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The CEO Overhang Effect

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Abstract

We document that CEOs reduce investment, increase net leverage, and expand net share repurchases over their tenure. To explain these patterns, we develop a dynamic model of a firm run by a sequence of CEOs. Each CEO has a finite tenure and chooses investment, financing, and payout to maximize her utility over wealth under a contract that combines a base salary with equity-based pay. The model identifies a new mechanism, the CEO overhang effect, which arises because the CEO's horizon is truncated and future CEOs are also granted equity. As a result, over her tenure a growing share of the returns to the firm's capital and of its costs of debt shifts from current shareholders, including the CEO, to future CEOs. The incumbent CEO therefore underinvests and levers up. She also increasingly repurchases shares, because a larger stake becomes more valuable to her as turnover approaches. Calibrating the model, we infer that the resulting agency cost amounts to 6% of shareholder value.

Keywords: CEO tenure, CEO turnover, executive compensation, corporate investment, capital structure, share repurchases, agency costs

JEL Classification: G31, G32, G34, G35, M12

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The CEO Overhang Effect*

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November 18, 2026

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1 Introduction

Over the past three decades, U.S. corporations have changed substantially how they invest and how they return cash to shareholders. Corporate investment rates have declined despite high profitability (see, e.g., Gutiérrez and Philippon, 2017), and share repurchases have become the dominant form of payout: in 2024, S&P 500 firms alone repurchased a record $943 billion of their own shares.[1] These changes have drawn considerable debate. Share repurchases are a tax-efficient way to return excess cash to shareholders. Critics, however, call the surge in buybacks "corporate cocaine": a short-term stimulus that inflates stock prices and executive pay at the expense of long-run investment.[2] On this view, the decline in investment and the rise in payouts reflect weak corporate governance.[3]

Motivated by this debate, we study both theoretically and empirically how CEO incentives may distort corporate policies. As a first step, we document that, as CEOs progress through their tenure, they reduce investment, increase net leverage, and expand net share repurchases. We next rationalize these trends with a new economic mechanism, which we call the *CEO overhang effect*. As in models of debt overhang, the effect arises because the CEO neither runs the firm nor holds its stock indefinitely. We show that this truncated horizon, coupled with the equity granted for free to future CEOs, leads any wealth-maximizing CEO to destroy shareholder value in a long-lived firm.

We begin our analysis by exploring empirically how corporate policies change over CEO tenure. Our panel covers 5,457 CEO cycles at 2,935 U.S. public firms between 1992 and 2020. A CEO cycle is the tenure of one CEO at one firm. We find three patterns. Net leverage rises by 4.12 percentage points of total capital over a CEO cycle, which is 62% of its sample mean. Net repurchases rise by 0.53 percentage points, or 77% of their mean. Total investment falls by 0.64 percentage points, or 4% of its mean.[4] These are changes within a

[1] S&P Dow Jones Indices, "S&P 500 Q4 2024 Buybacks Increase 7.4% and 2024 Expenditure Sets New Record by Increasing 18.5%," press release, March 19, 2025.

[2] "Corporate Cocaine," *The Economist*, September 13, 2014. Available at https://www.economist.com/leaders/2014/09/13/corporate-cocaine.

[3] "The Repurchase Revolution," *The Economist*, September 13, 2014. Available at https://www.economist.com/business/2014/09/12/the-repurchase-revolution.

[4] Table B.1 defines these variables.

CEO cycle, so they do not reflect differences across CEOs or firms. They remain when we control for firm characteristics and macroeconomic conditions, and when we drop the first or the last year of each cycle, so aggregate trends and the years around turnover do not drive them.

To understand the economic mechanism driving these patterns, we develop a dynamic model of an infinitely lived firm run by a sequence of CEOs. Each CEO maximizes her utility over wealth. The CEO runs the firm over a fixed tenure, subject to a compensation contract combining base salary and equity-based pay. Upon CEO turnover, the firm grants each incoming CEO a fraction of its equity, priced at market value, consistent with Hall and Murphy (2000). The CEO manages the firm actively, deciding on its investment, debt, and net equity financing policies throughout her tenure.

Two core agency conflicts then emerge in our model. The first is between current shareholders, including the CEO, and all future CEOs. Each future CEO receives a claim on equity without paying for it, so current shareholders bear the full cost of corporate decisions but share their returns with every future CEO. These claims are large and have grown over time: equity-based pay accounts for most of the rise in CEO pay since the 1980s (Hall and Liebman, 1998; Frydman and Saks, 2010), and CEO pay scales with firm size (Gabaix and Landier, 2008). The second conflict is between the CEO and current shareholders. An impatient CEO values the firm's cash flows differently from shareholders, so her policies depart from those that maximize shareholder value throughout the tenure. Together, the two conflicts of interest help explain the documented trends.

We first explain why investment declines over the CEO cycle. As turnover approaches, a growing share of the return on capital accrues to future CEOs through their grants, so the incumbent CEO invests less over time. A unit of capital installed early in her tenure pays off mostly while she runs the firm, whereas the return on a unit installed in her later years accrues mostly to future CEOs. This force is present even when the CEO is as patient as shareholders. It is a limiting case of the conflict between old and new shareholders in Myers and Majluf (1984), in which the new claims are issued at zero price by contract, and its consequences parallel debt overhang (Myers, 1977). If the CEO is impatient, she has

an additional incentive to underinvest, because she discounts projects at a higher rate than current shareholders.

Our model can also explain the rising trend in leverage over the CEO cycle. As in the leverage ratchet effect of Admati, DeMarzo, Hellwig, and Pfleiderer (2018), the CEO as a current shareholder keeps raising leverage because future CEOs, whose grants absorb part of the debt repayment, bear an increasing share of the financing cost. This force is present even when the CEO is as patient as shareholders. An impatient CEO also has an incentive to borrow and pay out the proceeds, particularly early in the cycle.

Lastly, we rationalize the rising trend in net share repurchases. In addition to the standard argument that share repurchases are more tax-efficient than dividends (see, e.g., Warusawitharana and Whited, 2016), in our model they allow the CEO to increase her equity stake. Whether the CEO then prefers repurchases over dividends to maximize equity compensation over time depends on her impatience. A firm that maximizes shareholder value, or a patient CEO, uses all available cash flow to repurchase shares at all times. An impatient CEO can instead issue equity early in the tenure to pay herself a higher dividend, and switch to repurchases later in the cycle.

The core mechanism behind these trends therefore closely parallels the debt overhang problem in Hennessy (2004). In that paper, debt overhang results from a truncated shareholder horizon up to the time of default, in conjunction with a costly bankruptcy procedure which leaves shareholders with zero continuation value upon default. Similarly, in our model, the CEO overhang problem follows from the truncation in the CEO's horizon by contract, in conjunction with frictions which endogenously lead to a reduction in her terminal utility upon turnover. Such frictions include the equity granted for free to future CEOs and senior employees, as well as the CEO's preferences over wealth.

We then calibrate the model to match moments of investment, net leverage, net repurchases and profitability in the data. The calibrated model reproduces the sign of the three trends: over the tenure, the baseline CEO, like the average CEO in our sample, reduces total investment, increases net leverage and raises net share repurchases. The calibration implies that the average CEO is considerably more impatient than shareholders: she discounts future

payoffs at about 7.5% per year, against 4.3% for shareholders. This is consistent with the standard assumption in dynamic contracting models that the manager discounts the future at a higher rate than investors (DeMarzo and Sannikov, 2006; Biais, Mariotti, Plantin, and Rochet, 2007).

We use the calibrated model to measure the agency cost of CEO overhang. We compare the value of the firm when run by its sequence of CEOs, net of turnover costs, with the value of the same firm when optimally run to maximize shareholder value. The total agency cost is large and amounts to 6.0% of shareholder value in our baseline calibration with an impatient CEO. An otherwise identical but patient CEO still generates an agency cost of 4.8%. Hence, the CEO overhang effect, strictly speaking, leads to a 4.8% loss in shareholder value, and the remaining 1.2 percentage points are lost due to CEO impatience.

Finally, we use the calibrated model to study how shareholder value varies with the pre-specified terms of the CEO contract. We find that a larger equity stake aligns the incentives of the CEO with those of current shareholders, but it also aggravates the conflict of interest with future shareholders, which grows with the grants to future CEOs. A higher base salary increases operating costs. Yet because the salary scales with firm size, it can also mitigate the underinvestment caused by CEO overhang. Our results therefore question conventional wisdom: in our setting, higher CEO equity ownership need not mitigate agency conflicts, and the CEO's base salary can do more than simply ensure her participation.

Related Literature

The findings in our paper contribute to multiple strands in the literature.

Our empirical findings on corporate trends relate to the literature on CEO tenure and the horizon problem. Concerning investment, Pan, Wang, and Weisbach (2016) show that disinvestment is highest early in a CEO's tenure and that investment, including acquisitions, rises over the tenure, which they attribute to agency problems as the CEO gains control over the board. Meanwhile, focusing on R&D, Gonzalez-Uribe and Groen-Xu (2017) find that longer contracts foster exploratory innovation, and Dechow and Sloan (1991) show that CEOs cut R&D in their final years in office. We measure internal investment in physical and

intangible capital, as in Peters and Taylor (2017), and find that it declines over the CEO's tenure.

The related empirical literature further includes Pan, Wang, and Weisbach (2018), who show that credit spreads rise around CEO turnover and decline as uncertainty about the new management resolves, and Edmans, Fang, and Lewellen (2017) and Ladika and Sautner (2020), who find that investment falls as more of the CEO's equity vests. These papers study one outcome around a specific event. We follow investment, leverage and repurchases over the whole tenure, and we explain the three trends with a single mechanism. Buybacks respond to executive options and EPS dilution (Fenn and Liang, 2001; Kahle, 2002; Bens, Nagar, Skinner, and Wong, 2003), and their rise has been linked to lower investment (Almeida, Fos, and Kronlund, 2016; Kahle and Stulz, 2017; Gutiérrez and Philippon, 2017). We show that the two move together within the tenure of a CEO: repurchases rise as investment falls.

On the theory side, we add to the literature on manager–shareholder conflicts, which focuses on shirking, perks and empire building (Jensen and Meckling, 1976; Jensen, 1986). The conflict between the current CEO and all future CEOs, whose grants are claims issued at zero price, parallels debt overhang with a truncated shareholder horizon (Myers, 1977; Hennessy, 2004), the conflict between old and new shareholders in Myers and Majluf (1984), and, for leverage, the ratchet effect of Admati et al. (2018). The second conflict, between the CEO and current shareholders, arises from her preferences: CEO impatience relates to managerial myopia (Stein, 1989) and short-termism (Terry, 2023; Edmans, Fang, and Huang, 2022). In an extension, we allow for CEO risk aversion, show the CEO distorts corporate policies to smooth her compensation as in Lambrecht and Myers (2012, 2017), and find that risk aversion further exacerbates short-termism, similar to Marinovic and Varas (2019). Our predictions on the CEO overhang effect and its implications for trends in corporate policies do not rely on risk aversion or moral hazard.

Finally, we add to dynamic and structural models of CEO turnover, which study how boards hire, fire and pay their CEOs (Taylor, 2010; Anderson, Bustamante, Guibaud, and Zervos, 2018; He and Schroth, 2024; Capron, Hamilton, Hincapié, and Lyman, 2026; Lyman, 2026), and to structural estimates of agency costs (Taylor, 2010, 2013; Morellec, Nikolov,

and Schürhoff, 2012, 2018; Nikolov and Whited, 2014; Wu, 2018), by quantifying the costs of CEO overhang and impatience. In these models turnover is a decision of the board, whereas in ours the contract sets the CEO's tenure and the cost of each transition is the equity granted to the incoming CEO.

The remainder of the paper proceeds as follows. Section 2 presents the novel empirical facts on CEO tenure and corporate policies. Section 3 develops the model, and Section 4 characterizes the corporate policies chosen by the CEO. Section 5 calibrates the model, uses it to uncover the mechanism behind the trends, and quantifies agency costs. Section 6 concludes.

2 Motivating Stylized Facts

This section documents how firms' investment, financing and payout policies change over CEO tenure. We first show these patterns in figures and then report the corresponding regression coefficients, together with a set of robustness checks.

2.1 Data

We build our sample from Equilar and complement it with ExecuComp and Compustat North America. We drop regulated (SIC 4900–4999), financial (6000–6999), and quasi-governmental firms (9000–9999). We require non-missing values for the policy variables and winsorize all variables at the 1st and 99th percentiles within each fiscal year. We keep CEOs who stay in office for at least one year and whose tenure begins within the sample window, and we measure tenure from each CEO's year of appointment. A CEO cycle is the tenure of one CEO at one firm. The panel covers 1992 to 2020 and contains 5,457 CEO cycles at 2,935 firms, with 24,714 firm-year observations. The regressions in Table 1 and the calibration use the 4,507 cycles of at least two years, with 23,764 firm-year observations.

The Equilar data have two advantages. First, Equilar covers a broad cross-section of publicly traded U.S. firms, whereas ExecuComp is limited to firms in the S&P 1500. Our sample therefore includes smaller, younger, and less profitable firms. Second, Equilar pro-

vides detailed information on CEO ownership, wealth, and compensation, which we use to discipline the model. Because Equilar starts in 2006, we extend the sample back to 1992 with ExecuComp.

We scale the firm's policies by its total capital, the sum of gross property, plant and equipment and the intangible capital stock of Peters and Taylor (2017). The data and the model, in which capital is the only asset, are then measured in the same units. Investment is total investment: capital expenditure plus R&D plus a share of selling, general and administrative expenses, as in Peters and Taylor (2017), over total capital at the start of the year. Leverage is net leverage: debt minus cash over total capital at the end of the year. Repurchases are net repurchases: share repurchases minus equity issuance over total capital at the start of the year. Unless stated otherwise, investment, leverage and repurchases refer to these three measures throughout the paper. Profitability, which the calibration targets, is gross profit: sales minus the cost of goods sold, over total capital at the start of the year.

Table B.1 defines the variables, and Table B.2 reports summary statistics. The average firm in our sample invests 14.4% of its total capital per year, has net leverage of 6.4%, and repurchases 0.6% of its total capital net of equity issuance. On the sample of Table 3, which the calibration targets, the three figures are 14.3%, 6.6% and 0.7%. Gross profit is 35.5% of total capital (36.1% on that sample). Net leverage varies widely: the median firm-year has net leverage of 9.3%, and 36% of firm-years hold more cash than debt. Net repurchases are strongly right-skewed: in the median firm-year they are almost zero.

In the first year of tenure, the CEO's effective ownership stake, which includes option holdings, is 1.7% on average and 0.7% at the median. In cycles of at least two years the mean is 1.5%, the entry stake used in the calibration. Excluding options, the CEO holds 1.3% of the firm's shares on average and 0.4% at the median. The stake is not diluted over the tenure: effective ownership rises from 1.7% in the first year to 2.6% in the fifth and changes little thereafter, as sales of shares then offset new equity grants. At a CEO change the CEO's stake falls by one percentage point, because the incoming CEO starts with a smaller stake than the predecessor held.

The average CEO cycle in our sample lasts five years, and the median cycle lasts four.

Completed cycles last 6.1 years on average. Figure B.1 shows the distribution of CEO tenure. Panel A reports the number of firm-year observations by the CEO's tenure year, and Panel B the distribution of the length of CEO cycles. Both distributions are right-skewed, and long cycles are uncommon. Because the policies of a CEO who stays three years and of one who stays twelve cannot be compared year by year, our main exhibits either split cycles by their length or measure tenure relative to the length of the cycle.

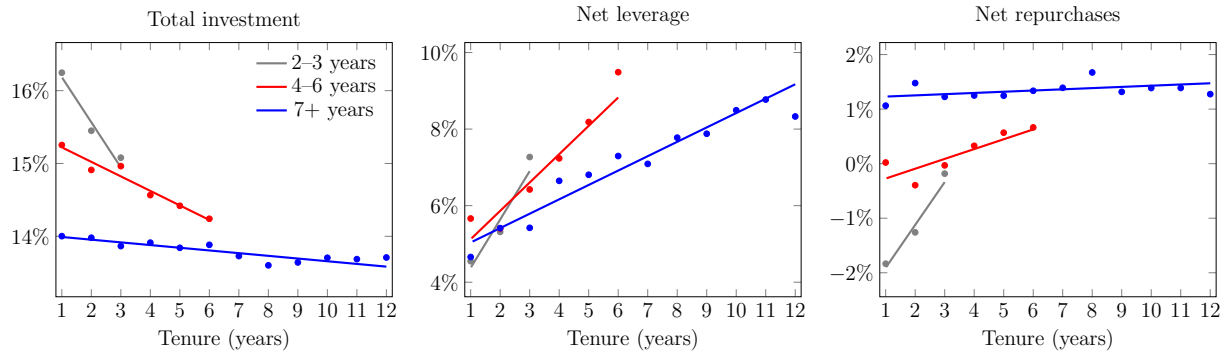
2.2 Corporate Policies over CEO Tenure

Figure 1 shows how corporate policies change over the CEO's tenure. We split CEO cycles of two years or more into three groups of about 1,500 cycles each: cycles of two to three years, of four to six years, and of seven years or more. For each policy and each group, we regress the policy on tenure-year indicators and on firm and year fixed effects. The dots are the estimated coefficients on these indicators, shifted to the group's mean so that they are on the scale of the policy. The firm fixed effects absorb time-invariant differences across firms, and the year fixed effects absorb aggregate conditions. The tenure-year coefficients therefore capture how a firm's policies change as its CEO's tenure advances, net of the business cycle. The lines are the corresponding fitted linear trends, estimated separately for each group over its own tenure range.

Figure 1 shows three patterns. Over the CEO's tenure, investment declines, net leverage increases steadily, and net repurchases increase. Net leverage rises in each of the three groups, and by a similar amount over the whole cycle: a CEO who stays three years compresses into three years what a CEO who stays ten spreads over ten. The decline in investment and the rise in net repurchases are concentrated in cycles of up to six years. This suggests that the patterns are related to how far the CEO is from the end of her tenure rather than to the number of years she has been in office.

Table 1 reports the corresponding regression coefficients, with standard errors clustered by firm and year. Panel A measures tenure as the fraction of the CEO cycle elapsed. This puts cycles of different lengths on a common scale, and the coefficient is the change in the policy from the start to the end of a cycle. Figure B.3 shows the corresponding profiles.

Figure 1: **Corporate Policies over CEO Tenure, by Length of the CEO Cycle.** The figure shows total investment, net leverage and net repurchases, in percent of total capital, by tenure year, for cycles of 2–3 years (gray), 4–6 years (red) and 7 years or more (blue, up to year 12). Dots are tenure-year coefficients with firm and year fixed effects, levelled at each group's mean; lines are the fitted slopes. Table B.1 defines the variables.



These changes over a cycle are the trend moments that the calibration targets in Section 5. The model's cycle has a fixed length, so the change over the cycle, and not the slope per year, is the quantity that is comparable across cycles of different lengths, in the data and in the model. Over a CEO cycle, total investment falls by 0.64 percentage points of total capital, net leverage rises by 4.12 percentage points, and net repurchases rise by 0.53 percentage points. The net leverage estimate is statistically significant at the 1% level, and the investment and repurchase estimates at the 5% level. Relative to their sample means, these changes are a 4% decline in investment, a 62% increase in net leverage and a 77% increase in net repurchases. Panel B reports the slopes of the fitted lines of Figure 1, per year of tenure, for each group of cycles.

2.3 Robustness

We assess the robustness of the trends to alternative empirical choices. Table B.3 reports tenure coefficients for each case and Figure B.2 the corresponding tenure profiles. In these exhibits, tenure is measured in years over the first nine years of each cycle. The regressions include CEO–firm fixed effects, so the coefficients compare each CEO with herself at different

Table 1: **Corporate Policies over the CEO Cycle.** The table reports regression coefficients of each policy on CEO tenure, in percentage points of total capital, with firm and year fixed effects. In Panel A tenure is the fraction of the cycle elapsed, so the coefficient is the change from the first to the last year of a cycle; in Panel B it is the tenure year, by length of the cycle. CEO cycles of two years or more: 23,764 firm-years in 4,507 CEO cycles; standard errors clustered by firm and year in parentheses. Panel A gives the trend targets of the calibration. *, **, ***: significance at 10%, 5% and 1%. Variable definitions are in Table B.1.

	Total investment	Net leverage	Net repurchases
Panel A: relative tenure, cycles of all lengths			
Fraction of the cycle elapsed	-0.64**	4.12***	0.53**
	(0.26)	(0.66)	(0.25)
Panel B: tenure year, by length of the CEO cycle			
Cycles of 2–3 years	-0.62**	1.26**	0.78***
	(0.27)	(0.51)	(0.30)
Cycles of 4–6 years	-0.20**	0.74***	0.18**
	(0.09)	(0.21)	(0.09)
Cycles of 7+ years (tenure years 1–12)	-0.04	0.38***	0.02
	(0.04)	(0.13)	(0.04)

points of her tenure (Panel A). In this design, an additional year of tenure is associated with a decline in total investment of 0.48 percentage points of total capital, an increase in net leverage of 0.95 percentage points and an increase in net repurchases of 0.19 percentage points. All three are significant at the 1% level.

