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Impact of internal governance on investment policy: Evidence from CEO voluntary turnovers☆

Ivan E. Brick[a,*], Darius Palia[a], Yankuo Qiao[b]

[a] Rutgers Business School at Newark and New Brunswick, United States of America
[b] The George B. Delaplaine Jr. School of Business, Hood College, United States of America

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ABSTRACT

The theoretical and empirical literature suggests that CEO might not make risky long-term investments if the CEO believes that the benefit of such investments would not materialize or is not recognized by the market until after the CEO has retired. This paper tests the predictions of the Acharya, Myers, and Rajan (2011) internal governance model to counteract the CEO's tendency to forego such investments on a sample of voluntary CEO turnovers. We find that the optimal level of sharing of tasks between the CEO and her top-management team, the firm's internal governance, is dependent on the CEO's career horizon. Additionally, we find the effect of internal governance only matters for older CEOs. We also find that the closer the internal governance is to the optimal level, the smaller is the underinvestment for an older outgoing CEO. We find that the new incoming CEO divests profitably the assets acquired under good internal governance. Finally, we find that optimal internal governance is found to have positive effects on corporate innovation. Our results are robust to continuous matching by generalized propensity score and controlling for the CEO's explicit pay-performance sensitivity, succession plan, and pay duration.

1. Introduction

Managerial agency theory suggests that CEOs who own less than 100% of their firm deviate from shareholder value maximization because of moral hazard and/or asymmetric information problems (e.g., Fama & Jensen, 1983a, 1983b; Jensen & Meckling, 1976). One particular source of the owner-manager conflict could be differential investment horizons between the CEO and her shareholders (e.g., Bertrand & Mullainathan, 2003; Stein, 1988, 1989). When the CEO's horizon is shorter, she might forgo valuable long-term investments in the myopic belief that the benefit will only begin to materialize long after her term and therefore she would prefer not to put in the extra effort and enjoy a quieter life professionally.[1] One way to mitigate the myopic horizon problem is to give explicit incentive contracts to the CEO such as more unvested option contracts (Cheng, 2004; Dechow & Sloan, 1991; Kabir, Li, & Veld-

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* Corresponding author.
E-mail addresses: ibrick@business.rutgers.edu (I.E. Brick), dpalia@business.rutgers.edu (D. Palia), qiao@hood.edu (Y. Qiao).

[1] See Yim (2013), Serfling (2014), Li, Low, and Makhija (2017), and Chari, David, Duru, and Zhao (2019) who find that CEOs near retirement are more risk-averse consistent with the quiet-life hypothesis first articulated by Hicks (1935).

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Merkoulova, 2018 and Xu & Yan, 2014).[2]

But there might be an *additional* mechanism to mitigate the myopic horizon problem, namely, the firm's internal governance. Specifically, we test the prediction of an influential theoretical paper by Acharya, Myers and Rajan (2011; referred to as AMR) which suggests that that internal governance maximizes firm value when neither the CEO nor her subordinates are dominant. Specifically, they state on page 690: "To understand how the differences among diverse agents lead to internal governance, we first consider a partnership *run by an old CEO who is about to retire* (emphasis added)". The AMR model predicts that with proper internal governance, the managerial agency problem resulting from CEO myopia is reduced. That is, AMR theorize that a subordinate manager, who is the successor to the CEO and thus has a longer horizon, mitigates the horizon problem of the incumbent CEO during the transition period prior to the CEO's planned retirement. If the current CEO puts in place policies that destroy the capital and reputational stock of the firm, then the successor will find herself running a diminished firm in the future. Accordingly, the subordinate who hopes to succeed the current CEO will oppose myopic CEO policies designed for the short run. As such, to a certain extent, the current CEO must concede to the wishes of the subordinate in exchange for her assistance to support the operational activities necessary to boost the current earnings and stock price, both of which are important factors in the CEO's current compensation. On the other hand, the subordinate might be reluctant to expend managerial effort to increase the company's successful current valuation for which she does not fully benefit. Moreover, since the CEO is essential to coordinating all efforts to ensure seamless operational activities throughout the firm, it would be value-damaging if too many administrative duties regarding the firm's business operations are conducted by the subordinate. AMR define *internal governance* of the firm by the role of the subordinate who acts as counterweight to the CEO.

One can interpret the subordinate in the AMR model as the team of top executives in the firm, several of whom are potential successors of the current CEO. Accordingly, internal governance works best when neither the CEO nor the subordinates are dominant. AMR define a variable δ which is "the fraction of *tasks* assigned to the CEO" (p.700; emphasis added). A fully decentralized team would have $\delta = 0$, and one where the CEO makes all the contributions is where $\delta = 1$. AMR predicts that an optimal δ^* (i.e., optimal internal governance) that maximizes firm value is when both the CEO who is approaching retirement and her subordinates contribute to the firm. No such effect is predicted for young CEOs who are not planning to retire.

We empirically test the theoretical predictions of AMR using a manually collected large sample of voluntary CEO turnovers from 1996 to 2017. We use a similar methodology to Parrino (1997) to identify voluntary CEO turnover. To proxy for the fraction of *tasks* assigned to the CEO (δ), we use the fraction of CEO titles divided by the total number of executive titles held by the top five executives. We regress our performance measure (industry-adjusted market value of equity to book value) on δ, its squared term δ^2, distance from retirement (defined as $Horizon = max(65 - age, 0)$), their interactions and a wide set of control variables that proxy for prior firm performance and external corporate governance mechanisms such as CEO incentive contracts and board of director characteristics.

We find the following results. First, we find that a firm's optimal internal governance (δ^*) is not a constant but varies with distance from the CEO's retirement age. Second, we find that the change in the firm's investment rate just before the CEO's voluntary departure increases as internal governance is maximized, i.e., closer to δ^*. These results are consistent with the predictions of AMR, implying that internal governance can serve as a complementary mechanism in resolving managerial myopia as the CEO nears retirement. We also find that the dynamic optimal δ^* exists for older CEOs but not for younger CEOs. We argue that these results are consistent with AMR's model since older CEOs are more likely to face the agency problems of myopia or the desire for a quieter life. Younger CEOs are more concerned with their reputation and its impact on their career trajectory, consistent with the Gibbons and Murphy (1992) model. Furthermore, we find that firm performance is increasing and then decreasing in δ for older CEOs, in line with the implications of the AMR model.

Third, the flip side to understanding the changes in the investment rate as the older CEO approaches retirement is that the new CEO might divest poorly performing assets acquired by the previous CEO. Accordingly, we examine the impact of internal governance on the firm's disinvestment rate and profitability in the year of the CEO's retirement. We find that good governance has a positive impact on the profitability of asset disposals for the first year of new CEOs. These findings suggest that with good internal governance, the older outgoing CEO was less likely to overpay for assets.[3]

Fourth, we do not find any relationship between effective internal governance and a firm's innovation input (i.e., the proportion of assets spent on R&D). However, we find that older outgoing CEOs of firms with effective internal governance are more likely to conduct impactful and quality corporate innovation as measured by the number of total citations scaled by the number of patents. Moreover, younger CEOs who leave voluntarily (presumably because they found other opportunities) are more likely to increase R&D expenditures, and these R&D expenditures are proven to be more impactful as measured by the number of citations.

These results are robust to continuous matching by generalized propensity score and the inclusion of additional covariates controlling for external governance variables, prior firm performance, and CEO pay duration. Our results add to the growing literature on internal governance demonstrating the impact of the management team on corporate investment policy. Our paper complements the findings of empirical internal governance studies that do not examine firm investment policy. Specifically, Landier, Sauvagnat, Sraer, and Thesmar (2012) find that a firm's profitability increases with the number of executives appointed before the current CEO. Cheng, Lee, and Shevlin (2016) find that the extent of real earnings management decreases with key subordinate executives' horizons. Jollineau, Vance, and Webb (2012) document that subordinates' ethical standard reduces their willingness to accede to the CEO's request

[2] See Section II of this paper for a more detailed description of these papers.

[3] A potential reason why the new CEO is disposing of profitable older assets is due to the differential skill-asset match between the new CEO and the older outgoing CEO.

for income-increasing estimates. Jain, Jiang, and Mekhaimer (2016) find that firms with better internal governance have lower information asymmetry and higher liquidity. Similarly, Mekhaimer, Abakah, Ibrahim, and Hussainey (2022) find that subordinates' horizon is positively associated with long-term investment growth, and research and development expenditures. These papers find a linear relationship between the internal governance and the output performance metrics. In contrast, utilizing a proxy for task delegation across the top management team, which is consistent with the theoretical implications of AMR, we find a non-linear relationship between internal governance and firm performance incorporating CEO horizon measures. The resulting dynamic optimum results in a richer set of implications of internal governance for a wide set of corporate activities.

To the best of our knowledge, Aggarwal, Fu, and Pan (2017; AFP) is the only study that empirically investigates the theory of internal governance using executive titles and quadratic model specifications. Their paper shares the following similarities with our paper. One, using the AMR model as motivation, AFP and our paper test the role of internal governance on investment. In doing so, both papers measure internal governance based on the relative balance of job responsibilities between the CEO and the rest of her team, while using job titles as a proxy for job responsibilities. Two, both studies find a hump-shaped relation between internal governance and firm value. We confirm that the hump-shaped relationship holds in our sample.

However, we differ from the AFP in the following ways. One, we study the impact of internal governance on innovation input and output whereas AFP does not. Two, we examine changes in firm variables (investment rates, disinvestment, and innovation) in the full year just before voluntary retirement (not including the CEO transition year so that our results are not confounded by the actions of the incoming CEO), whereas AFP's analysis examines changes in investment rates over all CEO-years. Three, our paper allows optimal internal governance to vary with distance from retirement age to control for reputational and career concerns – which is not explicitly factored in the model specification of AFP. Based on the career horizon-varying dynamic optimal δ^*, we define distance as the absolute difference between the firm's observed δ and the estimated dynamic optimal δ^*. We find that as the firm's internal governance variable approaches its optimum, the reduction in the investment rate and the quality of the innovation output is mitigated.

This paper proceeds as follows. Section 2 reviews the related literature and Section 3 describes our data, variable construction and sample characteristics. The empirical results are reported in Section 4 and Section 5 presents our conclusions.

2. Literature review

Stein (1988 and 1989) demonstrates that a CEO might behave myopically by not making long-term investments if the CEO believes that the benefit of such investments would not materialize or is not recognized by the market until after the CEO has retired. The impact of the current long-term investments would depress current earnings and thus, the current stock price. Therefore, a manager more aligned with the short-term stock price may turn down valuable investment opportunities. Managerial myopia can become more acute if the investment horizon of the CEO is short compared to the firm's stockholders and is most likely as the CEO approaches retirement. Similarly, Bertrand and Mullainathan (2003) demonstrate that a CEO may prefer a quiet life, first proposed by Hicks (1935), and therefore, be less willing to reallocate a firm's resources to increase operating efficiency. One might expect that the quiet life motivation becomes stronger as the CEO nears retirement since often the gains from managerial effort are long-term and are more likely to accrue to her successor. Accordingly, as the CEO approaches retirement she is inclined to reduce her efforts resulting in reducing the firm's capital expenditures, mergers and acquisitions activity and investments in R&D. Finally, Prendergast and Stole (1996) develop a managerial learning model that predicts that young executives are more willing to take on too risky projects to signal their ability. However, as they get older they learn from their previous mistakes and overcompensate by rejecting projects of elevated risk.

