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ALL GOOD THINGS COME TO AN END: CEO LIFE CYCLE AND FIRM PERFORMANCE

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All good things come to an end: CEO life cycle and firm performance*

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Abstract

We provide evidence that CEO tenure exhibits an inverted U-shaped relation with firm value and M&A announcement returns, consistent with benefits (e.g., experience, learning, relations) and costs (e.g., CEO-firm mismatch, entrenchment, reluctance to change) arising over a CEO's time in office. Depending on the dynamics of a firm's economic environment which affect the cost-benefit relation of tenure, we find economically meaningful variation in the point in time at which costs start to outweigh benefits. The documented CEO life cycle is robust to a large set of robustness tests, including various alternative explanations, CEO-firm fixed effects, and nonparametric estimations, and is supported by an analysis of CEO sudden deaths. Economic recessions and regulatory changes in corporate governance as exogenous shocks to the cost-benefit relation of tenure further support our findings.

JEL classification: G30, G34, J24

Keywords: CEO heterogeneity, CEO tenure, CEO term limits, economic environment, firm value, mergers and acquisitions

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1 Introduction

> "It's a familiar cycle: A CEO takes office, begins gaining knowledge and experience, and is soon launching initiatives that boost the bottom line. Fast-forward a decade, and the same executive is risk-averse and slow to adapt to change—and the company's performance is on the decline. The pattern is so common that many refer to the "seasons" of a CEO's tenure […]." ("Long CEO tenure can hurt performance", *Harvard Business Review*, March 2013)

In recent years, there has been a debate in both the business press [1] and among legal scholars (see, e.g., Whitehead, 2011) about how long chief executive officers (CEOs) should stay in office and, accordingly, about the usefulness of CEO term limits. Two questions are at the heart of this debate. First, how do CEO's evolve over their time in office and thereby affect firm performance? Second, do some CEOs overstay at the detriment of shareholders?

In this study, we investigate the relation between CEO tenure and firm performance to address these questions. We build on Hambrick and Fukutomi's (1991) theoretical work on the dynamics of CEO tenure and its empirical implications. In particular, we posit an inverted U-shaped relation between CEO tenure and firm performance which reflects the net effect of the benefits and costs that arise over the CEO's time in office (see *Figure 1a*).

Among the benefits are on-the-job learning and gaining experience (e.g., Davies and Easterby-Smith, 1984; Gabarro, 1987) and establishing valuable relations with people inside and outside the firm (e.g., Luo, Kanuri, and Andrews, 2013). These benefits can be expected to increase over tenure with a declining marginal positive impact on firm performance. Among the costs are the increasing likelihood of a mismatch between the incumbent CEO and the firm (due to changes in firm environment) along with a CEO's growing aversion to risk her

[1] See, e.g., "How long is too long to be CEO?" in *The Washington Post* (April 16, 2014), the two articles both entitled "CEO term limits" in *The Washington Post* (May 26, 2009) and *Forbes Magazine* (November 14, 2006) as well as "Been a CEO for ten years? Your time's about up?" in *Business Insider* (April 16, 2007). Confirming the relevance of CEO tenure, Institutional Shareholder Services (ISS), the world's largest proxy advisor, has recently added CEO tenure to its analytical framework to assess corporate governance quality (see ISS, 2014).

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reputation as well as a decreasing ability and increasing reluctance to change, to admit mistakes, and to consider the advice of others (e.g., Miller, 1991; Prendergast and Stole, 1996). These costs can be expected to increase over tenure with an increasing marginal negative impact on firm performance. Increasing managerial entrenchment over time (e.g., Hermalin and Weisbach, 1998) is associated with additional costs and may reinforce the negative relation between CEO tenure and firm performance at high tenure levels as entrenched CEOs are less likely to get fired (e.g., Coles, Daniel, and Naveen, 2014a).[2]

We find empirical evidence for the existence of an inverted U-shaped relation between CEO tenure and firm value (Tobin's Q). We further examine announcement returns to acquisitions, which constitute major corporate investments associated with significant value creation, and document a similar inverted U-shaped pattern. We control for the age and power of CEOs, whether they are founders, and take past performance as well as firm and governance characteristics into account. For the average S&P 1500 firm, our evidence suggests that the costs of tenure start to outweigh the benefits after about a decade. The documented cost-benefit relation is economically meaningful: we estimate a 4.8% increase in firm value over CEO tenure for the period during which benefits outweigh costs, while firm value decreases by 5.2% over the same number of years of tenure in the later period where costs outweigh benefits. Further, consistent with the increasing negative marginal effect of the costs of tenure on firm performance we posit, very large tenure values are associated with large declines in firm value. Nonparametric estimations confirm the aforementioned results (see *Figure 1b*).

The non-linear relation between CEO tenure and firm value is robust to various changes and extensions to our empirical setting. First, our results hold when (time-varying) industry fixed effects, firm fixed effects, CEO-firm fixed effects, or random effects are accounted for.

[2] For example, investment distortions, such as manager-specific investments (Shleifer and Vishny, 1989), or managerial preferences for "the quiet life" (Bertrand and Mullainathan, 2003) constitute costs of entrenchment.

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Second, they are robust to several alternative explanations including a non-linear relationship between firm value and CEO (or firm) age, CEO ownership, CEO power, or outside director tenure which may all be potentially captured by the CEO's tenure. Our results also survive the inclusion of additional controls for firms' (dis)investment activities and managerial compensation. Third, when we use residuals from a regression of CEO tenure on CEO and firm characteristics to account for hard-to-disentangle variables, such as CEO and firm age, CEO power or past performance, our results are confirmed. Fourth, supporting our general hypothesis, we also find an inverted U-shaped relation between firm value and two alternative measures of tenure, the CEO's overall time with the company and her time on the firm's board of directors. However, we show that it is the CEO's time at the helm of the company which (primarily) affects firm value. Fifth, our results are robust to the exclusion of CEOs with very long tenures or those CEOs who leave the firm during the first years after assuming office. Sixth, our results remain qualitatively similar when we exclude firms or CEO-firm pairs with few observations from our sample. Finally, alternative measures of firm performance, i.e., return on assets and the growth rate of Tobin's Q, again confirm our results.

We also attempt to rule out alternative explanations for our findings which are related to a potential survivorship bias of either the CEOs or the firms they run. For example, CEOs with very good performance may get recruited to run bigger companies while poorly performing CEOs may stay with their companies (with survival being facilitated by entrenchment in poorly governed firms). Similarly, successful CEOs may receive a larger compensation resulting in higher opportunity costs of work and thus earlier retirement. Finally, the acquisition of a company may cause at least part of the effect as the respective CEO-firm pair will disappear and the high (average) returns to target companies will result in a higher valuation. All our tests suggest that none of the explanations drive our results.

Using several measures for the dynamism of a firm's economic environment (based on industry shocks and industry classifications and age), we provide evidence that the non-linear relation between CEO tenure and firm value depends on the dynamics of the firms' environment. These analyses constitute tests of the posited cost-benefit relation of CEO tenure described above. Specifically, we would expect that the benefits of tenure, particularly the CEO's accumulation of experience and knowledge, have a shorter half-life in more dynamic settings, while the costs of tenure, particularly the potential CEO-firm mismatch together with the CEO's decreasing ability and willingness to adapt and change, are likely to increase faster. Consistently, we find that the CEO tenure at which the costs start to outweigh the benefits shifts to smaller (larger) values in more (less) dynamic settings relative to our estimations for the average firm. This variation in the cost-benefit relation of tenure is economically meaningful, ranging from three to six years (or 25% to 50% of the estimates for the average firm).

As part of our identification strategy, we use different exogenous shocks to the cost-benefit relation of CEO tenure. First, we use economic recessions, including the financial crisis of the late 2000s. While we expect the CEO learning period to be extended in difficult economic times as CEOs gain new, valuable experience and likely have to solve more problems (see Arrow, 1962; Kempf, Manconi, and Spalt, 2014), CEO entrenchment is expected to become less costly due to positive effects of managerial discretion during difficult times (see, e.g., Li, Lu, and Phillips, 2016). Consequently, the number of years after which the costs of tenure start to outweigh the benefits is predicted to shift to larger values during recessions. We find empirical support for this prediction. Second, similar to Guo and Masulis (2015), we use the implementation of SOX and the concurrent NYSE and NASDAQ listing rule changes as an exogenous (positive) shock to the overall level of corporate governance. We find optimal CEO tenure to shift to larger values post SOX consistent with reduced costs of both CEO entrenchment and CEO-firm mismatch due to more stringent governance. Following a similar

reasoning, we further use Cain, McKeon, and Solomon's (2014) takeover index, an exogenous measure for the market for corporate control, and find CEO tenure to shift to larger (smaller) values for firms with a higher (lower) takeover susceptibility.

Finally, we analyze abnormal stock returns in reaction to announcements of sudden CEO deaths as a measure of CEOs' future contributions to shareholder value. This analysis constitutes a test of our hypothesis about the costs and benefits arising over a CEO's tenure and provides evidence whether some CEOs stay too long at the detriment of shareholders. As sudden deaths occur randomly and are likely to be exogenous to current firm and market conditions, this approach further mitigates endogeneity concerns. Consistent with our hypothesis and panel regression results, we find significantly different abnormal stock returns which are negative (positive) for tenure values below (above) the sample median or the threshold of 12 years of tenure. Consequently, we further find stock returns to increase in CEO tenure in multivariate regressions which account for CEO and firm characteristics. This suggests that some CEOs may indeed stay at the helm for too long.

The evidence we provide has important policy implications. While it indicates that regular CEO turnover can be valuable for shareholders, it does not support a one-size-fits-all policy of CEO term limits. As the cost-benefit relation of CEO tenure varies significantly with a firm's economic environment, which is subject to shocks, corporate boards should frequently assess and monitor the CEO's fit with the company and its environment. As CEOs become more powerful over their tenure, they are likely to influence board composition to distort board monitoring and avoid turnover (Cohen, Frazzini, and Malloy, 2012; Coles, Daniel, and Naveen 2014a; Fracassi and Tate, 2012).[3]

[3] CEOs who stay at the top for too long (e.g., due to power/entrenchment and the option value of the CEO-firm match) and CEOs who leave their firm too early (e.g., due to health reasons or because they are headhunted to run bigger companies) are in line with the inverted U-shaped relation between CEO tenure and firm value. In this regard, Figure 2a shows that CEO power increases significantly over tenure, while Figure 2b shows that the

Our study contributes to the recent literature on the relation between CEO learning and adaptability, investment quality, CEO power, and CEO tenure. Guay, Taylor, and Xiao (2014) provide evidence that CEOs have problems adapting to industry shocks which are found to increase the likelihood of CEO turnover. In line with the increasing power of CEOs over their time in office, the authors further find that high-tenure CEOs are less likely to leave the firm, even after industry shocks. Pan, Wang, and Weisbach (Forthcoming) find that corporate disinvestments become less likely over a CEO's time in office, while (net) investment quantity increases with tenure, and investment quality decreases. The authors provide evidence that the latter result can be explained by CEOs' growing control over the board. While the aforementioned studies focus on potential costs of increasing CEO power over tenure, our study investigates the cost-benefit relation over the CEO's time in office, taking CEO power into account, and documents that this relation depends on the firms' economic environment.

Apart from the above papers, the study closest to our work is Huang (2013). In contrast to our study on CEO tenure and firm value, the author examines the advice and monitoring role of outside directors and provides evidence for an inverted U-shaped relation between average outside director tenure and firm value, consistent with costs and benefits over directors' time on the board. He does neither consider CEO tenure nor industry dynamics.

In general, our study extends the literature on CEOs' influence on firm policies and value (see, e.g., Adams, Almeida, and Ferreira, 2005; Bennedsen, Pérez-González, and Wolfenzon, 2007, 2011; Bertrand and Schoar, 2003; Dittmar and Duchin, Forthcoming; Fee, Hadlock, and Pierce, 2013; Graham, Harvey, and Puri, 2013). Supporting extant work, the

likelihood of forced turnover increases over a CEO's first years in office but significantly declines thereafter, consistent with both theory (e.g., Jovanovic, 1979) and empirical evidence (e.g., Allgood and Farrell, 2003; Brookman and Thistle, 2009). Further, voluntary CEO turnover – which is partly exogenous to the firm – increases over the CEO's first 10 years in office, but decreases afterwards. Both forced and voluntary turnover are significantly higher for CEOs with tenure below 10 years. In unreported regressions, we find our results to remain qualitatively similar when we control for the likelihood of CEO turnover (using hazard rates).

evidence we provide suggests that CEOs matter for firm value. However, while the literature focuses on the heterogeneity across different CEOs, the results of our study indicate that the same CEO can have a different impact on firm value over her time in office. Thus, heterogeneity with respect to the same CEO seems to matter as well.

The remainder of this paper is organized as follows. Section 2 describes our data and variables. Section 3 presents the empirical evidence of the inverted U-shaped relation between CEO tenure and firm value, including a variety of robustness tests, as well as additional evidence for mergers and acquisitions and firm profitability. In section 4, we examine how the optimal CEO tenure varies depending on the economic environment firms operate in. Our identification strategy is presented in Section 5. Conclusions follow.

2. Data and Variables

2.1 Data

Our initial sample consists of all S&P 1500 companies over the period 1998 to 2011 as covered by ISS (formerly RiskMetrics).[4] For these firms, we collect governance data from ISS' Governance segment and director-level data from the Director segment. We complement this dataset with data from several other databases. First, we match our sample with ExecuComp to obtain information on several CEO characteristics including tenure, age, gender, and an annual description of titles (i.e., chairman and president). We obtain data on whether the CEO is the company's founder from Board Analyst's The Corporate Library database for the years 2001 to 2011. Data for earlier years is hand-collected from proxy statements. Accounting data and business segment information is retrieved from Compustat. Finally, stock price information stems from the Center for Research in Security Prices (CRSP). After excluding

[4] ISS provides data from 1996 on. However, due to problems of data availability and consistency for the years 1996 and 1997 (see, e.g., Faleye, Hoitash, and Hoitash, 2011), we choose 1998 as the starting point of our sample.

utilities and financial firms (SIC codes 4000-4999 and 6000-6999), because of differences in accounting and regulation, our final sample (with all available data) consists of 12,427 firm-year observations covering 1,782 firms and 3,064 unique CEO-firm pairs.

2.2 Variables

Our main variable of interest is *CEO tenure* calculated as the fiscal year minus the year the CEO became the company's CEO (ExecuComp data item "BECAMECEO"). CEOs are identified using the ExecuComp variable 'CEOANN'. Following Masulis and Mobbs (2014), we replace missing observations by the number of years the CEO has been serving on the company's board of directors (provided by ISS).[5] To investigate a potential nonlinear relation between CEO tenure and a series of output variables, we also include *CEO tenure squared*, i.e., the square of *CEO tenure*, in most of our regressions.

Our main output variable is *Tobin's Q*, defined as the sum of the market value of equity and the book value of total assets minus the book value of equity, divided by the book value of total assets. Other output variables include return on assets (*ROA*), announcement returns to acquisition announcements, and announcement returns to unexpected CEO deaths. *ROA* is calculated as earnings before interest, taxes, depreciation and amortization (EBITDA) divided by the book value of total assets at the end of the previous year and is winsorized at the 1st and 99th percentiles. Announcement returns to acquisition announcements and unexpected CEO deaths are defined below, in Sections 3.3 and 5.3 of the paper, respectively.

