Y	Y	Y
R ²	0.570	0.706	0.819	0.134	0.647	0.725	0.824
N	87734	87734	87734	87734	87734	87734	87734
Survival Sample (at least 20 years)							
R ²	0.516	0.695	0.824	0.158	0.651	0.730	0.833
N	28026	28026	28026	28026	28026	28026	28026

Table 4: CEO tenure, board structure, and compensation

This table presents the relations between the CEO's tenure and other variables with board independence (Panels A and B), CEO-chair duality (Panel C, column 1), and total current compensation including salary and bonus (Panel C, column 2). Column 6 of Panel A measures CEO tenure effects using the method of Altonji and Shakotko (1987), which at each point in time reflects the proportion of a given CEO's ultimate tenure. Firms with only one reported director are excluded from the sample. Firm fixed effects are used throughout the table except for columns 1 and 7 of Panel A. All standard errors are adjusted for sample clustering at the firm level. *, **, and *** represent results significant at the 10, 5, and 1% levels, respectively.

Panel A: CEO tenure and board independence

Dep. Var.:	# Indept. / # Total Directors (Independence ratio)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample period:	1996-2011	1996-2011	Full	Full	Full	Full	Full	Full
Model:	OLS	OLS	OLS	OLS	OLS	AS (1987) IV	OLS	OLS
CEO tenure	-0.317*** (-7.44)	-0.024 (-0.69)	-0.136*** (-6.06)	-0.141*** (-6.50)	-0.142*** (-6.61)	-0.155*** (-7.99)	-0.243*** (-8.51)	-0.148*** (-6.34)
CEO tenure × ROA (first 3 yr)	-	-	-	-	-	-	-	-0.597* (-1.72)
Firm age (Time trend)	0.037*** (2.73)	-	0.380*** (23.88)	0.254*** (11.31)	-	-	-	-
log(board size)	9.852*** (9.92)	9.466*** (9.15)	-	8.366*** (12.48)	11.018*** (16.91)	11.017*** (16.91)	13.146*** (17.74)	11.064*** (16.37)
log(N. officers)	-0.769*** (-2.58)	-0.480*** (-2.58)	-	-3.777*** (-17.58)	-4.457*** (-15.73)	-4.454*** (-15.74)	-5.843*** (-16.21)	-4.410*** (-15.20)
log(assets)	1.703*** (9.90)	0.035 (0.11)	-	1.657*** (6.62)	0.284 (1.08)	0.290 (1.10)	1.239*** (7.21)	0.319 (1.17)
q	1.021*** (5.56)	-0.041 (-0.23)	-	0.216 (1.39)	0.030 (0.19)	0.030 (0.19)	0.311* (1.77)	0.077 (0.49)
ROA	-5.228*** (-3.23)	-4.764*** (-3.82)	-	-1.698 (-1.52)	-2.496** (-2.26)	-2.465** (-2.23)	-6.160*** (-4.49)	-
ROA (first 3 yr)	-	-	-	-	-	-	-	-5.625** (-2.26)
Tangibility	1.964* (1.74)	1.896 (1.09)	-	5.801*** (4.44)	3.241** (2.50)	3.244** (2.51)	4.698*** (4.89)	3.182** (2.41)
Firm fixed effects	N	Y	Y	Y	Y	Y	N	Y
Year fixed effects	Y	Y	N	N	Y	Y	Y	Y
R ²	0.167	0.707	0.625	0.644	0.664	0.218	0.221	0.665
N	21257	21257	87734	87734	87734	87174	87734	82209

Panel B: CEO tenure, board independence and cumulative number of CEO turnovers

Dep. Var.	# Indep. / # Total Directors (Independence ratio)			
	(1)	(2)	(3)	(4)
Sample	Full			
CEO tenure	-0.091*** (-3.12)	-0.100*** (-3.57)	-0.126*** (-4.63)	-0.263*** (-8.96)
N. cumulative CEO turnovers	0.576** (2.55)	0.531** (2.53)	0.208 (1.03)	-0.172 (-1.15)
Firm-level controls	N	Y	Y	Y
Firm fixed effects	Y	Y	Y	N
Year fixed effects	N	N	Y	Y
R ²	0.626	0.644	0.664	0.221
N	87734	87734	87734	87734

