This draft: July 2010

The Internal Governance of Firms[1]

Viral V. Acharya
NYU-Stern, CEPR, ECGI and NBER

Stewart C. Myers
MIT and NBER

Raghuram Rajan
Booth School of Business
University of Chicago and NBER

We develop a model of internal governance where the self-serving actions of top management are limited by the potential reaction of subordinates. Internal governance can mitigate agency problems and ensure that firms have substantial value, even with little or no external governance by investors. External governance, even if crude and uninformed, can complement internal governance and improve efficiency. This leads to a theory of investment and dividend policy, where dividends are paid by self-interested CEOs to maintain a balance between internal and external control. Our paper can explain why partnerships work well even if control rights are concentrated at the top, why a public firm's shares have value even when shareholders have limited power, and when structuring an entity as a publicly-held firm is better than structuring it as a partnership.

[1] We thank Ashwini Agrawal, Franklin Allen, Effi Benmelech, John Coates, Douglas Diamond, Alex Edmans, Milton Harris, Roni Kisin, Mark Rubinstein, Amit Seru, Jeremy Stein, Raghu Sundaram, Rob Vishny, Michael Weisbach, Luigi Zingales and seminar participants at AEA Meetings (2010), Canadian Corporate Governance Institute, UC Berkeley, Chicago Booth, Harvard, Michigan State, MIT, NBER Corporate Finance Workshop (Fall 2008), NBER Law and Economics (Spring 2010), NYU Financial Economics Workshop, NYU-Stern, Federal Reserve Bank of Philadelphia, Tuck, UCLA, and the Western Finance Association (WFA 2009) for helpful conversations and comments. Ramin Baghai and Hanh Le provided excellent research assistance. Rajan acknowledges support from the Center for Research on Securities Prices at the University of Chicago, the National Science Foundation, and the Initiative on Global Markets.

Electronic copy available at: http://ssrn.com/abstract=1350580

The people you pay are more important over time than the people who pay you.[2]

A public corporation is commonly viewed as an organization run by CEOs and monitored by a board of directors on behalf of shareholders. This view separates decision management (by the CEO and other managers) from decision control (by the board) and from investment and risk-bearing (by public shareholders). This governance structure is viewed as reasonable and efficient (Fama and Jensen (1983a, b) and Jensen (2000)), provided that decisions are made to maximize the value of shareholders' residual claim. Many public corporations thrive with this governance structure.

Yet the clear evidence that public corporations "work" has to be set against the equally clear evidence that most shareholders have little control over boards (Monks (2008)) and that many boards treat CEOs generously (Bebchuk and Fried (2004)). CEOs are self interested, not automatically faithful servants of the shareholders (see, for example, Jensen (1986, 1993), Morck, Shleifer and Vishny (1990) and Shleifer and Vishny (1989, 1997)). The market for corporate control can provide some discipline, but it is hard to see it as effective in controlling operational decisions. How then can one reconcile the survival and apparent efficiency of the public corporation with the weak channels through which it is supposedly governed?

In this paper, we argue that there are important stakeholders in the firm, particularly subordinate managers, who care about its future even if the CEO acts in his or her short-term self interest and shareholders are dispersed and powerless. These stakeholders, because of their power to withdraw their contributions to the firm, can force the CEO to act in a more public-spirited and far-sighted way. We call this process *internal governance*.

The main departure of this paper from most of the existing literature is to see the firm as a composition of diverse agents with different horizons, different interests and different

[2] J. W. Lorsch and T. J. Tierney (2002), p. 64.

Electronic copy available at: http://ssrn.com/abstract=1350580

opportunities for misappropriation and growth.[3] To understand how the differences among diverse agents lead to internal governance, we first consider a partnership run by an old CEO who is about to retire. The CEO has a young manager working under him who will be the future CEO. Three ingredients go into producing the firm's cash flow: the firm's capital stock; the CEO's ability to manage the firm, based on his skill and firm-specific knowledge, and the young manager's effort, which allows her to learn and prepare for promotion.

We assume the CEO can commit to an investment plan, which means the CEO will leave behind a pre-determined amount of capital stock. The CEO can appropriate everything else: he can divert cash out of the firm, consume perks, or convert cash to leisure by shirking. The CEO cannot directly commit future CEOs to any course of action in this period or in the future. [4]

Because the CEO has a short horizon, he could simply decide to take all of the cash flow, investing nothing for the future. But he needs the young manager's effort in order to generate the cash flow. If the manager sees that the CEO will leave nothing behind, she has scant incentive to exert effort, and cash flow falls significantly. To forestall this, the CEO commits to investing some fraction of current cash flow, building or enhancing the firm's capital stock in order to create a future for his young employee, thereby motivating her. This allows the firm to build substantial value, despite being led by a sequence of myopic and rapacious CEOs.[5]

[3] The survey evidence in Graham, Harvey and Puri (2010) confirms that managers other than the CEO perform important functions, especially in large and complex firms.

[4] It is hard to write contracts that specify future investment, since both the quantity and design of investment should depend on the arrival of opportunities, on forecasted business conditions and on the CEO's business judgment, which are nearly impossible to measure or verify. Managers' learning effort is equally hard to contract on, though it can be rewarded ex post through promotion (Prendergast (1993)). However, we do not require explicit contracting here. All we need is some mechanism to make investment visible and credible to the junior manager.

[5] Of course, most CEOs are not the caricatures that economic models like ours make them out to be, yet it is reassuring that even though we imbue them with no redeeming qualities, our model still has them investing for the future. In particular, while our CEO is myopic and self-interested, he acts as if he cares about his subordinates and the survival of the firm. This reduced form appears to describe well the observed behavior of CEOs. Donaldson and Lorsch (1983) conclude from interviews that continuity of the firm is CEOs' primary objective. Donaldson (1985) describes top management's objective as maximizing corporate wealth, not shareholder value.

Electronic copy available at: http://ssrn.com/abstract=1350580

We show that internal governance is most effective when both the CEO and the manager contribute to the firm's cash flows. If the CEO's contributions dominate, he has no desire to limit his capture of cash flow in order to provide incentives for the manager. If the manager's contributions dominate, she has little incentive to learn, because she cannot capture value today, and learning will be of little use when she does become the CEO.

We extend the basic model by allowing the CEO to commit to sell the firm to the manager when he retires. We show that this extends the horizon of the CEO so much that if the manager's incentive to exert effort were not limited (because the manager does not internalize current cash flows) the CEO would invest at the efficient level. This *rolling partnership* therefore increases investment to a *constrained efficient* level -- it essentially reduces the agency problem at the firm down to the problem of incentivizing managerial effort. Of course, many junior managers will lack the wealth to buy the firm from the CEO, and therefore the rolling partnership will often not be feasible. Outside equity can help recover some of the effects of the rolling partnership, however. We show that a combination of internal governance and a rudimentary form of outside governance by shareholders can improve the efficiency of the firm dramatically.

To see the intuition, suppose the firm is a public corporation. Following Fluck (1998) and Myers (2000), we assume that shareholders have only the crude but basic property right to take over the firm and its capital stock, firing the CEO if necessary. In equilibrium, shareholders do not intervene, because the CEO delivers just enough value to the shareholders to keep them at bay. Value is delivered by paying out cash dividends or by investing cash to increase the capital stock -- a larger capital stock increases the future value of shareholders' claim.

Outside equity thus has no direct control over investment or effort decisions; it has no operational influence. Even so, it can greatly enhance investment by the CEO and the value of the firm. The CEO can sell a portion of the cash flow generated by future generations of CEOs to outside shareholders. Thus he indirectly replicates the sale to the manager in a rolling partnership by using shareholders as the intermediary. This gives the current CEO the incentive to invest

more, as he forces future generations of CEOs to pay for the investment he makes. The resulting steady-state capital stock can be greater or less than the constrained efficient level. But it always is greater than in our base case where the CEO cannot sell the firm to his manager.

We also obtain a theory of dividend policy. Shareholders do not care whether they are paid in cash or by increases in the firm's capital stock. Although the dollar paid out as dividends and the dollar left behind as investment costs the same to the CEO, initially he prefers to compensate shareholders by investing, because investment motivates greater effort by the manager. With decreasing returns to investment, however, the rate of return on investment falls, and eventually the CEO makes the manager worse off by investing more; the additional investment increases cash flows in the next period, when the manager will be CEO, but the increased capital stock also increases shareholders' claim. When return on investment is low, the future cost to the manager of satisfying the shareholders can dominate. Then the current CEO will switch to paying dividends, not because shareholders prefer dividends to capital gains, but because more investment will reduce the rents going to the manager below her participation constraint. This then gives us a dividend policy that follows the life cycle of a firm. No dividends are paid when the firm is young and investment profitable, but dividends commence when the firm is mature. The firm starts paying out when additional investment would impose too heavy a future burden on junior managers, who will have to meet the expectations of outside shareholders.

We find that this combination of internal and external governance can encourage greater investment and longer CEO horizons than with external governance only. The combination also eliminates rents that would be extracted by top management with purely internal governance.

We offer these models to make a general point: The traditional description of the firm falls short on three counts. First, control need not be exerted just top down, or from outside; it can also be asserted bottom-up. The CEO has to give his subordinates a reason to follow, else they can withdraw their contributions to the firm. This is how the subordinates exert control over

the CEO. Second, the view that there is one residual claimant in the firm, the shareholder, is too narrow. Anyone who shares in the rents or quasi-rents generated by the firm has some residual claim, and thus there is no easy equivalence between maximizing shareholder value and maximizing efficiency. Third, the fact that CEOs and managers get rents at different horizons means that each one has to pay attention to others' residual claims in order to elicit co-operation. The checks that parties inside the firm impose on each other ensure that the firm can function and survive, even if outside governance is weak.

The rest of the paper is as follows. In section I, we present a simple two-period model of internal governance. In section II, we extend the analysis to an overlapping generations model. Section III examines rolling partnerships. Section IV explores external governance by public shareholders and the relative merits of partnerships and public firms. Section V discusses how our results relate to prior literature. We conclude in section VI.

I. A two-period example

Consider a firm with a CEO and a manager. The firm has some assets in place k_0. The CEO controls the firm's capital investment decisions in the current period and can either augment the capital stock by new investment or run it down, for example by diverting assets out of the firm. Once the CEO decides how much capital stock he will leave behind, he backs up his decision through internal audit and accounting procedures sufficient to convince the manager that enough cash flows and existing assets will be ring-fenced to commit the CEO to his decision.[6]

The manager then decides how much she will engage in firm-specific learning effort s at a private cost, which for simplicity we also assume to be s. The firm generates a cash flow $C(k_0, s)$ in the current period, which is increasing in capital stock this period and manager's

[6] So at the beginning of the period, a new CEO can appropriate both capital stock and cash flows. This is not critical; with some added notation, we can handle situations where the CEO can take only cash flows, not capital. Also, internal auditing and accounting procedures may not be necessary to commit the CEO to invest. The manager is an insider who can observe investment first-hand. But there has to be some way for the CEO to commit investment before the manager commits effort.

effort. At the end of the period, the CEO walks off with all of the cash or capital that was not ring-fenced for investment. Thus, if he leaves behind capital k at the end of the period, the CEO's proceeds are $C(k_0, s) - (k - k_0)$.

Since the manager receives no cash flow this period, her motivation to exert effort arises from the franchise value she inherits next period. Let the franchise value, $V(k, s)$, increase in next period's capital stock and the manager's effort (learning) this period. The discount rate is r.

Given this two-period model of the firm, the CEO's decision problem is

$$\max_{k \geq 0} C(k_0, s) - (k - k_0)$$

$$s.t. \qquad s \in \arg\max_{\hat{s}} \left[\frac{1}{(1+r)} V(k, \hat{s}) - \hat{s} \right]$$

Then, CEO's first-order condition is given by $\frac{dC}{ds}\frac{ds}{dk} - 1 = 0$, and the manager's effort *s* satisfies the first-order condition $\frac{dV}{ds} = (1+r)$. Thus, the CEO has incentives to invest in this period only if it motivates the manager to exert effort, that is, if and only if, $\frac{ds}{dk} > 0$. Applying the implicit function theorem to manager's first-order condition, the sensitivity of managerial effort to CEO investment is $\frac{ds}{dk} = -\left(\frac{d^2V}{dsdk}\right) \Big/ \left(\frac{d^2V}{ds^2}\right)$.

Thus, assuming that the franchise value $V(k, s)$ is increasing and concave in *s*, the CEO has incentives to invest in this period if and only if $\frac{d^2V}{dsdk}$ is positive, or in words, if and only if the firm's capital stock and managerial effort are complements for its franchise value.

If this strategic complementarity condition is met, then the CEO, who is entirely selfish and myopic, nevertheless invests for the future. By investing, the CEO improves the franchise

value that is inherited by the manager. This motivates the manager to exert greater effort in the current period, enhancing CEO's take-home compensation.

We call this result *internal governance*. Before proceeding further, however, it may be useful to check our basic assumption that junior managers are younger than the CEO and likely to succeed him or her. Standard & Poor's ExecuComp database provides annual data on the top five executives in S&P 1500 Index U.S. firms from 1992. Table 1 shows that the executives other than the CEO are, on average, 4 years younger than the CEO. The difference is similar across firm age quintiles and across firm size quintiles, though CEOs in younger firms tend to be younger. Table 2 shows that nearly 80% of new CEOs are appointed from the top 4 executives in the firm in the previous year (top 4 because one of the top 5 in the previous year is typically the old CEO). This suggests a high frequency of internal promotion. Furthermore, the average tenure of the previous year's top 5 executives after the new CEO is appointed is 3.1 years (Table 2, Panel B), suggesting that the old team typically outlasts the old CEO. Finally, Panel A of Table 3 shows that the CEO continues year-to-year with a frequency of 83%. But Panel B shows that at least one of the previous year's top 4 non-CEO executives stays on 95% of the time. Thus top managers usually outlast the CEO and have longer horizons.