[5] We identify the company's CEO in ISS by applying the methodology described in Mobbs (2013). A member of the board of directors is considered to be the CEO of the company if, first, the ISS variable „CLASSIFICATION" states that the director's board affiliation is classified as employee / insider ("E") and, second, if the variable "EMPLOYMENT_CEO" equals one, indicating that her primary employment title is CEO. Using this methodology, we are able to identify a firm's CEO within ISS in 99.8% of the cases in which we could not identify a CEO in ExecuComp. CEO tenure is then calculated as the fiscal year minus the year the CEO has joined the board of directors (ISS variable "DIRSINCE").

In our analyses, we control for several additional CEO characteristics including the age of the CEO in years (*CEO age*), a dummy variable set to one if the CEO is female (*CEO gender*), and a dummy variable set to one if the CEO is the firm's founder (*Founder CEO*).

Further, CEOs typically become more powerful as their tenure increases (see, e.g., Hermalin and Weisbach, 1998; Ryan and Wiggins, 2004). To account for effects of CEO power on firm value, and to separate CEO power from CEO tenure, we use the variable *CEO power index*. It is based on the following variables: (i) *CEO ownership*, i.e., the fraction of common shares held by the CEO, (ii) *Co-Option* which is the fraction of directors appointed after the CEO assumed office (Coles, Daniel, and Naveen, 2014a), (iii) *Duality* which is a dummy that equals one if the CEO is also the chairman of the board, (iv) *Involved CEO* which is a dummy that equals one if the board has a separate nominating committee and the CEO is a member or if such a committee does not exist (Shivdasani and Yermack, 1999), (v) *Only insider* which is a dummy that equals one if the CEO serves as the only inside (i.e., executive) director on the board of directors, and (vi) *President* which is a dummy that equals one if the CEO has the title of president of the firm. Adams, Almeida, and Ferreira (2005) use the latter four variables to measure CEO power. The *CEO power index* is the sum of the following dummy variables: *CEO ownership* above median, *Co-Option* above median, *Duality*, *Involved CEO*, *President*, and *Only insider*. In robustness tests, we use the individual index components instead of the aggregated *CEO power index*.

We control for a series of additional corporate governance variables. The board characteristics are *Board size,* i.e., the number of directors on the board (e.g., Yermack, 1996), *Busy board* defined as an indicator variable which is equal to one if a majority of the independent directors hold two or more additional outside directorships, and zero otherwise (Fich and Shivdasani, 2006), and the fraction of independent directors on the board, *Independence ratio*. To measure the alignment of interests between independent directors and

shareholders, we also control for the average fraction of shares outstanding held by each independent director (e.g., Masulis and Mobbs, 2014), *Independent director ownership*. Finally, we control for the entrenchment index, *E-index*, proposed by Bebchuk, Cohen, and Ferrell (2009). In some extensions and robustness tests, we further control for the average tenure of outside directors, *Outside director tenure*, and its squared term (following Huang, 2013) and a dummy variable *New CEO* indicating that a CEO assumes office in a given year.

We control for a similar set of firm characteristics as used in the aforementioned literature: *Book leverage* is calculated as the book value of long-term debt plus the book value of current liabilities, all divided by the book value of total assets. *Business segments* is the natural logarithm of the number of business segments as reported in Compustat's Segment database. *CapEx* is defined as capital expenditures divided by total assets and *R&D* as research and development expenses as a fraction of total assets. *Firm age* is equal to the number of years the company has been covered in CRSP at the time. *Firm risk* is the annualized standard deviation of the logarithm of daily stock returns over the fiscal year. *Operating CF* is the annual cash flow from operations divided by total assets. *Sales growth* is defined as growth in total revenue to the previous year and *Total assets* as the natural logarithm of the book value of total assets. Most of these firm characteristics enter the regressions with one lag (*Book leverage*, *CapEx*, *Firm risk*, *Operating CF*, *R&D*, and *Total assets*). Firm value regressions additionally include Tobin's Q with one lag as an explanatory variable (to capture the relation between past performance and tenure as well as unobserved firm and CEO heterogeneity).[6] Appendix A provides an overview and detailed definitions of all variables used in the paper.

[6] Results remain qualitatively similar when we exclude the lag of Tobin's Q (see also footnote 9).

2.3 Summary statistics

Table 1 presents summary statistics (at the firm-year level) for the previously defined variables. In terms of CEO tenure, which takes on values between 0 and 60 years, the cross-sectional average is about 7.7 years. While 24% of all firm-year observations show tenure values in excess of 10 years, in 21% of all observations CEOs leave the firm during their first three years in office, the period often referred to as "honeymoon". We further consider the 3,064 CEO-firm pairs in our sample (instead of firm-year level data). We define *Maximum CEO tenure* as the largest value of CEO tenure in the sample per CEO-firm pair. Using this definition of tenure, we find that the average CEO tenure is 8.4 years. It increases to 10.4 years when we exclude CEOs who leave the firm during their honeymoon period. 28% (14%) of all CEOs reach a maximum tenure of more than 10 (15) years, i.e., almost a third of all S&P 1500 CEOs stay with their firm for more than a decade.

With respect to the other CEO characteristics, we find that mean CEO age is 56 years, 2% of all CEOs are female, and 12% are founders of the firm they lead. The fraction of newly hired CEOs (*New CEO*) is 7%. The CEO power index has a mean of 3 (relative to a minimum of 0 and a maximum of 6). As can be seen from Figure 2a, CEO power increases significantly with CEO tenure, at least over the first 15 years.

Turning to the components of the CEO power index, on average CEO ownership amounts to 3% (with a median of 1%), 38% of directors on the board were appointed after the CEO assumed office (*Co-Option*), 58% of the CEOs also hold the position of the chairman of the board, 18% are involved in director selection, 57% of the CEOs are the only insiders on the board of directors, and 58% hold the title of the firm's president. 25% of CEOs hold both the chairman and the president title.

Mean board size is 9 directors, with about 20% of boards being busy. On average, the E-index is 2.47, board independence is 71%, tenure of outside directors is 8.2 years, and stock

ownership of the average independent director is 0.2%. Regarding firm characteristics, we find mean book leverage to be around 40% and the average number of business segments to be 3. CapEx amounts to 5%, R&D to 3%, and operating cash flow to 13% of total assets.[7] Average firm age is 25 years. One-year sales growth is 10% and mean total assets amount to US$ 6,212 million. Mean Tobin's Q is 1.99.

Overall, the summary statistics compare well to those in recent corporate governance studies (e.g., Adams, Ferreira, and Almeida, 2005; Bebchuk, Cohen, and Ferrell, 2009; Fahlenbrach, 2009; Huang, 2013; Li, Lu, and Phillips, 2016; Masulis and Mobbs, 2014).

3. CEO Tenure and Firm Value

In this section, we investigate the relation between CEO tenure and firm value. We expect longer tenure to be associated with more experience, knowledge, and valuable personal connections of the CEO. However, eventually the CEO-firm match, and in particular the CEO's ability and willingness to adapt to changes, is expected to decrease over tenure as the firm and its industry evolve over time. Moreover, CEOs may become increasingly entrenched. Hence, we expect an inverted U-shaped relation between CEO tenure and firm value. The results of various tests of this relation are presented in Sections 3.1 and 3.2, where we rely on Tobin's Q as our measure of firm value, and in Section 3.3 where we use the stock market reaction to announcements of corporate acquisitions to measure firm value.

3.1 Firm Value Analysis

We analyze the relation between CEO tenure and firm value by estimating regressions of *Tobin's Q* on *CEO tenure*, *CEO tenure squared*, and a number of controls for CEO, corporate governance, and firm characteristics (presented in Section 2.2). All regressions also include year and firm fixed effects to account for unobserved variables which are either

[7] Data on R&D expenditures are missing for 3,847 (31%) of the 12,427 firm-year observations in our sample. We replace these missing observations by zero.

constant across firms or constant over time. The functional form we assume in these regressions is supported by additional tests. Most important, we perform nonparametric locally weighted regressions (lowess) of residuals of *Tobin's Q* on *CEO tenure*.[8] As can be seen from Figure 1b, the nonparametric regression results suggest that the relation between firm value and CEO tenure, apparent in the data, is hump-shaped.

Our regression results are shown in *Table 2*. As a starting point, we estimate our baseline regression model without and with the squared term of CEO tenure. The results are reported in Columns 1 and 2, respectively. The coefficient on *CEO tenure* is negative and statistically insignificant in Column 1. In contrast, it is positive and significant (at the 5% level) in Column 2 and the coefficient on *CEO tenure squared* is negative and significant (at the 1% level). Hence, the results are consistent with CEO tenure capturing both benefits and costs and suggest that CEO tenure and firm value indeed exhibit an inverted U-shaped relation as motivated above. The estimated inflection point, i.e., the CEO tenure at which costs start to outweigh benefits, is 12.5 years in Column 2. In Column 3, we replace the variable *CEO power index* by its six constituents and in Column 4 we include (three-digit SIC code) industry×year fixed effects in order to control for time-varying factors particular to an industry and find the results to remain virtually unchanged, while the inflection point decreases further to 12.2 and 10.6 years, respectively. Finally, in Column 5, we account for outliers and potential interim CEOs by excluding all observations with tenure values smaller than 1 and larger than 38 (i.e., we exclude the 1st and the 99th percentiles of *CEO tenure*). The results remain qualitatively similar and yield an inflection point of 11.1 years.

[8] The residuals of Tobin's Q are from a regression of our baseline model, shown in Column 2 of Table 2, where we omit the variables *CEO Tenure* and *CEO Tenure Squared*. We also obtain the inverted U-shaped relation between firm value and CEO tenure when we analyze the residuals from the same regression model using CEO-firm fixed effects instead of firm-fixed effects (not reported for brevity). In addition, we follow Mudambi (1997) and run (unreported) polynomial regressions of *Tobin's Q* on polynomials of order 1 to 4 of the variable *CEO tenure*. The corresponding test statistics (i.e., adjusted R-squared, AIC and BIC information criteria) suggest the use of the second-order polynomial.

Turning to our control variables, we find founder CEOs to be associated with a higher firm value, consistent with, e.g., Fahlenbrach (2009). Supporting previous studies, we also find both board size (e.g., Yermack, 1996) and busy boards (e.g., Fich and Shivdasani, 2006) to be negatively related to firm value. All other CEO characteristics and governance measures are estimated to be insignificant. Results for firm characteristics are consistent with prior studies.[9] In sum, the results indicate that, on average, the costs of increasing CEO tenure outweigh the benefits after the first 11-12 years of a CEO's time in office.

3.2 Tests on the Robustness of the Firm Value Analysis

We perform a battery of robustness tests on the results shown in Section 3.1. As a first test, we replicate our regressions in Table 2 with firm fixed effects replaced by industry fixed effects based on three-digit SIC industries or by random effects (with industry controls). The results (not reported for brevity) confirm the inverted U-shaped relation between CEO tenure and Tobin's Q. In the following, we present various other tests in more detail.

3.2.1 Interim CEOs, CEO-firm match, and outliers

We analyze whether our results are influenced by non-optimal matches between firms and CEOs, interim CEOs, or outliers in the CEO tenure variable. First, we reestimate the regression reported in Column 2 of Table 2 excluding all observations for which CEO tenure is smaller than 1. Second, we exclude all CEOs who leave the company in their "honeymoon period" (the first three years in office). Thereby, we avoid cases of firms headed by interim CEOs and, more important, restrict our sample to CEOs that originally were considered good matches. This mitigates possible concerns of endogenous CEO-firm matching. Third, we

[9] The coefficients on the firm characteristics and all fixed effects are not reported for space reasons. We find that the coefficients of the variables *Business segments* and *Total assets* are significantly negative, while the coefficients of the variables *Operating CF*, *R&D*, *Sales growth* and the lag of *Tobin's Q* (coefficient of 0.222) are significantly positive. When we exclude the lag of *Tobin's Q* from the regressions or use two lags of this variable, results remain qualitatively similar. The same holds true when we substitute the lag of *Tobin's Q* for the firm's stock market performance of the previous year.

exclude 349 observations (3% of the sample) for which *CEO tenure* takes on values above 30 years. Fourth, we exclude founder CEOs who tend to have higher tenure values and who may differ substantially in the level of entrenchment, incentives, and the learning effect from non-founder CEOs. Fifth, we exclude CEOs who rejoin their company (*Rejoined CEOs*), identified via the ExecuComp data item "REJOIN". Sixth, we exclude CEOs with more than one CEO position over the sample period (*Multiple CEOs*). In both cases, *CEO tenure* might not accurately reflect the costs and benefits of a CEO's time in office. Seventh, we exclude family firms from our sample as CEOs may have less impact on firm value in these firms given that de facto firm control likely remains with the family members. Family firm data for the years 2001 to 2010 is from Ron Anderson's website (www.ronandersonprofessionalpage.net). The results from all these tests are reported in Appendix B and confirm those shown in Table 2.

3.2.2 Alternative explanations

In the next set of robustness tests, reported in *Table 3*, we attempt to rule out a number of alternative explanations. First, *CEO tenure* and *CEO tenure squared* may simply pick up the effect of a non-linear relation between CEO age or firm age and firm value. Hence, in Column 1, we add *CEO age squared* as an additional control variable to our standard specification as reported in Column 2 of Table 2. In Column 2, we extend our standard specification to include *Firm age squared*. When we use a firm's foundation age (obtained from The Corporate Library) instead of its age since IPO in unreported regressions, the result remains qualitatively similar. Second, CEO tenure and its squared term may simply capture an inverse U-shaped relation between CEO power and firm value as power grows with longer tenure and as it may have both costs and benefits (Adams, Almeida, and Ferreira, 2005; Li, Lu, and Phillips, 2016; Sah and Stiglitz, 1986). Hence, in Column 3, we add a squared term of *CEO power index* to our standard regression. Third, Huang (2013) reports an inverse U-shaped relation between outside director tenure and firm value. As director tenure may correlate with CEO tenure, in

Column 4, we extend our standard specification to include *Outside director tenure* and its squared term. Fourth, we investigate whether the upward sloping part of the inverted U-shaped relation is the outcome of new CEOs hired in response to poor previous performance (i.e., after the old CEO was fired). Denis and Denis (1995) provide evidence for changes of firm performance following top management turnover. We thus supplement our standard specification by the dummy variable *New CEO* in Column 5. In Column 6, we include all these additional explanatory variables simultaneously. We find the inverted U-shaped relation between CEO tenure and firm value to hold across all six regression specifications with the coefficients on *CEO tenure* and *CEO tenure squared* always being significant at the 5% level or better.

In Columns 7 and 8 of Table 3, we provide an alternative way of addressing the concern that *CEO tenure* is correlated with a set of control variables used in our baseline regression model and might therefore capture the effects that these variables can have on firm value. In particular, a CEO's time in office (technically) increases with CEO and firm age and is expected to increase in CEO power and past firm performance, and to be higher if the CEO is the company's founder. Therefore, instead of *CEO tenure*, we use *Residual CEO tenure* which is the residual from a regression of *CEO tenure* on *CEO age*, *CEO power index*, *Firm age*, *Founder CEO*, *Tobin's Q lagged* and time fixed effects. The residual no longer captures the effects of the above variables on firm value. The results on *Residual CEO tenure* are qualitatively similar to those on *CEO Tenure* (with inflection points of 9.8 and 11.1 years) and further support the inverted U-shaped relation between CEO tenure and firm value.