Panel C: CEO tenure, chair duality and compensation

Dep. Var.	1 (CEO-Chair Duality)	Log (CEO compensation)
	(1)	(2)
CEO tenure	0.022*** (26.80)	0.024*** (5.83)
log(board size)	-0.105*** (-7.40)	0.044 (0.55)
log(N. officers)	-0.047*** (-6.89)	-0.073* (-1.73)
log(assets)	0.035*** (5.33)	0.297*** (7.98)
q	0.007* (1.70)	0.007 (0.21)
ROA	0.011 (0.33)	1.502*** (4.75)
Stock return	-	2.526*** (4.30)
Tangibility	0.053 (1.45)	-0.084 (-0.51)
Firm fixed effects	Y	Y
Year fixed effects	Y	Y
R ²	0.535	0.881
N	68645	3326

Table 5: Hedge fund activism and CEO tenure-board independence

This table examines the effect of the CEO’s tenure on board independence when the firm is targeted by hedge fund activists. “Target” is a dummy variable equal to one for plus or minus 10 years of firm-years that are targeted by activist hedge funds, and zero otherwise. “After” is a dummy variable equal to one for firm-years that were targeted by activist hedge funds within the past 10 years, and zero otherwise. Hedge fund activism events from 1994 to 2008 are drawn from Brav et al. (2009). Firms with only one reported director are excluded from the sample. All standard errors are adjusted for sample clustering at the firm level. *, **, and *** represent results significant at the 10, 5, and 1% levels, respectively.

Dep. Var.	Independence ratio
	(1)
	HFA targets & non-targets
Sample:	1984-2011
CEO tenure	-0.081** (-2.55)
CEO tenure × Target	-0.127 (-1.37)
CEO tenure × Target × After	0.326** (2.32)
Firm fixed effects	Y
Year fixed effects	Y
Firm-level controls	Y
R ²	0.666
N	34279
<i>F</i> -tests (p-value):	
CEO tenure × (1 + Target) = 0	0.02
CEO tenure × (1 + Target + Target × After) = 0	0.31

Table 6: Regulations, CEO tenure, and governance outcomes

This table examines the effect of the CEO's tenure on board independence, CEO-chair duality, and compensation for years before and after 2002 when new regulations and laws began to require firms to maintain majority independent boards. "Post 2002" is a dummy variable equal to one for years equal to or after 2002, and zero for years before 2002. The dependent variables are independence ratio, a dummy for CEO-chair duality, and the log of the CEO's current compensation in columns 1, 2, and 3. Firms with only one reported director are excluded from the sample. Firm and year fixed effects are used throughout the table. All standard errors are adjusted for sample clustering at the firm level. *, **, and *** represent results significant at the 10, 5, and 1% levels, respectively.

Dep. Var.	Independence ratio (1)	1 (Chair Duality) (2)	Log (Compensation) (3)
CEO tenure	-0.147*** (-6.65)	0.022*** (25.26)	0.023*** (5.53)
CEO tenure × Post 2002	0.100* (1.88)	0.005*** (2.70)	0.014 (0.45)
Firm age × Post 2002	0.058*** (2.93)	0.003*** (7.42)	0.006 (0.90)
log(board size)	11.103*** (17.09)	-0.098*** (-6.97)	0.042 (0.53)
log(N. officers)	-4.419*** (-15.59)	-0.045*** (-6.51)	-0.078* (-1.86)
log(assets)	0.295 (1.12)	0.036*** (5.56)	0.299*** (8.17)
q	0.013 (0.08)	0.006 (1.45)	0.016 (0.45)
ROA	-2.733** (-2.48)	-0.003 (-0.09)	1.651*** (5.62)
Tangibility	3.306** (2.55)	0.060* (1.65)	-0.062 (-0.37)
Firm fixed effects	Y	Y	Y
Year fixed effects	Y	Y	Y
R ²	0.664	0.536	0.880
N	87734	68645	3327

Table 7: CEO turnover conditional on firm performance and CEO power

This table examines how CEO power affects the sensitivity of CEO turnover to firm performance proxied by changes in return on assets (ROA) defined as income before taxes (as ‘IB’ in Compustat) scaled by lagged assets and average stock return for the 12-month period prior to the fiscal year ending date. All accounting variables are from Moody’s Industrial Manual or Compustat and stock returns are from CRSP. Linear probability models (i.e., OLS) with firm and year fixed effects are used throughout the table, although results largely hold up in logit models with firm fixed effects (i.e., conditional logit). As a proxy for CEO power, the columns from left to right use a dummy “Low independence” that is equal to one if the board independence ratio is in the first quartile, a dummy for CEO-chair duality, a dummy for average ROA during the CEO’s past three years in the fourth quartile, a dummy for average stock returns during the CEO’s past three years in the fourth quartile, and a dummy for CEO tenure in the fourth quartile. All standard errors are adjusted for sample clustering at the firm level. *, **, and *** represent results significant at the 10, 5, and 1% levels, respectively.