To derive the full implications of the model, we must endogenize the franchise value. We therefore introduce an overlapping generations model, where in each period, the previous period's manager becomes the new (selfish and myopic) CEO. This is what we turn to now.

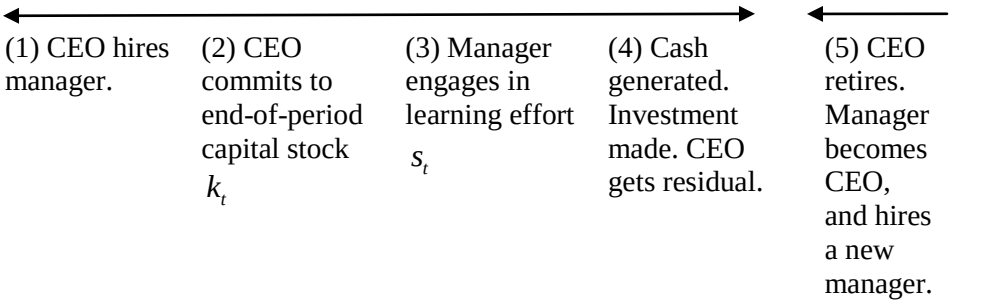
II. **The overlapping-generations model**

Consider a firm with a two-level managerial hierarchy. Each agent can work, at most, for two periods. At the top of the hierarchy is a CEO who is old. In the second layer is a young manager who will become CEO next period. We start with no outside investors, so it's best for now to think of the firm as an employee-financed partnership.

At the beginning of each period *t*, the current CEO commits to invest part of the period's cash flow. This determines the end-of-period capital stock k_t. After the CEO commits to the capital stock, the manager engages in firm-specific learning effort s_t at cost s_t. Learning also helps the manager become more productive as CEO; it may be much harder to acquire the knowledge at the CEO level, where vendors and customers will be far more circumspect and the CEO's time more limited.

The timeline of the model is in Figure 1.

Figure 1: Model timeline



The firm generates cash flows at the end of each period t.

$$C_t(k_{t-1}, s^{CEO}, s_t) = \theta_t \left(k_{t-1}\right)^{\gamma} [\, f(s^{CEO}) + g(s_t)], \tag{1.1}$$

where θ_t is a measure of how favorable the business environment is at time t and γ is a constant less than one. The function f indicates the CEO's contribution to cash flows, and its argument, s^{CEO}, is the firm-specific learning acquired by the CEO at t – 1 when he was a young manager. The function g captures the manager's contribution to cash flows, where s_t is the learning effort the manager exerts at time t. Both f and g are increasing and concave and obey INADA conditions. This setup ensures the strategic complementarity of capital stock and managerial

learning for firm value. All agents maximize the present discounted value of their remaining lifetime income.

We assume for now that the manager's wages are normalized to zero. The CEO appropriates $C_t - (k_t - k_{t-1})$, which is cash flow less investment. It will be convenient to say the CEO determines investment, though technically he determines end-of-period capital stock. At the end of every period, the current CEO retires, so he has no direct incentive to preserve firm value for the future. The manager becomes the new CEO, because he is the only one with the relevant human capital to succeed.

We assume no outside financing for the moment, leaving it for section III. We now solve the model and see what it implies for CEO investment and managerial effort.

2.1. Analysis

First best

We define two benchmark efficient cases where the CEO is assumed to be far-sighted, not myopic, and invests for the long run. The first-best (FB) outcome is investment and managerial learning pairs (k_t, s_t), for all t, that maximize the sum of all current and future cash flows net of investment and learning effort:

$$\max_{\{k_t, s_t\}} \sum_{i=0}^{\infty} \frac{1}{(1+r)^i} \left[\theta_{t+i} \left(k_{t+i-1}\right)^{\gamma} [f(s_{t+i-1}) + g(s_{t+i})] - (k_{t+i} - k_{t+i-1}) - s_{t+i} \right].$$

Then differentiating with respect to k_t, the first-best capital stock satisfies the condition:

$$\theta_{t+1} \gamma \left(k_t^{FB}\right)^{\gamma-1} [f(s_t^{FB}) + g(s_{t+1}^{FB})] = r, \tag{1.2}$$

which equates the marginal return on investment to the opportunity cost, and where s_t^{FB} is the first-best level of learning effort that satisfies:

$$\theta_t (k_{t-1}^{FB})^{\gamma} g'(s_t^{FB}) + \frac{\theta_{t+1}}{1+r} \left(k_t^{FB}\right)^{\gamma} f'(s_t^{FB}) = 1 \quad . \tag{1.3}$$

Since $\gamma < 1$, the first-best level of capital stock increases with the prospective quality of the business environment, θ_{t+1}, but does not directly depend on the current business environment θ_t. In contrast, the first-best level of managerial learning depends both on the current as well as the future business environment, since it affects current as well as future cash flows.

Constrained efficient case: Long-term CEOs

As a second benchmark, we define the *constrained efficient* (CE) outcome as the investment and managerial learning pairs (k_t, s_t), for all t, that arise from (i) investment decision of benevolent and long-term CEOs at each date t whose objective is to maximize the entire stream of cash flows net of capital and managerial investments (ii) learning in each period undertaken by managers who will become the (long-term) CEOs next period, but who do not internalize the effect of their learning on this period's cash flows. In other words, under the constrained efficient outcome, the CEO at time t maximizes the discounted sum of cash flows net of investment and learning costs, even while trying to incentivize the manager. He solves:

$$\max_{k_t} \sum_{i=0}^{\infty} \frac{1}{(1+r)^i} \left[\theta_{t+i} \left(k_{t+i-1}\right)^{\gamma} [f(s_{t+i-1}) + g(s_{t+i})] - (k_{t+i} - k_{t+i-1}) - s_{t+i} \right],$$

recognizing the moral hazard in the choice of managerial effort:

$$s_t \in \arg\max_{\hat{s}_t} \frac{1}{(1+r)} \left[\theta_{t+1} \left(k_t\right)^{\gamma} [f(\hat{s}_t) + g(s_{t+1})] - (k_{t+1} - k_t) \right] - \hat{s}_t.$$

Then, the constrained efficient capital stock can be shown to satisfy the condition

$$\theta_{t+1} \gamma \left(k_t\right)^{\gamma-1} [f(s_t^{CE}) + g(s_{t+1}^{CE})] + (1+r)\theta_t \left(k_{t-1}\right)^{\gamma} g'(s_t^{CE}) \frac{ds_t^{CE}}{dk_t} = r, \qquad (1.4)$$

which when compared to the first-best shows that the CEO invests not just to boost next period cash flow but potentially also to boost managerial learning in this period (if $\frac{ds_t^{CE}}{dk_t} > 0$). Note that s_t^{CE} is the constrained efficient level of learning effort that satisfies the first-order condition of

the manager in period t, $\frac{\theta_{t+1}}{1+r}\left(k_t^{CE}\right)^{\gamma} f'(s_t^{CE}) = 1.$[7] Thus, in contrast to the first best, the constrained efficient level of managerial learning depends only on the future business environment, because the manager ignores the effect of her learning on the current cash flows. In turn, as in the first best case, the constrained efficient level of capital stock increases with the prospective quality of the business environment, θ_{t+1}, but does not depend directly on the current business environment θ_t. However, there is an indirect dependence of capital stock on the current business environment θ_t since the CEO may use capital stock to motivate managers who under-invest in learning from standpoint of the firm. Indeed, this channel will be the only channel that motivates the CEO if he were myopic, as we consider next.

Myopic CEO case

In the case of firm with myopic CEOs, there is yet another source of moral hazard. In addition to the manager having too little incentive to learn, there is no direct rationale for the current CEO to commit to leave behind any capital stock, because that generates cash returns only after he has retired. However, as we saw in the two-period example, there is an indirect link because the CEO's investment affects the future income of the manager, and therefore the manager's incentive to engage in learning effort, which in turn affects the firm's cash flows today.

The CEO's income is extracted from the current period's cash flow, net of investment.

$$\theta_t \left(k_{t-1}\right)^{\gamma} [\, f(s^{CEO}) + g(s_t)] - (k_t - k_{t-1}) \tag{1.5}$$

Here s_t is the manager's equilibrium learning and s^{CEO} is the CEO's learning in the previous period (t − 1) when he was the manager. Differentiating w.r.t. k_t, we see that the CEO's marginal net return from investing is

[7] We show in the online appendix that the structure of the problem essentially ensures that we can ignore the effect of this period's choice of capital on next period's choice of these variables.

$$\theta_t \left(k_{t-1}\right)^{\gamma} g' \frac{ds_t}{dk_t} - 1. \tag{1.6}$$

This net return depends on current business conditions θ_t and capital stock k_{t-1}, because these determine the cash flow impact of any increase in the manager's learning effort induced by CEO investment. It also depends critically on how the manager's optimal learning effort varies with investment, that is, on $\frac{ds_t}{dk_t}$. As we saw with the two-period example, the *sensitivity of the manager's effort to firm investment* is the channel through which the CEO's investment feeds back into contemporaneous cash flows. And unlike in the constrained efficient case, this is the only reason why the myopic CEO invests for the future.

To see how this sensitivity is determined, as in the constrained efficient case, the manager chooses s_t to maximize her future rents as the CEO. She maximizes

$$\frac{1}{1+r}\left[\theta_{t+1}\left(k_t\right)^{\gamma}\left[f(s_t)+g(s_{t+1})\right]-(k_{t+1}-k_t)\right]-s_t. \tag{1.7}$$

Differentiating and setting the result equal to zero, we get $\frac{\theta_{t+1}}{1+r}\left(k_t\right)^{\gamma} f'(s_t) = 1$. So $s_t = f'^{-1}\left(\frac{1+r}{\theta_{t+1}\left(k_t\right)^{\gamma}}\right)$. Since f' is decreasing, learning is greater if the future is discounted less (lower *r*), if the expected future environment θ_{t+1} is better, and if the CEO leaves behind more capital stock k_t. Now totally differentiating the first order condition and rearranging, we obtain $\frac{ds_t}{dk_t} = \frac{-\gamma f'}{k_t f''}$ which is positive, implying that even a myopic CEO has incentives to invest for the future in order to motivate his manager today. This result is the essence of internal governance.

2.2. Specializing functions.

In order to illustrate implications of the overlapping-generations model and provide closed-form expressions for CEO's investment and manager's effort, we make specific assumptions on CEO's and manager's contributions to firm's cash flows. We retain these assumptions in section 2.3 below.

Assume that the CEO and manager could each generate a cash flow *h(s)* if they were assigned all the tasks in the firm, depending on their learning *s*.[8] The fraction of tasks assigned to the CEO is δ. The CEO's contribution to cash flows is $f(s) = \delta h(s),$ and the manager's contribution is $g(s) = (1-\delta)h(s)$. We set $h(s_t) = \frac{1}{b-1}(a + bs_t)^{\frac{b-1}{b}}$ with $a \geq 0$ and $b > 1$. To ensure convergence to steady state, we will assume $1 - \gamma b > 0$.

We analyze only the case with myopic CEOs, leaving details for the first-best and constrained efficient outcomes to the online appendix. Substituting the specific functional forms in the first order conditions for the manager and solving, we get:

$$s_t = \frac{-a}{b} + \frac{1}{b}\left(\frac{\theta_{t+1}\delta}{1+r}\left(k_t\right)^{\gamma}\right)^{b}. \tag{1.8}$$

Using the first order condition for the CEO and (1.8), we get the law of motion for the firm's capital stock as

$$k_t = \left[\theta_t(1-\delta)\gamma\left(\frac{\theta_{t+1}\delta}{1+r}\right)^{b-1}\right]^{\frac{1}{1+\gamma-\gamma b}}\left(k_{t-1}\right)^{\frac{\gamma}{1+\gamma-\gamma b}}. \tag{1.9}$$

The current business environment θ_t and the beginning-of-period capital stock k_{t-1} influence the end-of-period capital stock k_t, even though they have no effect on the returns

[8] None of the results that follow depend on the CEO and manager being equally productive. We can allow the CEO to be more productive than the manager, but this would make it harder to see the effects of increasing δ.

produced by that capital stock, which are driven by θ_{t+1}. The intuition is simple: end-of-period capital adds to the CEO's income only by enhancing his subordinate's learning effort today. That matters more for current cash flows if today's business environment is good or if the current capital stock is high. Put another way, appropriating an additional dollar is more attractive for the CEO if today's environment is bad or if the firm's capital stock is small, because the associated decline in effort by his employee does less absolute damage.

2.3. Decentralization of tasks in an internally governed firm

How important should the CEO's contribution to generating current cash flows be relative to the manager's contribution? Should the firm be designed so that the CEO makes all cash-flow relevant contributions ($\delta = 1$) or completely decentralized ($\delta = 0$) whereby the CEO only makes investment decisions and does not undertake tasks (or make decisions) that contribute to current cash flows? We evaluate choices in the steady state, $\theta_{t+1} = \theta_t = \theta$ and $k_t = k_{t-1} \forall t$.

Consider first the constrained efficient steady state capital stock. We show in the online appendix that

$$k^{CE} = \left[\frac{\gamma}{r} \frac{\theta^b \delta^{(b-1)}}{(b-1)(1+r)^{b-1}} \left(1 + (b-1)(1+r)(1-\delta)\right) \right]^{\frac{1}{1-\gamma b}}. \tag{1.10}$$

The steady state constrained efficient capital stock increases in the CEO's share of activity, δ. If the CEO internalizes the cash flows generated by future CEOs, it is best to address the managerial moral hazard problem by making the CEO the major contributor to cash flows. This way, the current manager has the strongest incentive to invest in learning, since all the cash flows resulting from this learning will be realized only when she is the CEO and thus fully internalized by her.