Consistent with the above predictions, Warner, Watts, and Wruck (1988) and Weisbach (1988) find strong evidence that accounting earnings and market value of the firm decline before CEO turnover. Additionally, Huson, Malatesta, and Parrino (2004) find evidence that the firm's accounting earnings and capital expenditure decline before CEO turnover, even among voluntary turnovers. Strong and Meyer (1987) show that the decision to write-down assets is strongly related to managerial turnover, indicating that retiring CEO's preferences are not aligned with current stockholders. Dechow and Sloan (1991), Murphy and Zimmerman (1993) and Weisbach (1995) find that during the transition period between the old and new CEO, there are significant asset divestitures, reduction in R&D expenditures and capital expenditures. Pan, Wang, and Weisbach (2016) show that the new CEO increases the level of capital expenditures. Lundstrum (2002), Cheng (2004), Serfling (2014), and Kabir et al. (2018) find that CEO's age[4] is negatively related to R&D investment. Similarly, Xu and Yan (2014) also find a negative relationship between CEO age and the innovativeness of the R&D expenditure.

The board of directors can greatly mitigate the agency costs associated with managerial myopia and quiet life through appropriate board monitoring and appropriate managerial compensation. Another mechanism that can be used is through internal governance. Internal governance is considered a monitoring mechanism that arises from the needed contributions of CEO subordinates to run the company. An influential paper by Acharya, Myers and Rajan (2011; AMR) models a firm with a two-level managerial hierarchy – a CEO who is old, and her subordinate who will become CEO in the next period. The myopic CEO creates moral hazard problems because she has little incentive to leave behind any capital stock after she retires. As such, the outgoing CEO tends to put in place policies that are designed to boost short-term earnings probably at the cost of the long-term capital and reputational stock of the firm. However, the

[4] Age has also been widely used as a proxy for the executives' employment horizon (see, for example, Brickley, Linck, & Coles, 1999, Dechow & Sloan, 1991, Gibbons & Murphy, 1992, Matëjka, Merchant, & Van der Stede, 2009 and Jain et al., 2016). All our results generally hold when we use age rather than the distance from retirement age. These results are not reported but are available from the authors on request.

subordinate who hopes to succeed the current CEO will oppose such CEO policies with which the successor will find herself running a diminished firm in the future. As such, the current CEO is "forced" to abide by the wishes of the subordinate, since the current CEO needs the assistance of the subordinate to produce current earnings that support the current stock price, which is an important factor in the CEO's current compensation. Moreover, the subordinate who exerts managerial effort to materialize CEO policies could learn from operational processes to become a more productive CEO in the future. On the other hand, giving too many administrative duties to the subordinate is not optimal especially if the success of the company is so dependent on the subordinate's effort. In this case, she is neither motivated to carry out the wishes of the CEO nor learn to become a more productive CEO since as the subordinate, she cannot internalize the successful current valuation and earnings.

The theoretical model of Landier, Sraer, and Thesmar (2009) has a different setting than AMR. In Landier et al. (2009), the vertical organizational structure consists of an informed Decision Maker (DM), in charge of selecting projects and an uninformed Implementer (I) who is in charge of the project's execution. In the face of a dissenting and unmotivated I, DM chooses to use objective information in the selection of projects to ensure successful outcomes. Preference heterogeneity between DM and I (or dissent), leads to more informed decision-making and less self-serving activities by the DM, which results in higher profitability.

Several empirical papers have found that internal governance is beneficial in other (non-investment-related) contexts. Landier et al. (2012) measure good internal governance by the number of executives appointed before the current CEO and find that firm's profitability increases with that number. Jain et al. (2016) measure internal governance as the difference in horizons between a CEO and his immediate subordinates and find that firms with better internal governance have lower information asymmetry and higher liquidity. Similarly, Mekhaimer et al. (2022) find that subordinates' horizon is positively associated with long-term investment growth, and research and development expenditures. Finally, Cheng et al. (2016) use the number of years to retirement to capture key subordinate executives' horizon incentives and their compensation relative to CEO compensation to capture their influence within the firm. They find that the extent of real earnings management decreases with key subordinate executives' horizon and influence. Note that these papers find a linear relationship between internal governance and performance. We find a non-linear relationship between internal governance and performance – which is consistent with the theoretical implications of AMR. The resulting dynamic optimum in turn results in a richer set of implications of internal governance for a wide set of essential corporate activities.

3. Data, variable construction and sample

AMR model a firm wherein the CEO knows that at the end of the period she will leave the firm to subordinates. Therefore, we restrict our sample to voluntary turnover by excluding any performance-related forced turnovers. To distinguish between the events of voluntary retirement and forced turnovers we use the procedure of Parrino (1997). According to Parrino (1997), a forced departure of a CEO is identified through any of the following three steps. First, forced departure is identified if a news release explicitly announces that the CEO leaves office due to forced termination, policy differences, or any other reasons (such as sales or profits being less than expected, etc.). Second, if there is no explicit news release of termination, Parrino (1997) assumes that individuals who are above the age of 60 years leave office voluntarily. For those under the age of 60 years, CEO turnover is considered forced if a) there is no public disclosure regarding her death, poor health, or acceptance of another position, or b) no public disclosure of retirement at least six months before the succession. Third, forced departures classified in the second procedure are reexamined using information surrounding the transition period and records in the individual's biography. Turnover is reclassified as voluntary if the individual takes a comparable position elsewhere or departs for ex-ante undisclosed reasons unrelated to the firm's policy and performance, such as personal interest confirmed by the departing CEO's biography or subsequent press releases. The CEO's age and the date of departure are obtained from ExecuComp. We obtain information regarding CEO turnover from various sources such as Bloomberg's Executive Profile and Biography, Wikipedia, SEC filings and Factiva.[5]

According to AMR, internal governance works best when neither the CEO nor their subordinate managers are dominant. The authors define a variable $\delta = f/(f+g)$, which is the fraction of tasks assigned to the CEO. A fully decentralized team would have $\delta = 0$, and one where the CEO makes all the contributions is where $\delta = 1$. To operationalize this metric, we follow the procedure used by Aggarwal et al. (2017). We first calculate the number of executive titles of the CEO (f) scaled by the total number of executive titles carried by the entire top management team of five executives ($f+g$). We utilize the technique of regular expression (*regex*) to calculate the number of titles for each executive. We use three steps to find δ. First, we use the *regex* procedure to provide a preliminary number of titles for each executive. Second, we recognize that *regex* has limitations when the title string is irregularly structured. For these companies, we manually check the title string given by ExecuComp. Third, we manually checked for a random sample of firm-years, and the *regex* procedure correctly captured the titles. To conserve space in the main text, we delineate the exact procedure using *regex* in Appendix B.

To determine the optimal level of internal governance, we need a suitable performance metric. Since the main channel through which internal governance mitigates agency problems is to constrain the CEO's myopic motives of under-investing in the firm's capital stock, our performance proxy should be able to efficiently recognize the growth potential rather than only focus on current cash earnings. Following the convention of the extant literature, we use a proxy for market performance defined as the market value of

[5] Note that the Parrino (1997) methodology does not always distinguish between voluntary turnover and voluntary retirement. Although the two are not necessarily the same, we hypothesize that older CEOs who leave for a new position might suffer an underinvestment problem and/or take less risk just prior to turnover, caused by the increasing desire for a quieter life. Our evidence that internal governance has a salutary effect on voluntary turnovers is consistent with this quiet life hypothesis.

equity divided by the book value of equity (M/B). M/B is winsorized at the 1% level in the Compustat universe. According to Chakravarthy (1986), M/B is an ideal measure for the success of strategic management, which ensures the firm's long-term adaptation to its business environment in the face of potential distortions from management. Additionally, M/B is a more forward-looking measure than ROA, as it incorporates the market's perception of the firm's growth opportunities. Given that M/B is also strongly associated with the condition of the industry in which it operates, we use the industry-adjusted performance measure of M/B at the two-digit SIC level. We regress our performance measure (industry-adjusted market value of equity to its book value) against δ, the career horizon of the CEO, their interaction and a wide set of control variables. We include the CEO's horizon variable because a younger CEO may voluntarily leave the firm to seek better opportunities. Accordingly, a younger CEO's motivation is more likely to be influenced by career concerns as suggested by Gibbons and Murphy (1992).

Accordingly, we empirically estimate the following regression specification.

$$Performance_{it} = \beta_0 + \beta_1\delta_{it} + \beta_2\delta_{it}^2 + \beta_3\delta_{it} \times \theta_{it} + \beta_4\delta_{it}^2 \times \theta_{it} + \beta_5\theta_{it} + \beta' X_{it} + \eta_k + \gamma_i + \lambda_t + \epsilon_{it} \quad (1)$$

The dependent variable is the industry-adjusted firm performance variable *M/B*. We include a linear and squared term for δ given that the optimal internal governance as measured by the fraction of titles held by the CEO as posited by the theory should be non-linear. To estimate the coefficients, we initially use OLS with firm fixed effects. In the knowledge that the CEO's horizon may potentially influence δ, one may interpret Eq. (1) as a reduced form of the endogenous relation between our internal governance variable and our CEO's *Horizon* variable, θ_{it}. *Horizon* is defined as the time to retirement measured as $max(65 - Age0)$, where 65 is the normal age for retirement, and *Age* is the age of the CEO. (We also repeated our analysis using CEO's *Age* instead of *Horizon* and the results are analogous.) The standard errors of all the fixed effects models are two-way clustered by firm and year. X_{it} represents a robust set of covariates controlling for firm fundamentals, CEO characteristics, external corporate governance variables, and η_k, γ_i,and λ_t are (single-digit SIC) industry, firm, and year fixed effects, respectively.[6]

Once we obtain the estimates for Eq. (1), we can find the first-order condition as a function of δ and θ by taking the first derivative of performance with respect to δ, setting it equal to zero to find δ^*. We then take the second derivative of performance with respect to δ to check if δ^* maximizes firm performance. As such, the effectiveness of a company's internal governance can be measured as the distance to the dynamic optimum, *Distance*, which is computed as the absolute value of its δ minus the dynamic optimum δ^* taking into account CEO's *Horizon*.

To determine if optimal internal governance mitigates agency problems caused by the shortening of the investment horizon of the CEO, we examine the relationship between the investment rate and our internal governance metric as described above. Investment rate (*Investments*) is defined as the sum of capital expenditures and acquisitions at the end of the period divided by total assets at the beginning of the period. We calculate the investment rate variable from Compustat. Although Aggarwal, Fu and Pan (2017; AFP) also find a hump-shaped relationship between capital expenditure and internal governance more prominently for older CEOs (age 56 and over), AFP does not use the hump-shaped relationship between capital expenditure and internal governance to determine the optimal δ^*. Finding the horizon-varying optimal internal governance allows us to explicitly model the economic ramifications of deviating from effective internal governance and simultaneously account for the executive horizon, the key influential factor in the theoretical framework of AMR. Additionally, this model specification enables us to explore the effect of internal governance on essential corporate activities such as innovation input (R&D expenditure) and output (citations per patent).