Dep. Var.	CEO Turnover [t]{0,1}				
	1926-2011	1960-2011	1926-2011		
	Low indep.	chairman dual	High ROA	High return	Long tenure
Sample:	(1)	(2)	(3)	(4)	(5)
Power proxy:					
$\Delta ROA [t]$	-0.206*** (-7.84)	-0.304*** (-5.97)	-0.359*** (-13.64)	-0.146*** (-5.36)	-0.181*** (-6.64)
$\Delta ROA [t] \times \text{Power}$	0.157*** (2.84)	0.215*** (3.71)	0.967*** (18.64)	-0.043 (-0.82)	0.013 (0.24)
Excess Ret [t]	-0.341*** (-6.94)	-0.546*** (-6.23)	-0.388*** (-8.08)	-1.373*** (-26.77)	-0.354*** (-7.07)
Excess Ret [t] \times Power	0.058 (0.69)	0.251*** (2.65)	0.278*** (3.16)	2.456*** (32.73)	0.145* (1.77)
Power	-0.002 (-0.53)	-0.209*** (-37.64)	-0.033*** (-8.35)	-0.015*** (-4.18)	0.063*** (18.95)
CEO tenure	0.007*** (22.43)	0.012*** (24.12)	0.007*** (22.48)	0.007*** (22.69)	- -
Log assets	-0.013*** (-4.82)	-0.009** (-2.37)	-0.013*** (-4.81)	-0.012*** (-4.48)	-0.012*** (-4.62)
q	-0.004* (-1.72)	0.000 (0.04)	-0.007** (-2.50)	-0.012*** (-4.54)	-0.004 (-1.59)
Firm fixed effects	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y
R ²	0.120	0.201	0.126	0.134	0.116
N	75925	50323	75925	75925	75925

Table 8: Abnormal stock returns around death- and health-driven CEO turnover

This table examines cumulative abnormal returns from two days before to two days after the announcement of CEO turnovers due to death and serious health issues of the departing CEO for U.S. firms from 1950 to 2011, conditional on proxies for CEO power: A dummy for CEO tenure higher than 11 years, the third quartile (Column 1); a dummy for whether the CEO is also the board chair (Column 2); and a dummy for whether the departing CEO is a founder of the firm (Column 3). Panel A reports for death-driven events only, and Panel B reports estimates for both death and health-related events. To increase sample size, in this table only NASDAQ firms are included in addition to NYSE/AMEX firms. White standard errors are reported in parentheses. *, **, and *** represent results significant at the 10, 5, and 1% levels, respectively.

Dep. Var.	Cumulative abnormal returns [-2,2]		
	(1)	(2)	(3)
Panel A: Death only, 1950-2011			
High tenure	0.039*** (2.68)	-	-
Chair duality	-	0.031** (2.59)	-
Founder	-	-	0.032** (2.53)
Constant	0.002 (0.42)	-0.013 (-1.35)	-0.002 (-0.41)
R ²	0.037	0.022	0.030
N	246	223	260
Panel B: Death and health, 1950-2011			
High tenure	0.027** (2.05)	-	-
Chair duality	-	0.031*** (3.01)	-
Founder	-	-	0.031*** (2.62)
Constant	0.006 (1.16)	-0.013* (-1.66)	-0.001 (-0.12)
R ²	0.015	0.023	0.025
N	320	295	336

Appendix Table 1: CEO tenure and board independence: Subsample and survival analyses

This table provides robustness tests for the effect of CEO tenure on board independence and board chair dual titles. Panels A and B split the full sample into subsamples consisting of different time periods, and examine board independence and dual chair titles; Panel C uses subsamples that require that the firm survive more than a certain number of years; Panel D examines board independence and dual chair titles using a subsample of NYSE firms only, and a sample that includes firms listed on all exchanges (including the NASDAQ). Firms with no or only one reported director are excluded. All standard errors are adjusted for sample clustering at the firm level. *, **, and *** represent results significant at the 10, 5, and 1% levels, respectively.