Contrast this with the first best steady state capital stock, where (see online appendix)

$$k^{FB} = \left[\frac{\gamma}{r} \frac{\theta^b}{(b-1)} \left(\frac{\delta}{1+r} + (1-\delta) \right)^{b-1} \right]^{\frac{1}{1-\gamma b}}. \tag{1.11}$$

Here the steady state capital stock falls with δ. The manager's effort falls off as more of the returns to effort get postponed to the future, when she becomes the CEO. Hence optimal capital investment also falls. The ratio of steady state capital stocks, $\frac{k^{CE}}{k^{FB}}$, thus increases in δ, approaching 1 as $\delta \to 1$. Thus the constrained efficient outcome converges to first best when the CEO is responsible for the bulk of value added. In practice, founder-owned and managed firms are likely to be ones where the founder internalizes the value generated by future CEOs (his descendants). Our model suggests the founder should not give up tasks to his progeny when he is at the helm but give them all up when they take over.[9] The analysis can be repeated with cash flows (and cash flows net of investment and effort) to obtain similar conclusions.

Let us now turn to how tasks might be allocated when CEOs are myopic. Substituting $k_t = k_{t-1} \forall t$ in Eq. (1.9) and simplifying, we get

$$k^{SS} = \left[\gamma (1-\delta) \delta^{b-1} \frac{\theta^b}{(1+r)^{b-1}} \right]^{\frac{1}{1-\gamma b}}. \tag{1.12}$$

Comparing with the first best, we get

$$\frac{k^{SS}}{k^{FB}} = \left[\frac{r(1-\delta)\delta^{b-1}}{(b-1)\left(\delta + (1-\delta)(1+r)\right)^{b-1}} \right]^{\frac{1}{1-\gamma b}}. \tag{1.13}$$

It is easy to see that this ratio is zero when $\delta = 0$ and when $\delta = 1$ and is maximized in between. In other words, the ratio of the steady-state capital stock with myopic CEOs relative to the efficient capital stock goes to zero when the CEO contributes nothing to current cash flow ($\delta \to 0$) or the manager contributes nothing ($\delta \to 1$). The intuition is interesting. If δ is very high, the CEO does not really need the manager's effort, and hence sees little need to invest. If δ is very low, today's manager, who reaps the benefit of her effort only when she is the CEO, sees little merit in effort, because that effort will do little to enhance her future rents. Thus the

[9] The analysis can be repeated with cash flows (and cash flows net of investment and effort) to obtain similar conclusions.

ratio is maximized at a positive, intermediate level of δ. We get a similar interior maximum when we compare the ratios of cash flows or cash flows net of effort and investment. Also, not surprisingly, $\frac{k^{SS}}{k^{CE}} < 1$ for all δ (again, see online appendix).

Our main result for the steady-state comparisons can be summarized as:

Proposition 1:

When the CEO has a long term horizon, it is efficient for the CEO to make all cash-flow relevant contributions ($\delta = 1$ is optimal). When the CEO is myopic, firm value is maximized when the CEO's contribution to the firm's cash flows is neither too large nor too small relative to manager's contribution ($0 < \delta < 1$). For a given contribution of CEO to cash flows (given δ), the myopic firm's CEO invests less than the long-term CEO.

Put differently, internal governance is obviously unnecessary when the CEO has the long term interests of the firm at heart, as might be the case with entrepreneurial founders who see the firm as a labor of love or their bequest to future generations. There is no need for the manager to make substantial contributions, unless the CEO is overwhelmed by the magnitude of his tasks. The founder can afford to hoard tasks. Hoarding may be efficient, because the next generation has the maximum incentive to hone their skills, as they anticipate the time they take control. But as we move away from founders to more professional CEOs, who may have shorter horizons, more cash flow-critical tasks should be allocated to the manager so that she can exert internal governance over the CEO (also see Hellmann and Puri (2002) on the "professionalization" of firms). In other words, when a family enterprise moves to using professional top management, it may also want more delegation of tasks lower down.[10] Of course, an alternative to reducing δ might be to increase the myopic CEO's horizon. We will consider this shortly.

[10] One implication would then be that in larger and more complex family owned firms where the ageing founder cannot possibly do all the tasks, the transition to internal governance as professional CEOs are brought in will be easier.

2.4. Essential aspects of the mechanism of internal governance

We have assumed a CEO who is selfish, myopic and unconstrained by external governance. The future welfare of the firm or its employees has no weight in his objective function. All this can be relaxed. Also, none of what the CEO does need be illegal. In a similar vein, the "CEO" can be a stand-in for top management, while the "manager" could stand for critical employees outside the top-management suite.

But what precisely are necessary conditions for internal governance to work and for it to be an important support to corporate performance? Consider the necessary ingredients: First, the CEO should believe that undertaking future-oriented actions will increase current cash flows, and thus his welfare. This requires key stakeholders like customers and employees (see Hirschman (1970), Titman (1984)) to be interested in the future, even if the CEO is not. Customers are, however, typically at a distance, and leaving aside the purchase of high-value durable goods, are unlikely to be appropriately informed or concerned about a seller's future health.

This then leaves employees, particularly early- or mid-career managers, as the stakeholders most concerned, informed, and able to act against short-sighted CEOs. They can be a reliable part of a mechanism of internal governance only if they have a stake in the future of the firm. This requires some firm-specific rents (or quasi-rents), which can come from some firm-specific ability or costs of leaving the firm, such as the costs of moving house and family. The absence of such rents, either because external governance severely limits what employees can appropriate, or because employees are interchangeable across firms, would render internal governance ineffective.[11]

[11] If CEOs could be hired in a competitive market and firm-specific knowledge had little value, then clearly the manager would see few rents in the future and would not exert effort. Internal governance would break down. Similarly, if the manager could take his expertise elsewhere and be adequately rewarded, he would have the incentive to exercise effort regardless of what the CEO did, and internal governance would again break down. Finally, we have not modeled the bargaining game between the manager and the CEO, both at the time of hiring and at the time of promotion. Clearly, the extent of labor market competition at each stage will affect the precise solution, but the qualitative results we obtain will not be greatly affected.

Do we need the actions (investment and effort) to be staggered? If there are contemporaneous complementarities between CEO actions and managerial actions, the former could spur the latter. However, for this to be effective in improving manager incentives, the CEO should also commit to paying the manager an appropriate share of current rents. This may be difficult, since learning effort is hard to contract on.[12] Our model (also see Prendergast (1993)) suggests that the rewards to learning may be prospective control rents from promotion in the firm, which suggests a model where CEO actions, such as investment, have long term effects.

In summary, the existence of future firm-specific rents can make employees far more effective in exerting internal governance. However, they do not do this by asserting "voice" in Hirschman's terminology (probably an easy way to get fired), but by reducing effort. None of this needs any coordination on the part of employees, or any appeal to the board of directors or to external governance.

III. Partnerships and efficiency

In Sections I and II, the manager earned rents in the future as CEO, but did not pay for these prospective rents other than by incurring a cost for learning effort. The CEO would like to extract these rents by bargaining down the manager's wage. He could do so if he could get aspiring managers with independent wealth, or with the ability to borrow against personal income, to bid for the position (and the right to succeed the CEO). The resultant negative wage (relative to the normalized wage of zero) would essentially be the price at which he sells the firm to the manager. How would decisions change?

Suppose the CEO sets the manager's wage at the same time as he commits to investment. In a competitive labor market for managers, the CEO can charge the manager an amount that sets

[12] Internal governance would break down if the CEO could pay for current performance and fully motivate the manager, without having to resort to indirect methods like investment. Therefore implicit in our model is the notion that much of employee motivation comes from the prospect of a long term career in the firm, including promotion. This is why we emphasize the control rents that the employee gets from moving up in the firm, which are typically non-contractible, rather than immediate pay.

her exactly at the reservation level of zero. This amount is the present value of the manager's future cash flow as the CEO minus her current investment in learning:

$$w_t(k_t) = \frac{1}{1+r}\left[\theta_{t+1}\left(k_t\right)^{\gamma}\left[f(s_t)+g(s_{t+1})\right]-(k_{t+1}-k_t)+w_{t+1}(k_{t+1})\right]-s_t.$$

How does this affect the CEO's investment? The CEO's objective is

$$\max_{k_t} \quad \theta_t\left(k_{t-1}\right)^{\gamma}\left[f(s^{CEO})+g(s_t^{SB})\right]-(k_t-k_{t-1})+w_t(k_t)$$

Substituting for $w_t(k_t)$, and in turn for $w_{t+1}(k_{t+1})$, and so on, we can see that the CEO's objective takes the form of the entire present discounted sum of value created by the firm, which means he chooses the firm-value maximizing k_t given managerial response $s_t(k_t)$.

Of course, we do not quite achieve first best because when choosing effort, the manager still does not internalize the cash flow appropriated by the current CEO. But we do achieve the constrained efficient outcome. The CEO "sells" the firm to the manager (see also Kreps (1990)[13]). The manager in turn anticipates that she will sell the firm when she is the CEO to the next manager at the price that internalizes all effects of that period's investment choice, and so on. The firm now becomes a *rolling partnership* where senior partners sell the firm to junior partners. We summarize this discussion as follows:

Proposition 2: *When there are no constraints on junior managers' ability to borrow against future returns to their human capital and managers are hired in a competitive labor market, a "rolling partnership" – a private firm where the CEO commits to selling the firm to the hired manager – attains the efficient investment, limited only by the moral hazard problem of managerial effort.*

[13] Kreps (1990) focuses on the role played by reputation in lengthening decision-making horizons of myopic agents. In particular, he considers a model where an overlapping set of managers co-operate, by mutually trusting each other, since a manager next period "buys" the reputational capital of the current manager and this sale incentivizes the current manager for the long run, preventing defections motivated by his short-termism. See also Gomes (2000) and Morrison and Wilhelm (2004).

Many law firms are examples of rolling partnerships, in which associates put in long hours and sweat equity, hoping to become senior partners who can collect rents generated by the firm's franchise value and the next generation of associates. But law firms do not require an expensive stock of capital. Managers in more capital-intensive firms will find it hard to raise sufficient money solely by sweat equity, and the usual moral hazard problems will complicate attempts to borrow against future rents.[14] One could think of the retiring CEO (retiring senior partners) accepting a promissory note from the manager (junior partners) in return for turning the firm over, but that would imply the old CEO retains some ability to enforce claims on cash flows. But once we allow outsiders to have some power of enforcement over cash flows, we enter the realm of external financing.

IV. External Governance

4.1. Outside Equity

Assume now that the firm seeks outside financing. This is feasible only if investors have some meaningful property rights. For simplicity we examine equity financing only.[15] Following Fluck (1998) and Myers (2000), outside shareholders can take over the assets of the firm at the beginning of period *t* realizing β ($0 \le \beta < 1$) per dollar of capital stock. If, however, the CEO can make a dividend commitment (see below) that satisfies them, they go away and return one period later, when they can threaten to take over the assets at that time. Shareholders have no control over any decisions the CEO makes in between. Think of β as a governance parameter, with $1 - \beta$ measuring the costs to public shareholders of exercising their property rights. A lower β also reduces the market capitalization of the firm and the amount that shareholders are

[14] Lambrecht and Myers (2008) point out that corporate borrowing may allow managers to monetize future rents, because corporate borrowing is senior to rents as well as shareholder returns. We leave the choice of debt vs. equity financing to future research, however.

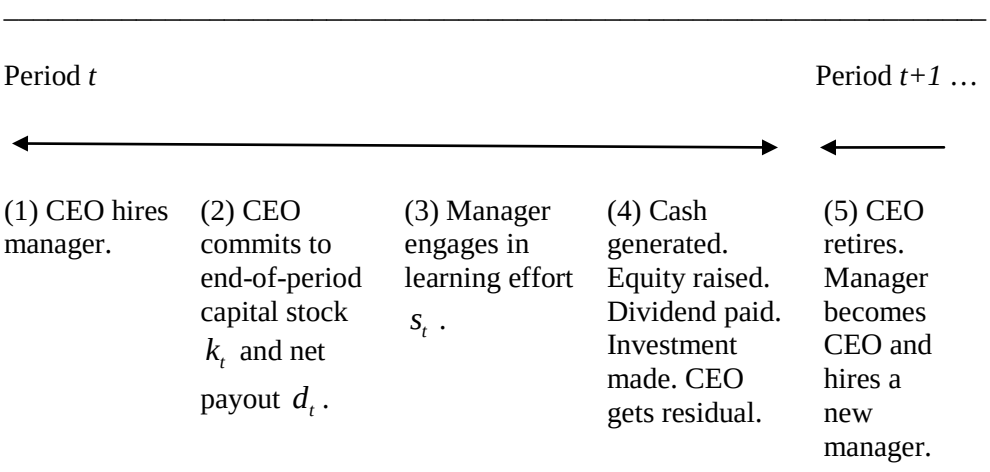
[15] Equity and debt are distinguishable even in a risk-free setting. We model equity as having absolute property rights and the ability to intervene in any period, but at a cost. Debt has contractual rights and can intervene only if the contract is breached. See Myers (2000).

willing to invest. A private firm or partnership, where outside equity have no property rights, has $\beta = 0$.

The CEO can issue additional equity (inflows) or pay dividends (outflows). The amount raised through additional equity adds to the cash flow that the CEO can appropriate. As before, the CEO makes a commitment at the beginning of the period. This is now the sum of the capital stock and the dividend (if any) rather than the capital stock alone. The committed dividend is paid out to shareholders at the end of the period, when cash flows are generated. It will be convenient in what follows to focus on the dividend net of equity issues. Let that *net dividend payout* be d_t.

We first analyze the net dividend and investment decisions of a public going concern (that is, subsequent to an initial public offering (IPO)). Then we analyze the CEO's decisions and the value of the firm at IPO. The time line for a public going concern is given in Figure 2.

Figure 2: Timeline with outside equity



Again the CEO has to commit to the end of period capital stock k_t, but now the commitment goes to shareholders as well as the junior manager. Note that the commitment to the manager makes monitoring and control by outside shareholders less stressful. They can depend on the junior manager to track and confirm investment. Internal governance reassures shareholders that cash flow is actually invested.