We first control for firm characteristics, including size, profitability, tangibility, and market-to-book (Panel B). All three trends remain statistically significant. The net leverage trend falls to 0.39 percentage points per year, and the repurchase trend doubles. Second, we use alternative variable definitions: physical investment, gross leverage, and gross repurchases (Panel C). The decline in investment and the rise in leverage remain significant. The rise in repurchases is not significant when repurchases are measured gross of equity issuance, so the trend in net repurchases reflects mainly a decline in equity issuance over the CEO's tenure. Net equity issuance is the financing choice in our model, in which an impatient CEO issues equity early in her tenure and repurchases shares late (Proposition 4). Third, we

replace the CEO–firm fixed effects with CEO fixed effects (Panel D). Fourth, we control for macroeconomic conditions, namely the BAA corporate bond spread, a recession indicator, and GDP growth (Panel E). In these two cases, the three trends are similar to the baseline.

Panel F replaces tenure years with relative tenure, as in Panel A of Table 1, in the CEO–firm fixed-effect design. The signs and the significance of the trends do not change. Panel G shows that all three trends retain their sign and statistical significance when we include all tenure years instead of the first nine, drop the first or the last year of each cycle, restrict the sample to cycles of at least four years, or use firm fixed effects instead of CEO–firm fixed effects. With firm fixed effects, which also compare successive CEOs of the same firm, the net leverage trend is about half as large. Figure B.4 shows the aggregate tenure profiles under the firm and year fixed effects of Figure 1, under CEO–firm fixed effects with a broad set of macroeconomic controls in place of year effects, and under CEO–firm fixed effects alone. The three patterns are present in each. Figure B.5 repeats Figure 1 with CEO–firm fixed effects in place of firm and year fixed effects: investment declines and net leverage increases over tenure in each group, and the slopes are steeper in shorter cycles, as in Figure 1.

Taken together, corporate policies follow systematic trends over the CEO's tenure: investment decreases, and net leverage and net repurchases increase. We argue that these trends are consistent with the *CEO overhang* effect. The next section develops a dynamic model of a firm run by CEOs with a finite contract length, which explains them.

3 Model

This section develops a tractable dynamic model of a firm run by a sequence of CEOs with finite tenure, in which the *CEO overhang effect* arises.

3.1 Setup

We consider an infinitely lived firm run by a sequence of CEOs. Its shareholders are risk-neutral and discount cash flows at a rate $r > 0$.

We first characterize the problem of an incumbent CEO, hired under a standard compen-

sation contract with a fixed, finite tenure. After running the firm for T years, she retires, and a different CEO runs the firm. We then impose conditions on CEO turnover that determine the continuation value of the firm under the next CEO and keep the setting stationary across CEO cycles.

The CEO's preferences over wealth. The CEO has utility over wealth, and we assume that she is risk-neutral in each period:

$$U(W_t) \equiv W_t, \tag{1}$$

where W_t is the CEO's total compensation each period. The CEO's per-period utility therefore scales linearly with firm size.

The CEO discounts utility across periods at her own discount factor $\beta > 0$. She can be more impatient than the other shareholders, and $\xi \equiv \frac{1}{1+r} - \beta \geq 0$ measures her impatience (DeMarzo and Fishman, 2007a,b).

The CEO's compensation contract. Each period, the CEO receives a base salary and holds an equity stake that she cannot sell until the end of her tenure, as in the canonical agency-theoretic treatment of fixed and incentive pay in Holmström and Milgrom (1991). We assume that her compensation increases linearly with the firm's capital K_t, consistent with the result in Gabaix and Landier (2008) that larger firms pay their CEOs more.

The CEO's total compensation each period W_t is therefore equal to:

$$W_t \equiv (1 - \tau_p) \cdot \omega K_t + \varphi_t \cdot (1 - \tau_d) D_t \tag{2}$$

where $\omega \geq 0$ is the salary per unit of capital, τ_p is the personal income tax rate, φ_t is the CEO's contract-specified share of firm equity, D_t is the firm's dividend payment, and τ_d is the tax rate on dividends.

The CEO is granted a fixed number of shares at the start of her tenure. She owns them and receives their dividends, but she cannot sell them until she retires at the end of period T, as under a holding requirement. Through equity issues and share repurchases, the CEO's

equity share still changes over her tenure, from $\varphi_0 > 0$ at its start until her retirement at time T. The CEO's equity share evolves according to:

$$\varphi_{t+1} \equiv \varphi_t \left(1 + \frac{X_t}{S_t - X_t}\right)^{-1}, \qquad t < T,$$

where equity issues $X_t > 0$ dilute the CEO's equity share and repurchases $X_t < 0$ raise it. The term $S_t - X_t$ is the value of equity at which the firm trades its own shares with outside shareholders at time t, where

$$S_t \equiv \frac{1}{1+r} \mathbb{E}_t \left[V_{t+1}\right], \qquad t < T, \tag{3}$$

is the ex-dividend market value of equity, with V_{t+1} the value function of shareholders in equation (10) under the CEO's policies. At $t = T$, S_T is the market value of equity upon CEO turnover in equation (11).

The contract length T is exogenous. The last period, T, has two stages. At its start, the CEO makes her last corporate policy decisions, as in any other period, and earns the regular compensation W_T in equation (2). At the end of period T, she retires and sells her shares. Her terminal utility in period T is:

$$U_T \equiv W_T + \varphi_T(S_T - X_T) \tag{4}$$

where the first term on the right-hand side is the standard intra-period utility and the second is the utility from the proceeds of selling her shares at the end of period T. As we explain below, she sells her shares at the ex-dividend market value of equity at time T.[5]

Production technology and productivity shocks. The firm's production function has constant returns to scale and is subject to CEO-specific productivity shocks Z_t. Operating profits, net of the CEO's salary, are therefore $(Z_t - \omega)K_t$. Productivity resets when a new CEO takes office: every CEO starts her tenure with the same productivity $Z_0 > 0$. In

[5]In the data, CEOs reduce their holdings as they leave. In her last fiscal year in office, the number of vested shares the CEO holds falls for 56% of CEOs, against 32% a year earlier, and 36% of them cut their holdings by more than a quarter, against 8%. We do not observe their holdings after they leave.

every subsequent period of her tenure, $t \geq 1$, we assume for tractability that productivity is drawn independently from a uniform distribution on $\left[\underline{Z}, \overline{Z}\right]$, with $0 < \underline{Z} < \overline{Z}$ and mean $\mu \equiv (\underline{Z} + \overline{Z})/2$. In the calibrated model of Section 5, Z_t instead follows a mean-reverting process in logs, to fit the data.

Investment and financing frictions. The CEO chooses the firm's investment, equity and debt financing, which are subject to standard neoclassical frictions. The firm's gross investment I_t is defined as:

$$I_t = K_{t+1} - (1 - \delta)K_t, \tag{5}$$

with capital depreciation rate $\delta \in [0, 1]$. Depreciation is deductible from income taxes. When the CEO adjusts the capital stock by investing or disinvesting, the firm incurs convex adjustment costs, as in Abel and Eberly (1994), equal to

$$\Psi(K_t, K_{t+1}) = \frac{\psi}{2K_t} \left[K_{t+1} - (1 - \delta)K_t\right]^2. \tag{6}$$

The firm is financed each period by either equity $X_t > 0$ or a one-period debt contract worth B_t. Debt is subject to a collateral constraint ensuring debt is risk-free:

$$B_{t+1} \leq \bar{b} K_{t+1}, \tag{7}$$

where $\bar{b} \in (0, 1]$ captures asset tangibility and $\lambda^b_{t+1} \geq 0$ is the multiplier on the collateral constraint. The firm also pays convex costs of debt and equity issuance:

$$\frac{\kappa}{2K_t} \max\{X_t, 0\}^2 \quad \text{and} \quad \frac{\nu}{2K_{t+1}} (B_{t+1} - B_t)^2$$

with $\kappa > 0$ and $\nu > 0$. These costs make the marginal cost of external financing increasing (see, e.g., Bond and Meghir, 1994; Hennessy and Whited, 2007). Share repurchases ($X_t < 0$) are costless.

Corporate distributions and the firm's budget constraint. The firm pays out ei-

ther through dividends D_t or through share repurchases $X_t < 0$. The dividend tax makes repurchases cheaper for shareholders. Let

$$\Pi_t \equiv (1-\tau_c)\left[(Z_t-\omega-\delta)K_t - rB_t\right] - \frac{\psi}{2}\frac{I_t^2}{K_t}$$

denote the firm's net income, after the depreciation and interest expenses, which are deductible from corporate taxes, and after the adjustment costs of investment. For any period $t \leq T$, we use the firm's budget constraint to express dividends as:

$$D_t = \Pi_t - (I_t - \delta K_t) + B_{t+1} - B_t + X_t - \frac{\kappa}{2K_t}\max\{X_t, 0\}^2 - \frac{\nu}{2K_{t+1}}(B_{t+1}-B_t)^2, \qquad (8)$$

that is, net income plus net borrowing and net equity issues, less net investment and issuance costs. The multiplier $\lambda_t^d \geq 0$ is associated with the non-negativity constraint on dividends.

3.2 The CEO's Optimization Problem and CEO Turnover

The CEO's optimization problem. Up to time T, the CEO maximizes her utility over wealth by choosing the firm's investment, equity and debt financing. When she retires at the end of period T, she receives utility U_T from her regular compensation in period T and from the sale of her shares. Her value function and optimization problem are:

$$\mathcal{M}_t(Z_t, K_t, B_t, \varphi_t) = \max_{I_t, B_{t+1}, X_t} E_t\left[\sum_{s=t}^{T-1}\beta^{s-t}U(W_s) + \beta^{T-t}U_T\right], \qquad (9)$$

subject to the collateral constraint in equation (7), the firm's budget constraint in equation (8), and the non-negativity constraint on dividends, which makes the CEO issue equity when the budget constraint binds. Terminal utility U_T is defined in equation (4).

The value function of shareholders. For any set of corporate policies, the expected

shareholder value is:

$$V_t(Z_t, K_t, B_t, \varphi_t) = E_t \left[\sum_{s=t}^{T-1} \left(\frac{1}{1+r} \right)^{s-t} ((1-\tau_d)D_s - X_s) + \left(\frac{1}{1+r} \right)^{T-t} V_T \right], \tag{10}$$

where $V_T \equiv (1-\tau_d)D_T - X_T + S_T$ includes the market value of equity S_T after CEO turnover.

Throughout our analysis, we further assume that the firm is infinitely lived, which requires that shareholder value remains non-negative. This holds without further conditions in the absence of pseudo-fixed operating costs ($\omega = 0$). When the firm bears the pseudo-fixed operating cost $\omega > 0$, we assume that the lower bound on productivity $\underline{Z}$ is sufficiently large so that shareholder value remains non negative as time goes to infinity.

CEO turnover and the endogenous asset multiple χ. We close the model with a cycle-stationary setting in which a sequence of identical CEOs runs the firm, as in Anderson et al. (2018). CEO turnover involves turnover costs, and the asset multiple χ is a fixed point.

Transactions at turnover. CEO turnover involves two transactions, which shareholders execute with asset sales at the end of period T. The first is a debt rebalancing. After the outgoing CEO chooses her policies at time T, and before the new CEO takes over at time $T+1$, shareholders reset the debt balance from B_{T+1} to B_0. Every incoming CEO thus starts with the same debt relative to her initial capital, and every outgoing CEO sells her shares at the end of period T with the same leverage ratio. Since assets are sold at their market value, the rebalancing is a fair exchange rather than a cost, as Appendix A shows.

The second transaction, the only turnover cost, is the compensation of the incoming CEO.[6] At the end of period T, the firm buys the shares granted to her at their market value, at a cost $\varphi_0 S_T$, where

$$S_T \equiv \frac{1}{1+r} (\chi K_{T+1} - B_0) \tag{11}$$

is the ex-dividend market value of equity at the end of period T. Both transactions are

[6] In value terms the grant dilutes existing shareholders. The outgoing owners keep a fraction $1/(1+\varphi_0)$ of the firm's net worth at turnover, the same fraction as if the firm issued φ_0 new shares per existing share to the incoming CEO.

executed with asset sales at the market value of the firm's assets, so that the assets sold are the difference between the capital in place when the CEO makes her period-T decisions, K_{T+1}^{-}, and the capital stock K_{T+1} handed over to the incoming CEO. Equation (A.5) in Appendix A states the asset-sale identity that links the two.

CEO initial conditions. The model is stationary across CEO cycles. To this end, all CEOs start their tenure with the same state variables B_0 and φ_0. Since the productivity shocks Z_t are CEO-specific and all CEOs are ex-ante identical, each CEO also starts with the same productivity Z_0.

Asset multiple at turnover. The CEO sells her shares at the end of period T, after the period-T policies and the turnover costs, at the market value of equity S_T, so that her stake is worth $\varphi_T(S_T - X_T)$. For S_T to be the fair market value of equity at turnover, the firm's asset multiple, χ, must be consistent with the continuation value of the firm under the next CEO.

We therefore solve for χ as a fixed point of the shareholders' value function. Because every incoming CEO runs the firm under the same contract terms for the same T periods, shareholder value is:

$$\chi K_0 - B_0 = E_0 \left[\sum_{t=0}^{T} \left(\frac{1}{1+r} \right)^t ((1-\tau_d)D_t - X_t) + \left(\frac{1}{1+r} \right)^{T+1} (\chi K_{T+1} - B_0) \right]. \quad (12)$$

The left-hand side of equation (12) is shareholder value when a new CEO starts at time $t = 0$: the asset multiple χ times the firm's capital K_0, net of the initial debt B_0. The right-hand side is the value of the firm under this CEO until her mandate ends. At $T + 1$ another CEO takes over, and shareholder value is again χ times the firm's capital at that time, net of B_0. By design, the capital stock K_{T+1} left after turnover plays the role of the initial stock K_0 in the incoming CEO's cycle, and χ is therefore net of the grants paid to all future CEOs. In line with standard practice by boards (Hall and Murphy, 2000), the incoming CEO's grant is valued at its grant-date fair value, S_T, which is therefore both the price at which the outgoing CEO sells her shares and the price at which shareholders pay for the incoming CEO's grant.

4 Corporate Policies Optimally Chosen by CEOs

We next analyze the corporate policies chosen by shareholders (our benchmark) and by a CEO (our case of interest). The value function of the CEO is homogeneous of degree one in K_t, as Appendix A shows in deriving the scaled problems in equations (A.3) and (A.4), so that $\mathcal{M}_t(Z_t, K_t, B_t, \varphi_t) \equiv m_t(Z_t, b_t, \varphi_t)K_t$. The value function of shareholders is also linear in K_t, so that $V_t(Z_t, K_t, B_t) \equiv v_t(Z_t, b_t)K_t$. We can therefore write all first-order conditions in scaled quantities. The scaled quantities linked to corporate policies are $b_t \equiv B_t/K_t$, $x_t \equiv X_t/K_t$, $i_t \equiv I_t/K_t$, $d_t \equiv D_t/K_t$, and $s_t \equiv S_t/K_t$.

4.1 Benchmark Corporate Policies

We begin with a firm run indefinitely by a benevolent CEO who maximizes shareholder value, defined in equation (10). As in the neoclassical literature, let

$$q_t \equiv \frac{1}{1+r} E_t[v(Z_{t+1}, b_{t+1})]$$

denote shareholders' marginal value of capital at time t. We denote the firm's benchmark policies by the superscript *.

Proposition 1 (Benchmark Corporate Policies) *The optimal benchmark policies that maximize shareholder value in investment and net equity financing are given by:*

$$(1 - \tau_d + \lambda_t^{d\star}) \left[1 + \psi i_t^\star - b_{t+1}^\star + \frac{\nu}{2}\left((b_{t+1}^\star)^2 - \frac{b_t^2}{(1-\delta+i_t^\star)^2}\right)\right] = q_t^\star, \tag{13}$$

$$(1 - \kappa \max\{x_t^\star, 0\}) \left[(1-\tau_d) + \lambda_t^{d\star}\right] = 1, \tag{14}$$

whereas the corresponding benchmark debt financing policy $b_{t+1}^\star$ equals:

$$\left[1 - \nu\left(b_{t+1}^\star - \frac{b_t}{1-\delta+i_t^\star}\right)\right] \left[(1-\tau_d) + \lambda_t^{d\star}\right] = -\frac{1}{1+r}\mathbb{E}_t[v_b^\star] + \lambda_{t+1}^{b\star}. \tag{15}$$

and λ_t^d and λ_{t+1}^b are the multipliers on the dividend and the collateral constraints, respectively.

The first-order conditions in Proposition 1 resemble those of the neoclassical literature with financing frictions (see, e.g., Bond and Meghir, 1994; Hennessy and Whited, 2007). Investment increases with shareholders' marginal value of capital and decreases with a binding dividend constraint and with higher marginal adjustment costs net of debt proceeds. Debt issues balance the shadow cost of a binding collateral constraint and issuance costs against corporate tax savings and a looser dividend constraint. Lastly, the firm issues equity only if it is financially constrained, and otherwise strictly prefers untaxed share repurchases to taxed dividends. Because repurchases carry no issuance cost, an unconstrained firm pays no dividends: it pays out all free cash flow through repurchases, and $(1-\tau_d)+\lambda_t^{d\star}=1$ by (14).

The benchmark case has no CEO cycles: its policies depend on the firm's state, not on calendar time within a CEO's tenure. Hence, the benchmark case cannot explain the trends in corporate policies within the CEO cycle reported in Section 2.

4.2 The CEO's Optimal Investment Policy

Consider next the investment policy of the self-interested CEO. Because it solves the dynamic problem in equation (9), it no longer depends on the shareholders' marginal value of capital $q_t^\star$ but on the quantity q_t^m:

$$q_t^m \equiv \beta E_t \left[m_{t+1}(Z_{t+1}, b_{t+1}, \varphi_{t+1}) \right]$$

defined as the CEO's marginal value of capital at time t.

The CEO overhang effect on investment only: a special case. We first isolate the effect of CEO overhang on investment. Consider a firm with no operating costs ($\omega = 0$), subject to no financing frictions ($x_t = b_t = 0$ and $\lambda_t^d = 0$), run by a CEO as patient as shareholders ($\xi = 0$), with zero taxes and $Z_0 = \mu$. In this environment, the CEO has a constant equity share $\varphi_t = \varphi_0$, and decides only how much to invest until period T, when a new CEO takes over.

Proposition 2 (CEO overhang on investment only) *Let $\tau_c = \tau_d = \tau_p = 0$, $Z_0 = \mu$, $b_t = x_t = 0$, $\xi = 0$, $\omega = 0$, and $\lambda_t^d = 0$. Then the CEO has an equity share $\varphi_t = \varphi_0$, and her*

investment rule equals:

$$(1 + \psi i_t)\varphi_0 = q_t^m,$$

Moreover, the CEO's continuation value q_t^m *declines monotonically in* $t \in (0, T)$*, so that:*

$$\frac{\partial i_t}{\partial t} = \frac{1}{\psi\varphi_0}\frac{\partial q_t^m}{\partial t} < 0 \quad \textit{and} \quad \frac{\partial i_t}{\partial T} = \frac{1}{\psi\varphi_0}\frac{\partial q_t^m}{\partial T} > 0,$$

and, if $i_t < r + \delta$*,* i_t *converges to the benchmark investment rate as* $T - t \to \infty$*.*

Under the assumptions of Proposition 2, the CEO's marginal value of capital q_t^m is a sufficient statistic for investment. As productivity draws are independent, q_t^m is the same for every CEO at a given date, and investment depends only on how far the CEO is from turnover. The CEO values a marginal unit of capital differently during her tenure and at turnover. During her tenure, she values it by the cash flows it generates under her management. At turnover, she receives its market value net of the incoming CEO's grant, $\chi/[(1 + r)(1 + \varphi_0)]$ per unit of capital, which acts as a tax on investment. Because all subsequent CEOs receive the same grant, the endogenous asset multiple χ is also lower.

Proposition 2 thus explains the declining trend in investment documented in Section 2. As her horizon shortens, a growing share of the return on a marginal unit of capital accrues at turnover, and investment declines because capital is worth less at turnover than in the CEO's hands. A longer contract postpones turnover and gives the CEO a stronger incentive to invest. These trends therefore come from the equity grants to all future CEOs. Each unit of capital handed over to an incoming CEO raises her grant, so the outgoing owners keep only a fraction $1/(1 + \varphi_0)$ of their original equity, and the market value of equity itself is net of all future grants of subsequent CEOs. Absent the grants, with $\varphi_0 = 0$, investment is constant over the CEO's tenure, given all conditions in Proposition 2.

The equity grants create a conflict between the current owners and all future CEOs. The current owners, and the incumbent CEO with them, bear the full cost of investment but share its returns after turnover with all future CEOs. The conflict is thus a limiting case of the conflict between old and new shareholders in Myers and Majluf (1984), in which each

future CEO's marginal claim is issued at a zero price by contract, and its consequence is akin to the debt overhang of Myers (1977), with future CEOs in the role of the claimants who capture part of the returns to investment without contributing to its cost.

In Proposition 2, there is no conflict between the CEO and current shareholders: without taxes, the CEO values the firm's cash flows per share exactly as the market does. This explains why early in a long CEO cycle the investment rate is close to the benchmark $i_t^\star$, and yet as turnover approaches the CEO rule converges to i_T, which is pinned down by $1 + \psi i_T = \chi/[(1+r)(1+\varphi_0)]$, so that $i_T < i_t^\star$. If new CEOs started with a productivity different from the mean ($Z_0 \neq \mu$), the productivity reset would add another force. The proof of Proposition 2 in Appendix A gives the condition, (A.21), under which the decline survives. A CEO who starts below average productivity ($Z_0 < \mu$) reinforces the decline, and a CEO with high enough initial productivity ($Z_0 \gg \mu$) can reverse it.