We investigate further alternative explanations in Appendix C. As shown in Pan, Wang, and Weisbach (Forthcoming), firms' investments increase significantly over CEO tenure (with decreasing investment quality), while disinvestments decrease. Given that disinvestments efficiently reshape the firm, the inverted U-shaped relation between CEO tenure and firm value

might reflect this investment pattern. Thus, in addition to firms' capital expenditures already controlled for in all of our regressions, in Column 1, we control for firms' acquisition and divestiture activities. We use the dummy variables *Acquisition activity* and *Divestiture activity* set to one if a firm undertakes an M&A transaction or a divestiture in a given year. In Column 2, we control for CEOs' general managerial abilities, which may correlate with their tenure, using the *General ability index* provided by Custódio, Ferreira, and Matos (2013). This data is only available until 2007, restricting our sample period to 1998-2007. Further, the inverted U-shaped relation of CEO tenure and firm value might capture the effect of incentive structures changing over a CEO's time in office. In Column 3, we control for *CEO ownership* and its square to address a potential inverted U-shape of equity ownership and firm value (e.g., McConnell and Servaes, 1990). In Column 4 (5), we alternatively include the fraction of variable to total compensation (and its square). Column 6 shows the regression results when we include all additional controls simultaneously. Again, we find the inverted U-shaped relation between CEO tenure and firm value to hold across all regression specifications with all coefficients on *CEO tenure* and *CEO tenure squared* being statistically significant.

3.2.3 CEO survivorship

The inverted U-shaped relation between CEO tenure and firm value might not be the outcome of costs and benefits arising over a CEO's tenure, but might simply reflect that CEOs with very good performance get recruited to run bigger companies (see, e.g., Fee and Hadlock, 2003), while CEOs with relatively poor performance remain with their companies. The latter may still survive for longer time periods through entrenchment in poorly governed firms and, probably, due to a lack of succession planning. A similar argument is that successful CEOs receive a larger compensation resulting in higher opportunity costs of work and earlier retirement. The acquisition of a company, which is usually associated with high returns (see, e.g., Andrade, Mitchell, and Stafford, 2001) while terminating the CEO's tenure with this

company through the subsequent delisting of the target firm, may also cause part of the effect. We address these concerns in Appendix D where we reestimate the regression reported in Column 2 of Table 2 for different sub-samples. Specifically, in Column 1 we restrict the sample to S&P 500 companies as CEOs of these very large companies are less likely to get recruited to run even bigger firms. The focus on the 500 leading U.S. companies also reduces heterogeneity with respect to CEO talent. In Columns 2 and 3, we focus on wealthier CEOs, i.e., those with a cumulative total CEO compensation (relative to their tenure) above the median or with equity ownership above the median. In Column 4, we exclude CEOs who have exceeded the general retirement age of 65 years. These CEOs are more likely to lead companies that lack CEO succession plans, while at the same time they have fewer, if any, career concerns. In Column 5, we exclude the last observation for each firm in our sample to eliminate the effect of potential takeovers. Finally, in Column 6, we exclude firms that have become takeover targets over the sample period. Again, our main result is confirmed and the coefficients on *CEO tenure* and *CEO tenure squared* are statistically significant in all specifications.

In the next set of robustness tests, we attempt to mitigate concerns that our results are influenced by firms or CEO-firm pairs with only few observations in our sample. Therefore, we restrict our sample to firms with at least six firm-year observations or to CEO-firm pairs with at least six CEO-firm pair observations. The results from estimating the extended regression specification from Column 6 of Table 3 for these two restricted datasets are reported in Appendix E. The regression in Column 1 includes firm fixed effects and the regression in Column 2 CEO-firm fixed effects to account for unobserved CEO heterogeneity and endogenous CEO-firm matching. The results in both columns confirm our previous findings of an inverted U-shaped relation between CEO tenure and firm value. Both tenure coefficients are significant at the 5% level or better. In unreported regressions, we reestimate the regression

from Column 6 of Table 3 without restricting the sample to firms with at least six observations per CEO-firm pair and again confirm our results.

3.2.4 Alternative measures for CEO tenure

To analyze whether it is really tenure as a CEO that matters, versus other types of tenure, we conduct additional analyses in Appendix F. Specifically, we add measures of the CEO's overall tenure with the company or her tenure on the board of directors. If it is really tenure as a CEO which matters most for on-the-job learning, but is also associated with a loss of fit over time, we expect *CEO tenure* and its squared term to remain statistically significant once we add the other tenure variables to our baseline regression. To determine a CEO's tenure with the company, we use the ExecuComp data item "JOINED_CO", available for 6,521 firm-year observations, which provides the date on which a CEO first joined the company (in any position). CEO mean tenure with the company is 15.8 years in our sample. To compute the CEO's tenure on the board of directors, we use data item "DIRSINCE" in ISS. This variable is available for 12,406 firm-year observations. The CEO's mean tenure on the board of directors is 10.3 years in our sample. The results in Columns 1 and 3 of Appendix E show evidence of an inverted U-shaped relation between both alternative types of tenure and firm value, which supports our general reasoning of the cost-benefit relation of tenure. However, when we simultaneously include *CEO tenure* and its square and the CEO's tenure with the company and its square (in Colum 2), or *CEO tenure* and its square and the CEO's board tenure and its square (in Column 4), only the coefficients on *CEO tenure* and its square remain statistically significant. In Column 5, we also run our baseline regression while restricting the dataset to internal CEOs who, by definition, have joined the company before becoming the CEO. We again find an inverted U-shaped relation between CEO tenure and firm value.[10] In Column 6,

[10] Internal CEOs are defined as in Bebchuk, Cremers, and Peyer (2011) and account for 83% (or 10,283 observations) of our sample (Bebchuk, Cremers, and Peyer report 85%).

we use the ExecuComp data item "JOINED_CO" to control for the average tenure of a firm's top executives and again find our main result to hold. We conclude that the CEO's tenure at the helm of the firm is the most relevant tenure measure. Additionally, in Column 7 we standardize a CEO's tenure by her age to account for age-related differences in the costs and benefits of CEO tenure and as another way of controlling for CEO age. Similar to our previous results, we find an inverted U-shaped relation between CEO tenure and firm value when we use the variables *CEO tenure/age* and *CEO tenure/age squared*.

3.2.5 Further robustness tests

In Appendix G, we present results from an alternative approach to test our hypothesis of an inverted U-shape in the relation between CEO tenure and firm value. In particular, instead of regressing *Tobin's Q* on *CEO tenure* and its square, we now regress *the growth rate of Tobin's Q* (denoted as $(Q_t\text{-}Q_{t-1})/Q_{t-1}$) on *CEO tenure* and the controls from Column 2 of Table 2. We posit that the benefits of tenure increase over the CEO's time in office with a declining marginal positive impact on firm value, while the costs increase over tenure with an increasing marginal negative impact on firm value, leading to an inverted U-shaped (i.e., concave) relation between CEO tenure and firm value (see Figure 1a). This inverted U-shape is consistent with a negative relation between a CEO's tenure and the growth rate of Tobin's Q (as the derivative function of an inverted U-shape is monotonically decreasing). The results support our expectation. Specifically, the coefficient of *CEO tenure* is negative and significant at the 1% level in both regressions. We use the estimated coefficients from these regressions to calculate the number of years of CEO tenure after which the growth rate of Tobin's Q turns negative. Holding all control variables at their sample means, results indicate that the costs of CEO tenure outweigh the benefits after 9.6 to 10.0 years.

As a final robustness test to our main results, we replace Tobin's Q by return on assets (*ROA*) as an accounting measure of firm performance. The results are reported in Appendix H.

We estimate similar specifications as in Column 2 of Table 2 (except for *Operating CF* which is omitted) using industry fixed effects (Column 1), firm fixed effects (Column 2), and CEO-firm fixed effects (Column 3). The results confirm the previously documented inverted U-shaped relation between CEO tenure and firm performance.

3.3 Acquisitions as a Major Channel of Firm Value Creation

In this section, we investigate a major channel through which CEOs can create and destroy firm value, acquisitions. If the inverted U-shaped relation between CEO tenure and firm value reflects a trade-off between benefits and costs, the same trade-off should also be reflected in the CEOs' investment decisions. In particular, we would expect the accumulation of experience, knowledge and valuable relations to result in better investments throughout the earlier years of a CEO's tenure. As eventually the CEO's fit with the firm deteriorates in longer tenure, and the CEO becomes increasingly entrenched and reluctant to change, we expect investment decisions to become worse. In this regard, acquisitions are an ideal setting to study the quality of a CEO's decisions as they are among the largest and most easily observable investments which tend to be directly influenced by the CEO (e.g., Custódio and Metzger, 2013). Moreover, an analysis of announcement returns allows a straightforward market-based assessment of the quality of the CEO's acquisition decision.

We compile a dataset of acquisitions announced by our sample firms during the period 1998-2011. Data on mergers and acquisitions stem from Standard & Poor's Capital IQ database. We only include takeovers with a total transaction value of at least 5 million US dollars in which a majority stake (i.e., at least 50%) of the target firm is acquired. In addition, we require a transaction's total value to represent at least 5% (10%) of the acquirer's market capitalization 20 days prior to the announcement of the deal. These filters result in 1,823 (1,097) acquisitions made by 980 (732) distinct firms for which data on all control variables is

available. We also run regressions with a smaller set of controls (those typically used in the M&A literature) resulting in a larger sample of 2,164 observations.

We measure acquirer announcement returns over a three-day event window from one day before to one day after the event date (*CAR [-1,1]*), defined as the day of the acquisition announcement in Capital IQ (or the first trading day thereafter if the announcement was made on a non-trading day). Cumulative abnormal announcement returns are calculated using the market model with the (value-weighted) S&P 500 market index. We control for acquirer and deal characteristics. Acquirer characteristics include the CEO, corporate governance, and firm controls used in Section 3.1. The choice of deal characteristics follows previous research (e.g., Custódio and Metzger, 2013; Moeller, Schlingemann, and Stulz, 2004) and include payment method, target ownership status, relative deal size, industry relatedness, geographic relatedness, and whether the acquisition is hostile. We further control for the number of an acquirer's previous deals in the last five years to account for acquisition experience and the firm's acquisition set. The deal-related variables are defined in the caption of *Table 4*.[11]

The results from the regressions of *CAR [-1,1]* on *CEO tenure*, *CEO tenure squared*, the acquirer and deal characteristics, and industry and year fixed effects are reported in the first three columns of Table 4. Columns 1 and 2 report the results for the sample of acquisitions whose total transaction value represents at least 5% of the acquirer's market capitalization, while Column 3 reports the results for acquisitions with a relative size of at least 10%. In Columns 4 to 6, we estimate the same regression specifications but replace the industry by firm fixed effects. In Columns 1 and 4 we use a smaller set of controls in order to compare our (OLS) results to the existing literature. Control variables have the expected signs. The results across all six specifications suggest an inverted U-shaped relation between CEO tenure and

[11] Mean values of the control variables for deal characteristics are not reported for brevity. They are in line with previous research. For example, relative deal size is 25% and the fraction of public targets is 34%. Custódio and Metzger (2013), for example, report values of 24% and 32%, respectively.

M&A announcement returns. Consistent with the results on the relation between CEO tenure and firm value, we find the inflection point of CEO tenure to be located in the area of 9.5-12 years when using firm fixed effects.[12]

Overall, the relatively lower returns to acquisition announcements associated with very short or very long CEO tenure suggest that there is some kind of optimal CEO tenure and that not all firms have an optimal CEO tenure. For short-tenured CEOs, a lack of firm-specific knowledge may result in the selection of relatively worse acquisition targets. Also, short-tenured CEOs may lack M&A experience and confidence, and thus may ultimately be associated with weaker negotiation outcomes important in corporate takeovers (see Custódio and Metzger, 2013). As CEO tenure advances, CEOs learn and improve on the aforementioned aspects. At some point, however, the CEO may have lost too much of her fit with the company, may be too entrenched, and thus selects non-optimal takeover targets (e.g., those with low synergies) or simply overpays (see Harford, Humphery-Jenner, and Powell, 2012). Empire building strategies or attempts to diversify the personal portfolio (Amihud and Lev, 1981) coupled with high CEO power may aggravate this problem.

4. Economic Environment and the Cost-Benefit Relation of CEO Tenure

This section investigates whether the relation between CEO tenure and firm value depends on the dynamics of the firms' environment, as argued in Hambrick and Fukutomi (1991) and Henderson, Miller, and Hambrick (2006).[13] Specifically, in more dynamic settings we would expect the benefits of tenure, particularly accumulated knowledge and experience,

[12] In unreported regressions, we use two alternative dependent variables, *CAR [-1,1]* winsorized at the 1st and 99th percentile level as well as the cumulative abnormal return for the seven-day event window from three days before to three days after the event date. Results are qualitatively similar.

[13] Both studies argue that CEOs have a fixed paradigm, i.e., they have a specific worldview and specific skills with a limited elasticity. They argue that a CEO's fit with the company depends on the dynamism of the industry the company operates in. While Hambrick and Fukutomi's (1991) study is theoretical, Henderson, Miller, and Hambrick (2006) provide initial empirical evidence consistent with differences in the CEO-firm (mis)match comparing 98 CEOs in the stable food industry with 228 CEOs in the more dynamic computer industry between 1955 to 1994. Their results suggest that CEOs lose their fit much faster in a more dynamic industry.

to have a shorter half-life, while a CEO-firm mismatch is more likely to occur and the CEO is less likely able to adapt to changes (which are typically exogenous to each firm). As a consequence, relative to the inflection point of CEO tenure (of 11-12 years) found for the average firm in Section 3, we expect the inflection point to shift to smaller (larger) tenure values in more (less) dynamic settings, i.e., the posited costs of CEO tenure are expected to outweigh the posited benefits after fewer (more) years of a CEO's time in office. The results of the following analyses therefore present empirical tests of the cost-benefit relation of and thus of the underlying costs and benefits of CEO tenure we posit in this paper.

As a first measure for the dynamism in a firm's environment, we use the industry dynamism index proposed by Coles, Daniel, and Naveen (2014b). The index is defined as the sum of the following four indicator variables: (i) a dummy whether the average annual sales growth of all firms in the industry is above the 50th percentile, (ii) a dummy whether the average R&D expenses to total assets at the industry level are above the 75th percentile, (iii) a dummy whether the average of the fluidity scores of Hoberg, Phillips, and Prabhala (2014) is above the 50th percentile, and (iv) a dummy whether the number of mergers in the industry divided by the number of firms in the industry (e.g., Harford, 2005) is above the 50th percentile. Industries are defined based on three-digit SIC codes. The index takes on discrete values between 0 and 4 (with a median value of 2) with higher values indicating higher industry dynamism. The results from reestimating our baseline regression as reported in Column 2 of Table 2 for sub-samples based on whether the industry dynamism index is above or below the median value are reported in *Panel A of Table 5*. The first column reports the results for firm-years with a dynamism index below the median (i.e., for firms operating in less dynamic settings) and the second column reports the results for firm-years with a dynamism index above the median (i.e., more dynamic settings).

The results of both regressions shown in Panel A confirm the inverted U-shaped relation between CEO tenure and firm value. Most importantly, we find the inflection point to be substantially lower (higher) for firms in more (less) dynamic settings (9.5 vs. 14.8 years). This suggests that the benefits of CEO tenure have indeed a shorter half-life, while the costs occur earlier if a firm's environment is more dynamic, consistent with the cost-benefit relation we posit. In terms of economic magnitude, the variation in the inflection point of CEO tenure, i.e., the CEO's time in office after which costs start to outweigh benefits, varies dramatically between more and less dynamic settings. Compared to the inflection point of 12.5 years found in our baseline regression from Column 2 of Table 2, we find that the inflection point is 19% (or 2.3 years) higher in less dynamic settings, while it is 24% (or 3 years) lower in more dynamic settings. Overall, the difference between the two inflection points is 5.3 years, which is more than the average CEO's contract term (see Xu, 2013).