Our multivariate regressions include many control variables. The first control variable is firm size, and to mitigate any skewness issues we take the natural logarithm of total assets (*Size*). One might expect agency costs to increase with leverage (Green & Talmor, 1986; Jensen & Meckling, 1976). We include the variable *Leverage* which we define as the sum of long-term debt plus short-term debt in current liabilities divided by beginning period total assets. We also control for other governance mechanisms as characterized by board characteristics, which are expected to play a role in constraining the CEO's discretion and are a potential substitute for internal governance. To do so, we collect data from ISS on board characteristics (number of directors and the fraction of outside directors on the board). We hence merge ExecuComp, Compustat and ISS to construct our sample. Because the distribution of managerial responsibility might be a function of firm complexity and firm age, we include as additional control variables, the number of business segments (*Segments)* and firm age (*Firmage*) defined as the difference between the current year and the first year the firm appears in Compustat. To control for the power of the CEO, we include a dummy variable *Chair* that equals one if the CEO is also the chair of the board of directors and zero otherwise. Additionally, we include an indicator variable *Founder* that equals one if the CEO is the founder of the company and zero otherwise. Another proxy for CEO power is the relative pay of the CEO, *Payslice,*[7] defined as the ratio of the total compensation of the CEO to the total compensation of the top five highest-paid executives.[8] Since the data in the ISS legacy database starts in 1996, our sample starts from 1996. Table 1 summarizes the definitions of each of our variables used in the empirical analyses.

[6] We found that 10% of the firm-year observations (or 5.8% of unique firms) did change their primary SIC industry code. Hence, although we use as our dependent variable the 2-digit SIC industry adjusted performance measure, it is not the case that the industry fixed effects would be subsumed by the firm fixed effects. We find that the F-statistic for our industry fixed effect is significant at less than the .1% level implying that the industry fixed effects are important. Nevertheless, we find that our coefficients estimates are almost identical with and without the inclusion of the industry fixed effects.

[7] CEO pay slice has been used to capture tournament incentives (Kale, Reis and Venkatesaran (2009), or CEO power and entrenchment (Bebchuk, Cremers, & Peyer, 2011; Feng, Ge, Luo, & Shevlin, 2011).

[8] In Table 11, we include a metric for long-term incentive pay and take into account if the firm has a formal succession plan. None of our results change.

Table 1
Variable definitions.

Variable	Description
M/B	The current year's industry-adjusted market-to-book ratio is defined as the firm's market-to-book ratio minus the industry's median market-to-book ratio. The median is calculated at the two-digit SIC industry-year level using the Compustat universe
δ	Denotes the current year's fraction of executive titles held by the CEO and proxies for the relative contribution of the CEO to the entire cash flow of the firm. It is calculated as the number of executive titles of CEO (f) scaled by the total number of titles carried by the top management team of the top five managers including the CEO ($f + g$). The number of titles is calculated using our screening method built upon *regex*.
f	Current year's number of executive titles carried by the CEO including chair and membership of board and executive committees
g	Current year's number of executive titles carried by the top four non-CEO executives ranked by total compensation
Investments	Current year's capital expenditures rate (capital expenditures/ beginning of period assets) + acquisition rate (acquisitions/ beginning of period assets)
SPPE	Current year's property sales/ beginning of period assets
SPPIV	Current year's gains or losses of property sales/beginning of period assets
Leverage	One-year lagged values of (long-term debt + debt in current liabilities)/ beginning of period assets
Size	One-year lagged values of the natural logarithm of assets
R&D	The amount of research and development expenditures/ beginning of period assets
Segments	One-year lagged values of the number of business segments where the firm operates
Firmage	One-year lagged value of the number of years that a firm has data available in Compustat
Directors	Total number of directors serving on the board in the current year
Outsiders	Fraction of outside directors serving on the board in the current year
Chair	A dummy variable takes the value of unity if the outgoing CEO is the chair of the board of directors in the current year
Founder	A dummy variable takes the value of unity if the outgoing CEO is the founder of the firm in the current year
Horizon	Distance to retirement is measured as$Max(65 - Age, 0)$, a proxy for the executive horizon of the CEO in the current year, where *Age* is the age of the CEO in the current year
Payslice	Fraction of total CEO compensation out of the total compensation for the whole management team in the current year.
PPS	Pay performance sensitivity is measured as the CEO's total portfolio delta (in thousands) in the current year.
Distance	*Distance* is the absolute value difference between the firm's δ and the optimum δ^* given by Eq. (2). If the CEO is younger than 53, the *Distance* variables are set equal to zero.
Impact	The impact of patenting activities is measured as the number of total citations scaled by the number of patents for a firm in the fiscal year
Young	A dummy variable that is equal to one if the CEO is younger than 54. Otherwise, it equals zero.
Succession	A dummy variable that takes the value of unity if the firm includes a CEO succession plan in its proxy statement and zero otherwise. This measure follows Cvijanović et al. (2023) and McConnell and Qi (2022) to determine whether or not a succession plan is in place for a firm in a given year.
Duration	The duration of CEO compensation follows Gopalan et al. (2014).

This table reports the variables used in our empirical analysis and their definitions.

We begin the sample construction by obtaining the job titles and employment history of the CEO and the other top four subordinate managers of S&P 1500 firms from ExecuComp for the years 1996 to 2017. We use the ExecuComp variables CEOANN and TITLEANN to help identify CEO and executive titles, respectively, for each firm-year observation. For this empirical study, we omit any observations from the sample if we cannot construct an internal governance measure (δ) for the firm. For example, we drop firm-year observations that report less than five executives, have missing values of executive total compensation (TDC1), report more than one CEO, or whose CEO identity cannot be clearly identified. To be consistent with the theoretical framework of AMR, we also ensure for each CEO turnover, the succeeding CEOs stay in office for at least two years to avoid accounting for turnover events in transition to interim CEOs who naturally have short executive horizons. Spanning fiscal years 1996 to 2017, the sample covers 3,257 CEO turnovers, 3,231 distinct firms and a total of 6,337 unique CEO-firm combinations. Detailed summary statistics of our sample are shown in Table 2.

Specifically, the average fraction of corporate titles of the CEO is 0.263, which is slightly greater compared with that found in AFP. The increase in sample mean may reflect the larger time span of our sample since we include several years of data beyond the 2008 financial crisis.[9] The sample distribution of δ is quite symmetric with extreme values ranging from smallest 0.055 to largest 0.643. The 1% percentile value is 0.111 and the 99% percentile value is 0.428, with a median value of 0.25 which is very close to average values of 0.26. Concerning both internal governance and other corporate financial variables, we have roughly similar means, medians, and standard deviations to those in Pan et al. (2016) and AFP. Additionally, we find that the variation of δ is more due to the variation of responsibility of non-CEO executives, indicating our internal governance variable is not simply the inverse of the definition of CEO power used by Adams, Almeida, and Ferreira (2005). Furthermore, this last finding indicates that the distribution of tasks is more concentrated upon giving more responsibilities to subordinates than the CEO amassing more titles for herself.

AMR predicts that investments are shareholder value-maximizing when there is a division of tasks (δ) between the CEO and her subordinates. But is δ just another proxy for CEO power (such as CEO pay slice) or other governance mechanisms (such as board size, proportion of outsiders on the board and CEO pay-performance sensitivity)? Table 3 presents the correlation matrix between δ, proxies for other governance structures (board size, proportion of outsiders on the board and CEO pay-performance sensitivity) and CEO power (pay slice and whether the CEO is the founder). We find that internal governance as defined by tasks/titles has a very low correlation with the proxies of other governance structures and CEO power. In no case is the correlation coefficient greater than 0.15. Accordingly, in our regressions below, we examine the impact of our internal governance measure while controlling for the other governance and CEO power variables.

[9] Our data extends to 2017 but the AFP study primarily ended in 2008,

Table 2
Descriptive statistics.

	N	Mean	Median	p25	p75	Std. Dev.	Skewness	Kurtosis
δ	28,268	0.263	0.250	0.222	0.300	0.069	0.566	3.848
f	28,268	2.646	2.000	2.000	3.000	1.042	2.135	10.759
g	28,268	10.103	10.000	8.000	11.000	2.807	1.948	10.769
Horizon	27,896	9.716	9.000	5.000	14.000	6.361	0.385	2.681
Distance	27,896	0.163	0.122	0.000	0.205	0.233	2.783	11.048
Young	27,896	0.324	0.000	0.000	1.000	0.468	0.781	1.560
Chair	28,268	0.579	1.000	0.000	1.000	0.494	-0.322	1.104
Founder	28,268	0.028	0.000	0.000	0.000	0.166	5.701	33.497
Payslice	28,266	0.331	0.332	0.292	0.372	0.083	-0.188	7.340
PPS	27,164	635.331	198.883	73.593	533.267	1510.539	5.385	35.847
M/B	28,028	1.632	0.425	-0.204	1.645	43.381	79.630	10129.030
Size	28,255	7.761	7.662	6.538	8.890	1.716	0.318	3.150
Leverage	28,254	0.246	0.223	0.073	0.359	0.247	15.921	956.478
R&D	28,255	0.029	0.000	0.000	0.029	0.066	6.821	104.487
Firmage	28,268	29.618	26.000	16.000	42.000	16.648	0.530	2.289
Segments	28,268	2.867	2.000	1.000	4.000	2.407	1.750	7.151
Directors	20,154	9.503	9.000	8.000	11.000	2.498	0.975	6.480
Outsiders	20,154	0.719	0.778	0.600	0.875	0.195	-1.036	3.353
Investments	16,004	0.102	0.058	0.026	0.117	0.173	8.742	164.148
SPPE	19,410	0.004	0.000	0.000	0.002	0.033	80.243	8980.798
SPPIV	25,257	-0.003	0.000	-0.001	0.000	0.049	-74.148	7240.234
Impact	8,930	5.459	2.500	0.788	6.167	10.483	8.710	158.859
Duration	9,279	1.133	1.052	0.620	1.531	0.817	11.187	469.531
Succession	28,268	0.284	0.000	0.000	1.000	0.451	0.956	1.914

This table reports the descriptive statistics of our sample for the period from 1996 to 2017. See Table 1 for variable definitions.

4. Empirical results

4.1. Internal governance and CEO horizon

We begin by estimating the relationship between internal governance and firm performance for each firm-year observation, utilizing a comparable quadratic model specification introduced by AFP. The regressions use our entire sample between 1996 and 2017, including non-transition years. The theory of AMR suggests that internal governance mitigates the older myopic manager's underinvestment problem.

Table 4 summarizes the results of regressing firm performance (current year's industry-adjusted market-to-book ratio) on the internal governance variable δ and control variables. Column (1) presents the results for the entire sample. Note that we do not obtain the predicted non-linear relationship between firm performance and our internal governance variable when we use the entire sample. As the CEO becomes older, her executive horizons will naturally become shorter, and the executive may turn myopic or more desiring to have an easier life professionally. Given that the original population of CEOs is a combination of far-sighted/career-driven executives and myopic/more laid-back executives, splitting the sample by CEO's *Horizon* might give us a better sample of myopic/laid back executives. (Henceforth, we will use the term myopia to reflect both myopia and the desire by the CEO to have an easier life.) As AFP does in their Table 4, we split the sample between CEOs whose expected *Horizon* is greater than 9 years (equivalent to CEO's being older than the median sample CEO age of 56) and those whose expected career *Horizon* is less than or equal to 9 years. Column (2) presents the results for older CEOs with a shorter horizon (*Horizon* $\leq$9 years) and column (3) presents the results for younger CEOs with a longer horizon (*Horizon* $>$9 years). According to the AMR model, we would expect to find that the coefficient on the linear δ term to be significantly positive and the coefficient on the δ^2 (square) term should be significantly negative only for CEOs with shorter *Horizon*.

Table 3
Correlation matrix between internal governance and other governance variables.