CEO investment: the general case. Proposition 2 isolates investment as the CEO's only tool to raise her dividend pay and keeps her ownership stake constant. In the general case of our model, investment also affects ownership, and the CEO's investment policy satisfies:

$$\left[(1-\tau_d)\varphi_t + \lambda_t^d\right]\left[1 + \psi i_t - b_{t+1} + \frac{\nu}{2}\left(b_{t+1}^2 - \frac{b_t^2}{(1-\delta+i_t)^2}\right)\right] = q_t^m + \frac{\beta\varphi_t x_t}{s_t}\mathbb{E}_t[m_{\varphi,t+1}] \quad (16)$$

The left-hand side is the firm's marginal cost of investment, scaled by the CEO's equity share. The right-hand side is the expected benefit of investment in terms of CEO utility.

As in Proposition 2, the CEO's expected benefit of investment depends on her marginal value of capital, q_t^m. Unlike in Proposition 2, it also depends on her marginal utility of ownership next period, $m_{\varphi,t+1}$. The second term on the right-hand side of her investment rule is the effect of investment today on her expected equity-based compensation tomorrow. The effect arises because CEO ownership increases with share repurchases ($x_t < 0$) and decreases with equity issues ($x_t > 0$).

An impatient CEO thus has an incentive to reduce investment and raise repurchases today, to increase her equity stake tomorrow. Because the expected marginal utility of ownership is strictly positive for the CEO, the second term on the right-hand side is negative

whenever $x_t < 0$. This force differs from the one in Proposition 2, which comes from the declining continuation value of the CEO as a shareholder and arises with a constant equity stake. It reflects a second agency conflict, between CEOs and current shareholders when their preferences differ.

4.3 The Optimal CEO Debt Financing Policy

Unlike in the benchmark, the CEO's debt policy depends on her own marginal cost of debt, which we denote by $m_{b,t}$, and not on the shareholders' marginal cost of debt $v^{\star}_{b,t}$.

The CEO overhang effect on debt financing: a special case. We first study a firm with a constant investment rate ($i = \delta$) and no equity issues ($x_t = 0$), run by a CEO who is as patient as shareholders ($\xi = 0$) and has no base salary ($\omega = 0$). As in Proposition 2, taxes are zero and $Z_0 = \mu$, so that debt has no tax advantage and a firm maximizing shareholder value would keep its debt balance constant: any trend in leverage arises from the CEO cycle. The CEO then decides only how much to borrow each period.

Proposition 3 (CEO overhang on debt financing only) *Let $\tau_c = \tau_d = \tau_p = 0$, $Z_0 = \mu$, $x_t = 0$, $i_t = \delta$, $\xi = 0$, $\omega = 0$, $\lambda^d_t = 0$. Then $\varphi_t = \varphi_0$ and the optimal CEO debt financing rule in the interior region $b_{t+1} \in (0, \bar{b})$ is given by*

$$[1 - \nu(b_{t+1} - b_t)]\,\varphi_0 = -\beta \mathbb{E}_t[m_{b,t+1}].$$

where the marginal cost of debt $-\mathbb{E}_t[m_{b,t+1}] > 0$ strictly decreases in $t \in (0, T)$, and debt increments equal

$$b_{t+1} - b_t = \frac{\beta^{T-t}}{\nu} \frac{\varphi_0}{1 + \varphi_0} > 0, \qquad t = 0, \ldots, T, \tag{17}$$

so that:

$$\frac{\partial (b_{t+1} - b_t)}{\partial t} = \frac{\beta}{\nu \varphi_0} \frac{\partial E_t[m_{b,t+1}]}{\partial t} > 0, \quad \textit{and} \quad \frac{\partial (b_{t+1} - b_t)}{\partial T} = \frac{\beta}{\nu \varphi_0} \frac{\partial E_t[m_{b,t+1}]}{\partial T} < 0. \tag{18}$$

Proposition 3 explains the rising trend in debt financing within CEO cycles. The CEO's marginal cost of debt is strictly declining in calendar time and increasing in remaining tenure, so that debt increments accelerate as turnover approaches. The source of the trend is the impact of the equity grants of future CEOs on the incumbent CEO. Debt raised before turnover is paid out to the current shareholders, including the CEO, who receive the full amount as dividends. At turnover, the incoming CEO receives a fraction $\varphi_0/(1+\varphi_0)$ of the firm's assets χ, so a unit of debt reduces the current shareholders' claim at turnover by only $1/(1+\varphi_0) < 1$. The subsequent CEOs bear the remainder of the cost through smaller grants. As the CEO's remaining horizon shortens, debt becomes more attractive because it allows greater debt-financed payouts, at a cost that is increasingly shared with the future CEOs.

Proposition 3 therefore reflects an agency conflict between the current owners and future CEOs who bear part of the repayment through smaller grants, rather than between the CEO and current shareholders. The mechanism parallels the incentive of shareholders to pay out value ahead of other claimants (Jensen and Meckling, 1976), and the leverage ratchet effect of Admati et al. (2018), in which shareholders keep raising leverage because part of its cost falls on other claimants. Here the claimants are the future CEOs who are granted equity for free. Proposition 3 requires two conditions, (A.22) and (A.26) in Appendix A: dividends must remain non-negative, which bounds productivity from below, and the collateral constraint must not bind before turnover, which requires $\bar{b}$ to exceed the leverage the CEO reaches at turnover.

CEO debt financing: the general case. Proposition 3 isolates the role of debt in raising CEO pay and keeps the ownership share $\varphi_t = \varphi_0$ constant. It therefore leaves out the CEO's incentive to use debt to raise her ownership and, with it, her long-term compensation.

In the general case, the first-order condition for the CEO's debt policy is:

$$\left[1-\nu\left(b_{t+1}-\frac{b_t}{1-\delta+i_t}\right)\right]\left[(1-\tau_d)\varphi_t+\lambda_t^d\right]$$
$$=\beta\mathbb{E}_t\left[-m_{b,t+1}\right]+\frac{\beta(1-\delta+i_t)\varphi_t x_t}{(1+r)s_t^2}\left(-\mathbb{E}_t[v_{b,t+1}]\right)\mathbb{E}_t\left[m_{\varphi,t+1}\right]+\lambda_{t+1}^b, \qquad t<T, \quad (19)$$

where $v_{b,t+1} < 0$ is the marginal value of debt for shareholders under the CEO's policies. The left-hand side is the net benefit of more debt today, in terms of CEO utility. The right-hand side is the net effect of more debt today on the CEO's utility tomorrow. The term with $E_t[m_{b,t+1}]$ captures the higher financing costs tomorrow, as in Proposition 3.

The second term on the right-hand side is new relative to Proposition 3: the effect of debt on CEO ownership. More debt can help the CEO repurchase more shares today ($x_t < 0$) and hold a larger stake tomorrow. This prospect lowers her perceived cost of debt. Debt and share repurchases are therefore complements from the CEO's perspective: when the budget constraint is slack, the CEO can repurchase shares using debt proceeds today, which in turn boost CEO ownership tomorrow. In the general case, the tax shield and the reset of leverage to b_0 at every turnover also contribute to rising leverage over the cycle: each CEO starts at $b_0 < \bar{b}$ and raises debt over her tenure.

4.4 CEO Equity Issues and Share Repurchases

The equity financing rule, for the CEO or for shareholders, depends on whether the dividend constraint binds ($\lambda_t^d > 0$). When it binds, the firm must raise equity to make ends meet, whoever decides, and equity issuance is not a choice.

We begin with a special case in which x_t is the only policy the CEO chooses. We assume $i_t = \delta$, $b_t = 0$, $\omega = 0$, $Z_0 = \mu$ and $\tau_c = \tau_p = 0$. We keep a positive dividend tax $\tau_d > 0$, so that the benchmark firm repurchases shares with all free cash flow at every date and the benchmark payout policy is unique.

Proposition 4 (CEO overhang on net equity issues only) *Let $\tau_c = \tau_p = 0$, $0 < \tau_d < 1$, $Z_0 = \mu$, $i_t = \delta$, $b_t = 0$, $\omega = 0$, $\kappa s_t > 1$, and $\underline{Z} \geq \delta + \frac{\psi}{2}\delta^2$. Then, for $t < T$, the optimal CEO net equity issues are given by:*

$$x_t = \begin{cases} \dfrac{1}{\kappa}\left[1 - \dfrac{\beta(1+r)\,\mathbb{E}_t[m_{\varphi,t+1}]}{(1-\tau_d)\,\mathbb{E}_t[v_{t+1}]}\right] > 0 & \text{if } \beta(1+r)\mathbb{E}_t[m_{\varphi,t+1}] < (1-\tau_d)\mathbb{E}_t[v_{t+1}], \\ -\left[Z_t - \delta - \frac{\psi}{2}\delta^2\right] \quad (d_t = 0) & \text{if } \beta(1+r)\mathbb{E}_t[m_{\varphi,t+1}] > (1-\tau_d)\mathbb{E}_t[v_{t+1}], \end{cases}$$

and, at turnover, $x_T = -\left[Z_T - \delta - \frac{\psi}{2}\delta^2\right]$ *($d_T = 0$). If* $\xi = 0$*, the CEO repurchases shares as in the benchmark. If* $\xi > 0$*, she repurchases shares with all available cashflows at every* t *with* $[\beta(1+r)]^{T-t} > 1 - \tau_d$*, and issues equity at the latest* t *with* $[\beta(1+r)]^{T-t} < 1 - \tau_d$ *and, if* $\mathbb{E}_{t-1}[d_t]/\mathbb{E}_{t-1}[v_t] \leq [1 - \beta(1+r)]/[\tau_d\beta(1+r)]$*, at every earlier date.*

Proposition 4 shows how the CEO's choice of x_t departs from the benchmark. A dollar paid out today as a dividend is worth $1 - \tau_d$ to the CEO per unit of ownership, as it is to outside shareholders. The same dollar used to repurchase shares at their market value $s_t = \mathbb{E}_t[v_{t+1}]/(1+r)$ given by (3) raises her ownership tomorrow by $(1+r)/\mathbb{E}_t[v_{t+1}]$ per unit of ownership, which she values at $\beta(1+r)\mathbb{E}_t[m_{\varphi,t+1}]/\mathbb{E}_t[v_{t+1}]$. She issues equity to pay dividends whenever ownership is worth less to her than its after-tax price, and repurchases shares with all available cashflows otherwise. The benchmark firm, instead, repurchases shares with all available cashflows at every date, since repurchases are tax-efficient compared to dividends.

Proposition 4 then shows that a patient CEO values her shares at their price and follows the benchmark policy, whereas the impatient CEO issues equity early in her tenure to pay dividends, and eventually switches to repurchasing shares with all available cashflows in the last years of her tenure. It follows that net repurchases rise over the CEO's tenure, consistent with the observed empirical trends in Section 2. The dividend tax gives the CEO a reason to repurchase shares near turnover, but the trend in net repurchases comes from her finite horizon combined with her impatience: as turnover approaches, she values her shares closer to their market value, at a fraction $[\beta(1+r)]^{T-t-1}$ of it once she repurchases at every remaining date.

CEO net equity issues: the general case. Proposition 4 shuts down the effects of investment, debt issues and a binding collateral constraint on net equity issuance. In the general case, the rule for net equity issues that maximizes the CEO's utility over wealth is:

$$\left[(1-\tau_d)\varphi_t + \lambda_t^d\right](1 - \kappa \max\{x_t, 0\}) = \beta(1 - \delta + i_t)\mathbb{E}_t\left[m_{\varphi,t+1}\right]\frac{\varphi_t}{s_t}, \qquad t < T. \tag{20}$$

When the dividend constraint does not bind, equation (20) shows the trade-off. The CEO balances the cost of repurchasing shares today, which lowers the dividends that pay

her, against the benefit tomorrow, when the repurchases have raised her ownership. The balance depends on the CEO's preferences and contract.

Compared with Proposition 4, the left-hand side of equation (20) shows how the shadow cost of a binding dividend constraint makes share repurchases even costlier today. On the right-hand side, a lower value of s_t (a more diluted or lower value of the CEO's equity stake) strengthens the CEO's incentive to increase her equity stake through share repurchases tomorrow.

4.5 Dissecting Agency Costs

We conclude the theoretical analysis by studying how the CEO-related frictions of the model create agency costs: a wedge between the firm's asset value under CEOs and under the benchmark policies. We assess this wedge at time T, at the start of a CEO cycle, so that it reflects all the choices that the CEO makes during her tenure.

Delegation to CEOs and CEO turnover are necessary for firms to function, and some turnover costs are unavoidable. To isolate the costs of the trends in corporate policies and of the CEO's preferences, we add the turnover costs θ back to shareholder value under CEOs. Let

$$\theta \equiv \frac{(1+r)^{-T}\,\varphi_0\,\mathbb{E}_0[S_T]/K_0}{1-(1+r)^{-(T+1)}\,\mathbb{E}_0\left[K^-_{T+1}\right]/K_0} \tag{21}$$

denote the present value of the turnover costs, that is, of the grants to every incoming CEO, over the current and all future CEO cycles, per unit of initial capital. The agency cost at time T is then:

$$\mathcal{A}_T = 1 - \frac{\chi - b_0 + \theta}{v^\star(Z_0, b_0)}. \tag{22}$$

The measure compares two ex-dividend shareholder values at the end of period T: the market value of equity in the benchmark case evaluated at Z_0 and b_0, and the market value of equity in the baseline model equal to $\chi - b_0$, to which we add back the present value of all future

turnover costs. It defines agency costs as the percentage change in shareholder value relative to the agency-free benchmark, as in Taylor (2010) and Nikolov and Whited (2014), among others. Because the agency cost is net of turnover costs, it is zero whenever CEOs follow the policies that maximize shareholder value: it captures only the distortions in corporate policies.

Proposition 5 (Agency costs and CEO frictions) *Assume* $\xi = 0$, $\omega = 0$, $\varphi_0 > 0$ *and* $0 < T < +\infty$. *The CEO's value function equals scaled shareholder value at time* T *such that* $m(Z_T, b_T, \varphi_T)/\varphi_T = v(Z_T, b_T, \varphi_T) = (1 - \tau_d)d_T - x_T + s_T$, *with* s_T *given by* (A.8). *The same holds at every* $t \leq T$. *Nonetheless, the agency cost borne by the firm at time* T *satisfies* $\mathcal{A}_T \geq 0$, *with equality if and only if the CEO's policies coincide with the benchmark policies, and* $\mathcal{A}_T > 0$ *in the special cases of Propositions 2 and 3, because the equity grants of future CEOs distort CEO incentives in* $t \in (0, T)$.

Proposition 5 identifies why the CEO's policies differ from the benchmark. The proposition switches off the two CEO parameters that create a wedge between the value function of the CEO and that of shareholders, the preference parameter ξ and the contract parameter ω, and shows that agency costs arise even then.

Even without these parameters, the CEO does not maximize shareholder value and does not choose the benchmark policies. With a finite tenure $0 < T < +\infty$, as in Proposition 5, CEO equity grants distort incentives and push the asset value χ below the benchmark without CEO turnover.

Proposition 5, and the model more generally, align with the debt overhang problem in Hennessy (2004), who interprets it as the result of a truncated shareholder horizon up to the time of default, in conjunction with costly bankruptcy, which leaves shareholders with zero continuation value upon default. In our model, CEO overhang results from the truncation of the CEO's horizon by contract ($0 < T < +\infty$), together with frictions that endogenously lower her terminal utility at turnover. Such frictions include the equity granted to future CEOs at zero price, the CEO's impatience $\xi > 0$, the CEO's salary $\omega > 0$ and the equity share dynamics.

4.6 Extensions

The results so far assume a risk-neutral CEO and a stylized compensation contract. We close the section with extensions of the baseline model. The first adds CEO risk aversion, which affects CEO incentives and can lead the CEO to distort corporate policies further. We also consider contracts that grant the CEO additional equity during her tenure. As in the baseline, the firm buys all granted shares at their market value, and the CEO owns them but cannot sell them until she retires at the end of period T. We give the main results here and the derivations in Appendix A.

Risk averse CEO. We give the CEO mean-variance preferences over wealth,

$$U(W_t) \equiv W_t - \frac{\gamma}{2} K_t \left(W_t/K_t\right)^2$$

where $\gamma > 0$ makes the CEO risk-averse. The CEO's marginal utility of wealth then decreases with her compensation. The CEO overhang effect remains, and risk aversion generates an additional conflict of interest between the CEO and the current risk-neutral shareholders. For instance, as the contract length T grows, the investment rate of a risk-neutral CEO converges to the benchmark investment rate (Proposition 2), whereas that of a risk-averse CEO keeps varying with productivity, and so does debt financing. When the sale of shares at turnover is the CEO's largest payment, she values a dollar received at turnover less than a dollar of dividends received during her tenure. She therefore pulls cash out of the firm before selling her shares: upon turnover, she borrows more than a risk-neutral CEO, pays dividends and does not repurchase shares, and, since the asset multiple χ is lower with risk aversion, she also invests less. The results parallel Lambrecht and Myers (2012, 2017), who show that risk-averse CEOs have an incentive to smooth managerial rents by distorting corporate policies, and Marinovic and Varas (2019), who show how a risk-averse CEO becomes sensitive to short-term results by the end of her cycle.

CEO equity grants during tenure. In our baseline model, the CEO only receives shares at the onset of her tenure, which determine her initial equity share φ_0. In practice, the CEO's contract may grant her a constant fraction g of the firm's shares at every date $t < T$,

so that her equity share follows:

$$\varphi_{t+1} = \varphi_t \left(1 + X_t/(S_t - X_t)\right)^{-1} + g.$$

A risk-neutral CEO as patient as shareholders who receives such grants maximizes shareholder value plus the present value of the grants she receives until turnover. At first glance, such additional grants may help counteract the immediate impact of CEO overhang on corporate policies. In the setting of Proposition 2, she has a greater incentive to invest, as her marginal value of capital is now q_t plus the value of her grants divided by her equity share. In the setting of Proposition 3, she borrows less before turnover than without grants, since debt lowers the value of her grants. Her repurchase incentives are the same as in Proposition 4. Because all future CEOs receive the same grants or enlarged equity compensation, however, g lowers the continuation value of the existing CEO: the asset multiple χ is lower as the firm bears additional costs, and the prospect of higher equity compensation to future CEOs strengthens the CEO overhang effect. The net effect of g on agency costs depends on which of these forces prevails. In the data, CEOs receive new equity grants during their tenure (Section 2.1), and the trends in corporate policies are present nonetheless.

Grants tied to earnings per share. The number of shares granted to CEOs is often tied to performance, and earnings per share are among the most common performance measures (Bens et al., 2003; Almeida, Fos, and Kronlund, 2016). We therefore add grants tied to earnings per share to the CEO's compensation. Let N_t denote the CEO's number of shares, so that the firm's earnings per share are:

$$\vartheta_t \equiv \varphi_t \Pi_t / N_t$$

The CEO receives at every date $t < T$ shares worth a fraction $\alpha \geq 0$ of the earnings on her shares, $\alpha \varphi_t \max\{\Pi_t, 0\}$. As α grows, a CEO as patient as shareholders maximizes her earnings per share until turnover. Grants tied to earnings per share, and thus to performance, do not remove agency costs. They can mitigate the losses that an impatient CEO imposes on shareholders by issuing equity to pay dividends in Proposition 4, but they still distort

the CEO's investment and debt policies. In the case of investment, grants reward capital only through the net income it earns until turnover, and the CEO investment rule departs from the benchmark. In the case of debt financing, as interest expenses reduce net income at every date until turnover, the CEO can reduce leverage over her tenure, in contrast with the positive trend in leverage documented in Section 2.

5 Quantitative Analysis

We next calibrate the model to the data and use it to explain the trends of Section 2. We describe the mechanism behind the trends, quantify agency costs, and study how firm value depends on the terms of the CEO contract.

5.1 Model Calibration

To calibrate the model, we use the sample from Section 2.1, and we measure investment i_t, leverage b_t, net repurchases $-x_t$ and profitability Z_t by total investment, net leverage, net repurchases and gross profit over total capital. Table 2 lists the parameters. We set most of them outside the model and calibrate four of them jointly.

The interest rate is 4.3%, the average real yield on Baa-rated corporate bonds over our sample period. The corporate tax rate is 25%, the ratio of income taxes paid to pretax income in our sample. The personal income tax rate, which applies to the CEO's salary, is 25.8%, the average federal income tax rate of the top 1% of taxpayers over our sample period.[7] The dividend tax τ_d is the extra tax cost of paying out through dividends instead of share repurchases. We set $\tau_d = 4.7\%$, the sample average of the effective dividend tax rate in Warusawitharana and Whited (2016).

The profitability process reproduces the mean, the variance and the serial correlation of gross profit over total capital, which averages 36%. The model has no aggregate or industry shocks, so we measure the variance and the serial correlation net of industry-by-year effects, with industries defined by two-digit SIC codes. The variance is that of the residuals from a

[7] Internal Revenue Service, Statistics of Income, Individual Income Tax Rates and Tax Shares, Tables 4.1 and 5.

regression of profitability on firm and industry-by-year fixed effects. The serial correlation is estimated in first differences of profitability net of its industry-by-year mean, which makes it robust to firm fixed effects. We set the depreciation rate δ equal to the mean investment rate in the data, 14.3%, so that capital is constant on average when the firm invests at the rate observed in the data. Entry net leverage b_0 is 3.4%, the mean net debt over total capital at the start of a cycle. The collateral capacity $\bar{b}$, 9% of capital, does not bind along the calibrated path.