Several alternative measures of firms' environmental dynamics support the above finding. In particular, we would expect the inflection point of CEO tenure to be lower for tech firms as accumulated knowledge and experience may more quickly become outdated and, hence, the negative value effect of a mismatch between the CEO and the firm and managerial entrenchment outweighs the positive value effect at an earlier time. A similar reasoning should apply to relatively young industries, typically characterized by higher environmental dynamics, as compared to relatively mature industries. Therefore, we reestimate our baseline regression from Column 2 of Table 2 for sub-samples of tech and non-tech firms and for sub-samples of young and mature industries. The results are reported in *Panel B and Panel C* of *Table 5*. In Panel B, we define tech firms based on four-digit SIC industries as suggested by Loughran and Ritter (2004). In Panel C, we define young industries as those with below sample median industry age, where industry age is measured as the average firm age of all companies operating in a firm's (three-digit SIC) industry. Not only do the results of all four regressions confirm the

inverted U-shaped relation between CEO tenure and firm value, but they are consistent with the posited cost-benefit relation of CEO tenure. Particularly, we find that the inflection point of tenure again varies considerably with firms' environmental dynamics. It is much lower (higher), i.e., costs outweigh benefits much earlier (later), for firms in more (less) dynamic settings. Relative to the inflection point of 12.5 years found in our baseline regression, the inflection point is 10.6 years for tech firms and 11.2 years for firms in young industries. For non-tech firms and firms in mature industries the inflection point is 13.7 and 14.2 years, respectively. The variation in inflection points is again economically meaningful.

In *Appendix I*, we provide additional robustness tests for the aforementioned findings. First, we use another index of environmental dynamism which is a 6-factor industry shock score based on Guay, Taylor, and Xiao (2014). The shock score (defined in the caption of Appendix I) is based on industry-wide changes, both expansions and declines, in advertising expenses, firm size, investments, R&D expenses, sales and sales concentration. Results from reestimating our baseline regression for sub-samples of firm-year observations in more shock-affected (with a shock score above the median) and less shock-affected industries are reported in Panel A. Second, Panel B reports results from regressions where we use an alternative definition of tech firms based on NAICS codes as provided by the U.S. Census. Again, we find the inflection point of CEO tenure to be much lower (higher) – 8.5 vs. 14.9 years in Panel A and 11.2 vs. 15.6 years in Panel B – in firms which are to a larger (lower) extent subject to environmental dynamism. In terms of economic magnitude, the variation of about 4 to 6 years in the inflection point of CEO tenure is substantial.

In sum, the results across Table 5 and Appendix I confirm the inverted U-shaped CEO tenure-firm value relation, suggest that this relation is significantly affected by firms' environments, and thereby provide important tests which support the underlying costs and benefits of CEO tenure we posit. The non-linear CEO tenure-firm value relation is further

supported by unreported regressions where we find that *CEO tenure* (without its squared term) is statistically insignificant in all regression models shown in Table 5 and Appendix I. Given the economically meaningful differences between the inflection points of CEO tenure found for more and less dynamic settings, the results of this section do not support a one-size-fits-all policy of CEO term limits.

5. Using Exogenous Shocks for Identification

5.1 Recessions as Shocks to the Cost-Benefit Relation of CEO Tenure

We use economic recessions, including the financial crisis of the late 2000s, as shocks to the posited costs and benefits of CEO tenure and hence the resulting cost-benefit relation. Specifically, we expect the CEO learning period to be extended in crises and recessions as CEOs gain new, valuable experience and likely have to solve more problems in difficult economic times (see Arrow, 1962, and Kempf, Manconi, and Spalt, 2014, for a similar reasoning and consistent evidence). In terms of the costs of tenure, we expect entrenchment to become less costly in crises and recessions due to positive effects of managerial discretion in difficult times (e.g., Li, Lu, and Phillips, 2016), while the CEO-firm match is unlikely to be affected considerably. We thus expect the inflection point of CEO tenure to shift to larger values for recession years, i.e., costs start to outweigh benefits at higher CEO tenures.

To test the aforementioned prediction, we classify our sample years as recession (or non-recession) years according to the NBER Business Cycle Expansions and Contractions data (http://www.nber.org/cycles.html). Comparable to the procedure in Section 4, we reestimate our baseline regression from Column 2 of Table 2 for sub-samples of recession and non-recession years and compare the estimated inflection points. The results are shown in *Table 6*. In Columns 1 and 2, we exclude year fixed effects from the regressions and compare the inflection point to the inflection point resulting from a reestimation of our baseline regression

with a recession dummy instead of year fixed effects. In Columns 3 and 4, we include year fixed effects in the regressions. The results support our expectation. The inflection point indeed shifts to larger tenure values for recession years. The increase in the inflection point is economically meaningful amounting to about 2 years (or up to 18%) compared to the baseline regression results. Consistently, we find that the inflection point shifts to smaller tenure values for non-recession years.

5.2 Regulatory Changes in Corporate Governance as Shocks to the Cost-Benefit Relation of CEO Tenure

In the following, we make use of regulatory changes in corporate governance as exogenous shocks to the posited cost-benefit relation of CEO tenure. First, we follow Guo and Masulis (2015) and use the implementation of SOX and the concurrent NYSE and NASDAQ listing rule changes – which significantly increased board and committee independence – as a positive shock to the overall level of corporate governance. Similar to Guo and Masulis, and given the stock exchange deadlines for compliance, we treat the fiscal year 2005 as the first year of compliance with SOX and the listing rules and denote the years after 2004 as the post-SOX period. We predict optimal CEO tenure to shift to larger values post-SOX as improved governance is expected to reduce the costs of both CEO entrenchment and CEO-firm mismatch. *Panel A of Table* 7 shows the regression results from reestimating our baseline regression from Column 2 of Table 2 for sub-samples for the pre-SOX and the post-SOX periods. In Columns 1 and 2, we exclude year fixed effects from the regressions and compare the inflection point to the inflection point resulting from a reestimation of our baseline regression with a post-SOX dummy instead of year fixed effects. In Columns 3 and 4, we include year fixed effects in the regressions. The results support our prediction. The inflection point of CEO tenure shifts to larger values after the implementation of SOX. The increase in the inflection point is again economically meaningful and amounts to at least 2 years (or 16%)

compared to the baseline regression results. Consistently, we find that the inflection point shifts to smaller tenure values for pre-SOX years.

Following a similar reasoning as above, we further use the takeover index provided by Cain, McKeon, and Solomon (2014), which is based on exogenous changes in U.S. state-level laws. As higher index values correspond to higher firm-level takeover susceptibility, i.e., more external governance through the market for corporate control, we predict the inflection point of CEO tenure to shift to larger (smaller) values for firms with higher (lower) index values. The results from reestimating our baseline regression for sub-samples of firms with high (i.e., above median) and with low takeover index values are shown in *Panel B of Table 7*. Again, the results support our prediction.

5.3 Evidence from Sudden CEO Deaths

We further aim to mitigate endogeneity concerns by employing an identification strategy based on unexpected deaths of incumbent CEOs, similar to, e.g., Bennedsen, Pérez-Gonzàlez, and Wolfenzon (2007) and Johnson et al. (1985). Unexpected CEO deaths offer plausibly exogenous identification of how markets assess a CEO's value because deaths occur randomly and are likely to be exogenous to current firm and market conditions. In particular, the stock price reaction to sudden deaths of CEOs measures the expected (i.e., future) contribution of CEOs to shareholder value (see Nguyen and Nielsen, 2014). Thus, given the hypothesized costs and benefits arising over the CEO's time in office, we expect a positive relation between a deceased CEO's tenure and the stock price reaction to his or her death.[14] Consequently, the evidence presented in this section provides an alternative test for the

[14] A positive stock price reaction suggests a negative contribution to firm value. Thus, a positive and linear relation between CEO tenure and the stock price reaction to sudden CEO deaths is consistent with our main findings as reported in Table 2. We refer the reader the motivation for the analysis reported in Appendix G.

hypothesized U-shaped relation between tenure and firm value and important additional evidence on whether some CEOs stay in office for too long.

We hand-collected a sample of CEO deaths between 1992 and 2012 from various sources including LexisNexis and Google using keyword searches of expressions "CEO", "Chief Executive Officer" and "death", "passed away", "deceased", etc. We consider all CEOs of firms with available data in CRSP. To ensure that the CEO's death conveys new information, we restrict our sample to unexpected deaths using the definition of Nguyen and Nielsen (2014), i.e., we classify deaths as sudden when the cause of death is a heart attack, stroke, or an accident or when the specific cause is unreported, but the death is described as unexpected or unanticipated or sudden. We exclude cases of sudden deaths for which the cause of death is a murder or suicide. This procedure leaves us with a sample of 80 sudden deaths of CEOs.[15] For these 80 events, we compute cumulative abnormal stock returns (CARs) over the 3-day period from the day before until the day after the announcement date (*CAR [-1,1]*). We use the market model with the CRSP value-weighted index as a proxy for the market return.

In *Panel A of Table 8,* we report results from univariate difference-in-means tests, for whether *CAR [-1,1]* differs depending on the deceased CEO's tenure. Specifically, we compare mean CARs across two sub-samples based on whether CEO tenure is above or below (or equal to) the sample median or above or below (or equal to) 12 years, the average inflection point determined in our earlier analyses. The results show that announcement returns of CEOs with shorter tenure dying unexpectedly are significantly lower than announcement returns of CEOs with longer tenure. Consistent with our hypothesis and results in Section 3, we find that the

[15] Comparable to Nguyen and Nielsen (2014), who report a mean market capitalization of US$ 1,260 million, a mean market-to-book ratio of 2.7, a (median) CEO age of 60 years, and a CEO tenure of 9.4 years, we find that the mean market capitalization in our sample is US$ 1,455 million, the market-to-book ratio is 2.8, the median CEO age is 60 years and the median tenure is 8.5 years (with a minimum value of zero). The cause of death is a heart attack in 44% of all cases, a stroke or accident in 25%, and in 31% it is unknown but unexpected.

sub-sample means of *CAR [-1,1]* have the expected signs: negative for the sub-samples of CEO tenure below (or equal to) 12 years and positive for the sub-samples of tenure above 12 years.

Panel B of Table 8 reports results from regressions of *CAR [-1,1]* and *CAR [-1,1] winsorized* (at the 5th and 95th percentiles) on *CEO tenure* and additional controls for CEO and firm characteristics (not available for all observations). The results are consistent with the univariate findings and suggest a positive relation between announcement returns to CEOs' unexpected deaths and CEO tenure. Specifically, announcement returns are significantly less negative when CEOs have longer tenure suggesting that long tenure periods are more negatively perceived by the market. This result is robust to controlling for the variables *Duality, Founder CEO,* and *President*, some of the most important CEO power measures (see Adams, Almeida, and Ferreira, 2005). Thus, the negative effect of high-tenured CEOs on shareholder value, at least to a certain part, seems to stem from costs arising with tenure, particularly CEO-firm mismatch, inability and reluctance to adapt to changes, other than the CEO's entrenchment.

In sum, the evidence found in this section supports our previous results and the hypothesized effects of the costs and benefits arising over the CEO's time in office. They indicate that some CEOs indeed stay in office for too long at the detriment of shareholders. Results suggest that a policy of frequent CEO turnover may be in the interest of shareholders.

6. Conclusion

In this study, we posit an inverted U-shaped relation between CEO tenure and firm value. This relation is the outcome of benefits – such as on-the-job learning, gaining experience and establishing valuable relations – and costs – such as entrenchment and an increasing likelihood of a CEO-firm mismatch together with a decreasing ability and willingness to change – that arise over the a CEO's time in office. The negative effects of CEO tenure are

likely to be reinforced by managerial power, which tends to increase over tenure, making CEO turnover less likely. We find strong empirical support for the posited non-linear relation between CEO tenure and firm value. Our results survive a large set of robustness tests and are also found for M&A announcement returns and firm profitability.

We further find substantial variation in the CEO's time in office after which costs of tenure start to outweigh benefits which depends on a firm's economic environment that determines the cost-benefit relation of tenure. Specifically, costs outweigh benefits much earlier (compared to the average firm) for firms operating in dynamic, fast changing environments, but much later in more mature and stable environments. Hence, the evidence presented in this paper does not support a one-size-fits-all policy of CEO term limits. Identification attempts to provide more causal evidence include economic recessions and regulatory changes to corporate governance as exogenous shocks to the cost-benefit relation of tenure as well as unexpected CEO deaths. The latter suggest that some CEOs may indeed stay at the top for too long at the detriment of shareholders. We conclude that while a general policy of regular CEO turnover may be valuable, firms should set term limits individually.

The insights from this study add to both the ongoing debate about the usefulness of term limits for CEOs and the recent literature that measures the extent to which CEOs matter. In particular, our study suggests that not only heterogeneity across different CEOs, but also heterogeneity with respect to the same CEO over her time in office matters.

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Figure 1a – The relation between firm value and CEO tenure
This figure illustrates the hypothesized relation between firm value and CEO tenure based on the cost-benefit relation over a CEO's time in office.

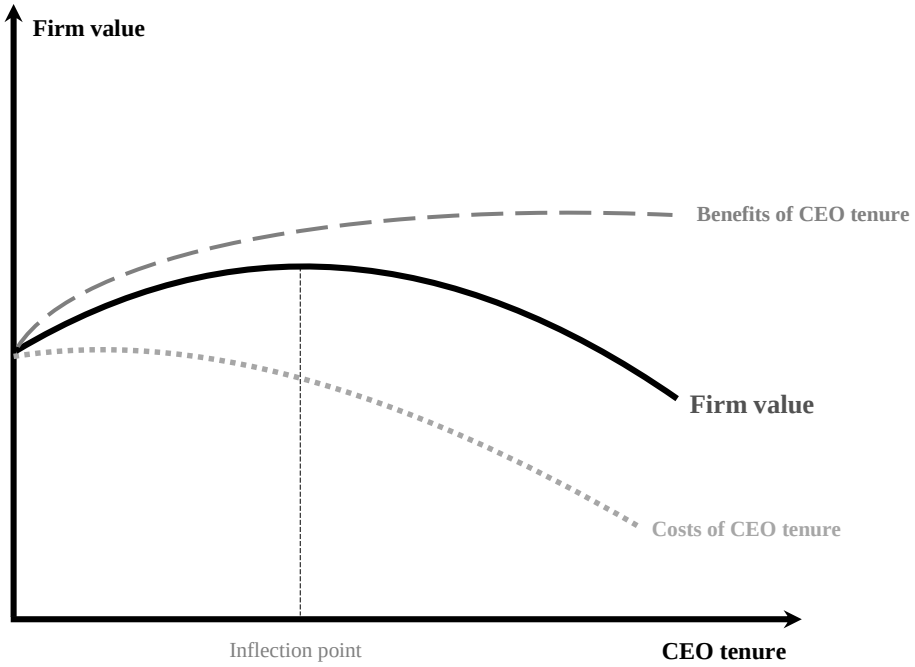

Figure 1b – Nonparametric plot of firm value against CEO tenure
This figure shows the results from locally weighted regression (lowess) of residuals of *Tobin's Q* on CEO tenure. The residuals are from a regression of our baseline model shown in column 2 of Table 2 where we omit the variables *CEO tenure* and *CEO tenure squared*. Lowess regression provides a nonparametric way of estimating the relation between firm value and CEO tenure. The bandwidth is 0.4.