4.2. Investment and Payout

The cash flow the CEO now has to leave behind is $(k_t - k_{t-1}) + d_t$, which is smaller than the new investment $(k_t - k_{t-1})$ whenever the net dividend is negative. [16] The ability to issue equity thus allows the CEO to internalize some of the future cash flows the firm will generate, much as he did in the rolling partnership with the sale to the manager. In a sense, the CEO sells a stake in the firm to new equity holders, who then collect from future CEOs. Equity holders thus serve as intermediaries between successive generations of CEOs.

This then implies two additional constraints in the CEO's maximization problem. First, equity holders have to be happy accepting the net dividend and coming back next period with the right to seize assets rather than taking over today. Investment gives shareholders an additional future claim on assets amounting to $\beta\left(k_t - k_{t-1}\right)$. They also receive a net dividend (possibly negative) of d_t. This total payoff to existing shareholders must exceed their required reservation payoff of $r\beta\, k_{t-1}$. Second, the need to meet equity's reservation payoff can reduce the manager's payoff next period when she becomes CEO. We therefore need to check whether the manager's participation constraint is met. The CEO's maximization problem is thus given by

$$\max_{k_t, d_t} \theta_t \left(k_{t-1}\right)^{\gamma} [\, f(s^{CEO}) + g(s_t)] - (k_t - k_{t-1}) - d_t, \qquad (2.1)$$

$$s.t. \qquad \beta(k_t - k_{t-1}) + d_t \geq r\beta k_{t-1} \qquad (2.2)$$

$$s_t \in \arg\max_{\hat{s}_t} \frac{1}{(1+r)}\left[\theta_{t+1}\left(k_t\right)^{\gamma} [\, f(\hat{s}_t) + g(s_{t+1})] - (k_{t+1} - k_t) - d_{t+1})\right] - \hat{s}_t \qquad (2.3)$$

$$and\ U(k_t) = \frac{1}{(1+r)}\left[\theta_{t+1}\left(k_t\right)^{\gamma} [\, f(s_t) + g(s_{t+1})] - (k_{t+1} - k_t) - d_{t+1}\right] - s_t \geq 0 \qquad (2.4)$$

[16] A seasoned equity issue will only be possible if new equity expects to get back what it puts in. Given equity's fixed control rights, a seasoned equity issuance will subtract an equivalent amount from what can be extracted by all equity holders. Therefore a seasoned equity issuance is exactly equivalent to a negative dividend from the perspective of existing equity holders – it dilutes their stake.

Eq. (2.4) is the manager's participation constraint. Let us now see how these additional constraints, and the change in the maximization problem, alter our description of firm behavior.

The CEO's incentive to invest and the manager's incentive to exert effort

The CEO has no reason to overpay outside equity, so (2.2) will hold with equality. The net dividend is $d_t = r\beta k_{t-1} - \beta(k_t - k_{t-1})$. In the early stages of a firm's life cycle, when it is investing heavily and growing rapidly, investment alone may give shareholders more than their minimum required rate of return. The CEO can offset this by reducing his effective investment through a negative net dividend, that is, an equity issue. As growth slows and the firm's capital stock rises relative to investment, the net dividend will have to turn positive; the firm will have to pay out cash to shareholders.

Turn now to the CEO's maximization problem. The value he has to leave behind is $(k_t - k_{t-1}) + d_t$, which equals $(1-\beta)(k_t - k_{t-1}) + r\beta k_{t-1}$. Essentially, the CEO can raise β of every dollar invested from outside equity, so his marginal personal cost of investing an additional dollar -- his *co-investment* -- is only $(1-\beta)$. Assuming the manager's participation constraint is satisfied, the return for the CEO from increasing capital stock is now $\theta_t k_{t-1}^{\gamma} g' \frac{ds_t}{dk_t} - (1-\beta)$, which exceeds the return he would have obtained in the case without outside equity (where $\beta = 0$). Also, with a higher capital stock, the manager's incentive to exert effort is higher.

Proposition 3: *The capital stock, k_t^{SE}, and managerial effort, s_t^{SE}, in a public going concern both increase with the governance parameter β. Other things equal, in a public firm ($\beta \in (0,1]$) they are both higher than in a private firm ($\beta = 0$).*

In the limiting case when $\beta = 1$, CEO does not need to sacrifice any current cash flows in order to invest. Investment can be fully financed by shareholders. He would then choose an

extremely high level of investment were it not for the manager's participation constraint.[17] Also note that, provided the manager's participation constraint is slack, the CEO would never pay a cash dividend. A dollar invested to increase capital stock satisfies shareholders just as well as a dollar paid in dividends, but has the added benefit of increasing the manager's incentives to exert effort. To obtain positive cash dividends when governance β is high, we have to turn to the manager's participation constraint.

The Manager's Participation Constraint

Substituting for the net dividend condition $[d_{t+1} = r\beta k_t - \beta(k_{t+1} - k_t)]$ in (2.4) and differentiating w.r.t. k_t, we get

$$U'(k_t) = \frac{1}{1+r}\left(\left[\theta_{t+1}\gamma k_t^{\gamma-1}\left(f(s_t) + g(s_{t+1})\right)\right] + (1-\beta) - \beta r\right) \qquad (2.5)$$

where the derivatives with respect to s_t, k_{t+1} and s_{t+1} drop out due to the Envelope Theorem. A greater capital stock left behind by the current CEO has three effects, as reflected on the right hand side of (2.5). The term in square brackets is the cash return on capital next period. The second term $1 - \beta$ is the amount next period's CEO can appropriate from every dollar of additional capital left to him. The third term βr is the return she has to pay equity to continue.

When $\beta < \frac{1}{(1+r)}$, the right hand side of (2.5) is always positive and the participation constraint is never hit. Intuitively, with weak governance not only does next period's CEO have more to appropriate from any capital stock left behind, but also equity holders can extract less. So next period's CEO is always made better off if the current CEO invests more. In this case, the

[17] The invested amount is not unbounded. The CEO invests only if it encourages the manager to exert more effort. If the CEO were to invest an infinite amount, the manager would not be able to generate enough cash next period to pay equity their required rate of return. So equity investors would intervene and liquidate the firm, and today's manager would have no incentive to exercise effort. So even ignoring the manager's participation constraint, the highest amount the CEO will invest, even though investment is free of cost to him, is the amount that will allow the manager to commit dividends and future capital stock when he is CEO that just prevents equity holders from intervening. The need to meet the manager's participation constraint will further limit the CEO's investment.

current CEO will choose k_t such that $\theta_t k_{t-1}^{\gamma} g' \frac{ds_t}{dk_t} - 1 + \beta = 0$, and then set net dividends $d_t = r\beta k_{t-1} - \beta(k_t - k_{t-1})$.

However, when external governance is strong, with $\beta > \frac{1}{(1+r)}$, the right hand side of (2.5) can turn negative. For example, when β=1, next period's CEO has to pay r out of cash flows for every additional dollar of capital stock she inherits but cannot appropriate any of it. If the cash flow produced by the marginal capital invested is sufficiently low, additional investment today can reduce the cash that next period's CEO gets, because the additional capital stock increases the capacity of outside equity to extract value by more than it increases the capacity of the next period CEO to generate cash. Since additional end-of-period capital stock also increases the manager's effort, her utility can be reduced by an increase in capital stock (both because future cash flows net of equity payout are lower and her effort is higher). When her utility falls to zero (her participation level), the current CEO cannot invest any more without losing the manager and will therefore pay out cash dividends.

We can state all this more formally for the case where business conditions are stable: $\theta_t = \theta \; \forall \; t$. For $\beta > \frac{1}{(1+r)}$, let the manager's utility function be well behaved so that $\lim_{k \to 0} U(k) > 0$, $\lim_{k \to \infty} U(k) < 0$, $U''(k) < 0$, and $U'(k) < 0$ for some *k*. Let β be sufficiently high that the steady state capital stock, k^{SE}, ignoring the participation constraint, is such that $U(k^{SE}) < 0$. This steady state cannot be attained, however, because the manager will stop participating long before the capital stock reaches k^{SE}. Let k^* be such that in steady state (with capital stock remaining unchanging in the future) we would have $U(k^*) = 0$. Let $\hat{t}$ be the first

period where the CEO would have set capital stock $k_{\hat{t}} > k^*$, were it not for the manger's participation constraint.

Proposition 4: *For any public firm financed with outside equity, there exists a critical value* $\beta^* \in \left(\frac{1}{(1+r)}, 1 \right)$ *such that if and only if* $\beta > \beta^*$, *the firm reaches a steady state in which the equilibrium utility for all future CEOs is zero (they are at their participation constraint and earn no rents net of effort). The steady state is hit in the first period* $\hat{t}$ *when* $k_{\hat{t}}^{SE} > k^*$ *and* k^* *is such that* $U(k^*) = 0$.

(i) *The steady state capital stock is* k^* *in period* $\hat{t}$ *and after, and the steady state dividend is* $d^* = r\beta k^*$ *in period* $\hat{t}+1$ *and after. In period* $\hat{t}$, *the net dividend (dividend net of SEOs) is* $[r\beta k_{\hat{t}-1}^{SE} - \beta(k^* - k_{\hat{t}-1}^{SE})]$, *which is a cash dividend if positive and an equity issue if negative.*

(ii) *The net dividend in all other cases is* $[r\beta k_{t-1}^{SE} - \beta(k_t^{SE} - k_{t-1}^{SE})]$ *which is a cash dividend if positive and an equity issuance if negative.*

Proof: As partly explained in the text and rest available in an online appendix.

The proposition then suggests the life cycle pattern of net dividend payments and investment that is empirically observed, even for firms with strong external governance,. In the early stages of a firm's life cycle, when k_t is low, capital investment will grow at a rate greater than (1+*r*). In these cases, the firm's net dividend payment is negative, that is, it raises external financing and does not pay out a cash dividends. As the firm becomes more mature and rates of return fall, the net dividend becomes less negative -- the reliance on external capital falls. Eventually external issues cease as the firm starts paying positive dividends.

In the special case when the firm's governance parameter is high, the firm's capital stock may quickly reach a high enough value that investing more would de-motivate the manager by

violating her participation constraint. In these circumstances, the CEO will stop investing, the capital stock will stabilize, future CEOs will also all be at their participation constraint, and the firm will make a steady cash dividend payout to investors.

4.3. Initial Public Offering

Let us see what happens earlier, when the CEO takes the firm public by an IPO in period τ . In keeping with the spirit of our analysis, the CEO appropriates the proceeds from the offering entirely. The CEO chooses investment k_τ to maximize

$$\theta\left(k_{\tau-1}\right)^{\gamma}\left[f(s^{CEO})+g(s_\tau)\right]-(k_\tau-k_{\tau-1})+\beta k_\tau \tag{2.6}$$

External governance allows outside shareholders to get value equal to share β of the capital stock next period. The first-order condition for the CEO's investment is given by

$$\theta\left(k_{\tau-1}\right)^{\gamma} g'(s_\tau)\frac{ds_\tau}{dk_\tau}-1+\beta. \tag{2.7}$$

Hence, as in the case of the ongoing concern, the CEO at the time of IPO also has a greater incentive to invest (for any initial level of capital stock) compared to the situation without outside equity. This is because a higher end-of-period capital stock also increases the proceeds he gets from the IPO. The ability to "sell" the firm lengthens the CEO's horizon.[18]

4.4. Example

Consider a numerical example with our specializing functions where we use the parameter values $(1+r)^{-1} = 0.95$, $\gamma = 0.2$, $(b-1)/b = 0.3$, $a = 0$, and $\theta = 1$. We also assume equal share of cash flows between the CEO and the manager. Suppose the CEO decides to take the

[18] There are obvious parallels between equity compensation and the "stake" the CEO has in an IPO. An equity stake works well in lengthening CEO horizons only when the CEO has a large stake and the firm is well governed (high β). Even so, the CEO only sees the cash flows equity can extract rather than the entire cash flows of the firm. So moderate CEO equity holdings in the typical large public firm are unlikely to resolve the CEO's incentive problem fully.

private firm public at τ =10, after it has reached (its private firm) steady state capital stock, $k_{\tau-1}$ = 0.0108. We consider two values of the governance parameter: $\beta = 0.5$ and $\beta = 0.9999$ (to approximate the limiting case where shareholders can intervene costlessly and will finance 100% of new investment). Figure 3a shows that when $\beta = 0.5$, investment grows almost four-fold at the IPO to k_{10}^{IPO} = 0.041 and converges in 6 more periods to a steady-state value of 0.057. Clearly, the IPO has boosted investment substantially (and also boosted managerial effort). The CEO would have little incentive to invest this much, were it not for the added incentive coming from the extra equity value he can raise through the IPO. Figure 3b shows that this effect is especially powerful as external governance improves. When $\beta = 0.9999$, the investment at the IPO grows to 106.31, reaching its steady-state value of 337.62 in just one period.

It is interesting to also examine the dividend policy of the firm post IPO. Figures 3c and 3d illustrate that when the firm is in its growth phase", its net dividend is negative as the firm invests at a fast pace. Eventually, once the firm reaches the steady state, net dividend becomes positive. No further capital issues are needed and the firm starts paying out a cash dividend. This dividend policy mirrors well the life-cycle of equity issues and dividends observed for young firms that go public, grow and eventually reach maturity.

Finally, what is the current manager's utility over these growth phases and as a function of the external governance? Figure 3e plots this utility net of the effort incurred on learning as a manager. When $\beta = 0.5$, this net utility ($U(k)$) rises steadily to a new steady state. Managers are able to extract rents in equilibrium. While this is beneficial for managers, it leads to lower investment. By contrast, when the external governance is relatively strong, the manager's net utility rises sharply in the IPO period but then declines rapidly once capital grows to a level where diminishing returns to scale kick in. Once the manager's ex ante utility reaches the reservation level of zero, each current CEO cannot grow capital any further (Figure 3b) without

violating his manager's participation constraint (Figure 3e) and thus is forced to pay outside equity cash dividends (Figure 3d).

4.5. Discussion

How do Internal Governance and External Governance Interact?