The three terms of the CEO contract are set to sample means. The cycle lasts six years, the mean length of completed CEO cycles.[8] Cash pay ω is 0.14% of total capital, the mean salary and bonus. The entry stake φ_0 is 1.5%, the CEO's mean effective ownership in the first year of tenure.

The remaining parameters, the investment adjustment cost ψ, the CEO's impatience ξ and the financing costs κ_r and ν, are chosen jointly to match the levels and within-cycle trends of total investment, net leverage and net repurchases. Each is pinned down mainly by one moment. The adjustment cost ψ sets the level of investment. The trends in investment and leverage arise from the grants to future CEOs (Propositions 2 and 3), and the CEO's impatience ξ sets their size. The debt issuance cost ν sets the speed at which leverage rises over the cycle and, with it, mean net leverage. We set the equity issuance cost κ to 92.4, so that equity issues stay small. In the quantitative analysis, we also depart from Section 3 by introducing a small cost of share repurchases, $\frac{\kappa_r}{2K_t}\min\{X_t, 0\}^2$ with $\kappa_r = 1.5$, far below the cost of equity issues ($\kappa = 92.4$). This parameter disciplines the level of net repurchases, and without it the CEO would switch from dividends to repurchases all at once. The theoretical results hold qualitatively with this cost, as the calibrated model shows.

Table 3 reports the fit. The model matches the levels of net leverage and net repurchases and the profitability moments, and it reproduces the sign of the three trends. Mean investment is 13.3% of capital, against 14.3% in the data. A lower adjustment cost would raise it, but the shareholder-value benchmark then has no finite value. Investment falls by 0.7

[8] In Section 3 the CEO decides at dates $t = 0, \ldots, T$, so that a CEO cycle lasts $T + 1$ years. In this section, and in the tables and figures, we state the horizon as the length of the cycle in years: the six-year cycle corresponds to $T = 5$ in the notation of Section 3.

percentage points of capital over the cycle, against 0.6 in the data, and net leverage rises by 2.7 points, against 4.1. Net repurchases rise by more than in the data, 3.4 against 0.5 points, because in the model they are concentrated in the last two years of the cycle. The mean CEO ownership is not targeted. In the data the CEO's stake rises over her tenure through new equity grants and averages 2.4% over all years, whereas in the model the CEO receives her stake at the start of her tenure and no grants thereafter.

Table 2: **Model Parameters.** The table reports the parameter values of the calibrated model and their sources. Parameters marked "Calibrated" are chosen jointly to match the levels and cycle trends of investment, net leverage and net repurchases in Table 3; the depreciation rate is set equal to the mean investment rate in the data. The parameters in Panel A are sample averages.

Symbol	Parameter	Value	Source
Panel A: economy-wide parameters			
r	Interest rate	0.043	Real Baa corporate bond yield
τ_c	Corporate tax rate	0.250	Income taxes paid / pretax income
τ_d	Dividend tax rate	0.047	Effective dividend tax rate
τ_p	Personal income tax rate	0.258	Income tax rate of the top 1% of taxpayers
Panel B: firm-specific parameters			
μ_z	Profitability drift	-1.059	Mean gross profit / total capital
ρ_z	Profitability persistence	0.741	Serial correlation of gross profit / total capital
σ_z	Profitability innovation s.d.	0.196	Variance of gross profit / total capital
δ	Depreciation rate of total capital	0.1427	Mean investment rate
ψ	Investment adjustment cost	7.400	Calibrated: investment level
$\bar{b}$	Collateral capacity	0.090	Does not bind along the calibrated path
b_0	Entry leverage	0.034	Mean net debt / total capital at cycle entry
κ	Equity issuance cost	92.4	Set to keep equity issues small
κ_r	Share repurchase cost	1.50	Calibrated: level of net repurchases
ν	Debt issuance cost	12.0	Calibrated: net leverage and its trend
Panel C: CEO-specific parameters			
T	Length of the CEO cycle (years)	6	Mean length of completed CEO cycles (6.1 years)
ξ	CEO impatience	0.0286	Calibrated: size of the investment and leverage trends
γ	CEO risk aversion	0	Risk-neutral CEO; Table 4 raises it to 13.4
ω	CEO cash pay / total capital	0.00139	Mean salary + bonus
φ_0	Entry CEO ownership	0.015	Mean effective CEO ownership in the first tenure year

The calibration implies that the average CEO is much more impatient than shareholders: she discounts future payoffs at about 7.5% per year, against 4.3% for shareholders. This is consistent with the standard assumption in dynamic contracting models that the manager

Table 3: **Model Fit.** The table compares data and model moments at the parameters of Table 2. Trends are the change in each policy over a CEO cycle, the coefficient on the fraction of the cycle elapsed (Table 1, Panel A, in the data; the same regression on simulated cycles in the model); levels are in percent of total capital. Standard errors in parentheses. † Not targeted.

Moment	Data	Model
Trends over a CEO cycle (pp of total capital)		
Total investment	-0.64 (0.26)	-0.66
Net leverage	+4.12 (0.66)	+2.72
Net repurchases	+0.53 (0.25)	+3.39
Levels (% of total capital)		
Mean profitability (gross profit)	36.06	36.05
Variance of profitability ($\times 10^4$)	120.56	120.65
Serial corr. of profitability	0.732	0.735
Mean total investment	14.27	13.28
Mean net leverage	6.64	6.28
Mean net repurchases	0.69	0.68
Mean CEO ownership†	2.40	1.50
Firm value		
Enterprise value net of cash / total capital (χ)†	1.446	1.984

discounts the future at a higher rate than investors (DeMarzo and Sannikov, 2006; Biais et al., 2007; DeMarzo and Fishman, 2007b; DeMarzo, Fishman, He, and Wang, 2012). The result also relates to the literature on CEO preferences and beliefs (see, e.g., Malmendier and Tate, 2005; Graham, Harvey, and Puri, 2013; Page, 2018) and to the costs of managerial short-termism in Terry (2023).

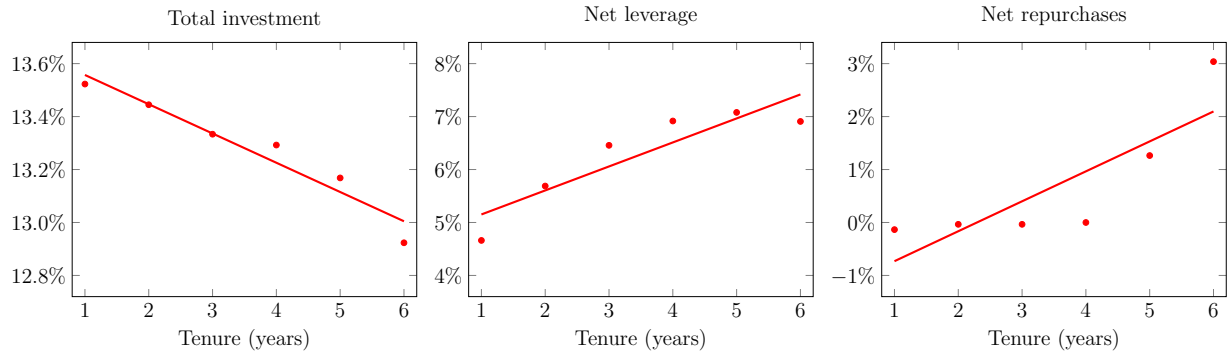
Figure 2 shows that the calibrated model reproduces the trends of Section 2: investment decreases over the cycle, and net leverage and net repurchases increase.

5.2 The Mechanism behind the Trends

We now use the calibrated model to show how the trends of Figure 2 arise.

Share repurchases and the increasing shadow value of ownership. Consider first the trend in net share repurchases, $-x_t$, in Figure 2. Proposition 4 shows that net repurchases rise when the marginal value of ownership $E_t[m_{\varphi,t+1}]$ rises over time, as in Panel A of Figure

Figure 2: **Model-Implied Trends.** The figure shows total investment, net leverage and net repurchases by tenure year in the calibrated model with $T = 6$, in percent of total capital. Dots are means across simulated CEO cycles and lines are the fitted slopes; the change over the cycle is the trend moment of Table 3.



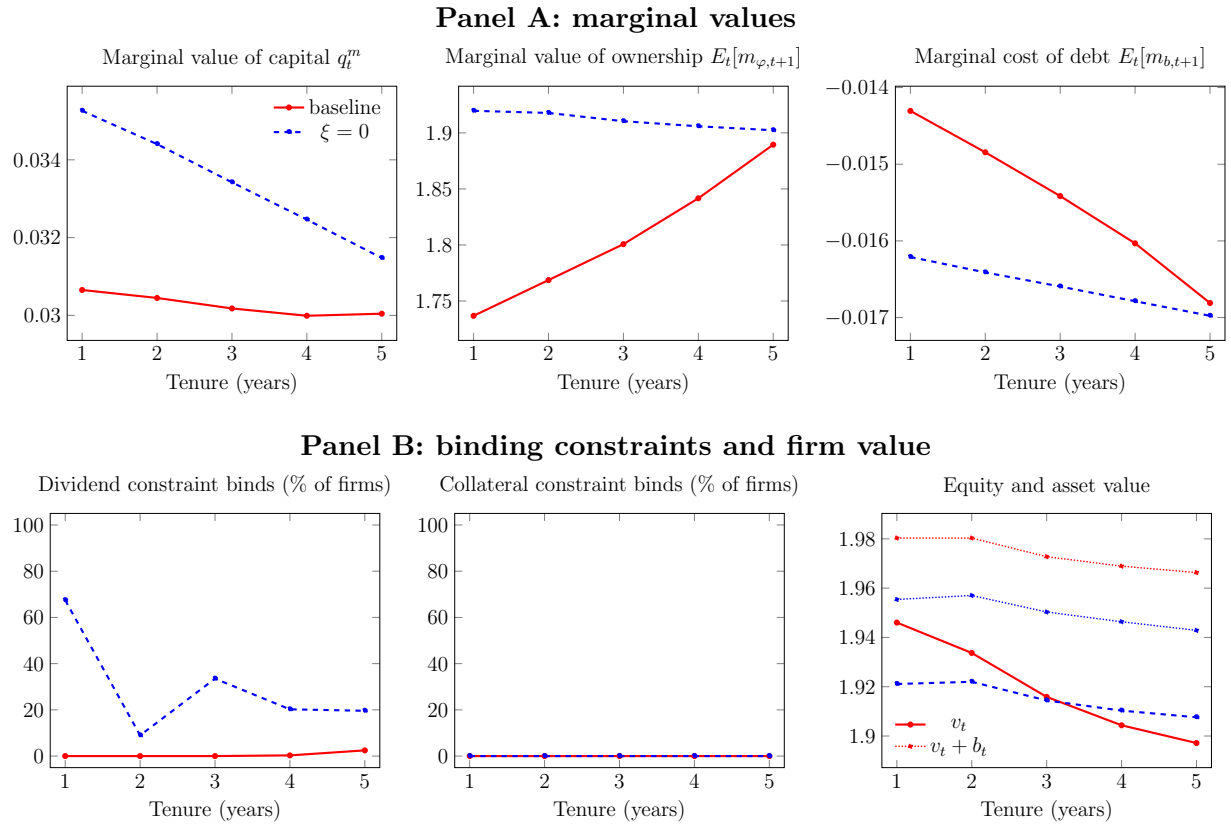
3. For the impatient CEO of the baseline calibration (solid red line), ownership becomes more valuable as the end of her tenure approaches.

The slope of $E_t[m_{\varphi,t+1}]$ depends on the CEO's impatience. For a patient CEO ($\xi = 0$, dashed line), the marginal value of ownership decreases over time, the opposite of the baseline. The patient CEO needs dividends less early in the cycle than an impatient CEO, so she accumulates equity early to maximize both her dividend income and the proceeds from selling her shares.

Declining investment and the shadow value of ownership. Consider next investment, i_t. The left panel of Figure 2 shows that investment decreases over the cycle in the baseline calibration. Two forces act on investment: a falling marginal value of capital to the CEO, q_t^m, which drives the decline, and the CEO's impatience, which lowers investment mostly early in the tenure.

Proposition 2 explains the first force. As a shareholder, the CEO becomes less interested in investing as her cycle unfolds, because she will not fully benefit from the resulting profits, in higher future dividends or in the market value of her stake. The rising marginal value of ownership affects how she pays out more than how much she invests: late in the tenure, she cuts investment and dividends to buy back shares.

Figure 3: **The Mechanism over CEO Tenure.** The figure shows, by tenure year, the CEO's marginal value of capital, marginal value of ownership and marginal cost of debt (Panel A), and the share of simulated firms in which the dividend and the collateral constraint bind together with equity value v_t and asset value $v_t + b_t$ per unit of capital (Panel B). Red is the baseline calibration; dashed lines are the same calibration with a patient CEO, $\xi = 0$. Years 1 to $T - 1$ are shown, as the CEO has no continuation value in the last year.



Panel A of Figure 3 shows the two marginal values for the baseline CEO (solid red line): q_t^m declines over the CEO cycle, by 2% (from 0.0307 to 0.0300), while $E_t[m_{\varphi,t+1}]$ increases by 9% (from 1.74 to 1.89). The decline in q_t^m is the force of Proposition 2, and it lowers investment as turnover approaches. Impatience works mostly on the level of investment: a more impatient CEO invests less from the start of her tenure, so that her investment declines less over the cycle (Table 4, Panel B). The rising marginal value of ownership drives her payout instead: it leads her to switch from dividends to share repurchases late in the

cycle, when investment is at its lowest. The joint pattern is consistent with recent studies showing that buybacks can coincide with lower investment (Almeida, Fos, and Kronlund, 2016; Kahle and Stulz, 2021; Gutiérrez and Philippon, 2017). For the patient CEO ($\xi = 0$, dashed line), both q_t^m and $E_t[m_{\varphi,t+1}]$ decrease over time, so the decline in her investment comes from q_t^m, which falls by 11% over the cycle (from 0.0353 to 0.0315).

The CEO's private debt financing incentives. In the baseline calibration, net leverage increases over the CEO cycle (Figure 2). Panel A in Figure 3 shows the CEO's marginal value of debt, $E_t[m_{b,t+1}]$, which is negative: its absolute value is her perceived marginal cost of debt. This cost rises over the cycle as leverage builds up, by 18% between the first and the fifth year (from 0.0143 to 0.0168), so that the CEO borrows most at the start of her tenure and less in every following year.

Proposition 3 shows that, without taxes, leverage increases over the cycle because the incoming CEO's grant absorbs part of the repayment of debt at turnover. In the calibrated model with taxes, rising leverage also comes from the tax advantage of debt and from the CEO's impatience: she borrows early in her tenure to pay out sooner, and a more impatient CEO borrows more (Table 4). Leverage stops rising in the last two years of the cycle, when she repurchases shares. She funds the repurchases by paying lower dividends and investing less, and does not borrow for them.

To connect the calibration to Propositions 2 and 3, we consider a patient CEO who does not value her salary. In this case, investment still declines over her tenure. Part of this decline comes from persistent profitability and its reset at turnover. Larger grants to incoming CEOs strengthen the decline, consistent with Proposition 2. They also shift the leverage trend upwards, consistent with Proposition 3. At the calibrated stake, however, leverage falls. Its trend becomes positive when we remove the dividend tax. The forces identified in the propositions thus remain at work, but their relative strength depends on the other model frictions.

Figure 3 also compares the CEO's perceived marginal cost of debt $E_t[m_{b,t+1}]$ (Panel A) with how often the collateral constraint binds (Panel B). The collateral constraint does not bind in any of the years shown. In the calibrated model, the cost of issuing debt limits how

fast the CEO raises leverage, and the collateral capacity never does.

Binding budget constraints and declining shareholder value. Panel B in Figure 3 shows that the dividend constraint associated with the multiplier λ_t^d binds more frequently towards the end of the CEO cycle in the baseline calibration, although for a small share of firms (2% in the fifth year). This could mean that the firm becomes more financially constrained as its leverage rises. Figure 3 as a whole, however, suggests another channel: dividends decline over the cycle, and a growing share of firms sets them to zero, as the CEO switches her payout from dividends to share repurchases. Consistent with this second channel, the trend in λ_t^d is reversed for a patient CEO ($\xi = 0$, dashed line), who repurchases shares from the start of her tenure: the dividend constraint binds for most firms early in the cycle and for fewer as turnover approaches.

Lastly, Panel B in Figure 3 shows the scaled value of equity v_t and the firm's asset value $v_t + b_t$, both per unit of capital, for the impatient CEO of the baseline calibration (solid red lines) and a patient CEO ($\xi = 0$, dashed and dotted blue lines). Equity value declines by about 3% over the years shown. Much of this decline reflects debt replacing equity as the CEO raises leverage, and the firm's asset value falls by less than 1%.

5.3 Corporate Policies in the Cross Section of CEOs

The baseline calibration describes a specific CEO profile that matches key moments in the data. CEO-related frictions, however, vary greatly in the cross section, and we now study how they affect corporate policies.

Impatient CEOs. The first column of Table 4 summarizes the impact of CEO impatience ξ. A more impatient CEO invests less, because she discounts projects at a higher rate than shareholders. A 1% increase in ξ reduces the average investment rate by 0.14% (Panel A). The effect is concentrated early in the cycle. Moving ξ from 0.9 to 1.1 times its baseline value lowers investment by about 0.8 percentage points of capital in the first year of the tenure and leaves it unchanged in the last year. The decline in investment over the cycle therefore flattens, by 0.9 percentage points (Panel B). A more impatient CEO also borrows

more to pay out: a 1% increase in ξ raises average net leverage by 0.47% (Panel A) and steepens its rise over the cycle, by 0.7 percentage points (Panel B). CEO impatience also alters the trade-off between dividends today and greater equity compensation tomorrow. A 1% increase in ξ reduces average share repurchases by 0.73% (Panel A), and leaves the rise in repurchases over the cycle almost unchanged (-0.1 percentage points, Panel B).

Table 4: **Corporate Policies and CEO Characteristics.** The table reports how the three policies respond to each CEO characteristic, with the others at the baseline. Panel A: arc elasticities of the policy means. Panel B: change in the cycle trend of each policy, in percentage points, when the characteristic moves from its low to its high value: ξ and ω from 0.9 to 1.1 times the baseline, T from 5 to 7 years, γ from 0 to 13.4. Baseline values in parentheses.

	Impatience ξ	Risk aversion γ	Base salary ω	Horizon T
Panel A: average effects (elasticities)				
Investment (baseline 13.28%)	-0.14	-0.16	0.10	0.10
Net leverage (baseline 6.28%)	0.47	0.07	-0.03	0.98
Repurchases (baseline 0.68%)	-0.73	-2.50	0.01	-1.23
Panel B: within-cycle effects (change in the cycle trend, pp)				
Investment trend (baseline -0.66 pp)	+0.90	-5.51	-0.97	-0.09
Leverage trend (baseline +2.72 pp)	+0.66	+2.22	-0.12	+2.61
Repurchase trend (baseline +3.39 pp)	-0.14	-3.40	+0.02	-0.68

Panel A of Figure 4 shows how ξ affects corporate policies over the CEO cycle. Impatience lowers investment mostly early in the tenure and raises leverage more as the tenure advances.

Risk averse CEOs. The second column of Table 4 shows the effect of CEO risk aversion. A risk-averse CEO cuts investment to smooth her income. Since $\gamma = 0$ in our baseline, we report the effect of raising γ from zero to 13.4. Doing so lowers the investment rate from 13.3% to 9.6% (Panel A). The effect strengthens over the cycle: investment is about 2.2 percentage points lower in the first year of the tenure and 7.9 points lower in the last, so that its decline over the cycle becomes steeper, by 5.5 percentage points (Panel B). Risk aversion has little effect on average leverage, but leverage rises by more over the cycle, by 2.2 percentage points (Panel B). Risk aversion also weakens the CEO's incentive to accumulate equity and lowers share repurchases, from 0.7% to -0.3% of total capital (Panel A). The

risk-averse CEO issues equity on net, and her repurchases no longer rise over the cycle (Panel B).