	δ	*Director*	*Outsiders*	*PPS*	*Payslice*	*Founder*
δ	1					
Directors	0.051***	1.0000				
Outsiders	0.144***	0.067***	1			
PPS	-0.033***	0.015**	-0.019***	1		
Payslice	0.060***	0.024***	-0.101***	-0.103***	1	
Founder	0.022***	-0.090***	0.082***	0.080***	-0.068***	1

This table reports the matrix of correlation coefficients for the internal governance variable (δ), other governance mechanisms (board size, proportion of outsiders on the board and CEO pay-performance sensitivity) and CEO power (pay slice and whether the CEO is the founder). See Table 1 for variable definitions. ***, ** and * denotes statistical significance at the 1%, 5% and 10% levels, respectively.

Table 4
Regressions of firm performance on internal governance for whole sample and subsamples by horizon.

	M/B		
	Whole Sample (1)	Horizon Shorter (2)	Horizon Longer (3)
δ	1.996*	5.707***	-2.777
	(1.70)	(3.34)	(-1.52)
δ^2	-2.045	-8.012***	4.229
	(-1.06)	(-2.98)	(1.39)
Size	-1.018***	-1.057***	-1.009***
	(-18.00)	(-12.99)	(-10.40)
Leverage	1.168***	1.477***	0.376
	(3.82)	(3.62)	(0.76)
Firmage	-0.053***	-0.029	-0.083***
	(-4.21)	(-1.46)	(-3.76)
Segments	-0.022**	-0.026*	-0.031*
	(-2.18)	(-1.78)	(-1.80)
Directors	-0.017	-0.021	-0.014
	(-1.59)	(-1.48)	(-0.80)
Outsiders	0.121	0.281	0.159
	(0.93)	(1.51)	(0.83)
Chair	-0.110**	-0.168**	0.058
	(-2.46)	(-2.57)	(0.74)
Founder	0.084	-0.372**	0.400**
	(0.64)	(-2.31)	(1.99)
Payslice	1.518***	1.548***	1.470***
	(5.18)	(4.22)	(3.08)
PPS	0.000***	0.000***	0.001***
	(16.87)	(10.53)	(9.99)
Ind FE	yes	yes	yes
Year FE	yes	yes	yes
Firm FE	yes	yes	yes
Adj.R^2	0.106	0.097	0.112
N	19,117	10,054	9,063

This table summarizes the results of regressing firm performance (current year's industry-adjusted market-to-book ratio) on the internal governance variable δ and other control variables. Column (1) presents the results for the entire sample, Column (2) presents the results for CEOs with shorter horizon (9 years or less) and Column (3) presents the results for CEOs with longer horizon (more than 9 years)[a]. Our sample period is from 1996 to 2017. See Table 1 for variable definitions. All regressions include industry dummies at the one-digit SIC level, firm-level fixed effects and year dummy variables. *t*-statistics are given in parentheses and all standard errors are two-way clustered by firm and year. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.
[a]The cutoff number is determined by the difference between retirement age equal to 65 years and our sample median CEO age of 56 years.

In column (3) (the subsample of younger CEOs), we find no statistically significant relationship between firm performance and the internal governance variables of δ and δ^2. However, in column (2) (the subsample of older CEOs), there is a statistically significant positive relationship between firm performance and δ, followed by a statistically negative relationship with δ^2. These results are consistent with the theory of AMR and with the empirical results of AFP.

However, the optimal internal governance may be a function of the CEO's horizon. Although proper internal governance is needed for older CEOs to mitigate CEO's myopia, a younger CEO's motivation is more likely to be influenced by career concerns as suggested by Gibbons and Murphy (1992). Hence, we regress our performance variable against δ and δ^2, the *Horizon* of the CEO, their interaction and a wide set of control variables as described in the previous section. Note that when we include the interaction term of the CEO's *Horizon* with δ and δ^2, we allow for the optimal internal governance variable to be a function of the CEO's horizon.

In Table 5, we find δ and δ^2 and their interaction terms are statistically significantly different from zero. Column (1) reports the coefficients when we use CEO's *Horizon* while excluding the control variables that are CEO-specific and unrelated to CEO horizon (i.e., *Chair, Founder, Payslice,* and *PPS,* respectively). Column (2) reports the coefficients when we include the CEO-specific control variables. Using the more comprehensive specification in column (2), we take the derivative of the firm's market value with respect to δ and set the derivative equal to zero. The optimal internal governance δ^* is given by:

$$\delta^* = (6.908 - 0.524\ Horizon)/(17.828 - 1.446\ Horizon) \quad (2)$$

We then take the second derivative of the first-order conditions with respect to δ and evaluate the sign of the second derivative at δ^* with respect to *Horizon*. It can be easily shown that when *Horizon* is greater than 12 (corresponding to the CEO age of 53) the second derivative is positive, indicating that δ^* does not optimize firm value. However, the second derivative is negative for CEOs who are 53 or older. Accordingly, δ^* minimizes firm value for younger CEOs but maximizes firm value for those older than 53. The finding that internal governance only maximizes firm value for older CEOs is consistent with the theoretical model of AMR.

Table 5
Regression of firm performance on internal governance incorporating horizon.

	M/B	
	(1)	(2)
δ	5.756***	6.908***
	(2.88)	(3.52)
δ^2	-7.174**	-8.914***
	(-2.14)	(-2.71)
Horizon	0.067**	0.097***
	(2.49)	(3.60)
Horizon × δ	-0.438**	-0.524***
	(-2.28)	(-2.76)
Horizon × δ^2	0.599*	0.723**
	(1.80)	(2.20)
Size	-0.938***	-1.009***
	(-16.09)	(-17.82)
Leverage	0.935***	1.170***
	(3.05)	(3.82)
Firmage	-0.039***	-0.051***
	(-2.97)	(-3.99)
Segments	-0.023**	-0.022**
	(-2.21)	(-2.22)
Directors	-0.023**	-0.016
	(-2.11)	(-1.52)
Outsiders	0.117	0.112
	(0.88)	(0.86)
Chair		-0.061
		(-1.31)
Founder		0.112
		(0.86)
Payslice		1.588***
		(5.38)
PPS		0.000***
		(16.97)
Ind FE	*Yes*	*Yes*
Year FE	*Yes*	*Yes*
Firm FE	*Yes*	*Yes*
Adj.R^2	0.107	0.108
N	19,117	19,117

This table summarizes the results of regressing firm performance (current year's industry-adjusted market-to-book ratio) on the internal governance variable δ, the CEO's *Horizon* variable, and other control variables. Our sample period is from 1996 to 2017. See Table 1 for variable definitions. All regressions include industry dummies at the one-digit SIC level, firm-level fixed effects and year dummy variables. *t*-statistics are given in parentheses and all standard errors are two-way clustered by firm and year. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

4.2. Impact of internal governance on a firm's investment policy

In this section, we examine the impact of internal governance on the firm's investment, disinvestment, R&D expenditure and innovativeness (cites per patent).

As the CEO approaches retirement, we expect the CEO to potentially forgo long-term and risky investments that are likely to benefit her successor. We hence explore if the reduction in investment as she approaches voluntary retirement is reversed with proper internal governance using the sample of firms undergoing voluntary turnover of their *older* CEOs. Accordingly, our primary variable of interest for the older CEO group is *Distance*, which is defined as the absolute value of the difference between δ and the estimated dynamic optimal δ^* as given by Eq. (2). For the younger CEOs, *Distance* is set to zero. That is,

$$Distance = \begin{cases} \mid \delta^* - \delta \mid & Horizon \geq 12 \\ 0 & Horizon < 12 \end{cases} \tag{3}$$

We, therefore, add a dummy variable, *Young*, which equals one if the CEO is younger than 53 years, and zero otherwise. Accordingly, we estimate the following multivariate regression.

$$\Delta InvestmentRate_{it} = \beta_0 + \beta_1 Distance_{it} + \beta_2' X_{i,t-1} + \beta_3' Young + \eta_k + \gamma_i + \lambda_t + \epsilon_{it} \tag{4}$$

Table 6
Regressions of changes in investment rates prior to CEO turnover on distance from dynamic optimal internal governance by horizon.

	ΔInvestments (-2, -1)			
	Whole Sample		Older CEOs	
	(1)	(2)	(3)	(4)
Distance	0.183***	0.169***	0.130***	0.131***
	(4.10)	(4.00)	(3.41)	(3.35)
M2B	0.009**	0.009**	0.009**	0.008*
	(2.51)	(2.36)	(2.08)	(1.87)
ROA	-0.310*	-0.313*	0.184*	0.212*
	(-1.86)	(-1.77)	(1.65)	(1.73)
Size	0.122***	0.131***	0.073***	0.068***
	(3.27)	(3.25)	(3.63)	(3.60)
Leverage	0.473**	0.476***	0.277***	0.285***
	(2.48)	(2.58)	(2.75)	(2.61)
Firmage	0.020**	0.020**	-0.004	-0.004
	(2.08)	(1.98)	(-0.64)	(-0.56)
Segments	-0.005	-0.005	-0.005	-0.005
	(-1.03)	(-1.06)	(-1.19)	(-1.15)
Directors	-0.007	-0.005	0.006	0.007
	(-1.04)	(-0.80)	(1.06)	(1.18)
Outsiders	-0.147**	-0.152**	-0.110*	-0.097*
	(-2.21)	(-2.25)	(-1.96)	(-1.69)
Chair		-0.037*		0.022
		(-1.74)		(1.19)
Founder		0.031		-
		(0.26)		(.)
Payslice		0.166		0.067
		(1.56)		(0.57)
PPS		-0.000		0.000
		(-0.50)		(0.09)
Young	0.088***	0.081***		
	(3.59)	(3.44)		
Ind FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes
Adj.R²	0.257	0.264	0.178	0.180
N	875	875	725	725

This table summarizes the results of the change in the investment rate of the firm prior to the voluntary retirement of the CEO. Columns (1) and (2) report the results for the whole sample, whereas columns (3) and (4) report the results for older CEOs only. The main explanatory variable of interest is *Distance*, defined for CEOs not younger than 53 years as the absolute value difference between the firm's δ and the optimum δ^* given by Eq. (2). Otherwise, *Distance* is set to zero. *Young* equals one for younger CEOs. See Table 1 for variable definitions. All regressions include industry dummies at the one-digit SIC level, firm-level fixed effects and year dummy variables. *t*-statistics are given in parentheses and all standard errors are two-way clustered by firm and year. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

We estimate Eq. (4) with firm, industry[10] and year fixed effects and include all the control variables of Table 4. The standard errors are two-way clustered by firm and year.

Table 6 summarizes our results. Columns (1) and (2) present the results for the change in the investment rate between two years (year = -2) prior to the turnover event and one year (year = -1) prior to the turnover event. Note that we do not define the change in investment rate to include from year -1 to year 0 because in year 0 the new CEO takes over the firm and it is not clear who is responsible for corporate decisions in that year. In column (1), we once again omit CEO-specific attributes that are unrelated to *Horizon* such as *Chair, Founder, PPS* and *Payslice.* In column (2), we include those CEO attributes in our regression model. In columns (3) and (4), we only use the older CEO sample and therefore we drop *Young* from our empirical specification. Note that a significantly positive regression coefficient on *Distance* implies that good internal governance reverses or mitigates the under-investment problem.

For all four regressions, the *Distance* variables' coefficients are positive indicating that the further the internal governance of the firm is from the optimum given the expected career horizon of the CEO, the greater the likelihood that the investment rate *decreases*. Note that the coefficients are significantly positive between years equal to -2 and years equal to -1, a time at which the new CEO has not been appointed and is not currently working on the transition with the older CEO. Accordingly, our results support the notion that internal governance mitigates CEO myopia (or her desire for a quieter professional life) for outgoing older executives.