We have earlier considered the case of only internal governance. Relative to that, the IPO expands investment and managerial effort for two reasons. First, the IPO changes the CEO's investment incentives in the period of the IPO. (We do not model when the CEO decides to undertake the IPO, though this is an interesting extension.) But the boost to capital stock given by the IPO alone would not be enough for sustained growth, for in the absence of outside equity, both capital stock and effort would subsequently decline to the steady state consistent with internal governance only. Outside equity prevents such a decline: Subsequent CEOs are required to compensate outside equity, but allowed to defer payment by building additional capital stock. This immediately alters the investment incentives of future CEOs, ensuring also that managerial effort remains high. As a result, the IPO potentially moves the firm to a better equilibrium.

What if we only had external governance? Clearly, the CEO would have no reason to invest for the future. He would be willing to commit to leaving behind only so much cash as to pay shareholders their opportunity cost, that is $(1+r)\beta k_{t-1}$. Because a dollar of capital stock is worth only β dollars to outside shareholders, the CEO is better off liquidating the capital stock and paying out β dollars in cash rather than leaving any capital behind. So a firm with a myopic CEO would not last beyond one period if only external governance were available. Both internal and external governance are required to take the public firm to a better equilibrium.[19]

External Governance and Rents

[19] Myers (2000) and follow-on papers – Lambrecht and Myers (2008), for example – avoids this problem by assuming a coalition of managers who maximize the present value of current and all future rents. This paper can be viewed as an investigation of how that coalition forms and survives.

In the steady state for the public firm with a high governance parameter (high β), the steady state CEO gets no rents. His participation constraint is just met – he appropriates just enough, after paying the required dividend, to compensate for his effort as manager in the previous period. But because he can appropriate all the cash flows at the margin, he has the maximum possible incentive to exercise effort. The firm cannot give him a better incentive scheme based on cash compensation.

The reason why CEO rents are reduced to zero, despite a succession of myopic and rapacious CEOs, is interesting. Each CEO cares only about his take, and about the manager only to the extent that his decisions affect the manager's effort. By increasing capital stock, the CEO raises managerial effort but also the capacity of shareholders to extract their return. Eventually, the rents of the future CEO will fall with more investment, even as the manager's effort keeps increasing, but the current CEO is not concerned – he is doing to his successor only what his predecessor did to him. The self interest of each CEO works on behalf of outside shareholders and ensures that future managerial rents are driven to zero. All this happens in a setting where outside shareholders have no way of affecting operating or investment decisions, and no direct way to limit the capture of cash flow by the CEO.

Even as future CEOs get reduced to their participation constraint when governance is good, the founding CEO can appropriate a substantial portion of the cash flows generated over time by future CEOs by undertaking an IPO. This then gives him strong incentives to be an entrepreneur and bring together the sources of the firm's net present value – patents, processes, or people. Thus, the difference in wealth between innovative entrepreneurs and professional managers is substantial. By contrast, when public firms have poor external governance, future CEOs appropriate a significant portion of future cash flows, investment ramps up slowly, and the founding CEO has lower incentives to innovate. The difference in wealth between innovative entrepreneurs and professional managers is now smaller.

Private Partnerships and Public Firms

We showed in Section III that a rolling partnership achieves the constrained efficient level of investment, that is, the investment that would obtain when CEOs have long-term horizons and the only source of inefficiency is that the manager does not have the full incentive to exert effort because she does not internalize current period cash flows. The rolling partnership achieved this outcome by requiring that the manager buy the firm -- at a competitive price – from the current CEO when he retires. We also showed in this section that in case of the externally governed firm, when the external governance parameter is sufficiently high, investment is constrained only by manager's participant constraint. Thus, in both cases, the equilibrium rent earned by managers in the steady state is zero. Does this imply that the externally governed firm also reaches the constrained efficient level of investment? The answer is no.

The intuition is interesting. In the case of rolling partnership, the current CEO receives the entire future stream of rents generated by the firm when his manager commits to buying him out. The current CEO then chooses investment to maximize his own proceeds, which is tantamount to maximizing the firm value taking account *also* of all the learning effort incurred by current and future managers.

Consider now the externally governed firm with perfect governance $(\beta = 1)$. The CEO faces no cost of investment whatsoever, because additional capital stock is fully paid for by external shareholders. Furthermore, the CEO does not internalize the effort costs incurred by the manager, which increase with investment. Thus, the CEO prefers to increase investment substantially and is only stopped by the need to provide his manager the incentive to participate. Thus, for sufficiently high external governance parameters, the public firm can over-exert its managers without optimally internalizing their effort choices. It can be shown formally that a (weak) sufficient condition for this to be the case is that external governance be sufficiently high and the CEO's contribution to cash flows relative to that of the manager be sufficiently high too.

Proposition 5: *For external governance β sufficiently close to one and CEO's contribution to cash flows δ also sufficiently close to one , we have $k^*(\beta) > k^{CE}$, $s^*(\beta) > s^{CE}$, and $CF^*(\beta) < CF^{CE}$, that is, the externally governed firm invests more, exerts employees more and produces a smaller steady-state cash flow compared to a rolling partnership (the constrained efficient case).*

Proof: Available in online appendix.

So given managerial effort, a private firm, where the manager buys the firm from the CEO and sells it in turn to her manager when she retires would be better than a public firm under the same circumstances. Indeed, Guinnane et al. (2007) argue that the limited private partnership form proved far more popular than the public firm structure for substantial periods in the history of several European countries. Of course, when the manager in a private firm is severely wealth constrained, the public firm can produce far greater value than the private firm, despite the additional distortions it introduces.

4.6. Other Empirical Implications

Let us turn to the empirical implications of our work. Other things equal, internal governance should help improve outcomes. Some factors that should enhance a firm's capacity for internal governance include relatively young employees with substantial firm-specific human capital, in an industry which typically emphasizes internal promotions and long term employment. We should find that internally governed firms tend to have longer horizons, as evidenced for example in greater research and development and lower propensity to use accounting artifice to boost profits temporarily.

While we have argued that internal and external governance are typically complements, internal governance can be effective when there is a breakdown of external governance. Firms that score more strongly on internal governance factors should do better in sectors where it is difficult for external governance to play a role – sectors such as services where the firm's

franchise value is tied up with human capital and external monitoring and control of management's performance is difficult. We mentioned law firms as an example.[20] Sectors that are stronger in factors promoting internal governance should be more likely to emerge and expand in countries that score poorly on external governance. Conversely, for a given quality of internal governance, better governed industries or countries will have higher equity valuations at their IPOs. Not only will equity reflect more of the value added by the firm's assets and operations, but also the life-cycle rents of future CEOs will be driven to zero, which will also contribute to equity values.

Exogenous changes in internal governance factors should be associated with a change in a firm's performance. For example, as a firm's employees age relative to top management, and both age in absolute terms, the firm should become more short-term oriented, and deteriorate in overall performance. Similarly, an acquisition by a firm with low internal governance attributes of a target that is in a sector that is especially reliant on internal governance should lead to a more significant deterioration in the performance of the target, and a worse market reception for the announcement of the acquisition.

In human capital intensive industries, where employees account for a substantial portion of value added and thus get high wages, managers are likely to have the wealth to buy the firm from the CEO. The typical firm will be structured as a rolling partnership. In capital intensive industries, where much of the value added comes from real assets, the manager's relatively lower wage will make it harder for her to buy the firm, and public firms will be the norm. This suggests an additional rationale for the association of public firms with capital intensive sectors – it is not just that capital intensive firms give outsider investors stronger control rights, it is also that they are harder to sell directly to internal owners. This also means that an increase in minimum

[20] Note that we are not arguing that internal monitoring and control of performance in the service sector is hard – the billable hours each lawyer produces and the nature of his clients' experience is easily ascertained. The real problem is external monitoring, since the quality of the services provided customers is hard to communicate in an objective way.

optimal scale or capital requirements will typically force more firms to go public – though other theories will deliver this prediction.

Finally, because the CEO in a public firm internalizes future cash flows through the ability to issue equity, a temporary change in current business conditions should have weaker effect on his investment incentives than in an internally governed firm (one without the option of a rolling partnership) where current business conditions are an important factor in determining the CEO's incentive to invest. Thus investment in industries and countries where internal governance prevails will be much more subject to fluctuations in business conditions (and hence more volatile) than investment in countries where external governance is strong. Booms will be stronger and busts more prolonged in the former.

V. Relationship to literature

Our model resembles Fama (1980), where concerns about the adverse reputational consequences of misappropriation on his post-retirement career keep the CEO on the straight and narrow. In contrast to the ex-post settling up in that model, the settling up in our model is contemporaneous and by parties whose interests are intimately involved – employees endogenously penalize excessive misappropriation. The difference is important, for instance, in explaining the effects of external finance (Section 3).

We are, of course, not the first to analyze the phenomenon of internal governance. Fama and Jensen (1983 a, b) as well as Hansmann (1996) refer to mutual or internal monitoring, though they do not undertake a detailed analysis. Landier, Sraer, and Thesmar (2006) appeal to the independence of top executives (as measured by their having preceded the CEO into the firm). Instead, we rely on their self interest -- the fact that they typically have career concerns inside the firm. The mechanism through which they have impact in our model is not through coordinated action or through appeal to a board of directors, but through their propensity to get de-motivated. This is neither exit nor voice, in the felicitous terminology of Hirschman (1970), nor active

whistle-blowing as in Dyck, Morse and Zingales (2007), but an uncoordinated, even implicit, strike.

Allen and Gale (2000, Chapter 12) also consider a model with overlapping generations of short-term CEO and managers vying for the CEO role next period. Allen and Gale assume complementarities between the CEO and managers in cash flow production, which gives the CEO the need to elicit co-operation and lengthens the effective horizon of decision-making. They explain based on the model the relative merits of the "stakeholder" focus of governance of Japanese firms at one extreme and the "shareholder" focus of Anglo-Saxon firms at the other extreme, with French and German firms somewhere in between.[21]

Similar to Allen and Gale (2000), Landier, Sraer, and Thesmar (2008) focus on situations where CEO and manager actions are complementary, and examine the role of optimal dissent in an organization. It is easier for a CEO to persuade the manager to follow him down the wrong path when they have similar private preferences over projects. Managers with different preferences would place greater constraints on the CEO, but at the cost of them being less enthusiastic when the CEO's correct project choice accords with his own preferences.

Finally, implicit in our framework is a theory of the firm and its boundaries. In our view, the firm is an agglomeration of assets and specialized human capital which give it unique capabilities (see, for example, Penrose (1959), Grossman and Hart (1986), Hart and Moore (1990), and Rajan and Zingales (1998, 2001)). The literature suggests the ability to control access to the rents the firm generates is top management's source of control. In this paper, we focus on the bottom-up influence over firm actions, exercised by those who have access but do not yet have explicit control, because of their ability to affect the firm's rents.

[21] Allen, Carletti and Marquez (2007) explore a related theme and study the effect of stakeholder capitalism in a setting where firms' concerns about employees and suppliers soften competition in product markets and enhance shareholder value. See also Hirota and Kawamura (2007).

V. Conclusion

We have probably only touched the range of phenomena that are affected by internal governance. For instance, the breakdown of internal governance may explain the increasing evidence of agency problems in financial firms in the recent crisis. When capital is relatively scarce and allocated based on detailed information available only within a firm, employees of financial firms are relatively immobile. Each one cares about the longer term future of their own firm, and has an incentive to monitor the actions of both colleagues and superiors, especially if the firm is a rolling partnership. As the firm switches to a limited liability public firm, and as capital becomes more widely available, employees become more mobile, and care less about the long term future of their firm. The internal pressure to worry about the long term, or to discipline rogue units, becomes weaker.

There is also a rich interaction between the internal structure of firms and the strength of internal governance. For example, we have focused on the case of only one manager. What if multiple managers competed in a tournament for the CEO position? What if the CEO foreswore competition amongst his subordinates and instituted a succession plan? Which structure would provide better internal governance? Under what circumstances? These questions suggest many interesting avenues for research. We have just touched the surface in this paper.

References

Allen, Franklin, and Douglas Gale, 2000, *Comparing Financial Systems*, The MIT Press, Cambridge.

Allen, Franklin, Elena Carletti, and Robert Marquez, 2007, Stakeholder capitalism, corporate governance and firm value, Working Paper, University of Pennsylvania.

Cremers, Martijn, and Yaniv Grinstein, 2008, The Market for CEO Talent: Implications for CEO Compensation, Working Paper, Yale School of Management.

Donaldson, Gordon, 1985, *Managing Corporate Wealth*, Praeger, New York.

Donaldson, Gordon, and Jay W. Lorsch, 1983, *Decision Making at the Top*, Basic Books, New York.

Dyck, Alexander, Adair Morse, and Luigi Zingales, 2007, Who blows the whistle on corporate fraud? *CEPR Discussion Paper No. DP6126*.

Fama, Eugene F., 1980, Agency problems and the theory of the firm, *Journal of Political Economy* 88, 288-307.

Fama, Eugene F., and Michael C. Jensen, 1983a, Separation of ownership and control, *Journal of Law and Economics* 26, 301-325.

Fama, Eugene F., and Michael C. Jensen, 1983b, Agency problems and residual claims, *Journal of Law and Economics* 26, 327-349.

Fazzari, Steven, R. Glenn Hubbard, and Bruce Petersen, 1988, Finance Constraints and Corporate Investment, *Brookings Papers on Economic Activity* 1, 141-195.

Fluck, Zsuzsanna, 1998, Optimal Financial Contracting: Debt Versus Outside Equity, *Review of Financial Studies* 11, 383-418.

Goel, Anand and Anjan Thakor, 2008, "Overconfidence, CEO Selection, and Corporate Governance", *Journal of Finance*, 63, 2737-2784.

Gomes, Armando, 2000, Going Public Without Governance: Managerial Reputation Effects, *Journal of Finance* 55, 615-646.

Gort, Michael, Henry Grabowski, and Robert McGuckin, 1985, Organizational capital and the choice between specialization and diversification, *Managerial and Decision Economics* 6, 2-10.