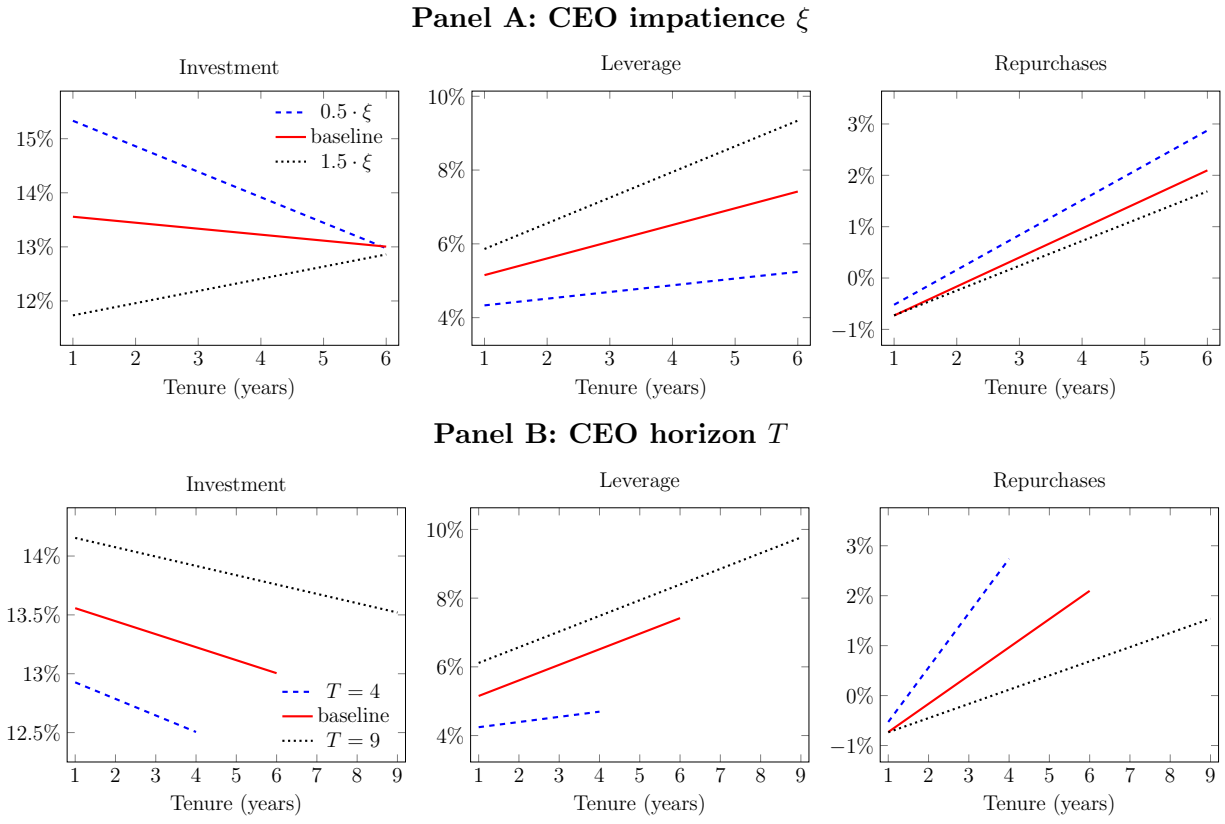
CEO base salary. The third column of Table 4 shows the effect of the CEO's base salary. A higher ω gives the CEO an incentive to invest more, because the salary increases with firm size. On average, a 1% increase in ω boosts the investment rate by 0.10% (Panel A). The effect is concentrated early in the cycle: moving ω from 0.9 to 1.1 times its baseline value raises investment by about 0.6 percentage points in the first year of the tenure and leaves it almost unchanged in the last. The decline in investment over the cycle therefore becomes steeper, by 1.0 percentage points (Panel B), as the CEO's incentive to grow the firm matters most when the end of her tenure is still far. The effects on leverage and on share repurchases are small: a 1% increase in ω lowers average leverage by 0.03% and raises average repurchases by 0.01% (Panel A), and leaves their trends almost unchanged (Panel B). Through its effect on investment, the base salary can thus offset the impatient CEO's incentive to underinvest, as we discuss in Section 5.5.

CEO contract horizon. The fourth column of Table 4 shows the effect of the contract horizon T. On average, a 1% increase in T increases the investment rate by 0.10% (Panel A), while the decline in investment over the cycle is almost unchanged (Panel B). A 1% increase in T also increases leverage by 0.98% (Panel A): with a longer horizon the CEO has more years over which to raise debt, and leverage rises by 2.6 percentage points more over a seven-year cycle than over a five-year cycle (Panel B). Lastly, a 1% increase in T reduces share repurchases by 1.23% (Panel A). The CEO switches from dividends to share repurchases in the last two years of her tenure whatever its length, as Proposition 4 implies, so that a longer horizon adds years of dividends and lowers average repurchases. The fitted trend in repurchases over the cycle is lower, by 0.7 percentage points (Panel B).

Panel B of Figure 4 shows the three policies for horizons of four and nine years. With a longer horizon the CEO invests more in every year of her tenure and builds up more debt: net leverage peaks at 4.7% of capital in a four-year cycle and reaches the collateral capacity of 9% in a nine-year cycle. Repurchases take place in the last two years at either horizon.

We next turn from the CEO's policies to their effect on firm value.

Figure 4: **Comparative Statics of the Model-Implied Trends.** The figure shows the fitted tenure trends of the three policies when one CEO characteristic varies, with the others at the baseline: impatience ξ at 0.5 and 1.5 times its baseline value (Panel A), and the horizon T at 4 and 9 years (Panel B). Red is the baseline calibration.



5.4 Decomposing Agency Costs

Proposition 5 identifies the frictions that create a wedge between the interests of shareholders and those of CEOs. The calibrated model lets us quantify how much shareholder value the CEO's distortions of corporate policies cost.

We begin by computing agency costs as in Proposition 5. The agency cost $\mathcal{A}_T$ in equation (22) compares the equity value of the firm in the benchmark case, which is run to maximize shareholder value and pays the CEO's base salary, with its equity value under the CEO, $\chi - b_0$, after adding back the present value θ of the shares granted to all future CEOs. In our baseline calibration the agency cost is 6.0%: the distortions in corporate policies cost

shareholders 6.0% of the value they would obtain in the benchmark. The grants themselves are a further cost: each CEO change costs shareholders the market value of the incoming CEO's grant, 1.5% of the firm's equity value, and since a new CEO arrives every six years, the present value over all future CEO changes amounts to 3.6% of benchmark equity value. The total value gap $\mathcal{G}_T = 1 - (\chi - b_0)/v^\star(Z_0, b_0)$ is therefore 9.6%. We focus on $\mathcal{A}_T$, because delegation, absent from the benchmark, is necessary for firms to function, and the compensation of future CEOs is to some extent inevitable.

Panel A of Table 5 reports both measures for a sequence of CEO cases that switch on, one at a time, the frictions of Proposition 5, so that each source of agency costs can be read off the difference between two rows. Panel B collects these differences. We start from a patient CEO ($\xi = 0$) who does not value her base salary, so that neither of the CEO's preference and contract parameters creates a wedge. Her agency cost is 4.8%. This is the agency cost of Proposition 5: it remains even though she values the firm's cash flows as the market does. The CEO's preferences and compensation add the remaining 1.2 percentage points, a small number that conceals two larger and offsetting forces. Impatience alone, with the salary not valued, adds 3.7 points: the impatient CEO under-invests. The salary motive offsets most of it: because the salary scales with firm size, valuing it gives the impatient CEO a reason to invest, and lowers her agency cost by 2.5 points. This is the mitigating role of the base salary discussed with Table 4. For the patient CEO, who does not under-invest, the salary motive raises the agency cost only slightly, by 0.6 points, but it lowers the value of her firm by more: she then invests more, and the total value gap rises from 8.7% to 10.8% (Panel A).

Panel C of Table 5 shows how the agency cost responds to the CEO characteristics. Moving impatience from 0.9 to 1.1 times its baseline value raises $\mathcal{A}_T$ from 5.8% to 6.2%. Moving γ from zero to 13.4 raises it from 6.0% to 10.7%, as the risk-averse CEO invests far less. A higher base salary lowers the agency cost, from 6.2% to 5.8% as ω moves from 0.9 to 1.1 times its baseline value, again because the salary tempers under-investment. Lengthening the contract horizon T from five to seven years lowers $\mathcal{A}_T$ from 6.2% to 5.8%, and the total value gap from 10.4% to 9.0%, as the grants to incoming CEOs are paid less often.

These magnitudes can be compared with existing structural estimates, keeping in mind

Table 5: **Agency Costs.** Panel A reports, for the benchmark and four CEO cases, equity value per unit of capital at the start of a CEO cycle, the agency cost $\mathcal{A}_T$ of equation (22), which adds back the present value θ of the shares granted to all future CEOs, and the total value gap $\mathcal{G}_T = 1 - (\chi - b_0)/v^\star(Z_0, b_0)$. The cases switch on, one at a time, impatience and the salary in the CEO's objective; in the "salary not valued" cases the firm pays the salary but the CEO does not value it. Panel B decomposes the baseline agency cost, in percent of benchmark equity value, reading each source off the differences between the rows of Panel A, and reports the present value of the grants, which separates $\mathcal{A}_T$ from $\mathcal{G}_T$. Panel C reports both measures when one CEO characteristic changes, with the others at the baseline. The asset multiple χ is re-solved in every case.

Panel A: equity value, agency cost and value gap by CEO case

	Equity value	Agency cost $\mathcal{A}_T$	Value gap $\mathcal{G}_T$
Benchmark (shareholder value maximization)	2.156	–	–
Patient CEO ($\xi = 0$), salary not valued	1.969	4.8%	8.7%
Patient CEO ($\xi = 0$)	1.923	5.4%	10.8%
Baseline CEO, salary not valued	1.922	8.5%	10.8%
Baseline CEO	1.950	6.0%	9.6%

Panel B: decomposition of the baseline agency cost

Patient CEO, salary not valued (Proposition 5)	4.8%	
CEO preferences and salary, together	1.2%	
impatience alone (salary not valued)	3.7%	
salary motive, impatient CEO	−2.5%	
salary motive, patient CEO	0.6%	
Agency cost $\mathcal{A}_T$	6.0%	
Present value of the grants to all future CEOs	3.6%	
Total value gap $\mathcal{G}_T$		9.6%

Panel C: sensitivity to CEO characteristics

	$\mathcal{A}_T$, low → high	$\mathcal{G}_T$, low → high
Impatience ξ (±10%)	5.8% → 6.2%	9.6% → 9.6%
Risk aversion γ (0 to 13.4)	6.0% → 10.7%	9.6% → 12.4%
Base salary ω (±10%)	6.2% → 5.8%	9.7% → 9.6%
Horizon T (5 to 7 years)	6.2% → 5.8%	10.4% → 9.0%

that the incentive problems differ: Morellec, Nikolov, and Schürhoff (2012) estimate agency costs of about 1.5% of equity value, and in Nikolov and Whited (2014) a 5% change in the agency parameters changes firm value, measured by Tobin's q, by 3 to 8%. Capron et al. (2026) estimate that firm value would be 9.6% lower if boards appointed CEOs without information about their quality, and 7.2% lower if they made firing decisions without it. In Terry (2023), managerial short-termism lowers social welfare by about 1% and growth by five

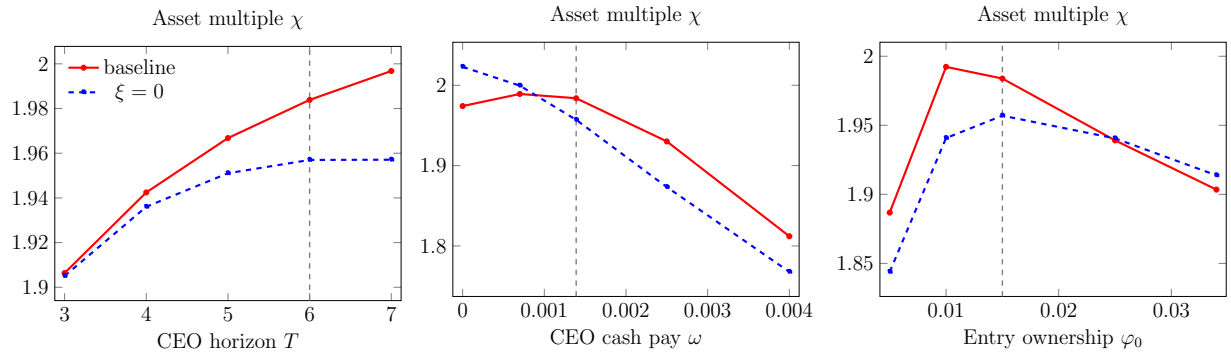
basis points a year, although it raises firm value by about 1% because it disciplines conflicted managers. In our model CEO impatience raises the agency cost, although at the calibrated salary the firm of the impatient CEO is worth slightly more than that of the patient CEO (Table 5, Panel A), because impatience tempers the growth that the salary motive induces.

5.5 Firm Value and the CEO Contract

So far we have taken the contract terms T, ω and φ_0 as given. We now ask how firm value depends on each of them. We vary one term at a time, holding the others at their calibrated values, and re-solve the model, including the asset multiple χ in equation (12). We do not solve for the optimal contract. On each term, the calibrated contract is within 1% of the highest firm value among the values we consider.

CEO contract horizon. The left panel in Figure 5 shows the stationary asset multiple χ as a function of the contract horizon T for the baseline calibration (solid red line) and for a patient CEO ($\xi = 0$, dashed line), with all other parameters at their baseline values. The patient CEO serves one purpose throughout this section: she separates the trade-offs embedded in the contract terms themselves from those that arise from the CEO's impatience.

Figure 5: **Firm value and the CEO contract.** The asset multiple χ as the CEO horizon T, her cash pay ω and her entry ownership φ_0 vary. Each point re-solves the model, including the fixed point for χ, with all other parameters at the baseline; the grey dashed line marks the baseline value. Red is the baseline calibration; the dashed line is the same calibration with a patient CEO, $\xi = 0$.



A longer contract horizon T reduces the frequency of grants to incoming CEOs and changes the CEO's investment incentives. In the calibrated model, firm value rises at a decreasing rate over the horizons we consider: for the baseline CEO, χ increases from 1.91 at a horizon of three years to 2.00 at seven years. For the patient CEO the gains from a longer horizon are exhausted sooner: χ rises from 1.91 at three years to 1.96 at six years and is flat thereafter. Because her salary scales with the size of the firm, the patient CEO invests more the longer her horizon, from 13.0% of capital a year at three years to 15.2% at seven, but extending her horizon beyond six years does not raise firm value further.

CEO base salary. The middle panel in Figure 5 shows that for the baseline CEO the asset multiple χ first increases with higher values of ω, and then decreases. Two forces work in opposite directions. First, a higher ω makes every unit of capital more expensive to shareholders through the salary bill. This is the negative force in the figure.

Second, there is a positive force, which comes from the CEO's incentive to build an empire. As base salary increases with firm size, a higher ω makes capital more valuable to the CEO, and gives her a strong incentive to invest. When this incentive outweighs the CEO's competing incentive to raise the equity part of her pay, a moderate salary raises asset value in the long run, because it offsets the impatient CEO's incentive to underinvest. Among the salaries we consider, χ is highest at 0.07% of capital, half of the calibrated value ($\chi = 1.99$ against 1.97 without any salary): the salary raises the CEO's investment from 11.4% of capital a year without a salary to 12.5% at that salary and 13.3% at the calibrated value. For the patient CEO there is no under-investment to offset, and χ declines in ω throughout, from 2.02 without a salary to 1.77 at a salary of 0.4% of capital. The base salary thus has a role beyond the one the literature usually gives it, a certainty equivalent or compensation for the CEO's reservation value.

CEO initial ownership. The right panel of Figure 5 shows two opposing forces on the asset multiple χ as the CEO's initial ownership φ_0 rises. At a relatively low value of φ_0, increasing CEO ownership strengthens alignment with shareholders: it changes the CEO's investment, financing, and payout choices in ways that increase shareholder value. A larger φ_0 also means that shareholders transfer a larger fraction of firm value to every incoming

CEO, so they bear larger turnover costs. The first force is the conventional view in the dynamic contracting literature: a larger stake mitigates agency conflicts. The second, higher turnover costs, is seldom discussed. In our model it dominates above a stake of about 1%, so a larger stake need not raise firm value.

In the calibrated model both forces are visible. A CEO with a small stake invests heavily, because her salary grows with the firm and her share in the payout is small: at $\varphi_0 = 0.5\%$ investment runs at 15.3% of capital in the baseline calibration, against 13.3% at the baseline stake, and this over-investment lowers asset value. The alignment force therefore dominates at low stakes: χ rises from 1.89 at $\varphi_0 = 0.5\%$ to 1.99 at $\varphi_0 = 1\%$, the highest value among the stakes we consider. It declines thereafter, to 1.90 at $\varphi_0 = 3.4\%$, as the transfer to every incoming CEO takes over. The same pattern holds for the patient CEO, whose firm value is highest, 1.96, at a stake of 1.5%. The model thus explains an initial stake that is low but positive, close to the 1.5% observed in the data, and large enough to curb empire building. Solving for the optimal contract, in which shareholders choose the horizon, the base salary and the initial stake jointly, is beyond the scope of this paper and a natural direction for future work.

6 Conclusion

This paper documents trends in corporate policies within CEO cycles and provides a theoretical framework that explains them. The framework identifies the CEO overhang effect: a mechanism by which CEOs optimally raise their compensation by reducing investment, increasing leverage and repurchasing more shares. Two agency conflicts emerge in the framework. The first, between current shareholders, including the CEO, and all future CEOs, whose equity grants are claims on the capital they inherit, is enough to generate the effect. The second, between the CEO and current shareholders, arises when the CEO is impatient, risk averse or paid a salary that grows with the firm. Together, the two conflicts help explain the trends in the data.

The quantitative analysis shows how the mechanism helps explain these trends. The

grants to future CEOs push investment down and leverage up as turnover approaches: debt raised late in the tenure is partly repaid by future CEOs. The calibrated CEO is also impatient, and she borrows early in her tenure to pay out sooner. Her marginal value of ownership increases over the tenure, so a larger stake becomes more valuable to her as turnover approaches. Late in her tenure she therefore switches her payout from dividends to share repurchases, which raises her equity stake.

Our paper also bears on the literature on dynamic contracting. Even under the standard contract of that literature, incentives fail, because CEOs choose corporate policies to their own advantage. Even a risk-neutral CEO as patient as shareholders, who values the firm exactly as the market does, distorts corporate policies, because future shareholders such as CEOs and senior employees are granted equity at zero price by contract. Our quantitative analysis then shows how firm value depends on the three terms of the CEO contract: its horizon, the CEO's base salary and her initial equity stake. Challenging conventional wisdom, our results show that agency conflicts need not be mitigated by a higher CEO equity stake, and the CEO's base salary can do more than ensure her participation.

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Appendix A Model Derivations

Scaled value functions. We first derive the scaled value functions used throughout the analysis. Consider the value function of shareholders under the benchmark policies. Using $K_{t+1} = (1-\delta+i_t)K_t$, $B_t = b_t K_t$, $B_{t+1} = b_{t+1}K_{t+1}$, $X_t = x_t K_t$, and $D_t = d_t K_t$, the dividend constraint can be written as

$$\begin{aligned} d_t &= \pi_t - (i_t - \delta) + (1-\delta+i_t)b_{t+1} - b_t \\ &\quad + x_t - \frac{\kappa}{2}\max\{x_t, 0\}^2 - \frac{\nu}{2(1-\delta+i_t)}[(1-\delta+i_t)b_{t+1} - b_t]^2, \end{aligned} \tag{A.1}$$

where $\pi_t \equiv \Pi_t/K_t = (1-\tau_c)(Z_t - \omega - \delta - r b_t) - \frac{\psi}{2}i_t^2$ is net income scaled by capital. In period T, (A.1) holds with $B_{T+1} = b_{T+1}K_{T+1}^-$ and $K_{T+1}^- = (1-\delta+i_T)K_T$, where K_{T+1}^- represents the assets in place when the CEO decides on corporate policies at the beginning of period T.

The shareholder problem is homogeneous of degree one in K_t. Hence $V_t(Z_t, K_t, B_t) \equiv v_t(Z_t, b_t)K_t$, and dividing the Bellman equation by K_t gives the scaled problem

$$v_t^\star(Z_t, b_t) = \max_{i_t, b_{t+1}, x_t} \left\{ (1-\tau_d)d_t - x_t + \frac{1-\delta+i_t}{1+r}\mathbb{E}_t[v_{t+1}^\star(Z_{t+1}, b_{t+1})] \right\}, \tag{A.2}$$

subject to $d_t \geq 0$ and $b_{t+1} \leq \bar{b}$.