Panel A: Subsample periods – board independence

Dep. Var.	Independence ratio		
	(1)	(2)	(3)
Sample:	1918-1947	1948-1977	1978-2011
CEO tenure	-0.227*** (-4.38)	-0.037 (-1.25)	-0.110*** (-4.03)
Firm-level controls	Y	Y	Y
Firm fixed effects	Y	Y	Y
Year fixed effects	Y	Y	Y
R ²	0.775	0.745	0.669
N	12943	30241	44550

Panel B: Subsample periods – board chair duality

Dep. Var.	1 (Chair duality)		
	(1)	(2)	(3)
Sample:	1918-1947	1948-1977	1978-2011
CEO tenure	0.013*** (5.21)	0.023*** (14.21)	0.027*** (29.69)
Firm-level controls	Y	Y	Y
Firm fixed effects	Y	Y	Y
Year fixed effects	Y	Y	Y
R ²	0.621	0.560	0.538
N	6195	21840	40610

Panel C: Firm survival

Dep. Var.	Independence ratio				
	(1)	(2)	(3)	(4)	(5)
Sample:	Full sample	Survive > 2 years	Survive > 5 years	Survive > 10 years	Survive > 15 years
CEO tenure	-0.142*** (-6.61)	-0.142*** (-6.61)	-0.141*** (-6.55)	-0.137*** (-6.30)	-0.131*** (-5.93)
Firm-level controls	Y	Y	Y	Y	Y
Firm fixed effects	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y
R ²	0.664	0.661	0.654	0.642	0.634
N	87734	87115	84687	78690	70755

Panel D: NYSE only subsample and all exchanges

Dep. Var.	Independence ratio		1 (Chair duality)	
	(1)	(2)	(3)	(4)
Sample:	NYSE only	All exchanges	NYSE only	All exchanges
CEO tenure	-0.145*** (-5.92)	-0.131*** (-6.38)	0.024*** (24.70)	0.025*** (34.70)
Firm-level controls	Y	Y	Y	Y
Firm fixed effects	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y
R ²	0.626	0.658	0.498	0.558
N	67312	143728	52400	116948

Appendix Table 2: Average effect of firm performance on CEO turnover

This table examines the sensitivity of CEO turnover to firm performance proxied by changes in return on assets (ROA) defined as income before taxes ('IB' in Compustat) scaled by lagged assets and average stock return for the 12-month period prior to the fiscal year ending date. All accounting variables are from Moody's Industrial Manual or Compustat and stock returns are from CRSP. Linear probability models (i.e., OLS) with firm and year fixed effects are used throughout the table, although results largely hold up in logit models with firm fixed effects (i.e., conditional logit). All standard errors are adjusted for sample clustering at the firm level. *, **, and *** represent results significant at the 10, 5, and 1% levels, respectively.

Dep. Var.	CEO Turnover [t]{0,1}					
	1918-2011		1926-2011		1918-2011	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ ROA [t]	-0.250*** (-10.03)	-	-0.182*** (-6.81)	-0.225*** (-10.06)	-	-0.173*** (-7.36)
Δ ROA [t-1]	-0.154*** (-6.32)	-	-0.101*** (-3.87)	-	-	-
Excess Ret [t]	-	-0.463*** (-10.81)	-0.336*** (-6.71)	-	-0.421*** (-10.07)	-0.325*** (-7.22)
Excess Ret [t-1]	-	-0.323*** (-8.40)	-0.252*** (-5.48)	-	-	-
CEO tenure	0.007*** (22.35)	0.007*** (22.92)	0.007*** (22.44)	0.007*** (22.39)	0.007*** (22.84)	0.007*** (22.43)
Log assets	-0.012*** (-3.95)	-0.013*** (-4.82)	-0.013*** (-4.25)	-0.013*** (-4.60)	-0.013*** (-4.86)	-0.013*** (-4.82)
q	-0.007*** (-2.77)	-0.000 (-0.18)	-0.001 (-0.18)	-0.009*** (-3.76)	-0.005* (-1.82)	-0.004* (-1.72)
Firm fixed effects	Y	Y	Y	Y	Y	Y
Year fixed effects	Y	Y	Y	Y	Y	Y
R ²	0.118	0.118	0.120	0.118	0.117	0.120
N	68735	80177	67145	77336	80769	75925