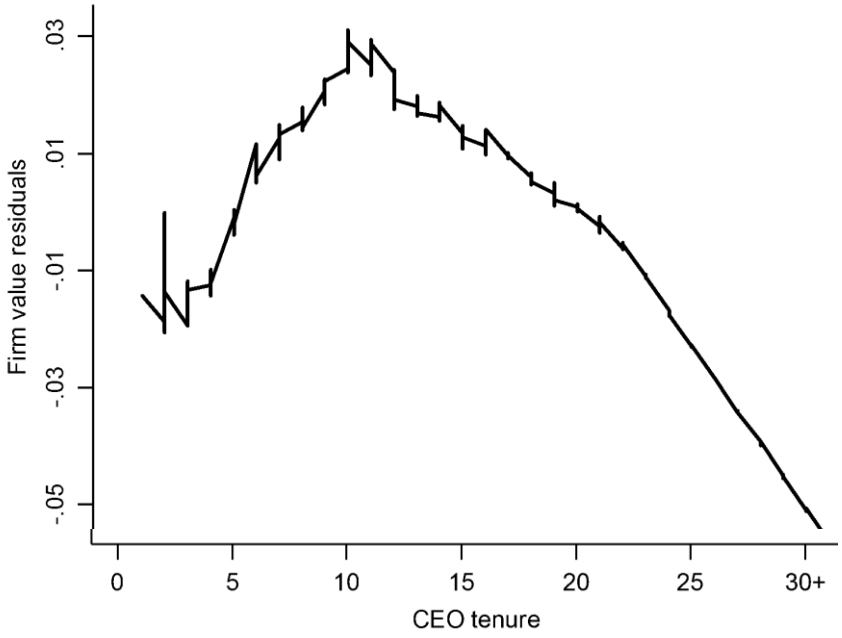

Figure 2a – CEO tenure and CEO power accumulation

This figure shows a plot of the results from a locally weighted regression (lowess) of the *CEO power index* on *CEO tenure*. The sample includes S&P 1500 firms over the period 1998-2011 excluding observations from regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). *CEO power index* is the sum of the following indicator variables: *CEO ownership* above median, *Co-Option* above median, *Duality*, *Involved CEO*, *President*, *Only insider*. *CEO tenure* is the number of years the CEO has been serving as the firm's CEO.

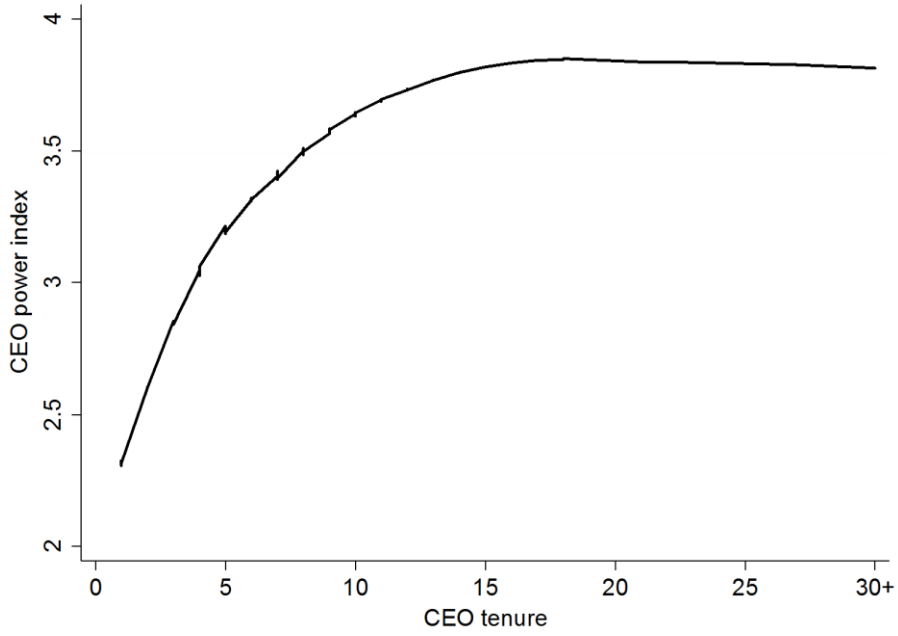

Figure 2b – CEO tenure and CEO turnover

This figure shows a plot of the results from a locally weighted regression (lowess) of CEO turnover on *CEO tenure*. The sample includes S&P 1500 firms over the period 1998-2011 excluding observations from regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). *Forced turnover* is an indicator variable that takes the value of one if the CEO departs at the end of the year, is younger than 60 years (following Coles, Daniel, Naveen, 2014a), and the firm's annual industry-adjusted stock return is below zero. *Voluntary turnover* is an indicator variable that takes the value of one if the CEO departs at the end of the year, is younger than 60 years, and the firm's annual industry-adjusted stock return is above zero. Industry adjustment is done by subtracting the median industry stock return based on 3-digit SIC cluster.

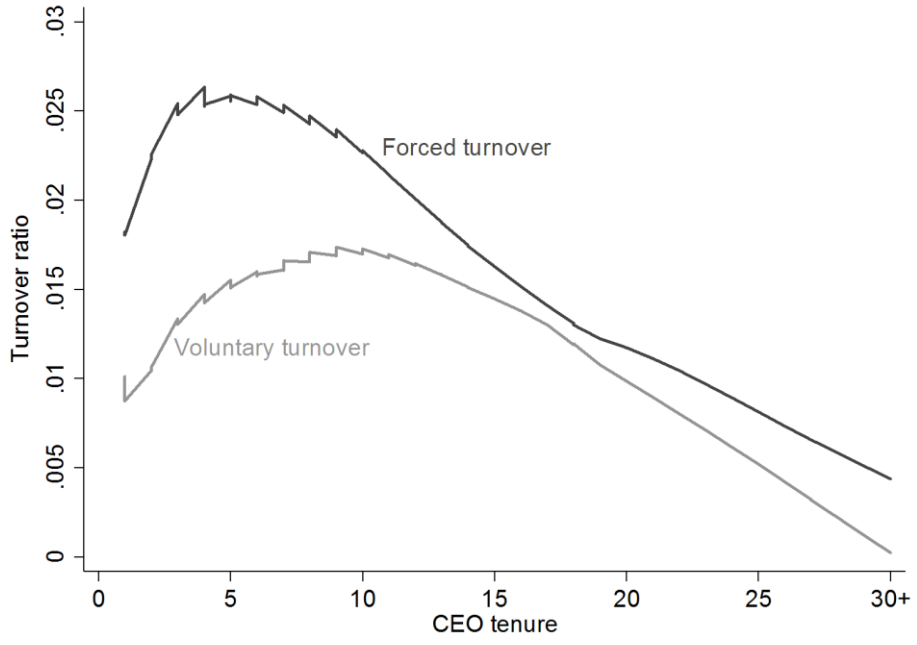

Table 1 – Summary statistics

This table provides descriptive statistics for the sample of S&P 1500 companies (excluding SIC codes 4000-4999 and 6000-6999) that consists of 12,427 firm-year observations based on 1,782 unique firms and 3,064 unique CEO-firm pairs over the period 1998-2011. *Maximum CEO tenure* is the largest value of *CEO tenure* in the sample per CEO-firm pair. A CEO is classified as a CEO who leaves the firm during her honeymoon period if *Maximum CEO tenure* is smaller than three years. All other variables are defined in Appendix A.

	Obs.	Mean	Median	1. Quartile	3. Quartile	SD
CEO tenure						
CEO tenure	12,427	7.67	5.00	2.00	10.00	8.02
CEO tenure > 10 yrs (dummy)	12,427	0.24				0.43
CEOs leaving during honeymoon (dummy)	3,064	0.21				0.41
Maximum CEO tenure	3,064	8.41	6.00	3.00	11.00	8.06
Maximum CEO tenure w/o CEOs leaving during honeymoon	2,416	10.37	8.00	5.00	13.00	8.00
Maximum tenure > 10 yrs (dummy)	3,064	0.28				0.47
New CEO (dummy)	12,427	0.07				0.25
CEO characteristics						
CEO age	12.427	55.66	56.00	51.00	60.00	7.38
CEO gender (dummy)	12,427	0.02				0.15
Founder CEO (dummy)	12,427	0.12				0.32
CEO power measures						
CEO power index	12,427	2.90	3.00	2.00	4.00	1.21
CEO ownership	12,427	0.03	0.010	0.003	0.026	0.06
Co-Option	12,427	0.38	0.33	0.11	0.63	0.30
Duality (dummy)	12,427	0.58				0.49
Involved CEO (dummy)	12,427	0.18				0.38
Only insider (dummy)	12,427	0.57				0.49
President (dummy)	12,427	0.58				0.49
Governance characteristics						
Board size	12,427	9.01	9.00	7.00	10.00	2.23
Busy board (dummy)	12,427	0.20				0.40
E-index	12,427	2.47	2.00	2.00	3.00	1.35
Independence ratio	12,427	0.71	0.75	0.63	0.83	0.16
Independent director ownership	12,427	0.002	0.0005	0.0002	0.001	0.005
Outside director tenure	12,427	8.23	7.63	5.60	10.11	3.78
Firm characteristics						
Book leverage	12,427	0.40	0.41	0.27	0.51	0.17
Business segments	12,427	2.81	3.00	1.00	4.00	2.29
CapEx	12,427	0.05	0.04	0.02	0.07	0.05
Firm age	12,427	25.11	19.00	11.00	35.00	19.34
Firm risk	12,427	0.46	0.41	0.31	0.55	0.21
Operating CF	12,427	0.13	0.12	0.07	0.17	0.10
R&D	12,427	0.03	0.01	0.00	0.05	0.06
ROA	12,402	0.16	0.15	0.10	0.21	0.12
Sales growth	12,427	0.10	0.08	-0.007	0.17	0.27
Tobin's Q	12,427	1.99	1.59	1.22	2.26	1.35
Total assets	12,427	6,211.67	1,355.68	556.39	3,944.00	26,765.89

Table 2 – CEO tenure and firm value

This table reports results from firm fixed effects regressions of *Tobin's Q* on *CEO tenure* or *CEO tenure* and its squared term along with CEO characteristics, CEO power measures, firm, and corporate governance characteristics. The sample includes S&P 1500 firms over the period 1998-2011 excluding regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). Regression (4) additionally contains interacted year and industry (based on three-digit SIC codes) fixed effects. Regression (5) excludes all observations with *CEO tenure* below one and equal to or above 38 years (the 1st and 99th percentiles). Regression (3) includes the set of individual components of the count variable *CEO power index*, instead of the aggregate index. All variables are defined in Appendix A. An intercept and year dummies are included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's Q				
	(1)	(2)	(3)	(4)	(5)
					$1 \leq$ *CEO tenure* ≤ 38
CEO tenure	**-0.0019**	**0.0150****	**0.0146***	**0.0128***	**0.0244****
	(-0.499)	**(2.558)**	**(1.670)**	**(1.737)**	**(2.173)**
CEO tenure squared		**-0.0006*****	**-0.0006*****	**-0.0006*****	**-0.0011*****
		(-3.680)	**(-2.880)**	**(-3.008)**	**(-3.194)**
CEO characteristics					
CEO age	0.0025	0.0020	0.0015	0.0054	0.0044
	(0.852)	(0.679)	(0.500)	(1.532)	(0.937)
CEO gender	0.0208	0.0272	0.0370	-0.0162	-0.0264
	(0.241)	(0.319)	(0.428)	(-0.173)	(-0.222)
CEO power index	-0.0088	-0.0235		-0.0309	-0.0205
	(-0.462)	(-1.197)		(-1.223)	(-0.759)
Founder CEO	0.3753***	0.4204***	0.4440***	0.4524***	0.7406***
	(2.641)	(2.898)	(2.924)	(2.782)	(2.941)
CEO power measures					
CEO ownership			-0.7439**		
			(-2.384)		
Co-Option			-0.0398		
			(-0.383)		
Duality			0.0257		
			(0.686)		
Involved CEO			-0.0228		
			(-0.549)		
Only insider			-0.0592		
			(-1.553)		
President			0.0020		
			(0.062)		
Governance characteristics					
Board size	-0.2590***	-0.2572***	-0.2777***	-0.2067*	-0.3088***
	(-2.689)	(-2.683)	(-2.888)	(-1.811)	(-2.702)
Busy board	-0.0539*	-0.0518*	-0.0506	-0.0351	-0.0454
	(-1.734)	(-1.671)	(-1.639)	(-1.050)	(-1.217)
E-Index	0.0174	0.0163	0.0153	0.0190	0.0267
	(1.088)	(1.025)	(0.982)	(1.037)	(1.272)
Independence ratio	-0.0348	-0.0454	-0.0239	-0.0464	-0.0353
	(-0.257)	(-0.336)	(-0.157)	(-0.261)	(-0.214)
Independent director ownership	-3.2313	-3.3973	-3.3480	-1.6211	-5.6174**
	(-1.472)	(-1.561)	(-1.530)	(-0.655)	(-1.979)
Firm characteristics	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry*year fixed effects	No	No	No	Yes	No
Observations	12,427	12,427	12,427	12,427	10,097
R-squared (within)	0.297	0.299	0.300	0.441	0.299
Inflection point (yrs)		**12.5**	**12.2**	**10.6**	**11.1**

Table 3 – Addressing alternative explanations for CEO tenure and firm value

This table reports results from firm fixed effects regressions of *Tobin's Q* on *CEO tenure* and its squared term along with CEO, firm, and corporate governance characteristics. The sample includes S&P 1500 firms over the period 1998-2011 excluding regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). *Residual CEO tenure* is the residual from a regression of *CEO tenure* on *CEO age*, *CEO power index*, *Firm age*, *Founder CEO*, *Tobin's* Q_{t-1} and year-fixed effects. All variables are defined in Appendix A. An intercept is included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's Q							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CEO tenure	**0.0131****	**0.0147****	**0.0151*****	**0.0147****	**0.0168*****	**0.0143****		
	(2.087)	**(2.537)**	**(2.616)**	**(2.521)**	**(2.584)**	**(2.119)**		
CEO tenure squared	**-0.0005*****	**-0.0006*****	**-0.0006*****	**-0.0006*****	**-0.0006*****	**-0.0005*****		
	(-2.940)	**(-3.663)**	**(-3.692)**	**(-3.674)**	**(-3.760)**	**(-2.975)**		
Residual CEO tenure							**0.0137****	**0.0133****
							(2.447)	**(2.053)**
Residual CEO tenure squared							**-0.0007*****	**-0.0006*****
							(-3.743)	**(-3.017)**
Alternative explanations								
CEO age squared	-0.0003					-0.0003		0.0029
	(-1.262)					(-1.239)		(0.296)
Firm age squared		-0.0810				0.0035		-0.0753
		(-1.523)				(0.353)		(-1.406)
CEO power index squared			0.0046			-0.0755		0.0029
			(0.464)			(-1.409)		(0.296)
Outside				0.0158		0.0121		0.0119
director tenure				(1.330)		(1.008)		(0.993)
Outside				-0.0010*		-0.0008		-0.0008
director tenure squared				(-1.853)		(-1.532)		(-1.517)
New CEO					0.0375	0.0347		0.0355
					(1.200)	(1.073)		(1.090)
CEO characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Governance characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,427	12,427	12,427	12,427	12,427	12,427	12,427	12,427
R-squared (within)	0.299	0.299	0.299	0.299	0.299	0.300	0.299	0.300