Interestingly, the coefficients of the dummy variable, *Young,* are positive in Columns (1) - (2), implying that firms may experience underinvestment during the transition year even for younger outgoing CEOs who have career and reputation concerns. It is possible

[10] Please see footnote 6.

that younger CEOs who leave their employers for better opportunities may face heightened transition frictions during their job search, resulting in a reduction in long-term investments. Nevertheless, it is possible that younger CEOs who voluntarily retire may want to underinvest to bolster the firm's earnings potential and their reputation.

The flip side to understanding the underinvestment problem is that CEOs might divest assets. Pan et al. (2016) find that disinvestment increases during the fiscal year when the new CEO takes over from the exiting CEO. In Table 7, we explore the impact of internal governance on the divestment rate and the gains obtained from the sale of assets. In Columns (1) and (2), we use as our dependent variable dollar property sales (Compustat item SPPE) that is scaled by beginning period assets and internal governance is defined for the outgoing CEO for the fiscal year prior to when the new CEO takes over. All other control variables are the same as before. The table is split into two panels. Panel A presents the results for the entire sample, and Panel B presents the results for the older CEOs only. The main independent variable of interest is again *Distance.* We find that *Distance* is statistically insignificantly related to dollar property sales for both samples.

There are two possible explanations for why the new CEO wishes to divest assets of the firm. The first explanation is that the new CEO recognizes that the old CEO made poor investment decisions, which the new CEO is correcting. If this were the case, we would expect the firm to recognize losses upon the disposal of these assets. The second explanation is that the outgoing CEO made appropriate acquisitions during her tenure, but the asset mix does not match well with the skill set of the incoming CEO. If this were the case, then the divested assets should not incur any loss and perhaps even a gain; the beneficial effect of good internal governance on investment policy is further strengthened, in that it not only mitigates the underinvestment problem but also improves the quality of acquired assets.

To examine these twin explanations, we regress the dollar gains/losses of property sales (Compustat item SPPIV) scaled by the beginning period assets. Note that according to Compustat when SPPIV is a positive number, it represents the losses incurred from an asset disposal. The regression results are presented in Columns (3) and (4) of Table 7 for the two panels. Panel A reports the results for the entire sample while Panel B reports the results for older CEOs (short horizon) only. Note that both coefficients on *Distance* are statistically significantly positive, suggesting that the further the distribution of tasks before the new CEO takes over is from its optimum level of tasks, the greater the loss the firm incurs when it sells its assets. This indicates that good internal governance reduces the probability that the new CEO is disposing of assets at a loss. Taken together, the empirical evidence of Tables 6 and 7 suggests that good internal governance improves the deteriorating investment policy of the outgoing myopic CEO both in terms of the quality of assets acquired and the level of capital expenditures. These findings suggest that with good internal governance, the older outgoing CEO was less likely to overpay for assets and that the reason for the incoming CEO to dispose assets is likely due to mismatch between the old asset mix and the skill set of the new CEO.

We now examine whether internal governance has an impact on a firm's innovation activities during the two years prior to the voluntary retirement of the CEO. Xu and Yan (2014) find that retiring CEOs are less likely to implement innovative R&D projects. We use two proxies to define a firm's innovation activities. The first proxy captures the firm's *input into innovation*, namely, *R&D,* defined as the amount of R&D expenditure divided by the total assets at the beginning of the fiscal year. The second proxy captures the firm's *output from innovation*, namely *Impact*, measured as the number of total citations scaled by the number of patents for a firm in the fiscal year. Columns (1) and (2) of Table 8 summarize the regression results of the change in the R&D investment rate beginning from two years prior to the turnover event to one year prior to the turnover event. We do not include the turnover event year since in that year corporate decisions are also impacted by the arrival of the new CEO. Furthermore, we are unable to estimate fixed effect regressions for the older CEO sample because of too few observations. Similarly, Columns (3) and (4) of Table 8 present the change in *Impact* beginning from two years prior to the turnover year 0 to year -1. Again, our main independent variable of interest is *Distance*. We find that the coefficients on *Distance* are not statistically significant for *R&D* suggesting that internal governance does not correlate with changes in the level of R&D expenditures. We also find that the coefficient is significantly positive for *Impact*. Note that we are taking the difference between t = -2 and -1 which implies that a positive *Distance* coefficient for *Impact* translates into a reduction in patent citations. This implies that optimal internal governance improves the quality and impact of R&D in terms of patent citations.

In addition, the coefficients for *Young* are significantly negative for all the regressions. We interpret these results as indicating that driven by career and reputation concerns, younger CEOs who leave voluntarily (presumably because they found other opportunities) are more likely to both increase the level of R&D expenditure and enhance the innovativeness of the R&D investment, as measured by the number of citations. We interpret these results to be consistent with the career concerns model of Gibbons and Murphy (1992).

4.3. Endogeneity

It is possible that our control variables and δ can be jointly determined by some unobserved omitted variables resulting in our empirical estimates of Table 5 to be adversely affected by endogeneity concerns. We believe that our results are not materially affected by endogeneity concerns for several reasons. First, we have included firm, industry and year fixed effects to control for time invariant omitted variables, along with a large set of time-varying control variables. Second, we use Hirano and Imbens (2004) continuous matching by the Generalized Propensity Scoring (GPS) method to confirm that our results do not suffer from endogeneity concerns. The GPS approach effectively balances covariates in the sample without relying on instrumental variables (IVs) of strict exclusion restriction. In Table 9, we report the GPS-adjusted and GPS-unadjusted *t*-statistics for each of our covariates. Appendix A describes in detail the GPS methodology and Table A1 presents the first stage regression to compute GPS. Note that the GPS-adjusted *t*-statistics are generally less than the GPS-unadjusted *t*-statistics and there are fewer adjusted t-statistics that are significant. Accordingly, we find that the mean values of our covariates are persistent across different levels of δ. Hence, GPS generally improves the independence of our internal governance variables.

Table 7
Regressions of SPPE and SPPIV at CEO turnover on distance from dynamic optimal internal governance by horizon.

Panel A: Whole Sample				
	SPPE		SPPIV	
	(1)	(2)	(3)	(4)
Distance	-0.010	-0.019	0.013*	0.016**
	(-1.18)	(-1.62)	(1.78)	(2.17)
M2B	-0.001	-0.001	-0.002	-0.001
	(-0.73)	(-1.24)	(-1.09)	(-0.95)
ROA	-0.117*	-0.131*	-0.022	-0.019
	(-1.72)	(-1.75)	(-0.65)	(-0.56)
Size	0.003	0.005	0.007*	0.007*
	(0.37)	(0.63)	(1.75)	(1.69)
Leverage	0.036**	0.035**	-0.068**	-0.069***
	(2.01)	(1.97)	(-2.48)	(-2.60)
Firmage	-0.001	-0.001	0.000	0.001
	(-0.85)	(-1.20)	(0.40)	(0.93)
Segments	-0.003	-0.003	0.001	0.001
	(-1.55)	(-1.52)	(1.44)	(1.10)
Directors	-0.002	-0.001	0.000	0.000
	(-1.49)	(-1.23)	(0.38)	(0.21)
Outsiders	-0.028	-0.028	0.035***	0.034***
	(-1.42)	(-1.43)	(2.93)	(2.98)
Chair		0.001		-0.006**
		(0.21)		(-1.97)
Founder		0.041		0.000
		(1.62)		(0.03)
Payslice		0.048*		-0.020
		(1.68)		(-1.36)
PPS		0.000		-0.000
		(0.25)		(-1.13)
Young	-0.000	0.001	-0.000	-0.001
	(-0.04)	(0.40)	(-0.02)	(-0.23)
Ind FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes
Adj.R^2	0.212	0.224	0.193	0.204
N	703	703	955	955

Panel B: Older CEOs				
	(1)	(2)	(3)	(4)
Distance	-0.009	-0.015	0.015**	0.015***
	(-1.02)	(-1.32)	(2.40)	(2.69)
M2B	0.002	0.001	-0.004*	-0.003*
	(1.05)	(0.71)	(-1.84)	(-1.92)
ROA	-0.223*	-0.232**	0.047	0.046
	(-1.96)	(-1.99)	(1.29)	(1.27)
Size	0.021	0.021	0.005	0.006
	(1.33)	(1.27)	(1.22)	(1.36)
Leverage	0.010	0.011	0.005	0.004
	(0.46)	(0.50)	(0.36)	(0.27)
Firmage	0.000	-0.001	-0.001	-0.000
	(0.09)	(-0.47)	(-0.99)	(-0.08)
Segments	0.000	0.001	0.001	0.001
	(0.18)	(0.84)	(0.93)	(0.41)
Directors	-0.005	-0.005	-0.000	-0.001
	(-1.55)	(-1.56)	(-0.66)	(-0.85)
Outsiders	-0.033	-0.042	0.010	0.013
	(-1.31)	(-1.62)	(1.16)	(1.39)
Chair		0.004		-0.003
		(0.92)		(-1.29)
Founder		-		-
		(.)		(.)
Payslice		0.037		-0.002
		(1.19)		(-0.11)
PPS		0.000		-0.000
		(0.87)		(-1.05)

(*continued on next page*)

Table 7 (*continued*)

	Panel B: Older CEOs			
	(1)	(2)	(3)	(4)
Ind FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes
Adj.R²	0.305	0.312	0.143	0.147
N	534	534	745	745

This table reports the results of the regression whereby the dependent variable is either the ratio of dollar fixed asset sales to beginning period total assets (*Sppe*) in the year of CEO turnover or the ratio of dollar gains or losses on fixed asset sales to beginning period total assets (*Sppiv*) in the year of CEO turnover. The two panels of the table, Panel A and Panel B, summarize the results for the whole sample and the subsample of older CEOs, respectively. The main explanatory variable is *Distance*. See Table 1 for variable definitions. All regressions include industry dummies at the one-digit SIC level, firm-level fixed effects and year dummy variables. *t*-statistics are given in parentheses and all standard errors are two-way clustered by firm and year. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 8
Regressions of innovation input and output prior to CEO turnover on distance from dynamic optimal internal governance by horizon.

	R&D (-2, -1)		*Impact* (-2, -1)	
	(1)	(2)	(3)	(4)
Distance	-0.002	-0.003	25.118*	74.130***
	(-0.64)	(-0.85)	(1.89)	(7.01)
M2B	-0.000	-0.000	-0.027	0.524
	(-0.62)	(-0.61)	(-0.04)	(1.08)
ROA	0.016	0.017	-6.105	4.015
	(0.55)	(0.56)	(-0.22)	(0.17)
Size	0.004	0.004	0.211	26.995***
	(1.16)	(1.27)	(0.03)	(5.68)
Leverage	0.009	0.009	93.226***	7.293
	(0.52)	(0.54)	(5.11)	(0.63)
Firmage	0.003**	0.003**	-6.907***	-8.972***
	(2.40)	(2.23)	(-4.09)	(-8.09)
Segments	-0.000	-0.000	3.110***	1.164***
	(-0.79)	(-0.96)	(3.68)	(2.67)
Directors	-0.000	-0.000	-4.372***	-4.055***
	(-0.75)	(-0.53)	(-3.58)	(-4.22)
Outsiders	0.012	0.013	20.702**	34.411***
	(1.31)	(1.34)	(2.48)	(4.10)
Chair		-0.001		-12.966***
		(-0.75)		(-4.93)
Founder		0.008		0.000
		(0.66)		(.)
Payslice		0.020		-152.954***
		(1.49)		(-8.34)
PPS		-0.000		-0.004***
		(-1.64)		(-8.58)
Young	-0.007**	-0.007**	-8.108**	-28.619***
	(-2.23)	(-2.40)	(-2.34)	(-7.85)
Ind FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes
Adj.R²	0.102	0.106	0.834	0.945
N	984	984	284	284

This table reports the results of the regression whereby the dependent variable is either a change in the R&D investment rate or the change in the impact of R&D. *R&D* is the dollar amount of research and development expenditures scaled by the beginning of period assets. *Impact* is the number of total citations scaled by the number of patents for a firm in the fiscal year. The main explanatory variable of interest is *Distance*. See Table 1 for variable definitions. All regressions include industry dummies at the one-digit SIC level, firm-level fixed effects and year dummy variables. *t*-statistics are given in parentheses and all standard errors are two-way clustered by firm and year. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Table 10 summarizes the regression coefficients of our model given by Eq. (1) after we include the flexible function of GPS. Note, the results in Table 10 are analogous to those of Table 5. Further note that the coefficients of the GPS variables are not significant. This suggests that our empirical results are not seriously affected with endogeneity. We obtain similar first-order conditions as before and moreover, the second derivative results lead to the same conclusion that internal governance is important to mitigate CEO myopia or preference for an easy life for older outgoing CEOs.