The CEO problem is homogeneous in the same way. Since $W_t = K_t[(1-\tau_p)\omega + \varphi_t(1-\tau_d)d_t]$, CEO utility can be written as $U(W_t) = K_t w_t$, where $w_t \equiv (1-\tau_p)\omega + \varphi_t(1-\tau_d)d_t$. It follows that $\mathcal{M}_t(Z_t, K_t, B_t, \varphi_t) \equiv m_t(Z_t, b_t, \varphi_t)K_t$. For $t < T$, dividing the CEO's Bellman equation by K_t therefore yields

$$m_t(Z_t, b_t, \varphi_t) = \max_{i_t, b_{t+1}, x_t} \{ w_t + \beta(1-\delta+i_t)\mathbb{E}_t[m_{t+1}(Z_{t+1}, b_{t+1}, \varphi_{t+1})] \}, \tag{A.3}$$

subject to $d_t \geq 0$ and $b_{t+1} \leq \bar{b}$, where $\varphi_{t+1} = \varphi_t(1 - x_t/s_t)$ and $s_t = (1-\delta+i_t)\mathbb{E}_t[v_{t+1}(Z_{t+1}, b_{t+1})]/(1+r)$ for $t < T$. At the terminal decision date, the CEO also receives the proceeds from selling her equity stake after the period-T trade, $\varphi_T(S_T - X_T)$, where $s_T \equiv S_T/K_T$. The corresponding scaled terminal problem of the CEO is

$$m_T(Z_T, b_T, \varphi_T) = \max_{i_T, b_{T+1}, x_T} \{ w_T + \varphi_T(s_T - x_T) \}, \tag{A.4}$$

subject to $d_T \geq 0$ and $b_{T+1} \leq \bar{b}$. The period-T corporate policies are chosen before turnover, on the capital stock K^-_{T+1}. After these choices, shareholders reset debt to $B_0 = b_0 K_{T+1}$ and purchase the incoming CEO's grant at $\varphi_0 S_T$, both with asset sales at the market value $(\chi - b_0)/(1+r) + b_0$ per unit of capital:

$$\left[\frac{\chi - b_0}{1+r} + b_0\right]\left(K^-_{T+1} - K_{T+1}\right) = b_{T+1}K^-_{T+1} - b_0 K_{T+1} + \varphi_0 S_T. \tag{A.5}$$

Since $S_T = (\chi - b_0)K_{T+1}/(1+r)$ by (11), the outgoing owners keep a fraction $1/(1+\varphi_0)$ of the firm's net worth at turnover, and the incoming CEO's grant takes the rest:

$$S_T = \frac{K^-_{T+1}}{1+\varphi_0}\left[\frac{\chi - b_0}{1+r} + b_0 - b_{T+1}\right]. \tag{A.6}$$

Since assets are sold at their market value, the reset of debt at turnover is a fair exchange: a unit of debt repaid at turnover reduces the outgoing owners' claim by $1/(1+\varphi_0)$, and the incoming CEO bears the remaining $\varphi_0/(1+\varphi_0)$ through a smaller grant. Dividing by K_T,

$$\frac{K_{T+1}}{K_T} = \frac{(1+r)(1-\delta+i_T)}{(\chi - b_0)(1+\varphi_0)}\left[\frac{\chi - b_0}{1+r} + b_0 - b_{T+1}\right], \tag{A.7}$$

$$s_T = \frac{1-\delta+i_T}{1+\varphi_0}\left[\frac{\chi - b_0}{1+r} + b_0 - b_{T+1}\right]. \tag{A.8}$$

Using (A.12)–(A.13) below and (A.8), the first-order conditions of (A.4) with respect to i_T, b_{T+1} and x_T are

$$\left[(1-\tau_d)\varphi_T + \lambda^d_T\right]\left[1 + \psi i_T - b_{T+1} + \frac{\nu}{2}\left(b^2_{T+1} - \frac{b^2_T}{(1-\delta+i_T)^2}\right)\right]$$
$$= \varphi_T \frac{1}{1+\varphi_0}\left[\frac{\chi - b_0}{1+r} + b_0 - b_{T+1}\right], \tag{A.9}$$

$$\left[(1-\tau_d)\varphi_T + \lambda^d_T\right]\left[1 - \nu\left(b_{T+1} - \frac{b_T}{1-\delta+i_T}\right)\right]$$
$$= \varphi_T \frac{1}{1+\varphi_0} + \lambda^b_{T+1}, \tag{A.10}$$

$$\left[(1-\tau_d)\varphi_T + \lambda^d_T\right](1 - \kappa \max\{x_T, 0\}) = \varphi_T. \tag{A.11}$$

Proof of Proposition 1. Direct differentiation of the debt-adjustment cost in (A.1) gives

$$\frac{\partial}{\partial i_t}\frac{\nu[(1-\delta+i_t)b_{t+1}-b_t]^2}{2(1-\delta+i_t)} = \frac{\nu}{2}\left[b_{t+1}^2 - \frac{b_t^2}{(1-\delta+i_t)^2}\right], \tag{A.12}$$

$$\frac{1}{1-\delta+i_t}\frac{\partial}{\partial b_{t+1}}\frac{\nu[(1-\delta+i_t)b_{t+1}-b_t]^2}{2(1-\delta+i_t)} = \nu\left[b_{t+1} - \frac{b_t}{1-\delta+i_t}\right]. \tag{A.13}$$

Substitution of (A.12)–(A.13) into the first-order conditions of (A.2), with $q_t^\star = (1+r)^{-1}\mathbb{E}_t[v_{t+1}^\star]$, gives the three conditions stated in Proposition 1. When $x_t^\star \leq 0$, (14) gives $\lambda_t^{d\star} = \tau_d$, and the envelope condition $v_{b,t}^\star = -[1+(1-\tau_c)r] + \nu\left(b_{t+1}^\star - \frac{b_t}{1-\delta+i_t^\star}\right)$ and (15) give $v_{b,t}^\star = -(1-\tau_c)r + (1+r)^{-1}\mathbb{E}_t[v_{b,t+1}^\star] - \lambda_{t+1}^{b\star}$. Iterating forward,

$$b_{t+1}^\star - \frac{b_t}{1-\delta+i_t^\star} = \frac{1}{\nu}\left[\tau_c - \sum_{s\geq 0}(1+r)^{-s}\mathbb{E}_t\left[\lambda_{t+s+1}^{b\star}\right]\right] \leq \frac{\tau_c}{\nu}, \tag{A.14}$$

with equality if the collateral constraint does not bind at any future date.

Proof of Proposition 2. With $\tau_c = \tau_d = \tau_p = 0$, $b_t = x_t = 0$, $\omega = 0$, (A.1) gives $d_t = Z_t - i_t - \frac{\psi}{2}i_t^2$, and the first-order condition of (A.3) gives $\varphi_0(1+\psi i_t) = q_t^m$. Substituting into (A.3),

$$m_t(Z_t) = \varphi_0 Z_t + (1-\delta)q_t^m + \frac{\varphi_0}{2\psi}\left[\frac{q_t^m}{\varphi_0} - 1\right]^2, \qquad \frac{\partial m_t}{\partial q_t^m} = 1 - \delta + i_t > 0. \tag{A.15}$$

Since Z_{t+1} is independent of Z_t,

$$q_t^m = \beta\left\{\varphi_0\mu + (1-\delta)q_{t+1}^m + \frac{\varphi_0}{2\psi}\left[\frac{q_{t+1}^m}{\varphi_0} - 1\right]^2\right\} \tag{A.16}$$

does not depend on Z_t, and is the same strictly increasing function of q_{t+1}^m at every t. At T, $b_0 = b_{T+1} = 0$ and $x_T = 0$, and (A.9) gives

$$1 + \psi i_T = \frac{\chi}{(1+r)(1+\varphi_0)}, \tag{A.17}$$

and $m_T(Z_T)$ is (A.15) with q_t^m replaced by $\varphi_0(1+\psi i_T)$. Since $\beta^{-1} - (1-\delta) = r + \delta$,

$$q_{T-1}^m - \varphi_0(1+\psi i_T) = \beta\varphi_0\left\{\mu + \frac{1}{2\psi}\left[\frac{\chi}{(1+r)(1+\varphi_0)} - 1\right]^2 - (r+\delta)\frac{\chi}{(1+r)(1+\varphi_0)}\right\}. \tag{A.18}$$

The right-hand side of (A.18) is positive if and only if the user-cost condition

$$\mu + \frac{1}{2\psi}\left[\frac{\chi}{(1+r)(1+\varphi_0)} - 1\right]^2 > (r+\delta)\frac{\chi}{(1+r)(1+\varphi_0)} \tag{A.19}$$

holds. With $Z_0 = \mu$, (A.19) holds for every T, as the step on the asset multiple below shows. Hence $q^m_{T-1} > \varphi_0(1+\psi i_T)$, and, since (A.16) is increasing, $q^m_t > q^m_{t+1}$ for every $t < T$ by induction, so that $i_t > i_{t+1}$.

Tenure at a given χ. Denote $q^m_t(T,\chi)$ to signify q^m_t under a contract of length T with the asset multiple χ. The recursion (A.16) and the terminal condition (A.17) depend on t only through $T-t$, so $q^m_t(T+1,\chi) = q^m_{t-1}(T,\chi)$, which exceeds $q^m_t(T,\chi)$ since q^m_t declines in t; at $t=0$, $q^m_0(T+1,\chi)$ is (A.16) applied to $q^m_0(T,\chi)$, and exceeds it for the same reason. By (A.17), $\varphi_0(1+\psi i_T)$ increases with χ, and (A.16) is increasing, so q^m_t increases with χ.

Asset multiple χ. Our proofs should take into account that the asset multiple is endogenously determined. With $b_0 = x_t = 0$, (11) and (A.6) give $S_T = \chi K^-_{T+1}/[(1+r)(1+\varphi_0)]$, and (12) gives

$$\chi = \sum_{t=0}^{T} \beta^t \frac{\mathbb{E}_0[D_t]}{K_0} + \beta^T \frac{\chi}{(1+r)(1+\varphi_0)} \frac{K^-_{T+1}}{K_0} = \frac{m_0(Z_0)}{\varphi_0}. \tag{A.20}$$

Let $\chi(T)$ denote the solution of (A.20) under a contract of length T.

The asset multiple increases with T. Write (A.16) as $q^m_t/\varphi_0 = H(q^m_{t+1}/\varphi_0)$, where $H(q) \equiv \beta\left\{\mu + (1-\delta)q + \frac{1}{2\psi}(q-1)^2\right\}$ is strictly increasing and convex, with slope $\beta(1-\delta+i)$ at $q = 1+\psi i$. By (A.18), $H(q) > q$ if and only if (A.19) holds at $\chi/[(1+r)(1+\varphi_0)] = q$, that is, if and only if q lies below the smaller fixed point of H, at which the slope of H is below one, or above the larger one. With $Z_0 = \mu$, (A.15) at $t=0$, (A.20) and (A.17) give

$$\frac{\chi(T)}{1+r} = H^{T+1}\left(\frac{\chi(T)}{(1+r)(1+\varphi_0)}\right),$$

where H^k denotes k applications of H. If $\chi(T)/[(1+r)(1+\varphi_0)]$ lay between the two fixed points of H, the right-hand side would not exceed it, which is impossible since $\varphi_0 > 0$; above the larger fixed point, investment would exceed $r+\delta$ and the value of the firm would be infinite. Hence (A.19) holds at $\chi(T)$ for every T. Below the smaller fixed point, the slope of H is below one and its iterates strictly increase, $H^{T+2}(q) > H^{T+1}(q)$. The right-hand side above is therefore a function of $\chi/(1+r)$ with slope below one, which shifts strictly up when the contract length rises from T

to $T+1$, so that $\chi(T+1) > \chi(T)$. Since q_t^m increases with T at a given χ, and with χ, by the previous step, $q_t^m(T+1, \chi(T+1)) > q_t^m(T+1, \chi(T)) > q_t^m(T, \chi(T))$ for every $t \leq T$.

Convergence of i_t to $i_t^\star$. The slope of (A.16) in q_{t+1}^m is $\beta(1-\delta+i_{t+1}) < 1$ if $i_{t+1} < r+\delta$, and its fixed point, divided by φ_0, is the benchmark $q_t^\star$, which solves the same recursion with zero taxes. This explains why i_t converges to $i_t^\star$ as the contract length T goes to ∞.

Productivity reset upon CEO turnover. For $t \geq 0$, Z_{t+1} is drawn from the uniform distribution, so (A.16) and (A.18) hold whatever Z_0, and $i_t - i_{t+1}$ has the sign of the difference between the two sides of (A.19) at every $t < T$. By (A.20) and (A.15) at $t = 0$, $\chi = Z_0 + (1-\delta)q_0^m/\varphi_0 + \frac{1}{2\psi}\left(q_0^m/\varphi_0 - 1\right)^2$, so that

$$\frac{\varphi_0\chi}{1+\varphi_0} - (Z_0 - \mu) = \mu + \frac{1}{2\psi}\left[\frac{\chi}{(1+r)(1+\varphi_0)} - 1\right]^2 - (r+\delta)\frac{\chi}{(1+r)(1+\varphi_0)}$$
$$+(1-\delta)\left[\frac{q_0^m}{\varphi_0} - \frac{\chi}{(1+r)(1+\varphi_0)}\right] + \frac{1}{2\psi}\left\{\left[\frac{q_0^m}{\varphi_0} - 1\right]^2 - \left[\frac{\chi}{(1+r)(1+\varphi_0)} - 1\right]^2\right\}.$$

$q_0^m/\varphi_0 - 1 - \psi i_T$ has the sign of the first line, and so do the terms in the second line, since (A.15) is increasing in q_t^m. Hence (A.19) holds if and only if

$$Z_0 - \mu < \frac{\varphi_0\chi}{1+\varphi_0}. \tag{A.21}$$

Finally, since i_t does not depend on Z_t, $d_t = Z_t - i_t - \frac{\psi}{2}i_t^2 \geq 0$, so that $\lambda_t^d = 0$, if and only if $\underline{Z} \geq i_t + \frac{\psi}{2}i_t^2$ for $t \geq 1$ and $Z_0 \geq i_0 + \frac{\psi}{2}i_0^2$. □

Proof of Proposition 3. With $\tau_c = \tau_d = \tau_p = 0$, $i_t = \delta$ and $x_t = 0$, $K_t = K_{T+1}^- = K_0$, $\varphi_t = \varphi_0$, and

$$d_t = Z_t - \delta - \frac{\psi}{2}\delta^2 - (1+r)b_t + b_{t+1} - \frac{\nu}{2}(b_{t+1} - b_t)^2 \geq 0, \tag{A.22}$$

which requires, along the debt path below, $\underline{Z} \geq \delta + \frac{\psi}{2}\delta^2 + (1+r)b_t - b_{t+1} + \frac{\nu}{2}(b_{t+1} - b_t)^2$ for $t \geq 1$, and the same with $Z_0 = \mu$ at $t = 0$. The envelope condition $m_{b,t} = \varphi_0[-(1+r) + \nu(b_{t+1} - b_t)]$ and the first-order condition combined result in

$$m_{b,t} = -\varphi_0 r + \beta\mathbb{E}_t[m_{b,t+1}], \qquad t < T. \tag{A.23}$$

At time T, (A.10) with $x_T = 0$ and $\lambda_T^d = \lambda_{T+1}^b = 0$ gives $1 - \nu(b_{T+1} - b_T) = 1/(1+\varphi_0)$, so that

$m_{b,T} = -\varphi_0[r + 1/(1+\varphi_0)]$. Since neither depends on (Z_t, b_t), and $r/(1-\beta) = 1+r$,

$$m_{b,t} = -\varphi_0(1+r) + \beta^{T-t}\frac{\varphi_0^2}{1+\varphi_0}, \tag{A.24}$$

$$b_{t+1} - b_t = \frac{1}{\nu}\left[1 + \frac{\beta m_{b,t+1}}{\varphi_0}\right] = \frac{\beta^{T-t}}{\nu}\frac{\varphi_0}{1+\varphi_0}, \qquad t \le T. \tag{A.25}$$

Hence $m_{b,t} < m_{b,t+1} < 0$, increments rise with t and fall with T, and the asset multiple χ does not enter into the analysis. The collateral constraint does not bind over the cycle if

$$\bar{b} > b_0 + \frac{(1+r)(1-\beta^{T+1})}{\nu r}\frac{\varphi_0}{1+\varphi_0}. \tag{A.26}$$

□

Proof of Proposition 4. With $\tau_c = \tau_p = 0$, $i_t = \delta$, $b_t = 0$, $\omega = 0$: $K_{t+1} = K_t$, $s_t = \mathbb{E}_t[v_{t+1}]/(1+r)$, $\varphi_{t+1} = \varphi_t[1 - (1+r)x_t/\mathbb{E}_t[v_{t+1}]]$ for $t < T$, and $m_t = \varphi_t m_{\varphi,t}$. Since the shocks Z_t are independent, $\mathbb{E}_t[m_{\varphi,t+1}]$ and $\mathbb{E}_t[v_{t+1}]$ do not depend on Z_t. The CEO solves

$$m_{\varphi,t} = \max_{x_t}\left\{(1-\tau_d)d_t + \beta\left(1 - \frac{(1+r)x_t}{\mathbb{E}_t[v_{t+1}]}\right)\mathbb{E}_t[m_{\varphi,t+1}]\right\}, \tag{A.27}$$

$$d_t = \left(Z_t - \delta - \frac{\psi}{2}\delta^2\right) + x_t - \frac{\kappa}{2}\max\{x_t, 0\}^2 \ge 0. \tag{A.28}$$

A dollar raised by issuing equity is paid out as a dividend, worth $1-\tau_d$ per unit of ownership net of the issuance cost, and dilutes the CEO's ownership by $(1+r)/\mathbb{E}_t[v_{t+1}]$, which she values at $\beta(1+r)\mathbb{E}_t[m_{\varphi,t+1}]/\mathbb{E}_t[v_{t+1}]$. The objective is therefore linear in $x_t \le 0$, with slope $(1-\tau_d) - \beta(1+r)\mathbb{E}_t[m_{\varphi,t+1}]/\mathbb{E}_t[v_{t+1}]$, and concave in $x_t > 0$, which gives the rule; under issuance, $x_t < 1/\kappa < s_t$. At T, the CEO trades shares at the price s_T at which she sells them, so that a dollar paid out through repurchases is worth one dollar per unit of ownership, and a dividend only $1-\tau_d$: she repurchases with all free cash flow, $d_T = 0$, and $m_{\varphi,T} = s_T - x_T = v_T$.

The CEO's valuation of her shares. In both cases of the rule, $m_{\varphi,t} = (1-\tau_d)d_t + \beta(1+r)\frac{\mathbb{E}_t[m_{\varphi,t+1}]}{\mathbb{E}_t[v_{t+1}]}(s_t - x_t)$, whereas shareholders value the same payouts at $v_t = (1-\tau_d)d_t + s_t - x_t$. Hence

$$\frac{\mathbb{E}_{t-1}[m_{\varphi,t}]}{\mathbb{E}_{t-1}[v_t]} = \frac{(1-\tau_d)\mathbb{E}_{t-1}[d_t]}{\mathbb{E}_{t-1}[v_t]} + \left[1 - \frac{(1-\tau_d)\mathbb{E}_{t-1}[d_t]}{\mathbb{E}_{t-1}[v_t]}\right]\beta(1+r)\frac{\mathbb{E}_t[m_{\varphi,t+1}]}{\mathbb{E}_t[v_{t+1}]}: \tag{A.29}$$

the CEO's valuation of her shares relative to their market value is a weighted average of one, for

the after-tax dividend that she and the market value equally, and of the same ratio next period, discounted by $\beta(1+r)$, for the shares she holds after the trade.

Patient CEO. With $\beta(1+r)=1$, $\mathbb{E}_{T-1}[m_{\varphi,T}]=\mathbb{E}_{T-1}[v_T]$ gives a repurchase at $T-1$, $d_{T-1}=0$, and, by (A.29), $\mathbb{E}_{T-2}[m_{\varphi,T-1}]=\mathbb{E}_{T-2}[v_{T-1}]$. By induction, the CEO values her shares at their price at every date and repurchases with all free cash flow, which is the unique benchmark policy.

Impatient CEO. If she repurchases at every date after t, dividends are zero at those dates, and (A.29) gives $\mathbb{E}_t[m_{\varphi,t+1}]/\mathbb{E}_t[v_{t+1}]=[\beta(1+r)]^{T-t-1}$: she discounts her shares by $\beta(1+r)$ for each remaining year in which she holds them. She then repurchases at t if and only if $[\beta(1+r)]^{T-t}>1-\tau_d$. Since $[\beta(1+r)]^{T-t}$ increases with t, she repurchases at every t with $[\beta(1+r)]^{T-t}>1-\tau_d$, and issues equity at the latest t with $[\beta(1+r)]^{T-t}<1-\tau_d$. Finally, if she issues equity at t, then $\beta(1+r)\mathbb{E}_t[m_{\varphi,t+1}]<(1-\tau_d)\mathbb{E}_t[v_{t+1}]$, and (A.29) gives

$$\beta(1+r)\frac{\mathbb{E}_{t-1}[m_{\varphi,t}]}{\mathbb{E}_{t-1}[v_t]}<\beta(1+r)\left[(1-\tau_d)+\tau_d\frac{(1-\tau_d)\mathbb{E}_{t-1}[d_t]}{\mathbb{E}_{t-1}[v_t]}\right]\leq 1-\tau_d,$$

under the stated condition on $\mathbb{E}_{t-1}[d_t]/\mathbb{E}_{t-1}[v_t]$, so she issues equity at $t-1$ as well. □

Proof of Proposition 5. (i) (A.4) gives $m_T=(1-\tau_p)\omega+\varphi_T[(1-\tau_d)d_T-x_T+s_T]$. With $\omega=0$ and $\xi=0$, $m_T=\varphi_T v_T$. Suppose $m_{t+1}=\varphi_{t+1}v_{t+1}$. Since shares are traded at their market value, each share the CEO holds at $t+1$ is worth its price at t: $\beta(1-\delta+i_t)\mathbb{E}_t[m_{t+1}]=\varphi_{t+1}s_t=\varphi_t(s_t-x_t)$. Hence $m_t=\varphi_t[(1-\tau_d)d_t-x_t+s_t]=\varphi_t v_t$, and, by induction, $m_t=\varphi_t v_t$ at every $t\leq T$. (ii) The CEO's policies and the debt reset, executed at market value by (A.5), are feasible for a firm that never changes CEO, which in addition saves $\varphi_0 S_T>0$ every cycle; by homogeneity, $v^\star(Z_0,b_0)>\chi-b_0$. (iii) We show that

$$\left[1-(1+r)^{-(T+1)}\frac{K^-_{T+1}}{K_0}\right]\mathcal{A}_T\,v^\star(Z_0,b_0)=v^\star(Z_0,b_0)$$
$$-\frac{1}{K_0}\,\mathbb{E}_0\left[\sum_{t=0}^{T}\frac{(1-\tau_d)D_t-X_t}{(1+r)^t}+\frac{1}{(1+r)^T}\left(\frac{v^\star(Z_0,b_0)}{1+r}+b_0-b_{T+1}\right)K^-_{T+1}\right],\quad\text{(A.30)}$$

where the right-hand side is the shareholder value, per unit of K_0, lost within one CEO cycle by following the CEO's policies until T instead of the benchmark policies, with the debt reset at turnover and the benchmark policies afterwards, and without turnover costs. By (12), (11) and

(A.6), with $B_0 = b_0 K_0$ at the start of the cycle, $B_0 = b_0 K_{T+1}$ at turnover and $B_{T+1} = b_{T+1} K_{T+1}^-$,

$$\chi - b_0 = \frac{1}{K_0}\,\mathbb{E}_0\left[\sum_{t=0}^{T} \frac{(1-\tau_d)D_t - X_t}{(1+r)^t} + \frac{1}{(1+r)^T}\left\{\left(\frac{\chi - b_0}{1+r} + b_0 - b_{T+1}\right) K_{T+1}^- - \varphi_0 S_T\right\}\right]. \tag{A.31}$$

Subtracting (A.31) from $v^\star(Z_0, b_0)$, with K_{T+1}^-/K_0 deterministic, $v^\star(Z_0, b_0) - (\chi - b_0)$ equals the right-hand side of (A.30) plus

$$(1+r)^{-(T+1)} \frac{K_{T+1}^-}{K_0} \left[v^\star(Z_0, b_0) - (\chi - b_0)\right] + (1+r)^{-T} \varphi_0\, \mathbb{E}_0[S_T]/K_0.$$

Hence, by (21),

$$v^\star(Z_0, b_0) - (\chi - b_0) - \theta = \frac{\text{right-hand side of (A.30)}}{1 - (1+r)^{-(T+1)} K_{T+1}^-/K_0}, \tag{A.32}$$

which, by (22), gives (A.30). The CEO's policies until T, the debt reset at turnover and the benchmark policies afterwards are feasible for a firm that never changes CEO, so the right-hand side of (A.30) is non-negative, and zero if and only if the policies coincide, by strict concavity of (A.2); hence $\mathcal{A}_T \geq 0$, with equality if and only if the policies coincide. Under the assumptions of Proposition 2, the benchmark investment rate is constant, since $q_t^\star$ does not depend on Z_t and the benchmark firm has no CEO cycle, whereas the CEO's investment rate strictly declines over $t < T$. Under those of Proposition 3, the benchmark firm keeps its debt balance constant, by (A.14) with $\tau_c = 0$, whereas the CEO's debt increments are strictly positive by (17). In both cases the policies differ, and $\mathcal{A}_T > 0$. □

Proofs for Section 4.6. Each extension switches on one feature at a time, with the others as in the baseline model, $\gamma = 0$, $g = 0$ and $\alpha = 0$, in the special cases of Propositions 2 to 4.