Table 4 – Evidence from acquisitions

This table presents results from regressions of three-day cumulative abnormal returns (*CAR [-1,1]*) around acquisition announcements on *CEO tenure* and its squared term along with CEO, acquirer (including corporate governance), and deal characteristics. To estimate abnormal returns, we use the market model with the S&P 500 index as a proxy for the market portfolio. *Cross-border* is a dummy variable whether a deal is cross-border, and zero for domestic deals. *Hostile* is a dummy variable that is set to one for deals defined by Capital IQ as hostile deals, zero otherwise. *Market-to-book* is the acquiring firm's market-to-book ratio defined as the acquirer's market capitalization 20 trading days prior to deal announcement divided by the acquirer´s common equity as of the end of the fiscal year prior the announcement of the M&A deal. *Number Previous deals* is the number of acquisitions made by the acquirer in the 5 years prior to deal announcement. *Payment includes stock* is a dummy variable that equals one if the consideration includes stock, and zero otherwise. *Public target* is dummy variable that equals one if the target firm is a listed company, and zero otherwise. *Relative size* is the deal's total transaction value divided by the acquirer's market capitalization 20 days prior to the announcement of the deal. *Same industry* is a dummy variable that equals one if the acquirer and the target belong to the same two-digit SIC industry, and zero otherwise. All other variables are defined in the Appendix A. Regressions (1) to (3) include year and industry fixed effects (based on Fama-French 48 industries), while regressions (4) to (6) include year and firm fixed effects. Robust t-statistics of the regression coefficients (in parentheses) are based on standard errors clustered by acquirer. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	CAR[-1,1]					
	Pooled OLS			Firm fixed effects		
Relative size:	≥ 5%	≥ 5%	≥ 10%	≥ 5%	≥ 5%	≥10%
	(1)	(2)	(3)	(4)	(5)	(6)
CEO tenure	**0.0012*** **	**0.0019*** **	**0.0029*** **	**0.0019***	**0.0023***	**0.0048*** **
	(2.823)	**(3.462)**	**(3.402)**	**(1.671)**	**(1.658)**	**(2.199)**
CEO tenure squared	**-0.00004*** **	**-0.00005*** **	**-0.0001*** **	**-0.0001***	**-0.0001***	**-0.0002*** **
	(-2.593)	**(-3.242)**	**(-2.829)**	**(-1.939)**	**(-1.723)**	**(-2.109)**
CEO characteristics						
CEO age	-0.0055**	-0.0040*	-0.0022	-0.0046	0.0009	0.0002
	(-2.122)	(-1.850)	(-0.598)	(-0.952)	(0.171)	(0.019)
CEO age squared	0.0001**	0.00004**	0.00002	0.00005	-0.000005	0.000008
	(2.305)	(2.017)	(0.772)	(1.099)	(-0.099)	(0.084)
CEO gender		0.0156	-0.0044**		0.0360*	0.0152
		(1.535)	(-2.069)		(1.759)	(0.458)
CEO power index		-0.0027*	0.0010		0.0013	0.0022
		(-1.724)	(0.111)		(0.472)	(0.547)
Founder CEO		0.0005	0.0224*		0.0411*	0.0943***
		(0.098)	(1.696)		(1.666)	(2.615)
Acquirer characteristics						
Book leverage		0.0145	-0.0070***		-0.0217	0.0489
		(1.214)	(-2.736)		(-0.902)	(1.296)
Business segments		-0.0003	0.0016		-0.0019	-0.0001
		(-0.124)	(0.405)		(-0.279)	(-0.011)
Firm age		0.0001	0.0001		0.0011	0.0034
		(0.944)	(0.973)		(0.393)	(0.819)
Firm risk		-0.0072	0.0162		0.0175	0.0225
		(-0.494)	(1.006)		(0.811)	(0.728)
Market-to-book	0.0009*	0.0006	-0.0239	0.0009	0.0001	-0.0056***
	(1.844)	(1.578)	(-1.357)	(0.563)	(0.126)	(-2.788)
Operating CF		0.0056	0.0009*		-0.0298	-0.0239
		(0.284)	(1.775)		(-0.944)	(-0.541)
Total assets	-0.0022*	-0.0037**	-0.0041	0.0045	0.0046	-0.0037
	(-1.819)	(-2.121)	(-0.145)	(0.737)	(0.662)	(-0.351)
Board size		-0.0040	-0.0106		-0.0375*	-0.0639*
		(-0.439)	(-0.841)		(-1.731)	(-1.707)
Busy board		-0.0002	0.0009		0.0217***	0.0220
		(-0.035)	(0.044)		(3.206)	(1.581)
E-index		0.0011	-0.0004		0.0006	0.0013
		(0.801)	(-0.230)		(0.160)	(0.178)
Independence ratio		-0.0084	-0.0023		0.0069	-0.0118
		(-0.602)	(-0.381)		(0.287)	(-0.332)
Independent director		-0.2340	-0.1274		-1.3230*	-1.6630
ownership		(-0.572)	(-0.259)		(-1.908)	(-1.296)
Deal characteristics						
Cross-border	0.0045	0.0044	-0.0087	0.0042	0.0028	0.0013
	(1.223)	(1.156)	(-1.175)	(0.822)	(0.508)	(0.140)
Hostile	-0.0360	-0.0387	-0.0079	-0.0078	-0.0139	-0.0443**
	(-1.077)	(-1.132)	(-1.366)	(-0.250)	(-0.441)	(-2.049)
Number previous deals	-0.0001	-0.0002	-0.0033	-0.0008	-0.0006	0.0012
	(-0.370)	(-0.423)	(-0.580)	(-0.944)	(-0.717)	(0.838)
Payment includes stock	-0.0069*	-0.0056	-0.0321	-0.0039	-0.0025	0.0013
	(-1.752)	(-1.267)	(-0.935)	(-0.723)	(-0.411)	(0.131)
Public target	-0.0075**	-0.0082**	0.0003	-0.0060	-0.0070	-0.0072
	(-2.035)	(-2.019)	(0.505)	(-1.143)	(-1.249)	(-0.841)
Relative size	-0.0067	-0.0071	0.0013	-0.0023	0.0045	0.0076
	(-1.100)	(-1.028)	(0.218)	(-0.271)	(0.444)	(0.634)
Same industry	-0.0034	-0.0027	-0.0054	-0.0089*	-0.0083	-0.0114
	(-0.984)	(-0.723)	(-1.067)	(-1.781)	(-1.588)	(-1.297)
Industry fixed effects	Yes	Yes	Yes	No	No	No
Firm fixed effects	No	No	No	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,164	1,823	1,097	2,171	1,823	1,097

Table 5 – Environmental dynamics and the cost-benefit relation of CEO tenure

This table presents results from firm fixed effects regressions of *Tobin's Q* on *CEO tenure* and its squared term along with CEO, firm, and corporate governance characteristics for industry sub-samples. The sample includes S&P 1500 firms over the period 1998-2011 excluding regulated financial and utility firms (SIC codes 4000-4999 and 6000-6999). Panel A reports sub-sample results for more versus less dynamic industries using the industry dynamism index proposed by Coles, Daniel, and Naveen (2014b). Industries are defined based on three-digit SIC clusters. *Dynamism index* is defined as the sum of the following four indicator variables. (i) *Growth industry* that equals one if the average annual sales growth of all firms in the industry is above the 50th percentile, zero otherwise, (ii) *R&D industry* that equals one if the average R&D expenses to total assets at the industry level is above the 75th percentile, zero otherwise , (iii) *High fluidity industry* which is set to one if the average of the fluidity scores of Hoberg, Philips, and Prabhala (2014) is above the 50th percentile, zero otherwise, and (iv) *Merger industry* that is set to one if the number of mergers in the industry divided by the number of firms in the industry (e.g., Harford, 2005) is above the 50th percentile, zero otherwise. Therefore, the index takes discrete values between 0 and 4, where higher values indicate higher industry dynamism. Panel B reports sub-sample results using the tech firm definition suggested by Loughran and Ritter (2004). According to their definition, a firm is considered a tech firm if the company is operating in one of the following four-digit SIC codes: 3571, 3572, 3575, 3577, 3578, 3661, 3663, 3669, 3671, 3672, 3674, 3675, 3677, 3678, 3679, 3812, 3823, 3825, 3826, 3827, 3829, 3841, 3845, 4812, 4813, 4899, 7371, 7372, 7373, 7374, 7375, 7378, or 7379. Panel C reports sub-sample regression results for mature and young industries. Industries are defined based on three-digit SIC clusters. The age of an industry is defined as the average firm age (based on the CRSP inclusion year) of all companies operating in the respective industry. *Mature industries* is an indicator variable that equals one if the industry age is above the median industry age. Accordingly, *Young industries* is an indicator variable that equals one if the industry age is equal to or below the median. Control variables are identical to those used in regression (2) of Table 2 which yields an inflection point of 12.5 years. Absolute and relative changes presented at the end of Panel A, B, and C are calculated with respect this inflection point. All variables are defined in Appendix A. An intercept and year fixed effects are included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A – Dynamism index (based on Coles, Daniel, and Naveen, 2014b)		
	≤ Median	> Median
CEO tenure	**0.0059***	**0.0397***
	(1.792)	**(1.685)**
CEO tenure squared	**-0.0002****	**-0.0021*****
	(-2.074)	**(-2.676)**
CEO characteristics	Yes	Yes
Governance characteristics	Yes	Yes
Firm characteristics	Yes	Yes
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	8,951	3,476
R-squared (within)	0.383	0.372
Inflection point (yrs)	**14.8**	**9.5**
Absolute change (yrs)	*+ 2.3*	*- 3.0*
Relative change (%)	*+ 18.5*	*- 24.0*

Panel B – Tech vs. non-tech firms (Loughran and Ritter, 2004)		
	Tech = 0	Tech = 1
CEO tenure	**0.0082***	**0.0444***
	(1.861)	**(1.725)**
CEO tenure squared	**-0.0003***	**-0.0021*****
	(-1.898)	**(-2.741)**
CEO characteristics	Yes	Yes
Governance characteristics	Yes	Yes
Firm characteristics	Yes	Yes
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	9,808	2,619
R-squared (within)	0.308	0.369
Inflection point (yrs)	**13.7**	**10.6**
Absolute change (yrs)	*+ 1.2*	*- 1.9*
Relative change (%)	*+ 9.6*	*- 15.2*

Panel C – Industry age		
	Mature industries	Young industries
CEO tenure	**0.0085***	**0.0201***
	(1.745)	**(1.773)**
CEO tenure squared	**-0.0003***	**-0.0009*****
	(-1.894)	**(-3.283)**
CEO characteristics	Yes	Yes
Governance characteristics	Yes	Yes
Firm characteristics	Yes	Yes
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	6,211	6,216
R-squared (within)	0.405	0.314
Inflection point (yrs)	**14.2**	**11.2**
Absolute change (yrs)	*+ 1.7*	*- 1.3*
Relative change (%)	*+ 13.6*	*- 10.4*

Table 6 – Exogenous shocks to the cost-benefit relation of CEO tenure: Recession vs. non-recession years
This table presents sub-sample results from firm fixed effects regressions of *Tobin's Q* on *CEO tenure* and its squared term along with CEO, firm, and corporate governance characteristics. The sample includes S&P 1500 firms over the period 1998-2011 excluding regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). *Recession* is an indicator variable that equals one if the observation year is classified as a recession year according to the NBER Business Cycle Expansions and Contractions data (http://www.nber.org/cycles.html). These are the years 2001, 2008 and 2009. All other years are defined as non-recession years. Regression (1) and (2) show regression results excluding year dummies. Regression (3) and (4) provide regression results including year dummies for the respective years. Control variables are identical to those used in regression (2) of Table 2 which yields an inflection point of 12.5 years. Absolute and relative changes shown below regressions (3) and (4) are calculated with respect to this inflection point. Absolute and relative changes shown below regressions (1) and (2) are calculated with respect to the inflection point of 13.7 years obtained from running of regression (2) of Table 2 with the indicator variable *Recession* instead of year fixed effects. An intercept is included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Recession	No recession	Recession	No recession
	(1)	(2)	(3)	(4)
CEO tenure	**0.0187***	**0.0147***	**0.0178***	**0.0126**
	(1.904)	**(1.906)**	**(1.811)**	**(1.645)**
CEO tenure squared	**-0.0006****	**-0.0006*****	**- 0.0006****	**-0.0006*****
	(-2.331)	**(-3.476)**	**(-2.211)**	**(-3.325)**
CEO characteristics	Yes	Yes	Yes	Yes
Governance characteristics	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	No	No	Yes	Yes
Observations	2,824	9,603	2,824	9,603
R-squared (within)	0.427	0.282	0.445	0.300
Inflection point (yrs)	**15.6**	**12.3**	**14.8**	**10.5**
Absolute change (yrs)	*+1.9*	*- 1.4*	*+ 2.3*	*- 2.0*
Relative change (%)	*+ 13.9*	*- 10.2*	*+ 18.4*	*- 16.0*

Table 7 – Exogenous shocks to the cost-benefit relation of CEO tenure: Regulatory changes in corporate governance

This table presents results from firm fixed effects regressions of *Tobin's Q* on *CEO tenure* and its squared term along with CEO, firm, and corporate governance characteristics for various sub-samples. The sample includes S&P 1500 firms over the period 1998-2011excluding regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). Panel A reports sub-sample results for the years before and after the implementation of the Sarbanes-Oxley Act (SOX) and the concurrent NYSE and NASDAQ exchange listing rules (collectively denoted as 'SOX'). Following the methodology used in Guo and Masulis (2015), *Post-SOX* (*Pre-SOX*) is an indicator variable set to one for the year 2005 (2004) and later (earlier) years, zero otherwise. Specifications (1) and (2) present pre- and post-SOX sub-sample regression results excluding year dummies. Specifications (3) and (4) show pre- and post-SOX subsample regression results including year dummies. Control variables are identical to those used in regression (2) of Table 2 which yields an inflection point of 12.5 years. Absolute and relative changes shown below regressions (3) and (4) are calculated with respect to this inflection point. Absolute and relative changes shown below regressions (1) and (2) are calculated with respect to the inflection point of 13.9 years obtained from running of regression (2) of Table 2 with the indicator variable *Post-SOX* instead of year fixed effects. Panel B reports sub-sample results for firms with a high (i.e., above median) and for firms with a low (i.e., equal to or below median) takeover susceptibility measured via the *Takeover index* introduced by Cain, McKeon, and Solomon (2014). The index is calculated based on a broad set of takeover laws and represents a measure of a firm-level takeover susceptibility, i.e., the market for corporate control. Higher index values correspond to higher takeover susceptibility. Index data is available at http://pages.uoregon.edu/smckeon/. Control variables are identical to those used in regression (2) of Table 2 which yields an inflection point of 12.5 years. Absolute and relative changes presented at the end of each column are calculated with respect this inflection point. All other variables are defined in Appendix A. An intercept is included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A – Pre-SOX vs. Post-SOX				
	Pre-SOX	Post-SOX	Pre-SOX	Post-SOX
	(1)	(2)	(3)	(4)
CEO tenure	**0.0214***	**0.0097****	**0.0191***	**0.0116****
	(1.925)	**(2.003)**	**(1.750)**	**(2.481)**
CEO tenure squared	**-0.0009*****	**-0.0003****	**-0.0008*****	**-0.0004****
	(-3.072)	**(-2.166)**	**(-2.915)**	**(-2.358)**
CEO characterisitcs	Yes	Yes	Yes	Yes
Governance characteristics	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	No	No	Yes	Yes
Observations	5,742	6,685	5,742	6,685
R-squared (within)	0.208	0.233	0.228	0.307
Inflection point	**11.9**	**16.2**	**11.9**	**14.5**
Absolute change (yrs)	*- 2.0*	*+ 2.3*	*- 0.6*	*+ 2.0*
Relative change (%)	*- 14.4*	*+ 16.5*	*- 4.8*	*+ 16.0*