Table 9
Balance given the generalized propensity score (GPS).

	Unadjusted			Adjusted for the GPS		
	Low	Middle	High	Low	Middle	High
Size	-4.100***	-4.845***	8.287***	-3.377***	-1.230	4.374***
Leverage	3.670***	0.244	-3.554***	0.515	0.691	-1.209
Firmage	-10.936***	0.873	8.413***	-5.245***	0.621	3.775***
Segments	-5.157***	0.704	3.609***	-2.437**	0.238	1.683*
Directors	-1.700*	-2.664***	4.120***	-1.138	-0.916	2.049**
Outsiders	-10.159***	-3.319***	12.112***	-5.170***	-1.288	6.496***
Payslice	-10.918***	4.576***	5.701***	-3.888***	1.148	2.210**
PPS	3.003***	-1.169	-1.552	0.958	-0.855	0.070
Chair	-20.672***	1.329	17.279***	-7.943***	0.355	7.454***
Founder	-0.469	-0.718	1.117	0.213	-0.550	0.367

This table presents the results of checking imbalances among major covariates of firm and CEO characteristics before and after GPS adjustment. It reports the unadjusted and GPS-adjusted *t*-statistics of the test of difference for the equality of means. See Table 1 for variable definitions. Independent *t*-tests are conducted for each covariate to investigate whether the mean in one of the three δ groups is different from those in the other two groups. Specifically, δ is divided into three groups: low, intermediate, and high. GPS in each group is approximated by evaluating at the group median δ. Discretizing both the level of δ and the GPS adjusted *t*-statistics are calculated by combining the five differences in means from GPS quintile groups, weighted by the number of observations in each group.

Nevertheless, GPS cannot address potential endogeneity due to unobservable covariates. However, we have also included a large set of time-varying control variables that control for CEO characteristics (such as CEO pay-performance sensitivity, whether the former CEO is the founder of the company), governance characteristics (such as the percentage of outside directors on the board, the size of the board) and various firm characteristics.

4.4. Robustness tests

In this subsection, we report the results of several robustness tests. It is possible that our internal governance variable may substitute for succession planning which can reduce the friction and inefficiency of management transition. Aggarwal et al. (2017) posit and find that the hump shape is more likely for those firms in industries that rely on internal succession. Consistent with Cvijanović et al. (2023), we create a dummy variable that captures succession planning. Specifically, we examine the proxy statements (DEF-14A) for each firm in our sample using a computer script to identify disclosure of succession plans. We search for keywords and/or phrases such as "leadership development," "succession plan(s)," and "succession planning," "plan(s) for succession." In Column (1) we report the results of a subsample of firms that have a formal succession plan. Essentially, we have the same quadratic relationship that we obtained in Table 5.

Gibbons and Murphy (1992) derive the optimal contract as a trade-off between explicit incentives and implicit contracts such as career concerns. Specifically, CEOs are implicitly incentivized early in their career from their reputation in the labor market, which could partially substitute for a higher explicit incentive contract. During these years, CEOs would be more willing to undertake costly unobservable managerial actions to correctly increase the market's assessment of their ability. Later in their career, CEOs require a higher explicit pay-performance sensitivity to compensate them for reduced career concerns or to induce the CEO not to slack off as she approaches retirement. However, explicit pay-for-performance may not be enough to cure CEO myopia and the board of directors may include horizon contracting to combat the short-sightedness of CEOs who plan to retire soon. For example, Kabir et al. (2018) find that the reduction in corporate activity by older CEOs is due to the large amount of inside debt (defined pension plans) that the CEOs hold. Accordingly, we now control for the compensation duration as defined by Gopalan, Milbourn, Song, and Thakor (2014) who calculate compensation duration as follows.

$$Duration = \frac{(Salary + Bonus) \times 0 + \Sigma_{i=1}^{n_1} Restricted\ stock_i \times t_i + \Sigma_{j=1}^{n_2} Option_j \times t_j}{Salary + Bonus + \Sigma_{i=1}^{n_1} Restricted\ stock_i + \Sigma_{j=1}^{n_2} Option_j} \quad (5)$$

We use BoardEx to obtain the contract details (vesting periods) for all components of the CEO's managerial contracts. In Column (2) of Table 11, we report the results of including *Duration* as an added independent variable to the regressions reported in Table 5. The coefficient of *Duration* is significantly positive indicating that firm value increases with contractual arrangements that mitigate the CEO's myopia problem. Nevertheless, the quadratic relationship between δ and market value and the significance of the interaction variables with *Horizon* are qualitatively similar to what we obtained in Table 5. We also examine the second derivative properties of the empirical specification and find that, as before, δ^* minimizes firm value for younger CEOs and maximizes firm value for older CEOs.

Table 10
Regression of firm performance on internal governance controlling for GPS.

	M/B			
	(1)	(2)	(3)	(4)
δ	5.982***	7.343***	6.415***	7.852***
	(2.86)	(3.57)	(2.87)	(3.56)
δ^2	-7.586**	-9.688***	-8.289**	-10.506***
	(-2.14)	(-2.79)	(-2.27)	(-2.91)
Horizon	0.068**	0.098***	0.069**	0.099***
	(2.49)	(3.62)	(2.54)	(3.67)
Horizon $\times$ δ	-0.439**	-0.527***	-0.447**	-0.537***
	(-2.29)	(-2.78)	(-2.34)	(-2.83)
Horizon $\times$ δ^2	0.601*	0.727**	0.615*	0.743**
	(1.81)	(2.22)	(1.85)	(2.27)
GPS	-0.003	-0.006	-0.027	-0.032
	(-0.43)	(-0.82)	(-0.61)	(-0.76)
GPS^2			0.003	0.003
			(0.96)	(1.14)
$GPS \times \delta$			-0.018	-0.024
			(-0.17)	(-0.24)
Size	-0.938***	-1.009***	-0.937***	-1.008***
	(-16.09)	(-17.81)	(-16.07)	(-17.80)
Leverage	0.940***	1.170***	0.939***	1.169***
	(3.07)	(3.82)	(3.06)	(3.82)
Firmage	-0.039***	-0.051***	-0.039***	-0.051***
	(-2.97)	(-4.01)	(-2.97)	(-4.01)
Segments	-0.023**	-0.022**	-0.023**	-0.022**
	(-2.22)	(-2.21)	(-2.22)	(-2.22)
Director	-0.023**	-0.016	-0.023**	-0.016
	(-2.10)	(-1.52)	(-2.09)	(-1.51)
Outsider	0.117	0.111	0.119	0.113
	(0.88)	(0.85)	(0.89)	(0.87)
Chair		-0.063		-0.061
		(-1.34)		(-1.28)
Founder		0.115		0.112
		(0.88)		(0.86)
Payslice		1.590***		1.600***
		(5.39)		(5.44)
PPS		0.000***		0.000***
		(16.97)		(16.96)
Ind FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Adj.R^2	0.054	0.107	0.054	0.107
N	19,117	19,117	19,117	19,117

This table summarizes the empirical results of regressing the internal governance variable δ and its squared term against firm performance variable (current year's industry-adjusted market-to-book ratio), controlling for GPS. See Table 1 for variable definitions. Our sample period is from 1996 to 2017. All regressions include industry dummies at the one-digit SIC level, firm-level fixed effects and year dummy variables. *t*-statistics are given in parentheses and all standard errors are two-way clustered by firm and year. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

One possible concern is that our results may be driven by few firms with multiple turnover events. However, out of 1991 firms that have turnovers in our sample, about 50% firms (958) experienced multiple turnovers. As such, we believe firms with multiple turnovers are pervasive and representative in our sample. On the other hand, the CEO turnover event itself is an important influential factor in determining δ. To control the variation of δ driven by turnovers, it is necessary to control firm fixed effects in the horizon-dynamic quadratic regression, resulting in horizon-specific optimal δ accounting for firm-specific effects. Accordingly, we need also to control for firm fixed effects and focus on within-firm variations when utilizing the optimal δ for the turnover regressions. Therefore, we believe that the inclusion of firm fixed effects is an empirical necessity and should not introduce material biases. Nevertheless, we repeat our regressions by adding a dummy variable equal to one for any firm that experienced a multiple turnover. We get similar results.[11]

[11] When we add the multiple turnover dummy variable, we drop firm fixed effects in order to avoid an identification problem. These results are not reported and are available from the authors upon request.

Table 11
Regression of firm performance on internal governance controlling for firms with succession planning or controlling for pay duration.

	M/B	
	Succession Sample (1)	Pay Duration (2)
δ	8.955**	12.518***
	(2.40)	(3.95)
δ^2	-12.526**	-18.456***
	(-2.10)	(-3.65)
Horizon	0.117*	0.147***
	(1.85)	(2.80)
Horizon $\times$ δ	-0.708*	-0.973***
	(-1.71)	(-2.77)
Horizon $\times$ δ^2	1.166*	1.597***
	(1.73)	(2.73)
Size	-1.031***	-0.045***
	(-6.47)	(-2.64)
Leverage	2.383***	0.017
	(4.63)	(1.00)
Firmage	0.014	0.174
	(0.46)	(0.84)
Segments	-0.044***	-0.021
	(-2.58)	(-0.23)
Directors	0.002	0.094
	(0.06)	(0.39)
Outsiders	-0.055	0.734*
	(-0.17)	(1.78)
Chair	0.222**	0.000***
	(2.20)	(11.10)
Founder	0.053	12.518***
	(0.23)	(3.95)
Payslice	0.167	-18.456***
	(0.29)	(-3.65)
PPS	0.000***	0.147***
	(8.82)	(2.80)
Duration		0.106**
		(2.48)
Ind FE	Yes	Yes
Year FE	Yes	Yes
Firm FE	Yes	Yes
Adj.R^2	0.072	0.111
N	6,216	7,271

This table summarizes the results of validating the *Horizon* dynamic relationship between firm performance (current year's industry-adjusted market-to-book ratio) and internal governance variable δ, controlling for succession planning and compensation duration. Column (1) reports the results of the subsample of firms that have a formal succession plan. Column (2) reports the results of including as control variable, *Duration*, a proxy for contract horizon indicating the weighted average percent of total pay that is long-term as defined by Gopalan et al. (2014). Our sample period is from 1996 to 2017. All regressions include industry dummies at the one-digit SIC level, firm-level fixed effects and year dummy variables. *t-statistics* are given in parentheses and all standard errors are two-way clustered by firm and year. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

5. Conclusions

The theoretical and empirical literature suggests that a CEO might not make risky long-term investments if the CEO believes that the benefit of such investments would not materialize or is not recognized by the market until after the CEO has retired. Similarly, when the CEO's horizon is shorter, she might forgo valuable long-term investments because she would prefer not to put in the extra effort and enjoy a quieter life professionally. The Acharya, Myers and Rajan (2011, AMR) model predicts that internal governance may mitigate the CEO myopia problem and that the optimal internal governance would trade off responsibilities or tasks between the CEO and the top executives. This paper empirically tests the predictions of the AMR model relating to internal governance on the firm's investment policy using a sample of firms wherein CEO turnover is voluntary. Our empirical specification allows us to consider the reputational and career concerns of younger CEOs who leave voluntarily and who presumably do not have a myopia problem. We find a dynamic optimal internal governance that varies by age for older CEOs, whereas optimal internal governance does not exist for younger CEOs. In other words, a firm's optimal internal governance (δ^*) is not a constant but varies with distance from the CEO's

retirement age. These results are consistent with the predictions of AMR, as older CEOs are more likely to face the agency problems of myopia. Younger CEOs are more concerned with their reputation and its impact on their career trajectory, consistent with the Gibbons and Murphy (1992) model. Furthermore, consistent with AMR, we find that firm performance is increasing and then decreasing in δ for older CEOs. Our results are robust to controlling for i) endogeneity concerns (using generalized propensity scoring), ii) measures of other governance mechanisms (i.e., board size, proportion of outsiders on the board, CEO pay slice, founder, CEO pay-performance sensitivity, pay duration and succession planning).