Graham, John, Campbell R. Harvey and Manju Puri, 2010, Capital Allocation and Delegation of Decision-Making Authority Within Firms, Working paper, Duke University.

Grossman, Sanford, and Oliver Hart, 1986, The costs and the benefits of ownership: a theory of vertical and lateral integration, *Journal of Political Economy* 94, 691-719.

Guinnane, Timothy, Ron Harris, Naomi Lamoureaux, Jean-Laurent Rosenthal, 2007, "Ownership and Control in the Entrepreneurial Firm: An International History of Private Limited Companies", working paper, Yale University.

Hansmann, Henry, 1996, *The Ownership of Enterprise*, Belknap Press, Cambridge.

Hart, Oliver, and John Moore, 1990, Property rights and the nature of the firm, *Journal of Political Economy* 98, 1119-1158.

Hellmann, Thomas, and Manju Puri 2002, Venture capital and the professionalization of start-up firms: empirical evidence, *Journal of Finance* 57, 169-197.

Hirschman, Albert, 1970, *Exit, Voice, and Loyalty: Response to Declines in Firms, Organizations, and States*, Harvard University Press, Cambridge.

Hirota, Shinichi and Kohei Kawamura, 2007, Managerial control inside the firm, *Journal of the Japanese and International Economies* 21, 324-335.

Jensen, Michael C., 1986, Agency costs of free cash flow, corporate finance, and takeovers, *American Economic Review* 76, 323-329.

Jensen, Michael C., 1993, The modern industrial revolution, exit, and the failure of internal control systems, *Journal of Finance* 48, 831-880.

Jensen, Michael, C., 2000, *A Theory of the Firm: Governance, Residual Claims, and Organizational Forms*, Harvard University Press, Cambridge.

Kaplan, Steven N., and Luigi Zingales, Luigi, 1997, Do investment-cash flow sensitivities provide useful measures of financing constraints?, *Quarterly Journal of Economics* 112, 169-215.

Kreps, David, 1990, Corporate culture and economic theory, in James E. Alt and Kenneth A. Shepsle, editors, *Rational Perspectives on Political Science*, Cambridge University Press, New York.

Lambrecht, Bart, and Stewart C. Myers, 2008, "Debt and Managerial Rents in a Real-Options Model of the Firm," *Journal of Financial Economics* 89, 209-231.

Landier, Augustin, David Sraer, and David Thesmar, 2006, Bottom-up governance, working paper, New York University.

Landier, Augustin, David Sraer, and David Thesmar, 2008, Optimal Dissent in Organizations, *Review of Economic Studies*, forthcoming.

Lorsch, Jay W. and T. J. Tierney, 2002, *Aligning the Stars: How to Succeed when Professionals Drive Results*. Boston, MA: Harvard Business School Press.

Monks, Robert A. G., 2008, *Corpocracy: How CEOs and the Business Roundtable Hijacked the World's Greatest Wealth Machine – And How to Get It Back*, John Wiley & Sons, New York.

Morck, Randall, Shleifer, Andrei, and Vishny, Robert W., 1990, Do managerial objectives drive bad acquisitions?"*Journal of Finance* 45, 31-48.

Morrison, Alan and William J. Wilhelm Jr., 2004, Partnership Firms, Reputation, and Human Capital, *American Economic Review* 94, 1682-1692.

Myers, Stewart C., 2000, Outside equity, *Journal of Finance* 55, 1005-1037.

Penrose, Edith T., 1959, *Theory of the Growth of the Firm*, John Wiley & Sons, New York.

Prendergast, Canice, 1993, The role of promotion in inducing specific human capital acquisition, *Quarterly Journal of Economics* 108, 523-534.

Rajan, Raghuram G., and Luigi Zingales, 1998, Power in a theory of the firm, *Quarterly Journal of Economics* 113, 387-432.

Rajan, Raghuram G., and Luigi Zingales, 2001, The firm as a dedicated hierarchy: a theory of the origins and growth of firms, *Quarterly Journal of Economics* 116, 805-851.

Shleifer, Andrei, and Robert W. Vishny, 1989,Management entrenchment: The case of manager-specific investments, *Journal of Financial Economics* 25, 123-139.

Shleifer, Andrei, and Robert W. Vishny, 1997, "A survey of corporate governance", *Journal of Finance* 52,737-783.

Titman, Sheridan, 1984, The Effect of Capital Structure on a Firm's Liquidation Decision, *Journal of Financial Economics* 13, 137-151.

Figure 3a: Investment with and without equity (low goverance case with beta = 0.5, IPO at t=10)

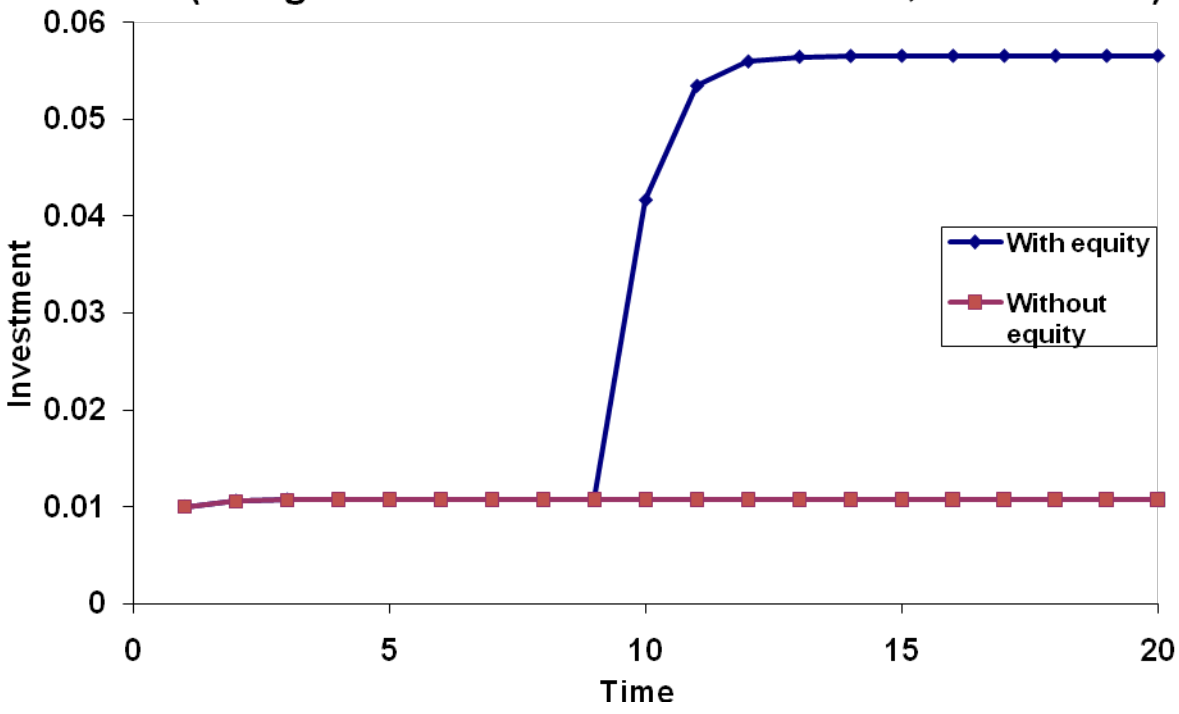
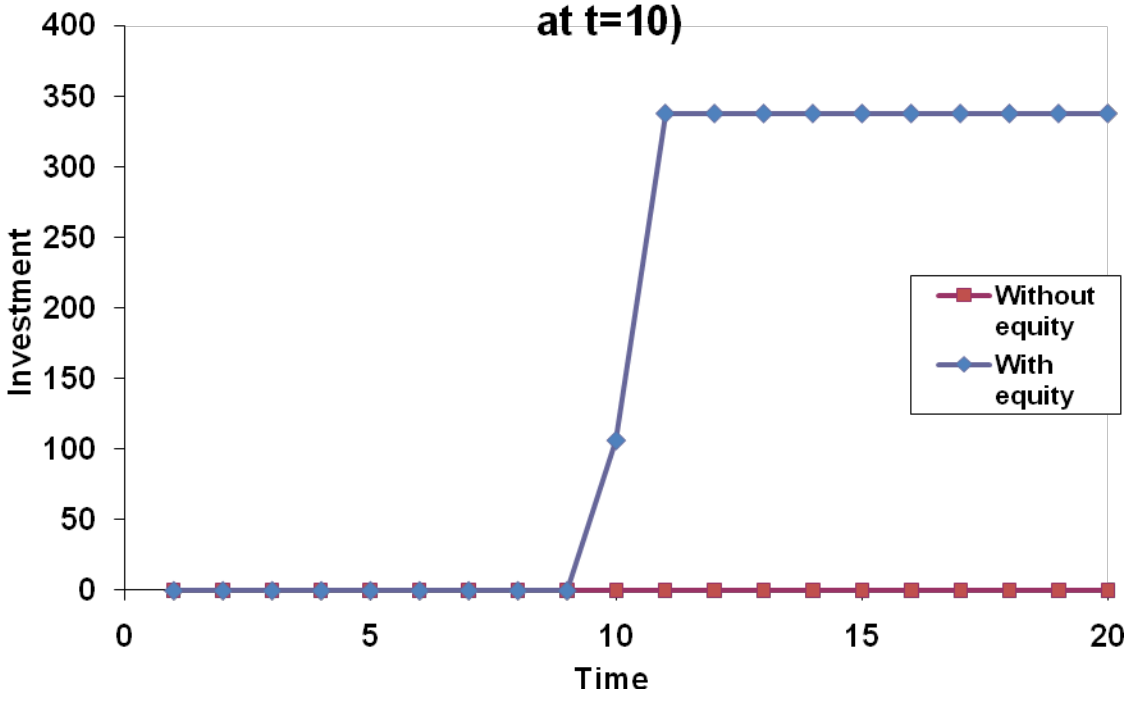


Figure 3b: Investment with and without equity (high governance case with beta = 0.9999, IPO at t=10)



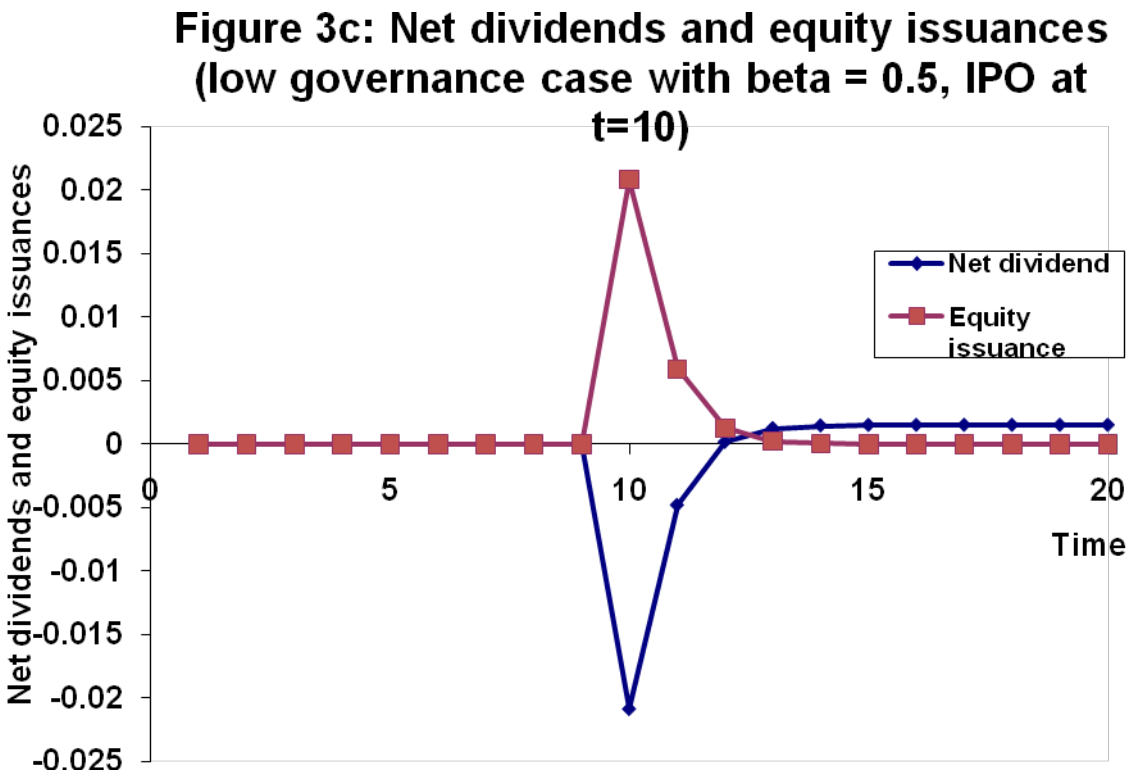


Figure 3c: Net dividends and equity issuances (low governance case with beta = 0.5, IPO at t=10)
Net dividends and equity issuances
0.025
0.02
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
0
5
10
15
20
Time
Net dividend
Equity issuance