Panel B – The market for corporate control		
	Takeover index ≤ median	Takeover index > median
CEO tenure	**0.0151**	**0.0165*****
	(1.256)	**(2.707)**
CEO tenure squared	**-0.0008*****	**-0.0005*****
	(-2.585)	**(-2.731)**
CEO characterisitcs	Yes	Yes
Governance characteristics	Yes	Yes
Firm characteristics	Yes	Yes
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	6,068	6,051
R-squared (within)	0.249	0.454
Inflection point	**9.4**	**16.5**
Absolute change (yrs)	*- 3.1*	*+ 4.0*
Relative change (%)	*- 24.8*	*+ 32.0*

Table 8 – Evidence from CEO sudden deaths

This table reports three-day announcement returns for a sample of CEOs who died suddenly between 1992 and 2012. The definition of sudden deaths follows Nguyen and Nielsen (2014). *CAR [-1,1]* is the three-day cumulative abnormal announcement return calculated using the market model with a CRSP value-weighted market index (as the market proxy), where the event day t=0 is the trading day on which the death of a CEO is first reported in the news (or the next trading day in case death was announced on a non-trading day). Panel A shows left- and two-tailed univariate difference-in-means tests (accounting for unequal variances between both subsamples) for *CAR [-1,1]*. Panel B reports multivariate results for regressions of *CAR [-1,1]* (Columns 1) or *CAR [-1,1] winsorized* (at the 5th and 95th percentiles) (Column 2) on CEO tenure and additional controls. Dummy variables for each decade (1990s, 2000s, and 2010s) are included in all regressions. The number of observations reported in specifications (1) and (2) is reduced due to data availability. All firm characteristics are winsorized at the 1st and 99th percentiles. All variables are defined in Appendix A. Robust t-statistics are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A – Difference-in-means tests

Expected sign	**(-)**	**(+)**	**left-tailed test (diff < 0)**	**two-tailed test (diff ≠ 0)**
	CEO tenure ≤ median	**CEO tenure > median**	**Difference**	**Difference**
CAR [-1,1]	-0.0252	0.0136	-0.0387**	-0.0387*
	(N=40)	(N=40)	(-1.846)	(-1.846)
	CEO tenure ≤ 12 yrs	**CEO tenure > 12 yrs**	**Difference**	**Difference**
CAR [-1,1]	-0.0233	0.0249	-0.0481**	-0.0481**
	(N=51)	(N=29)	(-2.081)	(-2.081)

Panel B – Multivariate regression results

	CAR [-1,1]	CAR [-1,1] winsorized
	(1)	(2)
CEO tenure	**0.0022****	**0.0019****
	(2.103)	**(2.062)**
CEO characteristics		
CEO age	0.0010	0.0010
	(0.954)	(1.066)
Duality	0.0261	0.0184
	(1.377)	(1.136)
Founder CEO	-0.0131	-0.0097
	(-0.593)	(-0.463)
President	0.0026	0.0036
	(0.155)	(0.248)
Firm characteristics		
Market capitalization	0.0130***	0.0120***
	(3.072)	(3.042)
Market-to-book	-0.0033*	-0.0029
	(-1.671)	(-1.615)
ROA	-0.0501	-0.0414
	(-1.240)	(-1.101)
Constant	-0.2406***	-0.2231***
	(-3.365)	(-3.427)
Decade controls	Yes	Yes
Observations	68	68
R-squared	0.312	0.339
F-statistic	3.32	3.63
p-value	0.0019	0.0009

APPENDICES

Appendix A – Variable definitions

Variable	Definition
Board size	Natural logarithm of the number of directors on the firm's board of directors. *Source: ISS (formerly RiskMetrics)*
Book leverage	(Long-term debt + current liabilities)/Total assets, all at the end of the previous fiscal year. *Source: Compustat*
Business segments	Natural logarithm of the number of business segments. *Source: Compustat Segments*
Busy board	Indicator variable that equals one if a majority of the independent directors hold two or more additional outside directorships, zero otherwise. *Source: ISS*
CapEx	Capital expenditures/Total assets, all at the end of the previous fiscal year. *Source: Compustat*
CEO age	Age of the firm's CEO measured in years. *Source: ExecuComp*
CEO gender	Indicator variable that equals one if the CEO's gender is female, zero otherwise. *Source: ExecuComp*
CEO ownership	Percentage of shares outstanding held by the CEO, winzorized at the 1st and 99th percentiles. *Source: ExecuComp, ISS*
CEO power index	The index is the sum of the following indicator variables: CEO ownership above median, Co-Option above median, Duality, Involved CEO, President, Only insider. The index can take on values between zero and six.
CEO tenure	Number of years the CEO has been serving as the firm's CEO, calculated by using the ExecuComp "BECAMECEO" variable. Missing or incorrect data is replaced by the number of years the CEO has been serving on the board as reported in ISS. CEO tenure takes the value of zero for the CEO's first year in office. *Source: ExecuComp, ISS*
Co-Option	Fraction of directors on the board who have been appointed to the firm's board after the current CEO assumed office. *Source: ISS*
Duality	Indicator variable that equals one if the CEO is also the chairman of the board, zero otherwise. *Source: ExecuComp*
E-Index	Entrenchment index based on six anti-takeover protection devices as proposed by Bebchuk, Cohen, and Ferrell (2009). *Source: ISS Governance database*
Firm age	Natural logarithm of the number of years the firm is listed in CRSP. *Source: CRSP*
Firm risk	Standard deviation of daily stock returns during the year, all at the end of the previous fiscal year. *Source: CRSP*
Founder CEO	Indicator variable that equals one if the CEO is the founder of the company, zero otherwise. *Source: The Corporate Library, hand collected*
Independence ratio	Percentage of directors on the board classified as independent directors. *Source: ISS*
Independent director ownership	Average fraction of outstanding shares held by all independent directors on the board, winzorized at the 1st and 99th percentiles. *Source: ISS*

Involved CEO	Indicator variable that equals one if (i) the board has established a nominating committee and the CEO serves as a member or (ii) if such a committee does not exist, zero otherwise. *Source: ISS*
MTB	Market-to-book ratio of equity, all at the end of the fiscal year. *Source: Compustat*
New CEO	Indicator variable that equals one if the firm's CEO took office in the current year, zero otherwise. *Source: ExecuComp*
Only insider	Indicator variable that equals one if the CEO is the only inside director on the board, zero otherwise. *Source: ISS*
Operating CF	Annual cash flow from operations/Total assets$_{t-1}$, all at the end of the previous fiscal year. *Source: Compustat*
Outside director tenure	Average number of years the outside directors have served on the firm's board. *Source: ISS*
President	Indicator variable that equals one if the CEO also holds the title of President of the firm, zero otherwise. *Source: ExecuComp*
R&D	R&D expense/Total assets, all at the end of the previous fiscal year. *Source: Compustat*
ROA	EBITDA/Total assets$_{t-1}$ *Source: Compustat*
Sales growth	Annual change in net sales divided by previous year's net sales: (Sales$_t$/Sales$_{t-1}$) - 1 *Source: Compustat*
Tobin's Q	(Total assets - Book equity + Market value of equity)/Total assets *Source: Compustat*
Total assets	Natural logarithm of total assets at the end of the previous fiscal year. *Source: Compustat*

Appendix B – Addressing interim CEOs, CEO-firm match, and different types of outliers

This table reports results from firm fixed effects regressions of *Tobin's Q* on *CEO tenure* and its squared term along with CEO, firm, and corporate governance characteristics. The sample includes S&P 1500 firms over the period 1998-2011 excluding regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). Specification (1) excludes all observations with CEO tenure values equal to zero. Regression specification (2) excludes all CEO-firm observations in which the CEO left the company during the honeymoon period, i.e., during the first three years in office. A CEO is classified as a CEO who leaves the firm during her honeymoon period if *Maximum CEO tenure* does not exceed three years. Specification (3) contains only firm-year observations with CEO tenure values below 30 years. Specification (4) restricts the sample to non-founder CEO observations. Specification (5) excludes CEOs who rejoined their company (based on ExecuComp item "REJOIN"). Specification (6) excludes CEOs who hold more than one CEO position in our sample over the sample period. Specification (7) excludes all family firm observations in our sample. Information on annual family firm classification for the Top-2000 largest U.S. public companies for the years 2001 to 2010 is obtained from Ron Anderson's professional website (www.ronandersonprofessionalpage.net). All variables are defined in Appendix A. Control variables are identical to those used in regression (2) of Table 2. An intercept and year fixed effects are included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's Q						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	CEO tenure > 0	w/o CEOs leaving during honeymoon period	*CEO tenure* < 30	*w/o Founder CEOs*	*w/o Rejoined CEOs*	*w/o Multiple CEOs*	*w/o Family firms*
CEO tenure	**0.0153****	**0.0166****	**0.0154****	**0.0149****	**0.0141****	**0.0151****	**0.0151****
	(2.031)	**(2.415)**	**(2.064)**	**(2.545)**	**(2.386)**	**(2.497)**	**(2.108)**
CEO tenure squared	**-0.0007*****	**-0.0007*****	**-0.0006***	**-0.0005*****	**-0.0006*****	**-0.0006*****	**-0.0006***
	(-3.730)	**(-3.765)**	**(-1.949)**	**(-2.653)**	**(-3.555)**	**(-3.598)**	**(-1.873)**
CEO characteristics:							
CEO age	0.0031	0.0030	0.0022	-0.0002	0.0020	0.0017	0.0009
	(0.896)	(0.754)	(0.726)	(-0.071)	(0.667)	(0.551)	(0.364)
CEO gender	0.0434	-0.0531	0.0067	-0.0070	0.0219	0.0278	0.0418
	(0.467)	(-0.485)	(0.078)	(-0.083)	(0.252)	(0.320)	(0.749)
CEO power index	-0.0173	-0.0283	-0.0242	-0.0385**	-0.0220	-0.0250	-0.0302***
	(-0.778)	(-1.297)	(-1.189)	(-2.440)	(-1.116)	(-1.255)	(-2.618)
Founder CEO	0.5223***	0.5812***	0.4529***		0.4237***	0.4324***	-0.1666
	(2.690)	(3.171)	(2.806)		(2.920)	(2.936)	(-1.197)
Governance characterisitics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample period	1998 - 2011	1998 - 2011	1998 - 2011	1998 - 2011	1998 - 2011	1998 - 2011	2001 - 2010
Observations	11,567	11,407	12,078	10,978	12,351	12,150	5,973
R-squared (within)	0.304	0.298	0.295	0.309	0.298	0.291	0.343

Appendix C – Alternative explanations (I)

This table presents results from firm fixed effects regressions of *Tobin's Q* on *CEO tenure* and its squared term along with CEO, firm, and corporate governance characteristics. The sample includes S&P 1500 firms over the period 1998-2011 excluding regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). Additional control variables are included. *Acquisition activity* is a dummy variable that equals one, if the firm is identified as an acquirer within our M&A sample (not restricted to M&As of a minimum relative deal size) and has announced an acquisition during the year, zero otherwise. *Divestiture activity* is a dummy variable that equals one if the company is indicated as the target by the SDC Platinum Mergers & Acquisitions Database of a deal which is labeled by the variable "ACQUSITION TECHNIQUE" as a "DIVESTITURE", zero otherwise. *General ability index* is defined as in Custódio, Ferreira, and Matos (2013) and is retrieved directly from the website of the Journal of Financial Economics. The index is only available for the period ending in 2007. *Fraction of variable compensation* is calculated as total compensation (ExecuComp item "TDC1") minus salary, all dividend by the total value of total compensation (TDC1". Values of total annual compensation before 2006 are adjusted following the methodology in Walker (2011). All other variables are defined in Appendix A. Control variables are identical to those used in regression (2) of Table 2. Year fixed effects and an intercept are included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's Q					
	(1)	(2)	(3)	(4)	(5)	(6)
CEO tenure	**0.0149****	**0.0150***	**0.0158*****	**0.0154*****	**0.0158*****	**0.0170****
	(2.547)	**(1.773)**	**(2.718)**	**(2.635)**	**(2.722)**	**(2.039)**
CEO tenure squared	**-0.0006*****	**-0.0007*****	**-0.0006*****	**-0.0006*****	**-0.0006*****	**-0.0007*****
	(-3.663)	**(-2.863)**	**(-3.652)**	**(-3.694)**	**(-3.765)**	**(-2.832)**
Further alternative explanations						
Acquisition activity	-0.0564***					-0.0485*
	(-2.996)					(-1.829)
Divestiture activity	0.0103					0.0401
	(0.468)					(1.357)
General ability index		-0.0684**				-0.0740**
		(-1.966)				(-2.117)
CEO ownership			-0.6336*			-0.8337
			(-1.843)			(-1.467)
CEO ownership squared			-0.0874			-0.2248
			(-0.991)			(-1.249)
Fraction of variable compensation				0.2996***	-0.4403**	-0.5618**
				(5.157)	(-1.986)	(-2.238)
Fraction of variable compensation squared					0.6462***	0.7597***
					(3.500)	(3.597)
CEO characteristics						
CEO age	0.0020	0.0023	0.0019	0.0024	0.0023	0.0025
	(0.673)	(0.520)	(0.645)	(0.801)	(0.793)	(0.560)
CEO gender	0.0301	0.0924	0.0318	0.0251	0.0256	0.1106
	(0.354)	(0.648)	(0.371)	(0.294)	(0.300)	(0.775)
CEO power index	-0.0233	-0.0191	-0.0202	-0.0219	-0.0214	-0.0113
	(-1.187)	(-0.726)	(-1.002)	(-1.107)	(-1.084)	(-0.409)
Founder CEO	0.4192***	0.6394***	0.4489***	0.4393***	0.4304***	0.6742***
	(2.892)	(2.987)	(2.959)	(3.008)	(2.942)	(2.957)
Governance characterisitics	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sample period	1998-2011	1998-2007	1998-2011	1998-2011	1998-2011	1998-2007
Observations	12,427	8,092	12,427	12,363	12,363	8,085
R-squared (within)	0.300	0.243	0.297	0.302	0.303	0.249