We find that good internal governance helps reduce older CEOs underinvesting before their exit, whereas bad internal governance does not. We also find that the divestment activity in the first fiscal year of the new incoming CEOs is profitable. Such findings are consistent with the theoretical predictions of AMR wherein the internal governance mechanism is effective when the CEO is myopic. Additionally, we find that older outgoing CEOs of firms with effective internal governance are more likely to conduct impactful and quality corporate innovation as measured by the total citations scaled by the number of patents in the fiscal year.

Future research might examine if internal governance has an impact on other managerial decisions such as payout policy, merger strategies and managerial disclosure policies.

CRediT authorship contribution statement

Ivan E. Brick: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Darius Palia:** Writing – review & editing, Writing – original draft, Formal analysis, Conceptualization. **Yankuo Qiao:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization.

Data availability

Data will be made available on request.

Appendix A. Continuous matching by generalized propensity score

In the knowledge that any potential instrumental variables for δ may directly affect firm performance and investment policy, and thus violate exclusion restriction, we use an alternative approach, continuous matching by Generalized Propensity Score (Hirano & Imbens, 2004), to mitigate endogeneity. Assuming that the conditional distribution of δ on the instruments *Horizon* and *Age* and other covariates (X) is a normal distribution, we could denote the relation between explanatory variables and covariates as follows.

$$\delta_{it} \mid X_{it} \sim N\left(\beta_0 + \beta_1' X_{it}, \sigma^2\right) \tag{A1}$$

The above expression also assumes that the mean level of δ is a function of covariates X_{it} while the variance (σ^2) does not. We use maximum likelihood estimation to estimate the coefficients of the above model and use the parameter estimates to calculate the conditional probability density function of δ for levels of treatment (Generalized Propensity Score or GPS) as follows. The parameter estimates are summarized in Table A1.

$$GPS_{it} = r(\delta, X) = \frac{1}{\sqrt{2\pi\hat{\sigma}^2}} exp\left(-\frac{1}{2\hat{\sigma}^2}\left(\delta_{it} - \beta_0 - \beta_1' X_{it}\right)^2 \right) \tag{A2}$$

As suggested in Hirano and Imbens (2004), we validate the generalized propensity score (GPS) by checking the effect of GPS on the balance of the covariates. If in general GPS could moderate mean differences of covariates across different levels of δ, the first stage specification for GPS does ameliorate endogeneity concerns. We calculate the GPS-adjusted t-statistics for the difference of means across different groups (treatment levels) of the variable of interest, δ. If the t-statistics are in general insignificant, namely, the means of the covariates are largely equal across different δ groups, the balancing property of GPS is effective and we can claim that δ is independent of the covariates, X, conditional on GPS, i.e., $X \perp \delta \mid r(\delta, X)$. Specifically, the test could be organized as follows: (a) Sort δ into three groups: low, middle and high; (b) For each group t, we approximate GPS by evaluating it at the median δ of the group. We then sort the GPS into quintiles ($k_t = 1, 2, \ldots, 5$) for each group t; (c) For each GPS quintile k_t determined by an explanatory variable group t, we test the mean difference of covariates X_i between values with $\delta \in t$ and values $\delta \notin t$, resulting in five t-statistics; (d) Given an explanatory variable group t, we combine the five differences in means weighted by the number of observations in each GPS quintile (W_{k_t}) as follows,

$$GPS - tstat = \sum\nolimits_{k_t=1}^{5} \frac{W_{k_t}}{\sum_{k_t}^{5} W_{k_t}} Stat_{k_t} \tag{A3}$$

where $Stat_{k_t}$ is the t-statistic for each t-test of the quintile group; (e) If GPS-adjusted t-statistics are generally insignificant, we could argue that the mean values of our covariates are persistent across different levels of δ. Hence, GPS generally improves the independence of our internal governance variable. As a result, we control GPS as a flexible function in the model specification of our interest to examine the severity of endogeneity. For example, let R_{it} be the GPS score for each firm observation, we estimate the hump-shaped relationship between performance and δ, and the regression is as follows.

$$OutcomeVariable_{it} = \beta_0 + \beta_1 \delta_{it} + \beta_2 \delta_{it}^2 + \beta_3' X_{it-1} + \beta_4 R_{it} + \beta R_{it}^2 \times \delta_{it} + \lambda_i + \mu_t + \varepsilon_{it} \tag{A4}$$

Table A1
Regression of internal governance measure δ on covariates.

	GPS First Stage
Horizon	0.001***
	(6.33)
Size	0.001
	(0.85)
Leverage	0.001
	(0.29)
Firmage	-0.002***
	(-4.77)
Segments	0.000
	(0.58)
Director	-0.001**
	(-2.43)
Outsider	0.022***
	(5.82)
Chair	0.035***
	(27.83)
Founder	-0.031***
	(-7.65)
Payslice	0.039***
	(5.73)
PPS	-0.000
	(-1.50)
Ind FE	Yes
Year FE	Yes
Firm FE	Yes
Adj.R^2	0.461
N	19,454

This table summarizes the first-stage results of GPS regression. Please refer to Table 1 for variable definitions. Our sample period is from 1996 to 2017. All regressions include industry dummies at the one-digit SIC level, firm-level fixed effects and year dummy variables. *t-statistics* are given in parentheses and all standard errors are two-way clustered by firm and year. ***, ** and * denotes statistical significance at the 1%, 5% and 10% levels, respectively.

Appendix B. Construction of the internal governance, δ, measure

Following the approach in Aggarwal et al. (2017), δ is calculated as the number of executive titles of CEO scaled by the total number of executive titles carried by the entire top management team of five executives. We split the title string of each executive using four delimiters or conjunction words: 1) ",", 2) ";", 3) "&", 4) "and". Then the number of pieces split from the title string is the number of corporate titles held by the executive. Moreover, as is done by Aggarwal et al. (2017), we eliminate terms such as "R&D", ", LLC", ", U. S.", etc., which can cause biases in counting the titles. However, according to the result of our manual checking, the above data processing procedures are still insufficient to generate a clean measure of the CEO's fraction of corporate titles, leading to serious measurement errors and misspecifications. For instance, in the fiscal year 2004, the executive title of Mark McDonald of AAR Corp. is recorded as "group vp-structures & systems, maintenance, repair and overhaul". The mechanical application of the aforementioned method would count five titles of the executive, who is the group vice president of a certain division with only 1 corporate title. As such, when dealing with our sample of extended longitudinal data from 1996 to 2017 with a varied cross-section of titles, the above method would result in quadrupling or quintupling the number of titles, introducing substantive biases into the primary proxy. To deal with this empirical challenge, we develop a well-rounded framework of title counting, utilizing the features and functions based on *regular expression* in R for string processing.

Regular expression or *regex* is a special string representation for abstracting and describing common patterns of multiple strings. R enables us to effectively process title strings using *regex* and thus is used as the primary programming language to develop the title-processing script for our paper. Based on intensive experiment, sampling and manual checking, we recognize the five most common patterns as the building blocks to constitute more complex strings that often trigger biased title counts: 1) "of … and …", 2) "of…, … and", 3) " of … and … and", 4) "of … and … of", 5) "… and … officer or head". Each of the above patterns represented by certain *regex* codes requires a particular form of treatment when computing the number of executive titles. The first *regex* is to identify the title strings in which the string contains "of" followed by at least one "and". For instance, in fiscal year 2003, Alan J. Black of GREAT ELM

CAPITAL GROUP INC carried the executive title recorded as "senior vp; managing director of Europe, Middle East and Africa", which is clearly captured by the first pattern. To fix the problem, we need to know whether or not, or if so, how many commas or/and "and" appear in that structure. Thus, we need to further utilize the second and third *regex* to figure out the detailed composition of the title string. Given the fact that the common patterns of the title string in the above example only contain one comma between "of" and "and", the correct number of titles can be calculated algorithmically as the number of split parts minus the sum of one and the number of commas, generating the result of two titles. Similar to the second and third common patterns, the fourth pattern is also closely associated with the first *regex* pattern. The fourth *regex* flags titles such as "Chairman, Chief Executive Officer, President, Chairman of American Airlines Inc, Chief Executive Officer of American Airlines Inc and President of American Airlines Inc", held by Gerard J. Arpey of AMERICAN AIRLINES GROUP INC, in the fiscal year 2009. The fourth pattern identifies title strings in which the word "and" connects multiple independent corporate titles, such as "Chief Executive Officer of American Airlines Inc" and "President of American Airlines Inc." Accordingly, we should follow the method of splitting purely by delimiters, resulting in 6 distinct titles. The last regular expression captures the corporate titles whose name contains the word "and" or the symbol "&". For example, "executive vp, general counsel, chief ethics & compliance officer" held by Paul R. Shlanta of SOUTHERN CO GAS in 2005 falls into this last category. The fifth *regex* pattern adjusts the word "and" or "&" in the title of "chief ethics & compliance officer" as one corporate title. Thus, based on the above five regular expressions, we could develop a title-processing system, which identifies all the abnormal patterns and allows us to fix the majority of the miscounting.