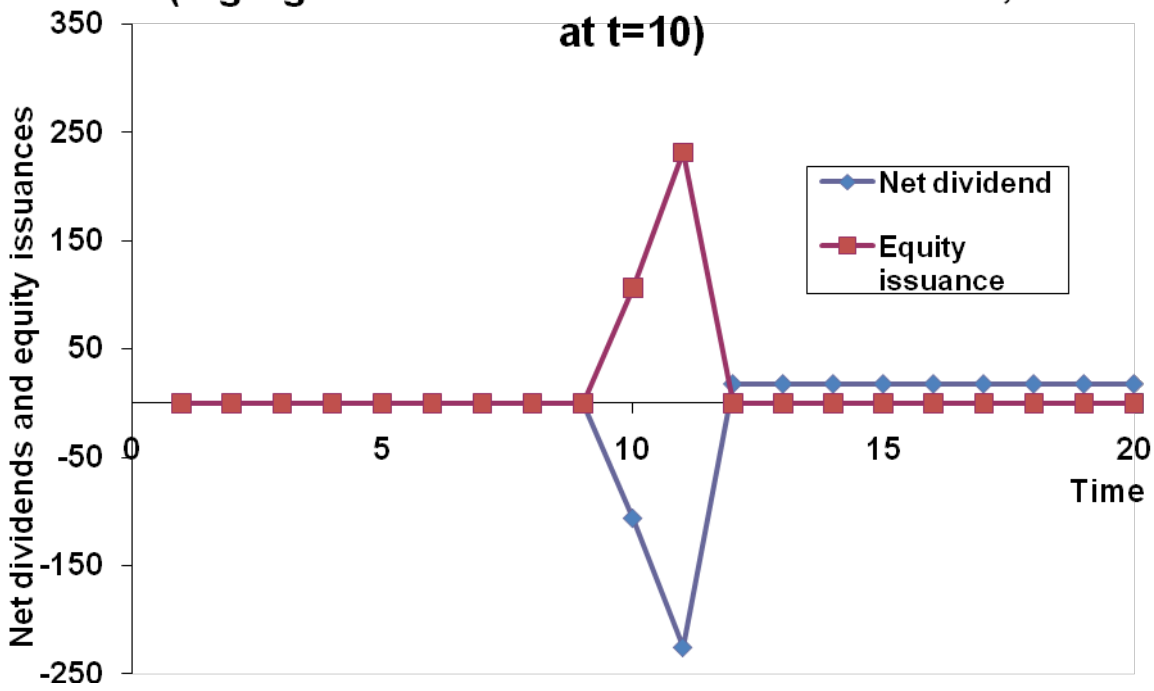


Figure 3d: Net dividends and equity issuances (high governance case with beta = 0.9999, IPO at t=10)
Net dividends and equity issuances
350
250
150
50
-50
-150
-250
0
5
10
15
20
Time
Net dividend
Equity issuance

Figure 3e: Manager's net utility for low (beta = 0.5) and high governance (beta = 0.9999), IPO at t=10

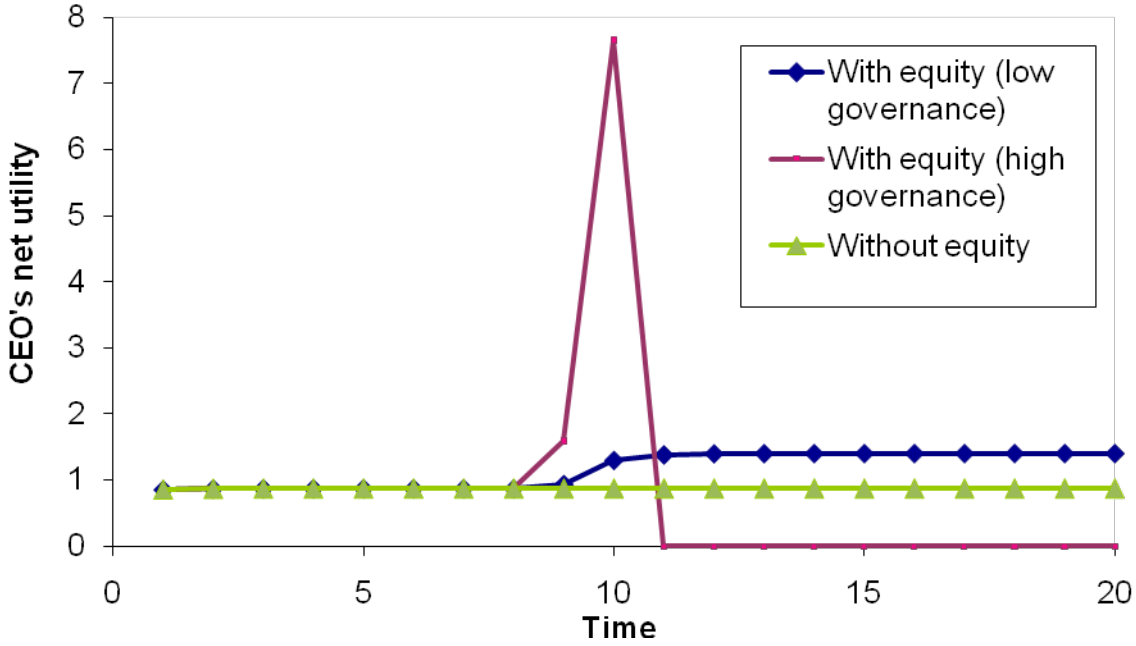


Table 1: Age difference between CEO and other top executives

This table presents a comparison of the age of CEOs as well as non-CEO top executives. The main source of data is ExecuComp. The dataset spans the years 1992-2008 and consists of 184,464 executive-year observations. A few executives have more than one observation per year (these are executives that are e.g. CEOs in one firm and VPs in another firm in the same year). In order to obtain a unique observation for each executive and year, the following sample selection is performed: if an executive has a CEO position and another position in a given year, we keep the CEO observation; if an executive has two non-CEO observations in a given year, we randomly keep one of the two for each year. This results in 1,278 (less than 1%) observations being deleted; the final number of executive-year observations is 183,186. To generate a measure for the *founder-status* of a CEO, data on the founding year of a company is obtained from Jay Ritter's homepage (http://bear.warrington.ufl.edu/ritter/FoundingDates.htm); this dataset covers firms that had IPOs in 1975 or thereafter. In statistics that rely on the identification of founder-status, only ExecuComp firms which can be matched to Jay Ritter's founding year data are retained in the sample (79,718 executive-year observations). A "founder-CEO" is defined as a CEO who became CEO at the time of the company's founding. Once such a founder-CEO leaves the company for another one, the status switches to "non-founder" in the new company. The measurement of *firm age* also relies on the match with Jay Ritter's founding year data; firm age is defined as the difference between the current year and the founding year. The cut-offs for the firm age quintiles are based on the unconditional sample distribution; a given firm may therefore migrate from one firm age quintile to the next over the sample period. *Firm size* quintiles are based on total assets from Compustat. Size quintile cut-offs are based on the unconditional sample distribution; a given firm may migrate from one size quintile to another over the sample period if its assets change sufficiently over time. *Segment* data is obtained from the Compustat segments file; the merged sample consists of 161,863 executive-year observations. Multi-segment firms are defined as firms which have more than one business segment. *Age difference* between CEO and non-CEO top executives is statistically significant at 1% level in all cases.

	CEO Age	Obns.	Non-CEO Age	Obns.	Age Difference (CEO vs. non-CEO)
Overall sample	55.6	25336	51.6	42686	4.0
Founder CEO	55.4	1745	N/A	N/A	N/A
Non-Founder CEO	53.8	9139	50.0	21341	3.8
Youngest firm age quintile (age < 13)	51.1	2070	47.6	4393	3.5
Firm age quintile 2	53.0	2225	49.0	4290	4.0
Firm age quintile 3	54.1	2254	49.9	4459	4.2
Firm age quintile 4	55.9	2151	51.3	4364	4.6
Oldest firm age quintile (age > 41)	56.2	2184	52.6	3835	3.7
Smallest size quintile (assets < 342 mn)	54.0	4504	49.6	8891	4.4
Size quintile 2	55.3	5176	50.9	9355	4.4
Size quintile 3	55.8	5215	51.9	8461	3.9
Size quintile 4	55.9	5166	52.6	7816	3.3
Largest size quintile (assets > 7127 mn)	56.9	5247	53.5	8098	3.4

Table 2: "Succession plan" of firms – Who is the next CEO?

In Panel A, this table presents the likelihood that when the firm has a new CEO, the replacement is from the pool of current (non-CEO) top-executives of the firm. Panel B shows the average tenure of non-CEO top executives in firms with new CEOs versus all firms. Data description is as in Table 1. All variables are constructed annually; the time-series averages of these variables across the sample period are reported in the table.

Panel A: *Nb. (new CEO_t)* is the number of new CEOs, i.e. CEOs who were either not CEOs in the preceding year or who were CEOs of another company in the preceding year. *Nb. (New CEO_t from non-CEO exec_[t-1])* is the number of new CEOs who were non-CEO executives of the same company in the preceding year. *Prob(New CEO_t from non-CEO exec_[t-1])* is the ratio of *Nb. (New CEO_t from non-CEO exec_[t-1]) to Nb. (new CEO_t).*The sample spans 1993-2008.

Panel B: The only column here reports the average tenure of non-CEO executives when there is a new CEO in the firm; i.e. when there is a new CEO in a given firm in year *t*, the number of consecutive years that non-CEO top executives remain in the firm from year *t* onwards is calculated. To avoid problems due to truncation, this sample is from 1993 to 2000.

	Panel A			**Panel B**
	Nb. (new CEO_t)	**Nb. (New CEO_t from non-CEO exec_[t-1])**	**Prob(New CEO_t from non-CEO exec_[t-1])**	**Avg. tenure of non-CEO execs in the firm when there is a new CEO**
Overall sample	356.2	289.1	0.794	3.1
Founder CEO	N/A	N/A	N/A	N/A
Non-Founder CEO	146.9	115.6	0.780	2.9
Youngest firm age quintile (age < 13)	46.9	38.6	0.798	2.6
Firm age quintile 2	33.3	26.8	0.769	2.9
Firm age quintile 3	29.9	22.8	0.782	3.1
Firm age quintile 4	27.0	21.4	0.814	3.4
Oldest firm age quintile (age > 41)	29.8	24.1	0.798	3.5
Smallest size quintile (assets < 342 mn)	92.5	76.2	0.775	3.0
Size quintile 2	76.4	62.6	0.795	3.3
Size quintile 3	70.9	56.8	0.786	3.0
Size quintile 4	61.9	49.9	0.800	3.3
Largest size quintile (assets > 7127 mn)	54.1	42.7	0.802	3.1

Table 3: Continuity of CEO and other top executives in the firm

This table presents the likelihood that a firm's CEO and other top executives continue in the firm from one year to the next. Data description is as in Table 1. All variables are constructed annually; the time-series averages of these variables are reported in the table (as the sample ends in 2008, and each data point requires data for two consecutive years, the time-series averages reported are for 1992-2007).

Panel A: *Nb. (CEO_t)* is the number of CEOs per year. *Nb. (CEO_[t+1] | CEO_t)* is the number of CEOs who, in the following year, are still CEOs of the same company. *Prob (CEO_[t+1] | CEO_t)* is the ratio of *Nb. (CEO_[t+1] | CEO_t)* to *Nb. (CEO_t)*.

Panel B: In the first column of Panel B, the average number of firms with at least one non-CEO top executive is reported. The second column reports the average number of firms with at least one non-CEO top executive who remains a top-executive at the same firm in the following year. Finally, column three shows the ratio of the corresponding values in columns two and one; this ratio can be interpreted as the likelihood that at least one non-CEO top-executive in a given year remains a top-executive in the following year.

	Panel A			**Panel B**		
	Nb. (CEO_t)	**Nb. (CEO_[t+1] | CEO_t)**	**Prob (CEO_[t+1] | CEO_t)**	**Nb. firms with at least 1 non-CEO top exec**	**Nb. firms with at least 1 non-CEO top exec at time t who remains a top-exec at time t+1**	**Likelihood that at least 1 non-CEO top-exec at time t remains a top-exec at time t+1**
Overall sample	1596.9	1312.6	0.828	1858.8	1759.9	0.948
Founder CEO	109.3	92.3	0.852	109.2	102.2	0.939
Non-Founder CEO	569.5	460.0	0.820	715.4	671.6	0.941
Youngest firm age quintile (age < 13)	133.7	107.6	0.820	197.4	185.3	0.937
Firm age quintile 2	142.3	115.1	0.822	168.2	158.1	0.941
Firm age quintile 3	138.4	112.3	0.823	155.3	144.9	0.940
Firm age quintile 4	128.3	105.6	0.843	144.8	136.3	0.950
Oldest firm age quintile (age > 41)	136.1	111.8	0.831	158.9	149.2	0.943
Smallest size quintile (assets < 342 mn)	289.8	235.7	0.817	411.9	389.8	0.938
Size quintile 2	326.4	265.3	0.814	377.0	353.3	0.937
Size quintile 3	325.6	266.6	0.828	363.8	343.8	0.948
Size quintile 4	323.2	269.9	0.839	354.8	338.4	0.955
Largest size quintile (assets > 7127 mn)	329.8	273.4	0.834	345.8	329.2	0.955

This draft: July 2010

Online Appendix:

The Internal Governance of Firms

Viral V. Acharya
NYU-Stern, CEPR, ECGI and NBER

Stewart C. Myers
MIT and NBER

Raghuram Rajan
Booth School of Business
University of Chicago and NBER

This online appendix derives model outcomes under the first-best, the constrained efficient case, and the myopic-CEO case. It also provides key steps in the proofs of Propositions 1 and 5.

I. Derivation of the first-best, constrained efficient and myopic-CEO outcomes

First best

The first-best (FB) outcome is investment and managerial learning pairs (k_t, s_t), for all t, that maximize the sum of all current and future cash flows net of investment and learning effort:

$$\max_{\{k_t, s_t\}} \sum_{i=0}^{\infty} \frac{1}{(1+r)^i} \left[\theta_{t+i} \left(k_{t+i-1}\right)^{\gamma} [\, f(s_{t+i-1}) + g(s_{t+i})] - (k_{t+i} - k_{t+i-1}) - s_{t+i} \right].$$

Let s_t^{FB} be the first-best level of learning effort whose first order condition takes account of the effect of learning on this period's cash flow as well as the next period's:

$$\theta_t (k_{t-1}^{FB})^{\gamma} g'(s_t^{FB}) + \frac{\theta_{t+1}}{1+r} \left(k_t^{FB}\right)^{\gamma} f'(s_t^{FB}) = 1$$

This equation determines s_t^{FB} in terms of k_t^{FB}. Next, denote cash flows net of investment and learning as $V_{t+1}(k_t, k_{t+1}) = \left[\theta_{t+1} \left(k_t\right)^{\gamma} [\, f(s_t^{FB}(k_t)) + g(s_{t+1}^{FB}(k_{t+1}))] - (k_{t+1} - k_t) - s_{t+1}^{FB}(k_{t+1}) \right]$.