Appendix D – Alternative explanations: CEO survivorship

This table reports results from firm fixed effects regressions of *Tobin's Q* on *CEO tenure* and its squared term along with CEO, firm, and corporate governance characteristics. The sample includes S&P 1500 firms over the period 1998-2011 excluding regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). Regression specification (1) restricts the sample to S&P 500 companies. Specification (2) restricts the sample to observations for which *Cumulative total CEO compensation* is above the sample median. *Cumulative total CEO compensation* is the sum of the value of total annual compensation (ExecuComp item "TDC1") the CEO has received over her tenure until the end of the fiscal year (standardized by CEO tenure). Values of total annual compensation before 2006 are adjusted following the methodology in Walker (2011). Specification (3) restricts the sample to observations for which the variable CEO ownership takes on values above the sample median. Specification (4) excludes all firm-year observations where the CEO's age exceeds the general retirement age of 65 years. In specification (5), the last firm-year observation for each firm in the sample is excluded. Specification (6) excludes firms that have been identified as takeover targets. All variables are defined in Appendix A. Control variables are identical to those used in regression (2) of Table 2. An intercept and year fixed effects are included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's Q					
	(1)	(2)	(3)	(4)	(5)	(6)
	S&P 500	*Cumulative total CEO compensation > Median*	*CEO equity ownership > Median*	*CEO age ≤ 65 yrs*	*w/o last sample observation for each firm*	*w/o takeover target firms*
CEO tenure	**0.0453*** **	**0.0483*** **	**0.0140***	**0.0165** **	**0.0156** **	**0.0149** **
	(3.045)	**(3.310)**	**(1.699)**	**(2.094)**	**(2.329)**	**(2.431)**
CEO tenure squared	**-0.0015** **	**-0.0020*** **	**-0.0005** **	**-0.0008*** **	**-0.0006*** **	**-0.0006*** **
	(-2.375)	**(-2.791)**	**(-2.246)**	**(-2.867)**	**(-3.527)**	**(-3.613)**
CEO characteristics:						
CEO age	-0.0062	0.0001	-0.0015	0.0037	0.0017	0.0028
	(-1.244)	(0.013)	(-0.235)	(0.907)	(0.513)	(0.898)
CEO gender	-0.1895	-0.0318	0.2986	-0.0206	0.0084	0.0110
	(-1.084)	(-0.255)	(1.331)	(-0.235)	(0.085)	(0.114)
CEO power index	-0.1096***	-0.0598*	0.0461	-0.0249	-0.0244	-0.0237
	(-3.463)	(-1.685)	(1.192)	(-1.160)	(-1.088)	(-1.147)
Founder CEO	0.5601**	0.4773	0.3341*	0.4734***	0.4851***	0.4189***
	(2.139)	(1.398)	(1.774)	(2.631)	(2.872)	(2.741)
Governance characterisitics	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,994	6,213	6,213	11,642	10,645	11,690
R-squared (within)	0.411	0.335	0.219	0.294	0.290	0.296

Appendix E – Excluding firms or CEO-firm pairs with few observations

This table presents results from firm fixed effects regressions of *Tobin's Q* on *CEO tenure* and its squared term along with CEO, firm, and corporate governance characteristics. The sample includes S&P 1500 firms over the period 1998-2011 excluding regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). Regression (1), the sample is restricted to firms with more than five firm-year observations and the regression includes firm fixed effects. Regression (2), the sample is restricted to CEO-firm pairs with more than five CEO-firm pair observations and the regression includes CEO-firm fixed effects. Control variables are identical to those used in specification (6) of Table 3. All variables are defined in Appendix A. An intercept and year fixed effects are included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's Q	
	(1)	(2)
	Firm obs. ≥ 6	CEO-firm obs. ≥ 6
CEO tenure	**0.0142****	**0.0242****
	(2.055)	**(2.075)**
CEO tenure squared	**-0.0005*****	**-0.0008****
	(-3.027)	**(-2.082)**
Alternative explanations		
CEO age squared	-0.0003	0.0003
	(-1.182)	(0.593)
CEO power index squared	0.0026	0.0031
	(0.233)	(0.347)
Firm age squared	-0.0891	-0.2092**
	(-1.420)	(-2.463)
Outside director tenure	0.0014	-0.0050
	(0.096)	(-0.276)
Outside director tenure sq.	-0.0005	-0.0001
	(-0.613)	(-0.109)
New CEO	0.0285	0.0710
	(0.835)	(1.262)
CEO characteristics		
CEO age	0.0400	-0.0299
	(1.207)	(-0.599)
CEO gender	0.0579	
	(0.684)	
CEO power index	-0.0435	-0.0507
	(-0.803)	(-0.994)
Founder CEO	0.4629***	
	(2.960)	
Governance characteristics		
Board size	-0.2819***	-0.1470
	(-2.785)	(-1.442)
Busy board	-0.0497	-0.0082
	(-1.584)	(-0.224)
E-index	0.0182	0.0180
	(1.127)	(0.970)
Independence ratio	-0.0616	0.1952
	(-0.429)	(1.598)
Independent director ownership	-2.7790	-1.4116
	(-1.241)	(-0.473)
Firm characteristics	Yes	Yes
Firm fixed effects	Yes	No
CEO-firm fixed effects	No	Yes
Year fixed effects	Yes	Yes
Observations	10,204	6,614
R-squared (within)	0.247	0.350

Appendix F – Alternative measures for CEO tenure

This table reports results from firm fixed regressions of *Tobin's Q* on *CEO tenure* and its squared term along with CEO, firm, and corporate governance characteristics. The sample includes S&P 1500 firms over the period 1998-2011 excluding regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). Specification (1) excludes all observations where the CEO is not classified as an *Inside CEO*. Following Bebchuk, Cremers, and Peyer (2011), a CEO is classified as an insider (*Inside CEO*) if the CEO joined the company more than a year before becoming CEO, or if the CEO is classified as the founder of the company (*Founder CEO*), or if the data item "JOINED_CO" is missing. Specification (2) uses the *Tenure with company* and its square as an alternative measure for CEO tenure, which is calculated as the fiscal year minus the year the CEO joined the company using the date the CEO has joined the company (data item "JOINED_CO") as reported in ExecuComp. Regression specification (3) uses both *Tenure with company* and *CEO tenure* as explanatory variables. Specification (4) uses the CEO's tenure on the board of directors (*Board tenure*) and its square as an alternative measure. *Board tenure* is defined as the fiscal year minus the year since the director has been serving on the firm's board of directors using the ISS data item "DIRSINCE". Regression (5) uses both *Board tenure* and *CEO tenure* as explanatory variables. Regression (6) uses the variable *executives' tenure with company* and its square, calculated as the average of the firm's executives' *Tenure with company* listed in ExecuComp. For specification (6), we require the data item "JOINED_CO" to be available for at least 50% of a firm's executives and a minimum number of three executives (per firm) listed in ExecuComp. In Specification (7), *CEO tenure* is standardized by *CEO age* (which is omitted from the set of controls). All other variables are defined in Appendix A. Control variables are identical to those used in regression (2) of Table 2. An intercept and year fixed effects are included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Tobin's Q						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
					Inside CEOs		
CEO tenure		**0.0258*** **		**0.0118** **	**0.0126** **	**0.0202***	
		(2.623)		**(1.988)**	**(2.212)**	**(1.733)**	
CEO tenure squared		**-0.0009*** **		**-0.0004** **	**-0.0006*** **	**-0.0007***	
		(-2.739)		**(-2.229)**	**(-3.476)**	**(-1.880)**	
Alternative measures							
Tenure with company	**0.0149***	0.0041					
	(1.725)	(0.487)					
Tenure with company squared	**-0.0004** **	-0.0002					
	(-2.134)	(-0.832)					
Board tenure			**0.0109***	0.0041			
			(1.961)	(0.660)			
Board tenure squared			**-0.0004*** **	-0.0002			
			(-3.489)	(-1.634)			
Executives' tenure with company						0.0028	
						(0.140)	
Executives' tenure with company squared						0.0004	
						(0.638)	
CEO tenure/age							**0.8915** **
							(2.445)
CEO tenure/age squared							**-2.1857*** **
							(-3.009)
CEO char.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Governance char.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm char.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,521	6,521	12,406	12,406	10,283	3,736	12,427
R-squared (within)	0.330	0.332	0.299	0.299	0.347	0.291	0.296

Appendix G – CEO tenure and growth in firm value

This table reports results from firm fixed effects regressions of the *growth rate of Tobin's Q* ($Q_t - Q_{t-1}/Q_{t-1}$) on *CEO tenure* along with CEO characteristics, CEO power measures, firm, and corporate governance characteristics. The sample includes S&P 1500 firms over the period 1998-2011 excluding regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). Regressions exclude Tobin's Q_{t-1} from the set of controls. All other control variables in regression (1) are identical to those used in specification (2) of Table 2, while all other control variables in regression (2) are identical to those used in regression (6) of Table 3 (excluding the squared terms of some controls). We calculate the turning point (defined as the simple zero) for equations (1) and (2) by setting the regression equation equal to zero and solving for *CEO tenure*, while holding all controls at their mean values. All variables are defined in Appendix A. An intercept and year dummies are included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	$\frac{Q_t - Q_{t-1}}{Q_{t-1}}$	
	(1)	(2)
CEO tenure	**-0.0026*** **	**-0.0021** **
	(-3.224)	**(-2.375)**
Alternative explanations		
Outside director tenure		-0.0021
		(-1.631)
New CEO		0.0197*
		(1.797)
CEO characteristics		
CEO age	0.0019***	0.0014*
	(2.614)	(1.918)
CEO gender	-0.0180	-0.0198
	(-0.682)	(-0.803)
CEO power index	0.0007	0.0028
	(0.177)	(0.730)
Founder CEO	0.0212	0.0376
	(0.903)	(1.218)
Governance characteristics		
Board size	-0.0763***	-0.1020***
	(-3.075)	(-4.044)
Busy board	-0.0115	-0.0117
	(-1.424)	(-1.530)
E-Index	0.0095***	0.0080**
	(2.661)	(2.062)
Independence ratio	0.0158	-0.0032
	(0.475)	(-0.093)
Independent director ownership	-0.3403	-0.5422
	(-0.425)	(-0.741)
Firm characteristics	Yes	Yes
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	12,427	12,427
R-squared (within)	0.1775	0.2607
Tenure (yrs) when growth turns negative	**9.6**	**10.0**

Appendix H – Return on assets (ROA)

This table presents results from fixed effects regressions of return on assets (*ROA)* on *CEO tenure* and its squared term along with CEO, firm, and corporate governance characteristics. The sample includes S&P 1500 firms over the period 1998-2011 excluding regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999). *ROA* is calculated as earnings before interest, taxes, depreciation and amortization (EBITDA) divided by the book value of total assets at the end of the previous year and is winsorized at the 1st and 99th percentiles. Results from regression (1) are based on a pooled OLS regression with industry fixed effects. Results from regression (2) stem from a firm fixed effects regression. Results from regression (3) are based on a regression including CEO-firm fixed effects. Control variables are identical to those used in regression (2) of Table 2, except for *Operation CF* which is excluded from the set of controls. All variables are defined in Appendix A. An intercept and year fixed effects are included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	ROA		
	Pooled	Firm FE	CEO-firm FE
	(1)	(2)	(3)
CEO tenure	**0.0016*** **	**0.0013*** **	**0.0015** **
	(3.484)	**(2.699)**	**(2.354)**
CEO tenure squared	**-0.00004*** **	**-0.00003** *	**-0.0001** **
	(-3.219)	**(-1.778)**	**(-2.371)**
CEO characteristics			
CEO age	0.0001	-0.0004*	0.0005
	(0.661)	(-1.730)	(1.339)
CEO gender	-0.0148**	-0.0038	
	(-1.975)	(-0.455)	
CEO power index	-0.0043***	-0.0007	0.0005
	(-3.322)	(-0.703)	(1.339)
Founder CEO	-0.0088	0.0096	
	(-1.422)	(1.244)	
Governance characteristics			
Board size	0.0071	0.0146**	0.0128
	(1.089)	(2.046)	(1.460)
Busy board	-0.0005	-0.0025	0.0001
	(-0.196)	(-1.052)	(0.021)
E-index	-0.0028**	-0.0013	-0.0019
	(-2.289)	(-1.007)	(-1.269)
Independence ratio	0.0059	-0.0100	-0.0049
	(0.591)	(-0.936)	(-0.400)
Independent director ownership	-0.4721*	-0.4337**	-0.4482**
	(-1.861)	(-2.016)	(-2.045)
Firm characteristics	Yes	Yes	Yes
Industry fixed effects	Yes	No	No
Firm fixed effects	No	Yes	No
CEO-firm fixed effects	No	No	Yes
Year fixed effects	Yes	Yes	Yes
Observations	12,400	12,400	12,400
R-squared (within)		0.323	0.315

Appendix I – Environmental dynamics and the cost-benefit relation of CEO tenure

This table presents results from firm fixed effects regressions of *Tobin's Q* on *CEO tenure* and its squared term along with CEO, firm, and corporate governance characteristics for various sub-samples. The sample includes S&P 1500 firms over the period 1998-2011excluding regulated utility and financial firms (SIC codes 4000-4999 and 6000-6999 Panel A reports sub-sample results using the *6-factor industry shock score* proposed by Guay, Taylor, and Xiao (2014). An industry is defined as a three-digit SIC cluster that contains at least ten firms in year t-1 and year t. An industry shock is measured based on the absolute value of the percentage change in the mean of the industry characteristic from fiscal year t-1 to fiscal year t, regardless of the direction of the change. The 6-factor industry shock score is the sum of the following six indicator variables: (i) Industry assets shock is set to one if the absolute value of the percentage change in the total value of industry assets (Δ Industry Assets) is above the 50th percentile, zero otherwise (ii) Industry investment shock is set to one if the absolute value of the percentage change in the total value of industry capital expenditures (Δ Industry Investment) is above the 50th percentile, zero otherwise, (iii) Industry HHI shock is set to one if the absolute value of the percentage change in the Herfindahl index of the industry sales concentration (Δ Industry HHI) is above the 50th percentile, zero otherwise, (iv) Industry R&D shock is set to one if the absolute value of the percentage change in the industry R&D expenditures (Δ Industry R&D) is above the 75th percentile, zero otherwise, (v) Industry sales shock is set to one if the absolute value of the percentage change in the total value of industry sales (Δ Industry sales) is above the 50th percentile, zero otherwise, (vi) Industry advertisement shock is set to one if the absolute value of the percentage change in the industry advertising expense (Δ Industry Advertising) is above the 50th percentile, zero otherwise.). Panel B reports sub-sample results using the tech firm classification provided by the U.S. Census Bureau. A firm is considered a tech firm if the firm is operating in one of the following industry segment according to the North American Industry Classification System (NAICS): 333295, 333315, 334111, 334112, 334113, 334119, 334210, 334220, 334413, 334511, 421430, 421690, 423430, 423690, 443120, 511140, 511210, 514210, 518210, 519130, 541330, 541511, 541512, 541513, 541519, 541710, 541711, 541712. All variables are defined in Appendix A. Control variables are identical to those used in regression (2) of Table 2 which yields an inflection point of 12.5 years. Absolute and relative changes shown at the end of Panel A and B are calculated with respect to this inflection point. An intercept and year fixed effects are included in all regressions, but not reported. Robust t-statistics adjusted for clustering by firm are reported in parentheses. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A – Industry shock score (based on Guay, Taylor, and Xiao, 2014)		
	≤ Median	> Median
CEO tenure	**0.0179****	**0.0085**
	(2.321)	**(1.077)**
CEO tenure squared	**-0.0006*****	**-0.0005*****
	(-2.720)	**(-2.674)**
CEO characteristics	Yes	Yes
Governance characteristics	Yes	Yes
Firm characteristics	Yes	Yes
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	6,726	5,701
R-squared (within)	0.325	0.296
Inflection point (yrs)	**14.9**	**8.5**
Absolute change (yrs)	*+2.4*	*-4.0*
Relative change (%)	*+ 19.2*	*- 32.0*

Panel B – Tech vs. non-tech firms (U.S. Census)		
	Tech = 0	Tech = 1
CEO tenure	**0.00747***	**0.04931***
	(1.824)	**(1.686)**
CEO tenure squared	**-0.00024****	**-0.00221****
	(-2.014)	**(-2.535)**
CEO characteristics	Yes	Yes
Governance characteristics	Yes	Yes
Firm characteristics	Yes	Yes
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	10,235	2,192
R-squared (within)	0.376	0.367
Inflection point (yrs)	**15.6**	**11.2**
Absolute change (yrs)	*+ 3.1*	*- 1.3*
Relative change (%)	*+ 24.8*	*- 10.4*