Risk averse CEO: preferences. The CEO has preferences $U(W_t) = W_t - \frac{\gamma}{2} K_t (W_t/K_t)^2$ over her compensation each period, and $U_T = U(W_T) + U\big(\varphi_T(S_T - X_T)\big)$ at turnover. Her value function remains homogeneous of degree one in K_t: the scaled problems (A.3) and (A.4) hold with w_t replaced by $w_t - \frac{\gamma}{2} w_t^2$ and $\varphi_T(s_T - x_T)$ by $\varphi_T(s_T - x_T) - \frac{\gamma}{2}[\varphi_T(s_T - x_T)]^2$. We assume $\gamma w_t < 1$ and $\gamma \varphi_T(s_T - x_T) < 1$, so that her marginal utility of wealth is positive.

Risk aversion and investment. Under the assumptions of Proposition 2, $w_t = \varphi_0 d_t$ with $d_t = Z_t - i_t - \frac{\psi}{2} i_t^2$, and the first-order condition with respect to i_t is $\varphi_0(1 - \gamma\varphi_0 d_t)(1 + \psi i_t) = q_t^m$, $t < T$. Since productivity draws are independent, q_t^m does not depend on Z_t, and implicit differentiation

gives

$$\frac{\partial i_t}{\partial Z_t} = \frac{\gamma\varphi_0(1+\psi i_t)}{\gamma\varphi_0(1+\psi i_t)^2 + \psi(1-\gamma\varphi_0 d_t)} > 0.$$

The CEO invests more when productivity is high, as a dollar of dividends is then worth less to her, so that her dividends vary less than one for one with productivity. With $\gamma = 0$, investment does not depend on Z_t, and converges to the benchmark investment rate as $T - t \to \infty$ (Proposition 2), whereas, with $\gamma > 0$, it still varies with Z_t. The CEO's policies thus differ from the benchmark policies, and, by the proof of Proposition 5, which applies to any policies, risk aversion generates agency costs even with $\xi = 0$ and $\omega = 0$.

Risk aversion and the asset multiple. Under the assumptions of Proposition 2, and if $(1 + r)^{-(T+1)} K^-_{T+1}/K_0 < 1+\varphi_0$ for every investment policy, χ is strictly lower with $\gamma > 0$ than with $\gamma = 0$. Let $\chi(\gamma)$ denote the solution of (A.20) when all CEOs have risk aversion γ. For any investment policy, the right-hand side of (A.20) increases with χ with slope $\beta^{T+1} K^-_{T+1}/[(1+\varphi_0)K_0] < 1$. With $\gamma = 0$, $m_t = \varphi_0 v_t$ by Proposition 5, so that, for any given χ, the risk-neutral CEO chooses the unique investment policy that maximizes the right-hand side of (A.20). The risk-averse CEO's policy is feasible but differs from it, by the previous paragraph, so that, at every χ, it yields a strictly lower right-hand side. The maximum of the right-hand side minus χ is therefore strictly decreasing in χ, zero at $\chi(0)$, and strictly positive at $\chi(\gamma)$, so that $\chi(\gamma) < \chi(0)$.

Risk aversion and investment at turnover. At T, the CEO maximizes $\varphi_0 d_T - \frac{\gamma}{2}(\varphi_0 d_T)^2 + \varphi_0 s_T - \frac{\gamma}{2}(\varphi_0 s_T)^2$, with $s_T = (1 - \delta + i_T)\chi/[(1 + r)(1 + \varphi_0)]$ by (A.8), which gives

$$1 + \psi i_T = \frac{\chi}{(1+r)(1+\varphi_0)} \cdot \frac{1 - \gamma\varphi_0 s_T}{1 - \gamma\varphi_0 d_T}.$$

She values a dollar received from selling her shares at $\varphi_0(1 - \gamma\varphi_0 s_T)$, and a dollar of dividends at $\varphi_0(1 - \gamma\varphi_0 d_T)$. If $s_T > d_T$, the last factor is below one, and $1 + \psi i_T < \chi(\gamma)/[(1 + r)(1 + \varphi_0)] < \chi(0)/[(1 + r)(1 + \varphi_0)]$, which is $1 + \psi i_T$ for a risk-neutral CEO by (A.17).

Risk aversion and debt financing. Under the assumptions of Proposition 3, in the interior region with $\nu(b_{t+1} - b_t) < 1$, the first-order condition with respect to b_{t+1} is

$$\varphi_0(1 - \gamma\varphi_0 d_t)\,[1 - \nu(b_{t+1} - b_t)] = -\beta\,\mathbb{E}_t[m_{b,t+1}], \qquad t < T,$$

with d_t given by (A.22). The right-hand side does not depend on Z_t, and, since the CEO's utility

is concave in her dividends and in the proceeds from selling her shares, which are concave in her debt policy, $\partial \mathbb{E}_t[m_{b,t+1}]/\partial b_{t+1} \leq 0$. Implicit differentiation then gives $\partial b_{t+1}/\partial Z_t < 0$: she borrows more when productivity is low. At T, with $\partial s_T/\partial b_{T+1} = -1/(1+\varphi_0)$ by (A.8),

$$1 - \nu(b_{T+1} - b_T) = \frac{1}{1+\varphi_0} \cdot \frac{1-\gamma\varphi_0 s_T}{1-\gamma\varphi_0 d_T},$$

so that, if $s_T > d_T$, $b_{T+1} - b_T$ exceeds the increment of a risk-neutral CEO, $\varphi_0/[\nu(1+\varphi_0)]$ by (17), whatever χ.

Risk aversion and share repurchases. Under the assumptions of Proposition 4, at T, a dollar paid out as a dividend raises the CEO's utility by $(1-\tau_d)\varphi_T(1-\gamma w_T)$, and a dollar paid out through repurchases raises it by $\varphi_T[1-\gamma\varphi_T(s_T - x_T)]$. Her terminal utility is concave in the split between the two, and, when she repurchases shares with all available cashflows, $w_T = 0$ and $s_T - x_T = v_T$. She therefore pays dividends rather than repurchasing shares at turnover if and only if $\gamma\varphi_T v_T > \tau_d$.

Equity grants during tenure: the CEO's value function. With grants, $\varphi_{t+1}S_t = \varphi_t(S_t - X_t) + gS_t$, and D_t in (8) is reduced by gS_t, $t < T$. With $\xi = 0$, for any corporate policies,

$$\mathcal{M}_t = \varphi_t V_t + \mathbb{E}_t\left[\sum_{s=t}^{T} \frac{(1-\tau_p)\omega K_s}{(1+r)^{s-t}} + \sum_{s=t}^{T-1} \frac{gS_s}{(1+r)^{s-t}}\right].$$

By backward induction: $\mathcal{M}_T = (1-\tau_p)\omega K_T + \varphi_T V_T$ by (4), and, if the equation holds at $t+1$, $\mathcal{M}_t = W_t + \mathbb{E}_t[\mathcal{M}_{t+1}]/(1+r)$ with $\mathbb{E}_t[\varphi_{t+1}V_{t+1}]/(1+r) = \varphi_{t+1}S_t = \varphi_t(S_t - X_t) + gS_t$ gives it at t. The CEO thus maximizes shareholder value plus the present value of her grants until turnover, per unit of ownership. When computing agency costs, we add the present value of the grants to the numerator of θ in (21).

Equity grants and investment. Under the assumptions of Proposition 2 with $g > 0$, $\varphi_t = \varphi_0 + gt$, the grant costs gS_t with $S_t = K_{t+1}\mathbb{E}_t[v_{t+1}]/(1+r)$, and, by the value function above, m_{t+1} equals $\varphi_{t+1}v_{t+1}$ plus the present value of her remaining grants per unit of K_{t+1}. The first-order condition with respect to i_t gives

$$1 + \psi i_t = q_t + \frac{1}{(1+r)\varphi_t}\left[g(1-\varphi_t)\,\mathbb{E}_t[v_{t+1}] + \frac{1}{K_{t+1}}\,\mathbb{E}_t\left[\sum_{s=t+1}^{T-1} \frac{gS_s}{(1+r)^{s-t-1}}\right]\right], \qquad t < T,$$

where the last term is strictly positive, whereas, without grants, $1 + \psi i_t = q_t$ by Proposition 5. At

T, no grant remains, and the investment rule is (A.17).

Equity grants and the asset multiple. Under the same assumptions, with $b_0 = 0$, $0 < g < 1$ and $(1+r)^{-(T+1)} K^-_{T+1}/K_0 < 1 + \varphi_0$, χ strictly decreases with g for given investment policies. With zero taxes, $V_t = D_t + S_t$, so that, for $t < T$, $S_t = \mathbb{E}_t[(Z_{t+1} - i_{t+1} - \frac{\psi}{2} i^2_{t+1})K_{t+1} + (1 - g\mathbb{1}_{\{t+1<T\}})S_{t+1}]/(1+r)$, with $S_T = \chi K^-_{T+1}/[(1+r)(1+\varphi_0)]$. Each S_t thus increases with χ. The fixed point (12) reads

$$\chi \left[1 - \frac{K^-_{T+1}}{(1+r)^{T+1}(1+\varphi_0)K_0} \right] + \frac{g}{K_0} \sum_{t=0}^{T-1} \frac{\mathbb{E}_0[S_t]}{(1+r)^t} = \frac{1}{K_0} \sum_{t=0}^{T} \frac{\mathbb{E}_0\left[(Z_t - i_t - \frac{\psi}{2} i_t^2)K_t\right]}{(1+r)^t},$$

whose left-hand side strictly increases with χ and g, and whose right-hand side depends on neither.

Equity grants and debt financing. Under the assumptions of Proposition 3, in the interior region, the CEO borrows strictly less than in (17) at every $t < T$, and as much at T. Since the firm pays the grants it gives the CEO, the value function above gives $\mathcal{M}_t/\varphi_t$ equal to the firm's payouts before the cost of the grants, which is the objective of Proposition 3 per unit of ownership, plus $(1-\varphi_t)/\varphi_t$ times the present value of her remaining grants. By the proof of Proposition 3, debt increments do not depend on the level of debt, so that a unit of debt raised at t raises debt by one unit at every later date, and, by the recursion for S_t above, with $g < 1$, lowers S_s at every $s \geq t$. The second term thus adds a strictly positive marginal cost of debt at every $t < T$, and none at T.

Equity grants and share repurchases. Under the assumptions of Proposition 4 with $\xi = 0$, the CEO maximizes V_t plus $1/\varphi_t$ times the present value of gS_s, $s < T$. Net equity issues affect neither the capital stock nor debt, and repurchasing shares with all available cashflows maximizes the market value of equity at every date, so that she repurchases shares with all available cashflows at every date.

Grants tied to earnings per share: the CEO's value function. With N_t the CEO's number of shares and $\vartheta_t = \varphi_t \Pi_t / N_t$, $\varphi_{t+1} S_t = \varphi_t (S_t - X_t) + \alpha N_t \max\{\vartheta_t, 0\}$, D_t in (8) is reduced by the cost of these grants, $t < T$, and, as for the grants above, with $\xi = 0$,

$$\mathcal{M}_t = \varphi_t V_t + \mathbb{E}_t \left[\sum_{s=t}^{T} \frac{(1-\tau_p)\omega K_s}{(1+r)^{s-t}} + \sum_{s=t}^{T-1} \frac{\alpha N_s \max\{\vartheta_s, 0\}}{(1+r)^{s-t}} \right].$$

As α grows, the weight on shareholder value vanishes, and the CEO maximizes the earnings on her

shares, $N_s\vartheta_s = \varphi_s\Pi_s$, until turnover. Since these grants depend on her future equity shares φ_s, share repurchases raise every grant until turnover.

Grants tied to earnings per share and share repurchases. Under the assumptions of Proposition 4, with $\Pi_t \geq 0$ and $\varphi_0 \to 0$, net income per unit of capital, $\pi_t = Z_t - \delta - \frac{\psi}{2}\delta^2$, does not depend on the CEO's policies, and the cost of the grants to the firm vanishes. With $R_t \equiv \beta(1+r)\mathbb{E}_t[m_{\varphi,t+1}]/\mathbb{E}_t[v_{t+1}]$, $m_t = \varphi_t m_{\varphi,t}$ and $m_{\varphi,t} = \max_{x_t}\{(1-\tau_d)d_t + R_t(s_t - x_t + \alpha\pi_t)\}$, so that, as in Proposition 4, she repurchases shares at t if and only if $R_t > 1-\tau_d$. If she repurchases at every date after t,

$$R_t = [\beta(1+r)]^{T-t}\prod_{s=t+1}^{T-1}\left(1+\alpha\frac{\mathbb{E}_{s-1}[\pi_s]}{\mathbb{E}_{s-1}[v_s]}\right) \geq [\beta(1+r)]^{T-t}:$$

every share she holds earns her a return of α times the earnings yield at every remaining date. By backward induction, she repurchases at every date at which she does with $\alpha = 0$, and at every date if $\beta(1+r) > 1-\tau_d$ and $\alpha\,\mathbb{E}_{t-1}[\pi_t]/\mathbb{E}_{t-1}[v_t] \geq \xi/\beta$ at every $0 < t < T$, since then $R_t \geq R_{t+1}$.

Grants tied to earnings per share and shareholder value. Under the same assumptions, (A.1) gives $d_t = \pi_t + x_t - \frac{\kappa}{2}\max\{x_t, 0\}^2$, so that the payout to shareholders is $(1-\tau_d)d_t - x_t = \pi_t - \tau_d d_t - \frac{\kappa}{2}\max\{x_t,0\}^2$, whereas the benchmark firm repurchases shares with all available cashflows and pays out π_t. The shareholder value lost at t is therefore $\tau_d d_t + \frac{\kappa}{2}\max\{x_t,0\}^2$, which is strictly positive at every date at which the CEO issues equity to pay dividends, and zero at every date at which she repurchases shares with all available cashflows. By the previous paragraph, the grants reduce the dates at which the CEO issues equity, and eliminate them under the stated conditions.

Grants tied to earnings per share and investment. Under the assumptions of Proposition 2, with $\varphi_0 \to 0$, $\pi_t = Z_t - \delta - \frac{\psi}{2}i_t^2$, and, as above, $m_{\varphi,t} = \max_{i_t}\{d_t + \beta(1-\delta+i_t)\,\mathbb{E}_t[m_{\varphi,t+1}] + \alpha R_t\pi_t\}$, where R_t does not depend on i_t. The first-order condition gives

$$1 + \psi i_t(1+\alpha R_t) = \beta\,\mathbb{E}_t[m_{\varphi,t+1}].$$

The grants weight the adjustment costs of investment by $1+\alpha R_t > 1$, since they reduce net income at once, and reward capital only through the net income it earns until turnover. With $\alpha = 0$, $m_{\varphi,t} = v_t$ by Proposition 5, and, as $\varphi_0 \to 0$, the CEO values capital at turnover at its market value $\chi/(1+r)$, so that she solves the shareholders' problem (A.2) and follows the benchmark rule

$1 + \psi i_t = q_t^\star$, from which her rule departs with $\alpha > 0$.

Grants tied to earnings per share and debt financing. Under the assumptions of Proposition 3, with $\Pi_t \geq 0$ and $\varphi_0 \to 0$, $\pi_t = Z_t - \delta - \frac{\psi}{2}\delta^2 - r b_t$, and $m_{\varphi,t} = d_t + \beta\, \mathbb{E}_t[m_{\varphi,t+1}] + \alpha R_t \pi_t$, with d_t given by (A.22). With $\alpha = 0$, $R_t = 1$, so that $\alpha R_t \pi_t = \alpha \pi_t + O(\alpha^2)$. By the proof of Proposition 3, as $\varphi_0 \to 0$, a unit of debt raised at t costs one dollar per unit of ownership, and, to first order in α, also reduces net income by r at every date $s = t+1, \ldots, T-1$. The first-order condition with respect to b_{t+1} is then $1 - \nu(b_{t+1} - b_t) = 1 + \alpha r \sum_{s=t+1}^{T-1} \beta^{s-t}$, so that, since $r\beta/(1-\beta) = 1$,

$$b_{t+1} - b_t = -\frac{\alpha}{\nu}\left(1 - \beta^{T-t-1}\right) < 0, \quad t < T-1, \qquad b_{t+1} - b_t = 0, \quad t = T-1, T :$$

the CEO reduces leverage over her tenure, whereas, with $\alpha = 0$ and $\varphi_0 \to 0$, she keeps it constant.

Appendix B Data and Additional Empirical Analysis

Table B.1: **Variable Definitions.** The table defines every variable used in the figures and tables and gives its source.

Variable name	Definition
Panel A: CEO-level variables (Source: Equilar and Execucomp)	
CEO tenure	Years since becoming CEO of the firm; tenure year 1 is the first year in office
Maximum tenure length	Total tenure length observed for a CEO–firm pair (right-censored in 2020)
CEO age	Age of the CEO in the fiscal year, computed from the age and the date on which it was recorded (Equilar; for CEOs covered only by Execucomp, the present age `PAGE`, recorded in 2020). Age at appointment is the age in the first year of tenure
CEO ownership	Shares held by the CEO, excluding options, as a fraction of shares outstanding (Equilar)
Effective CEO ownership	Shares owned plus 0.7× options and warrants, as a fraction of shares outstanding; its mean in the first tenure year is the entry stake φ_0 of the calibration
Cash pay	Salary (`SALARY`) plus bonus (`BONUS`) scaled by total assets (`at`); over total capital, the empirical counterpart of ω
Total compensation	Total compensation (`TDC1`) scaled by total assets (`at`)
CEO bonus	Bonus compensation (`BONUS`) scaled by total assets (`at`)

Continued on next page

Table B.1 continued from previous page

Variable name	Definition
CEO wealth	Accumulated compensation plus public equity holdings, scaled by total assets (`at`)
Panel B: Firm-level variables (Source: Compustat North America Annual & Peters and Taylor)	
Total capital	Gross property, plant and equipment plus the intangible capital stock of Peters and Taylor (2017), $\texttt{ppegt} + K^{int}$; the empirical counterpart of the model's capital K_t. Flows are scaled by total capital at the start of the year, stocks by total capital at the end of the year
Total investment	Capital expenditure plus R&D plus 0.3× SG&A net of R&D, over total capital, $(\texttt{capx} + \texttt{xrd} + 0.3\,(\texttt{xsga} - \texttt{xrd}))/K$; the baseline investment measure, and the model's i_t
Physical investment	Capital expenditure over total capital, $\texttt{capx}/K$ (the alternative definition)
Net leverage	Debt net of cash over total capital at the end of the year, $(\texttt{dlc} + \texttt{dltt} - \texttt{che})/K$; the baseline leverage measure, and the model's b_t
Gross leverage	Total debt over total capital, $(\texttt{dlc} + \texttt{dltt})/K$ (the alternative definition)
Net repurchases	Share repurchases net of equity issuance over total capital, $(\texttt{prstkc} - \texttt{sstk})/K$; the baseline payout measure, and minus the model's net equity issuance x_t
Gross repurchases	Share repurchases over total capital, $\texttt{prstkc}/K$ (the alternative definition)
Net debt issuance	Debt issued net of debt retired over total capital, $(\texttt{dltis} - \texttt{dltr})/K$
Dividends	Common dividends, `dvc/at`
Asset sales	Sale of property, plant and equipment, `sppe/at`
Gross profit	Sales minus cost of goods sold over total capital, $(\texttt{sale} - \texttt{cogs})/K$; the profitability measure targeted in the calibration, and the empirical counterpart of the model's profits per unit of capital
Gross profit over assets	Sales minus cost of goods sold over total assets at the start of the year, $(\texttt{sale} - \texttt{cogs})/\texttt{at}$; its serial correlation and its variance, scaled to the mean of gross profit over total capital, are the profitability moments of the calibration
Firm value	Market equity plus debt net of cash over total capital at the end of the year, $(\texttt{prcc_f} \times \texttt{csho} + \texttt{dlc} + \texttt{dltt} - \texttt{che})/K$; the empirical counterpart of χ
Profitability	Operating income before depreciation over total assets, `oibdp/at` (used in the summary statistics and as a control)
Size	Natural logarithm of total assets, log(`at`)
Tangibility	Net property, plant and equipment over total assets, `ppent/at`

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Table B.1 continued from previous page

Variable name	Definition
Market-to-book	Market equity (`prcc_f`×`csho`) plus book debt (`at` − `ceq`) over total assets
Cash flow volatility	Rolling three-year standard deviation of profitability
Investment volatility	Rolling three-year standard deviation of investment
Panel C: Macroeconomic controls (Source: FRED)	
BAA spread	Moody's Baa corporate bond yield less the ten-year Treasury yield, in percentage points
Recession	Indicator equal to one in a year containing an NBER recession month
GDP growth	Annual growth rate of real gross domestic product
VIX	Annual average of the CBOE volatility index
Term spread	Ten-year Treasury yield less the three-month Treasury bill rate, in percentage points
Ten-year yield	Annual average of the ten-year Treasury yield, in percent
Three-month rate	Annual average of the three-month Treasury bill rate, in percent
Federal funds rate	Annual average of the effective federal funds rate, in percent
CPI inflation	Annual growth rate of the consumer price index

Table B.2: **Summary Statistics.** The table reports summary statistics for the sample, 1992–2020, after the filters and winsorization used throughout the paper. The first block has one observation per CEO–firm cycle; the other blocks use the annual panel. Entry ownership is measured in the CEO's first tenure year, and the ownership variables are available from 2006. Variable definitions are in Table B.1.