Although *regex* is useful in minimizing misspecification, some highly complex titles can be identified by the system but can't be resolved algorithmically, and therefore we rely on manual correction.[12] For instance, D. Bryan Jordan carries the executive title "Chairman, Chief Executive Officer, President, Member of Credit Policy & Executive Committee, Member of Executive & Risk Committee, Chief Executive Officer of First Tennessee Bank, President of First Tennessee Bank and Director of First Tennessee Bank", which is a mixture of patterns one, two, three and four. Furthermore, throughout the entire timeframe from 1992 to 2017, we observe two distinct styles of recording executive titles. In early data, especially before 2000, the title field of executives commonly used symbols and abbreviations, such as using "-", "&", "offr." and "vp" to represent "of", "and", "officer" and "vice president"; in more current data, especially after 2007, the title field primarily uses full words and expressions to record the annual titles. Our title-processing framework can deal with both recording styles. We also use the program to identify and eliminate individuals who only held advisory positions, membership of committees and nonexecutive titles such as chairman. The specific definition, example and variation of the above-mentioned regular expressions are addressed in detail in the following table:

	Fiscal Year	CEO name	Company Name	Title String	Title Number
[1] "of … and …"	1996	John P. Jones, III	AIR PRODUCTS & CHEMICALS INC	"exec. v-p-gases & equip."	1
	2004	Gary F. Kennedy, Esq.	AMERICAN AIRLINES GROUP INC	"senior vp, general counsel & chief compliance officer-AMR and American"	3
	2012	Carlos Alban	ABBOTT LABORATORIES	"Senior Vice President of Proprietary Pharmaceutical Products and Global Commercial Operations"	1
[2] "of… [,]… and"	2003	Alan J. Black	GREAT ELM CAPITAL GROUP INC	"senior vp; managing director of Europe, Middle East and Africa"	2
	2013	Paul H. Grazewski	AMERICAN SCIENCE ENGINEERING	"Senior Vice President of Product Management, Marketing & Strategy"	1
	2017	Thomas P. Gibbons	BANK OF NEW YORK MELLON CORP	"Vice Chairman & CEO of Clearing, Markets and Client Management"	2
[3] " of … and … and"	2006	Susan L. Decker	ALTABA INC	"head of advertiser and Publisher group & chief finance officer"	2
	2007	Steven E. Buller, CPA	BLACKROCK INC	"managing director, head of accounting policy and controls & former chief finance officer"	2
	2012	Guy H. Kerr	BELO CORP -SER A COM	"Executive Vice President of Law & Government and Secretary"	2
[4] " of … and … of"	2009	Gerard J. Arpey	AMERICAN AIRLINES GROUP INC	"Chairman, Chief Executive Officer, President, Chairman of American Airlines Inc, Chief Executive Officer of American Airlines Inc and President of American Airlines Inc"	6
	2013	Gary F. Kennedy, Esq.	AMERICAN AIRLINES GROUP INC	"Chief Compliance Officer, Senior Vice President, General Counsel, Chief Compliance Officer of American Airlines Inc, Senior Vice President of American Airlines Inc and General Counsel of American Airlines Inc"	6
	2016	Donald E. Brandt, CPA	PINNACLE WEST CAPITAL CORP	"Chairman, Chief Executive Officer, President, Chairman of Arizona Public Service Company, Chief Executive Officer of Arizona Public Service Company and President of Arizona Public Service Company"	6

(*continued on next page*)

[12] We still had to manually check over 1,000 titles.

(*continued*)

	Fiscal Year	CEO name	Company Name	Title String	Title Number
[5] "… and … officer or head"	2000	Robert R. Herb	ADVANCED MICRO DEVICES	"executive vp, chief sales and marketing officer"	2
	2007	Paul R. Shlanta	SOUTHERN CO GAS	"executive vp, general counsel & chief ethics and compliance officer"	3
	2014	David W. Meline	AMGEN INC	"Executive VP, CFO and Principal Financial & Accounting Officer"	3
	2012	D. Bruce Sewell	APPLE INC	"Senior Vice President of Legal & Government Affairs, General Counsel and Secretary"	3
[1]+[2]+[3]	2014	Peter W. Quigley	KELLY SERVICES INC -CL A	"Senior Vice President of Employment Law & Litigation, Contracts Administration, Government Affairs & Risk Management and General Counsel"	2
	2017	Susan Louise Spradley	VIAVI SOLUTIONS INC	"Executive Vice President, General Manager of Business Operations & P&L and General Manager Product Line Management & Design, Network Enablement & Service Enablement"	3
	2011	Steven Jackson Sell	HEALTH NET INC	"President of Western Region Health Plan, Health Net, Inc. and President of Health Net of California, Inc."	2
[1] + [2] + [4]	2013	Jonathan David Kantor	CNA FINANCIAL CORP	"Executive Vice President, Secretary, General Counsel, Executive Vice President of CNA Insurance Companies, General Council of CNA Insurance Companies and Secretary of CNA Insurance Companies"	6
	2015	Valrie Hermann	RALPH LAUREN CORP	"Global Brand President of Luxury, Women's Collections, and World of Accessories"	1
[1]+[2]+[3]+ [4]	2012	P. Kelly Tompkins	CLEVELAND-CLIFFS INC	"Executive Vice President of Legal, Government Affairs and Sustainability and President of Cliffs China"	2
	2013	John J. Tracy	BOEING CO	"Chief Technology Officer, Senior Vice President of Operations, Engineering & Technology and Member of Executive Council"	3

References

Acharya, V.V., Myers, S.C., Rajan, R.G., 2011. The internal governance of firms. Journal of Finance 66 (3), 689–720.
Adams, R.B., Almeida, H., Ferreira, D., 2005. Powerful CEOs and their impact on corporate performance. Review of Financial Studies 18 (4), 1403–1432.
Aggarwal, R.K., Fu, H., Pan, Y., 2017. An empirical investigation of internal governance. Working Paper.
Bebchuk, L.A., Cremers, K.M., Peyer, U.C., 2011. The CEO pay slice. Journal of Financial Economics 102 (1), 199–221.
Bertrand, M., Mullainathan, S., 2003. Enjoying the quiet life? Corporate governance and managerial preferences. Journal of Political Economy 111 (5), 1043–1075.
Brickley, J.A., Linck, J.S., Coles, J.L., 1999. What happens to CEOs after they retire? New evidence on career concerns, horizon problems, and CEO incentives. Journal of Financial Economics 52 (3), 341–377.
Chakravarthy, B.S., 1986. Measuring strategic performance. Strategic management journal 7 (5), 437–458.
Chari, M.D., David, P., Duru, A., Zhao, Y., 2019. Bowman's risk-return paradox: An agency theory perspective. Journal of Business Research 95, 357–375.
Cheng, Q., Lee, J., Shevlin, T., 2016. Internal governance and real earnings management. Accounting Review 91 (4), 1051–1085.
Cheng, S., 2004. R&D expenditures and CEO compensation. The Accounting Review 79 (2), 305–328.
Cvijanović, D., Gantchev, N., Li, R., 2023. CEO succession roulette. Management Science 69 (10), 5794–5815.
Dechow, P.M., Sloan, R.G., 1991. Executive incentives and the horizon problem: An empirical investigation. Journal of Accounting and Economics 14 (1), 51–89.
Fama, E.F., Jensen, M.C., 1983a. Separation of ownership and control. Journal of Law and Economics 26 (2), 301–325.
Fama, E.F., Jensen, M.C., 1983b. Agency problems and residual claims. Journal of Law and Economics 26 (2), 327–349.
Feng, M., Ge, W., Luo, S., Shevlin, T., 2011. Why do CFOs become involved in material accounting manipulations? Journal of Accounting and Economics 51 (1-2), 21–36.
Gibbons, R., Murphy, K.J., 1992. Optimal incentive contracts in the presence of career concerns: Theory and evidence. Journal of Political Economy 100 (3), 468–505.
Gopalan, R., Milbourn, T., Song, F., Thakor, A.V., 2014. Duration of executive compensation. Journal of Finance 69 (6), 2777–2817.
Green, Richard C., Talmor, Eli, 1986. Asset substitution and the agency costs of debt financing. Journal of Banking & Finance 10 (3), 391–399.
Hicks, John R., 1935. Annual Survey of Economic Theory: The Theory of Monopoly. Econometrica 3, 1–20.
Hirano, K., Imbens, G.W., 2004. The propensity score with continuous treatments. In: Applied Bayesian modeling and causal inference from incomplete-data perspectives, 226164, pp. 73–84.
Huson, M.R., Malatesta, P.H., Parrino, R., 2004. Managerial succession and firm performance. Journal of Financial Economics 74 (2), 237–275.
Jain, P., Jiang, C., Mekhaimer, M., 2016. Executives' horizon, internal governance and stock market liquidity. Journal of Corporate Finance 40, 1–23.
Jensen, M.C., Meckling, W.H., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics 3 (4), 305–360.
Jollineau, S.J., Vance, T.W., Webb, A., 2012. Subordinates as the first line of defense against biased financial reporting. Journal of Management Accounting Research 24 (1), 1–24.
Kabir, R., Li, H., Veld-Merkoulova, Y., 2018. Do managers act opportunistically towards the end of their career? Journal of International Financial Markets Institutions and Money 56, 218–232.
Kale, J.R., Reis, E., Venkateswaran, A., 2009. Rank-order tournaments and incentive alignment: The effect on firm performance. Journal of Finance 64 (3), 1479–1512.
Landier, A., Sauvagnat, J., Sraer, D., Thesmar, D., 2012. Bottom-up corporate governance. Review of Finance 17 (1), 161–201.
Landier, A., Sraer, D., Thesmar, D., 2009. Optimal dissent in organizations. Review of Economic Studies 76 (2), 761–794.
Li, X., Low, A., Makhija, A.K., 2017. Career concerns and the busy life of the young CEO. Journal of Corporate Finance 47, 88–109.
Lundstrum, L.L., 2002. Corporate investment myopia: a horserace of the theories. Journal of Corporate Finance 8 (4), 353–371.
Matėjka, M., Merchant, K.A., Van der Stede, W.A., 2009. Employment horizon and the choice of performance measures: Empirical evidence from annual bonus plans of loss-making entities. Management Science 55 (6), 890–905.
McConnell, J.J., Qi, Q., 2022. Does CEO succession planning (disclosure) create shareholder value? Journal of Financial and Quantitative Analysis 57 (6), 2355–2384.
Mekhaimer, M., Abakah, A.A., Ibrahim, A., Hussainey, K., 2022. Subordinate executives' horizon and firm policies. Journal of Corporate Finance 74, 102220.
Murphy, K.J., Zimmerman, J.L., 1993. Financial performance surrounding CEO turnover. Journal of Accounting and Economics 16 (1–3), 273–315.

Pan, Y., Wang, T.Y., Weisbach, M.S., 2016. CEO investment cycles. Review of Financial Studies 29 (11), 2955–2999.
Parrino, R., 1997. CEO turnover and outside succession a cross-sectional analysis. Journal of Financial Economics 46 (2), 165–197.
Prendergast, C., Stole, L., 1996. Impetuous youngsters and jaded old-timers: Acquiring a reputation for learning. Journal of Political Economy 104 (6), 1105–1134.
Serfling, M.A., 2014. CEO age and the riskiness of corporate policies. Journal of Corporate Finance 25, 251–273.
Stein, J.C., 1988. Takeover threats and managerial myopia. Journal of Political Economy 46, 61–80.
Stein, J.C., 1989. Efficient capital markets, inefficient firms: A model of myopic corporate behavior. Quarterly Journal of Economics 104, s655–s669.
Strong, J.S., Meyer, J.R., 1987. Asset writedowns: Managerial incentives and security returns. Journal of Finance 42 (3), 643–661.
Warner, J.B., Watts, R.L., Wruck, K.H., 1988. Stock prices and top management changes. Journal of Financial Economics 20, 461–492.
Weisbach, M., 1995. CEO turnover and the firm's investment decisions. Journal of Financial Economics 37, 159–188.
Weisbach, M.S., 1988. Outside directors and CEO turnover. Journal of Financial Economics 20, 431–460.
Xu, C., Yan, M., 2014. Radical or Incremental Innovations: R&D Investment Around CEO Retirement. Journal of Accounting, Auditing and Finance 29 (4), 547–576.
Yim, S., 2013. The acquisitiveness of youth: CEO age and acquisition behavior. Journal of Financial Economics 108 (1), 250–273.