	Mean	Median	p_{25}	p_{75}	S.d.	N
CEO–firm spells						
Tenure length (years)	5.00	4.00	2.00	7.00	3.96	5,457
Age at appointment	52.1	52.0	47.0	57.0	7.1	5,442
Entry ownership (effective, %)	1.65	0.67	0.25	1.59	3.49	2,146
Entry ownership (shares only, %)	1.34	0.43	0.16	1.03	3.67	2,539
Firm-years						
Total assets ($M)	7,989	1,529	432	5,234	25,487	24,714
Market-to-book	1.62	1.24	0.85	1.92	1.25	24,714
Profitability (%)	9.90	11.97	7.13	16.96	15.09	24,714
Tangibility (%)	25.87	18.77	9.17	36.58	21.92	24,714
Total investment / total capital (%)	14.37	12.33	8.18	17.61	9.81	24,667
Net leverage / total capital (%)	6.44	9.28	-9.20	24.19	31.09	24,714
Net repurchases / total capital (%)	0.60	0.01	-0.37	2.50	8.83	24,667
Gross profit / total capital (%)	35.48	31.69	19.93	46.26	24.97	24,667
Dividends / assets (%)	1.24	0.10	0.00	1.77	2.19	24,714
CEO ownership (effective, %)	2.40	1.29	0.53	2.66	3.75	13,979
CEO ownership (shares only, %)	2.00	0.85	0.35	1.83	4.20	16,431
Cash pay / assets (%)	0.168	0.056	0.020	0.146	0.363	24,714
CEO wealth / assets (%)	10.07	3.43	1.41	8.66	22.59	14,243
Alternative definitions and controls						
Physical investment / total capital (%)	4.67	3.14	1.73	5.68	5.01	24,667
Gross leverage / total capital (%)	22.22	18.38	5.89	31.55	21.61	24,714
Gross repurchases / total capital (%)	2.86	0.27	0.00	3.26	5.63	24,667
Size (log assets)	7.29	7.33	6.07	8.56	1.89	24,714
BAA spread (%)	2.54	2.45	1.98	2.85	0.84	24,714
Recession indicator	0.158	0.000	0.000	0.000	0.365	24,714
GDP growth (%)	2.13	2.50	1.80	2.90	1.69	24,714

Table B.3: **Corporate Policies over CEO Tenure: Robustness.** The table reports coefficients of each policy on the tenure year over years 1 to 9, in percentage points of total capital per year, with CEO–firm fixed effects and standard errors clustered by firm and year. Panel A is the baseline; Panels B to E add firm controls, alternative definitions, CEO fixed effects and macroeconomic controls, as in Figure B.2; Panel F uses relative tenure; Panel G reports further sample and fixed-effect cuts. *, **, ***: significance at 10%, 5% and 1%.

	Total investment	Net leverage	Net repurchases
Panel A: baseline			
Tenure year	-0.477***	0.946***	0.193***
	(0.061)	(0.210)	(0.053)
Firm-years	22,011	22,058	22,011
Panel B: with firm controls (size, profitability, tangibility, market-to-book)			
Tenure year	-0.694***	0.392**	0.387***
	(0.082)	(0.178)	(0.055)
Panel C: alternative definitions (physical investment, gross leverage, gross repurchases)			
Tenure year	-0.203***	0.448***	0.012
	(0.033)	(0.163)	(0.042)
Panel D: CEO fixed effects (executive identity, full-coverage id)			
Tenure year	-0.491***	0.912***	0.140*
	(0.078)	(0.229)	(0.073)
Panel E: with macro controls (BAA spread, recession, GDP growth)			
Tenure year	-0.429***	1.030***	0.223***
	(0.049)	(0.203)	(0.044)
Panel F: relative tenure: coefficient per unit of the fraction of the spell elapsed			
Fraction elapsed	-4.016***	8.038***	1.416***
	(0.425)	(1.415)	(0.461)
Firm-years	24,667	24,714	24,667
Panel G: sample and fixed-effect cuts (tenure year, spell FE unless stated)			
Firm fixed effects instead of spell	-0.336***	0.514***	0.165***
	(0.066)	(0.104)	(0.036)
All tenure years (no nine-year window)	-0.399***	0.748***	0.142***
	(0.041)	(0.165)	(0.043)
Dropping the entry year	-0.450***	0.977***	0.190***
	(0.070)	(0.223)	(0.058)
Dropping the last observed year	-0.422***	0.893***	0.207***
	(0.057)	(0.228)	(0.047)
Spells of at least four years	-0.457***	0.924***	0.185***
	(0.056)	(0.201)	(0.049)

Figure B.1: **The Distribution of CEO Tenure.** The figure shows the number of CEO–year observations by tenure year (Panel A) and the number of CEO–firm cycles by their length (Panel B) in the sample.

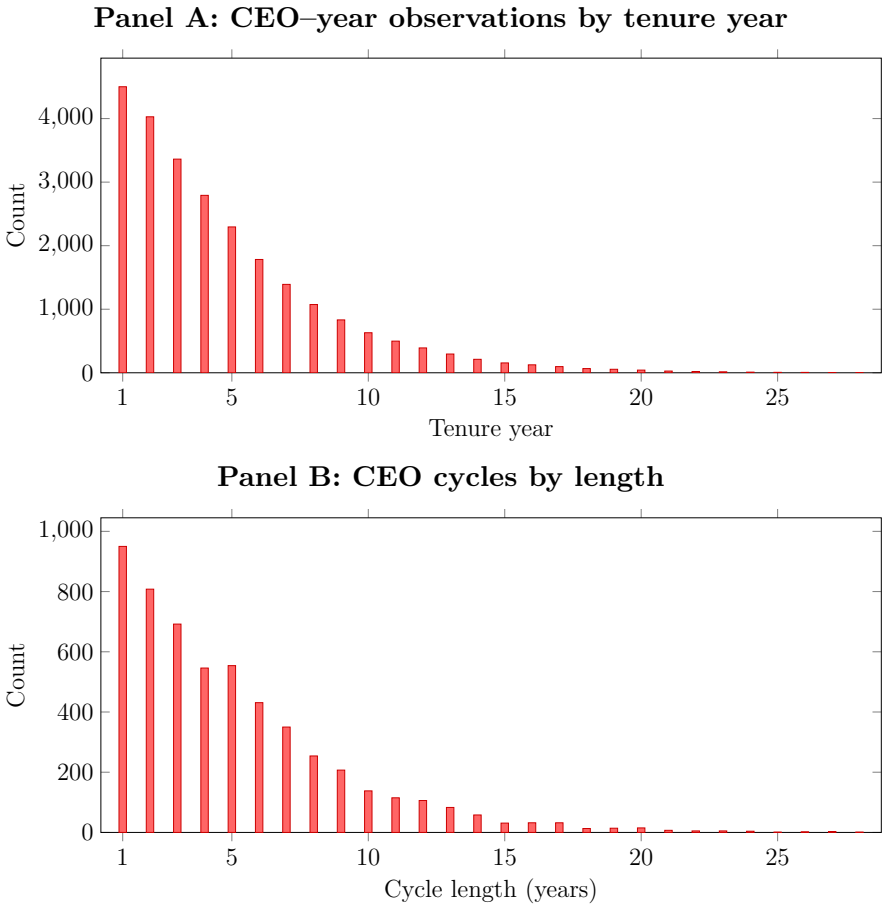


Figure B.2: **Corporate Policies over CEO Tenure: Robustness.** The figure repeats the tenure profiles of the three policies under four robustness cases: firm controls (Panel A), alternative definitions (Panel B), CEO fixed effects (Panel C) and macroeconomic controls (Panel D). Dots are the within profile by tenure year, with cycles of all lengths pooled, levelled at the sample mean; lines are the fitted slopes; the coefficients are in Table B.3.

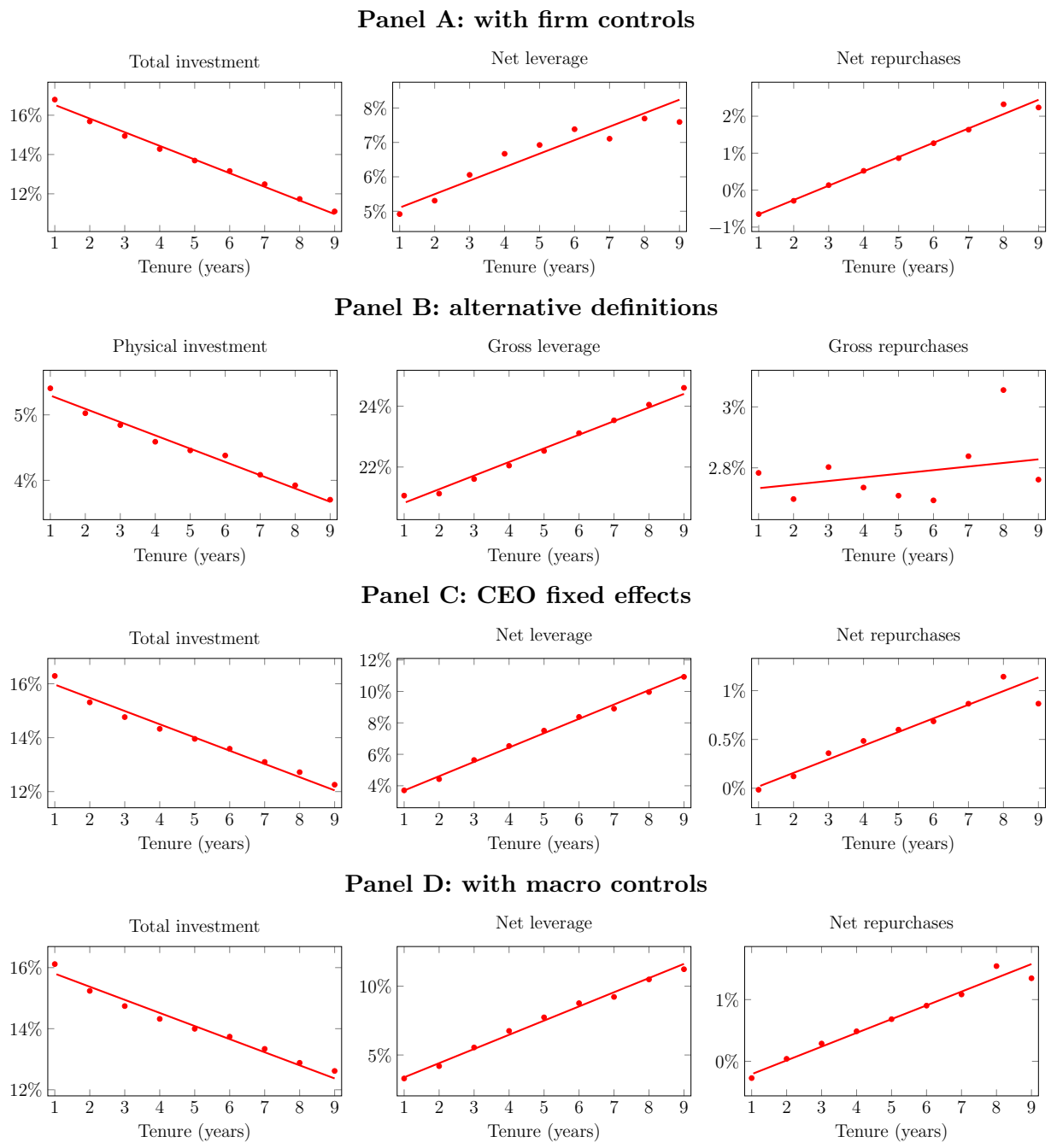


Figure B.3: **Corporate Policies over Relative CEO Tenure.** The figure shows the three policies against the fraction of the CEO cycle elapsed, in eight bins, with firm and year fixed effects, for cycles of two years or more. Dots are the within profile levelled at the sample mean; the line is the fitted slope, whose coefficient is Table 1, Panel A.

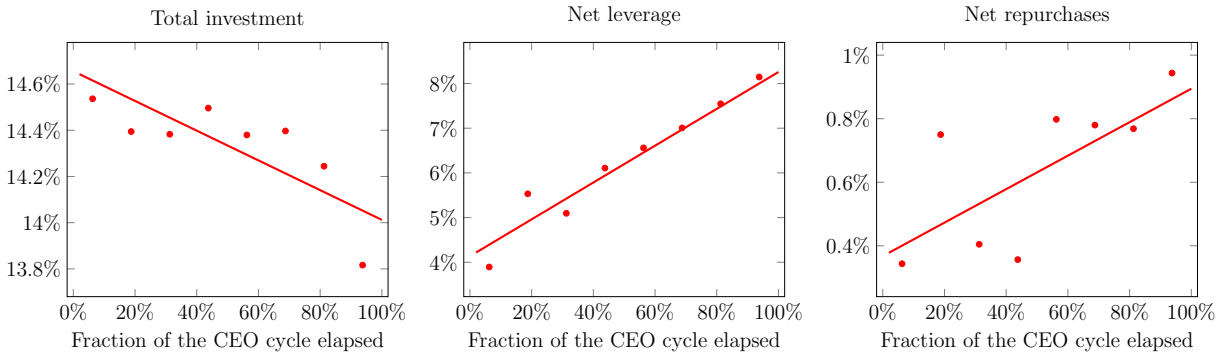


Figure B.4: **Corporate Policies over CEO Tenure under Three Designs.** The figure shows the tenure profiles of the three policies with firm and year fixed effects (Panel A), with CEO–firm fixed effects and the macroeconomic controls of Table B.1 in place of year effects (Panel B), and with CEO–firm fixed effects alone (Panel C). Dots are the within profile by tenure year, with cycles of all lengths pooled, levelled at the sample mean; lines are the fitted slopes.

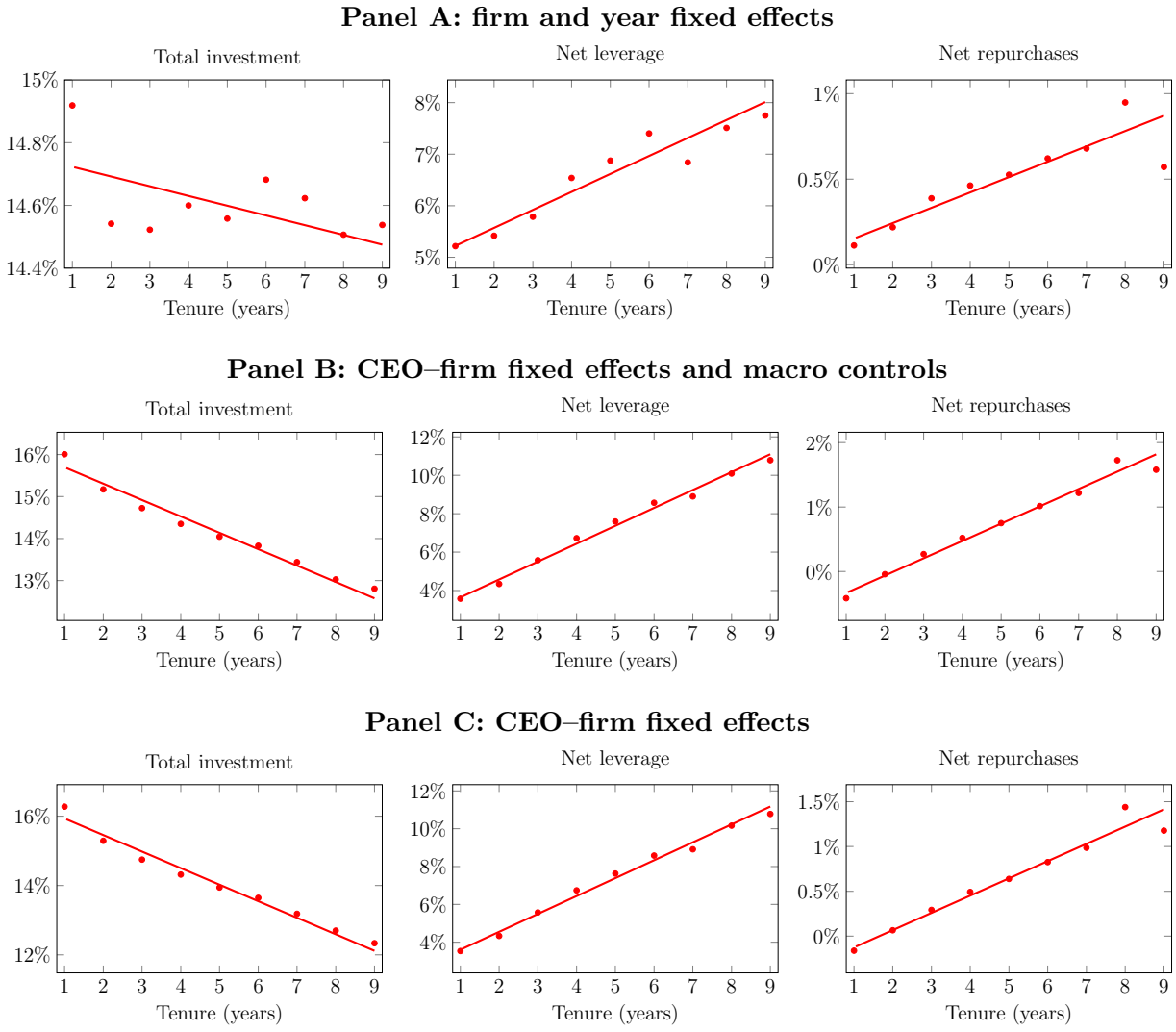
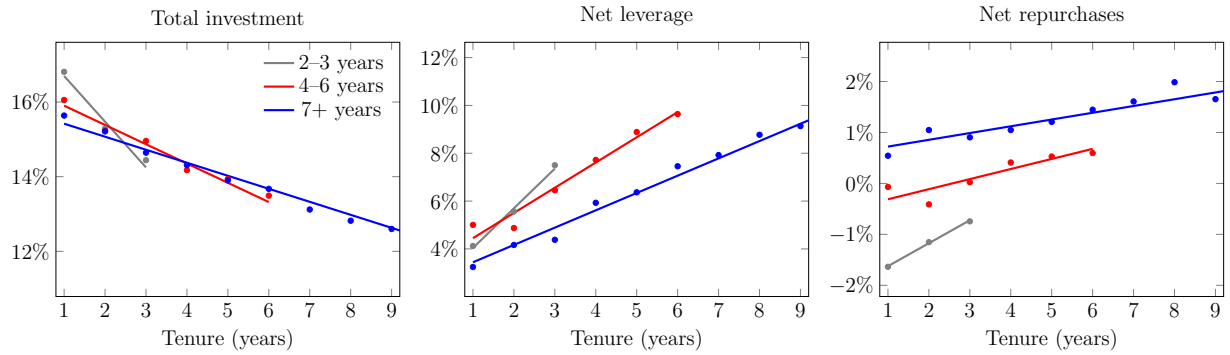


Figure B.5: **Corporate Policies over CEO Tenure, by Cycle Length, with CEO–Firm Fixed Effects.** The figure repeats Figure 1 with CEO–firm fixed effects in place of firm and year fixed effects, for cycles of 2–3 years (gray), 4–6 years (red) and 7 years or more (blue).



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