Then, the capital choice problem can be rewritten as

$$\max_{k_t} \sum_{i=0}^{\infty} \frac{1}{(1+r)^i} V_{t+i}(k_{t+i-1}, k_{t+i}).$$

In turn, the first-order condition with respect to capital stock k_t is

$$\frac{\partial V_t(k_{t-1}, k_t)}{\partial k_t} + \frac{1}{(1+r)} \frac{\partial V_{t+1}(k_t, k_{t+1})}{\partial k_t} + \sum_{i=1}^{\infty} \frac{1}{(1+r)^i} \left[\frac{\partial V_{t+i}(k_{t+i-1}, k_{t+i})}{\partial k_{t+i}} + \frac{1}{(1+r)} \frac{\partial V_{t+i+1}(k_{t+i}, k_{t+i+1})}{\partial k_{t+i}} \right] \frac{dk_{t+i}}{dk_t} = 0.$$

Note that these derivatives take account of the effect of s_t on k_t in cash flow V_t (but not of s_{t+1} on k_t in cash flow V_{t+1} as that is captured in the dependence of s_{t+1} on k_{t+1}). Now, it is clear that recursively if we have $\left[\frac{\partial V_{t+i}(k_{t+i-1}, k_{t+i})}{\partial k_{t+i}} + \frac{1}{(1+r)} \frac{\partial V_{t+i+1}(k_{t+i}, k_{t+i+1})}{\partial k_{t+i}} \right] = 0$ for all $i > 1$, then

indeed the first-order condition with respect to capital stock k_t is also

$\frac{\partial V_t(k_{t-1},k_t)}{\partial k_t}+\frac{1}{(1+r)}\frac{\partial V_{t+1}(k_t,k_{t+1})}{\partial k_t}=0.$ [1] This, in turn, is:

$$-1+\frac{1}{(1+r)}\left[\theta_{t+1}\gamma\left(k_t\right)^{\gamma-1}[f(s_t^{FB})+g(s_{t+1}^{FB})]+1\right]+\left[\theta_t\left(k_{t-1}\right)^{\gamma}\ g'(s_t^{FB})+\frac{1}{(1+r)}\theta_{t+1}\left(k_t\right)^{\gamma}\ f'(s_t^{FB})-1\right]\frac{ds_t^{FB}}{dk_t}=0 \quad .$$

But given the managerial first-order condition which also maximizes the entire stream of cash flows, we have that $\left[\theta_t\left(k_{t-1}\right)^{\gamma}\ g'(s_t^{FB})+\frac{1}{(1+r)}\theta_{t+1}\left(k_t\right)^{\gamma}\ f'(s_t^{FB})-1\right]=0$. Thus, the capital stock is given by the condition:

$$-1+\frac{1}{(1+r)}\left[\theta_{t+1}\gamma\left(k_t\right)^{\gamma-1}[f(s_t^{FB})+g(s_{t+1}^{FB})]+1\right]=0,$$

which can be rewritten as

$$k_t^{FB}=\left[\frac{\gamma\theta_{t+1}}{r}\left(f(s_t^{FB})+g(s_{t+1}^{FB})\right)\right]^{\frac{1}{1-\gamma}}.$$

Constrained efficient case: Long-term CEOs

Under the constrained efficient outcome, the CEO at time *t* maximizes the discounted sum of cash flows net of investment:

$$\max_{k_t}\sum_{i=0}^{\infty}\ \frac{1}{(1+r)^i}\left[\theta_{t+i}\left(k_{t+i-1}\right)^{\gamma}[f(s_{t+i-1})+g(s_{t+i})]-(k_{t+i}-k_{t+i-1})-s_{t+i}\right],$$

recognizing the moral hazard in the choice of managerial effort:

$$s_t\in\arg\max_{\hat{s}_t}\frac{1}{(1+r)}\left[\theta_{t+1}\left(k_t\right)^{\gamma}[f(\hat{s}_t)+g(s_{t+1})]-(k_{t+1}-k_t)\right]-\hat{s}_t.$$

In this case, note that there is moral hazard at the level of the manager when she invests in learning, so that the effects of learning on cash flows other than in the period when the manager is

[1] Given the recursive structure of the problem, this essentially ensures that we can ignore the effect of this period's choice of capital and effort on next period's choice of these variables.

the CEO are ignored. The manager chooses s_t to maximize her future rents as the CEO. She maximizes

$$\frac{1}{1+r}\left[\theta_{t+1}\left(k_t\right)^{\gamma}\left[f(s_t)+g(s_{t+1})\right]-(k_{t+1}-k_t)\right]-s_t.$$

Differentiating and setting the result equal to zero, we get $\frac{\theta_{t+1}}{1+r}\left(k_t\right)^{\gamma} f'(s_t)=1$. Thus, if s_t^{CE} is the constrained efficient level of learning effort, then it satisfies

$$\frac{\theta_{t+1}}{1+r}\left(k_t\right)^{\gamma} f'(s_t^{CE})=1.$$

Now, since the CEO does not internalize the cost of managerial learning, the CEO must take account of the effect of his investment choice on managerial action as that affects the firm's cash flows. Denote the managerial learning as $s_t^{CE}(k_t)$. Then, using the same recursive reasoning as in the case of the first-best, we obtain that the capital stock is given by the condition:

$$-1+\frac{1}{(1+r)}\left[\theta_{t+1}\gamma\left(k_t\right)^{\gamma-1}\left[f(s_t^{CE})+g(s_{t+1}^{CE})\right]+1\right]+\left[\theta_t\left(k_{t-1}\right)^{\gamma} g'(s_t^{CE})+\frac{1}{(1+r)}\theta_{t+1}\left(k_t\right)^{\gamma} f'(s_t^{CE})-1\right]\frac{ds_t^{CE}}{dk_t}=0 \quad .$$

Now, by manager's first order condition, we have that $\frac{\theta_{t+1}}{1+r}\left(k_t\right)^{\gamma} f'(s_t^{CE})=1$, so that the first order condition for capital stock can be rewritten as

$$\theta_{t+1}\gamma\left(k_t\right)^{\gamma-1}\left[f(s_t^{CE})+g(s_{t+1}^{CE})\right]+(1+r)\theta_t\left(k_{t-1}\right)^{\gamma} g'(s_t^{CE})\frac{ds_t^{CE}}{dk_t}=r.$$

This equation gives the law of motion of capital. Note that totally differentiating the first order condition for managerial learning and rearranging, we obtain $\frac{ds_t^{CE}}{dk_t}=\frac{-\gamma f'}{k_t f''}$ which is positive.

Thus, in the constrained efficient, the long-term CEO takes account not just of the direct effect of capital on cash flows but also its effect in terms of motivating managers who do not internalize

the effect of their effort on current period cash flows. Under specialized functions, more tractable expressions arise for the capital stock, as we will derive below.

Myopic CEO case

The myopic CEO's income is extracted from the current period's cash flow, net of investment:

$$\theta_t \left(k_{t-1}\right)^{\gamma} [\, f(s^{CEO}) + g(s_t)] - (k_t - k_{t-1})$$

Differentiating w.r.t. k_t, we see that the CEO's marginal net return from investing is

$$\theta_t \left(k_{t-1}\right)^{\gamma} g' \frac{ds_t}{dk_t} - 1.$$

The manager chooses s_t to maximize her future rents as the CEO. She maximizes

$$\frac{1}{1+r}\left[\theta_{t+1}\left(k_t\right)^{\gamma} [\, f(s_t) + g(s_{t+1})] - (k_{t+1} - k_t)\right] - s_t .$$

Differentiating and setting the result equal to zero, we get $\frac{\theta_{t+1}}{1+r}\left(k_t\right)^{\gamma} f'(s_t) = 1$. As in the case of constrained efficient case, totally differentiating the first order condition and rearranging, we obtain $\frac{ds_t}{dk_t} = \frac{-\gamma f'}{k_t f''}$ which is positive. It is clear that managerial first-order condition is the same but the long-run CEO takes account of more beneficial effects of capital investment on cash flows, so that the myopic CEO invests less than in the constrained efficient case.

Specializing functions

Assume that the CEO and manager could each generate a cash flow *h(s)* if they were assigned all the tasks in the firm, depending on their learning *s*. The fraction of tasks assigned to the CEO is δ. The CEO's contribution to cash flows is $f(s) = \delta h(s),$ and the manager's

contribution is $g(s) = (1-\delta)h(s)$. We set $h(s_t) = \frac{1}{b-1}(a + bs_t)^{\frac{b-1}{b}}$ with $a \geq 0$ and $b > 1$. To ensure convergence to steady state, we will assume $1 - \gamma b > 0$. Under these assumptions, we obtain that $h'(s_t) = (a + bs_t)^{-\frac{1}{b}}$ and $h''(s_t) = \frac{-1}{b}(a + bs_t)^{\frac{-1}{b}-1}$ so that $\frac{h'(s_t)}{h''(s_t)} = -(a + bs_t)$.

We focus the following analysis on the steady-state where θ is constant over time and so are capital stock and managerial learning.

First best

Under the specializing functions, the CEO's first-order condition takes the form

$$k^{FB} = \left[\frac{\gamma\theta}{r(b-1)}\left(a + bs\right)^{\frac{(b-1)}{b}} \right]^{\frac{1}{1-\gamma}}.$$

The manager's first-order condition takes the form

$$a + bs^{FB} = \left[\theta k^{\gamma} \left(\frac{\delta}{(1+r)} + (1-\delta) \right) \right]^{b}.$$

Substituting the second condition into the first, we obtain that

$$k^{FB} = \left[\frac{\gamma}{r} \frac{\theta^{b}}{(b-1)} \left(\frac{\delta}{1+r} + (1-\delta) \right)^{b-1} \right]^{\frac{1}{1-\gamma b}}.$$

Constrained efficient case: Long-term CEOs

Under the specializing functions, the CEO's first-order condition takes the form

$$k^{CE} = \left[\frac{\gamma\theta}{r} \left(\frac{1}{(b-1)} + (1+r)(1-\delta) \right) \left(a + bs\right)^{\frac{(b-1)}{b}} \right]^{\frac{1}{1-\gamma}}.$$

The manager's first-order condition takes the form

$$a + bs^{CE} = \left[\frac{\theta\delta}{(1+r)} k^{\gamma} \right]^{b}.$$

Substituting the second condition into the first, we obtain that

$$k^{CE} = \left[\frac{\gamma}{r} \frac{\theta^b \delta^{(b-1)}}{(b-1)(1+r)^{b-1}} \left(1 + (b-1)(1+r)(1-\delta)\right) \right]^{\frac{1}{1-\gamma b}}.$$

Myopic CEO case

Under the specializing functions, the CEO's first-order condition takes the form

$$k^{SS} = \left[\gamma\theta(1-\delta)\left(a+bs\right)^{\frac{(b-1)}{b}} \right]^{\frac{1}{1-\gamma}}.$$

The manager's first-order condition takes the form

$$a + bs^{SS} = \left[\frac{\theta\delta}{(1+r)} k^{\gamma} \right]^{b}.$$

Substituting the second condition into the first, we obtain that

$$k^{SS} = \left[\gamma\left(1-\delta\right)\delta^{b-1} \frac{\theta^b}{(1+r)^{b-1}} \right]^{\frac{1}{1-\gamma b}}.$$

II. Decentralization of tasks in an internally governed firm

Our main result for the steady-state comparisons between the first-best, the constrained-efficient and the myopic CEO can be summarized as:

Proposition 1:

When the CEO has a long term horizon, it is efficient for the CEO to make all cash-flow relevant contributions ($\delta = 1$ is optimal). When the CEO is myopic, firm value is maximized when the CEO's contribution to the firm's cash flows is neither too large nor too small relative to manager's contribution ($0 < \delta < 1$).

Proof: Using the steady state outcomes derived in Section I of this online appendix and comparing the constrained efficient case (long-horizon CEO) with the first best, we get

$$\frac{k^{CE}}{k^{FB}} = \left[\left(\frac{\delta}{\delta + (1-\delta)(1+r)} \right)^{(b-1)} \left(1 + (b-1)(1+r)(1-\delta)\right) \right]^{\frac{1}{1-\gamma b}}.$$

It is easy to see that this ratio is zero when $\delta = 0$, is increasing in and reaches its maximum value of 1 when $\delta = 1$.

Similarly, comparing the myopic CEO case with the first best based on steady state outcomes in Section I, we obtain

$$\frac{k^{SS}}{k^{FB}} = \left[\frac{r(1-\delta)\delta^{b-1}}{(b-1)\left(\delta + (1-\delta)(1+r)\right)^{b-1}} \right]^{\frac{1}{1-\gamma b}}.$$

It is easy to see that this ratio is zero when $\delta = 0$ and when $\delta = 1$, is positive throughout the relevant range, and is therefore maximized in between. Indeed, it can be shown that the maximum is unique. To see this, we define $\psi(\delta) = \left[\frac{(1-\delta)\delta^{b-1}}{\left(\delta + (1-\delta)(1+r)\right)^{b-1}} \right]$. Then, taking logs and differentiating with respect to δ, it can be shown that $\psi'(\delta) = 0$ is equivalent to the quadratic equation $r\delta^2 - b(1+r)\delta + (b-1)(1+r) = 0$. This equation has two roots. After some algebra, it can be shown that one of the roots is between 0 and 1, and the other is greater than 1. Since the relevant range is over 0 and 1, the maximum of $\frac{k^{SS}}{k^{FB}}$ is unique between 0 and 1.

Finally, note that

$$\frac{k^{SS}}{k^{FB}} = \left[\frac{r(1-\delta)(b-1)}{1 + (b-1)(1-\delta)(1+r)} \right]^{\frac{1}{1-\gamma b}} < 1 \forall \delta.$$

Q.E.D.

It can be similarly shown that cash flows and cash flows net of investment and managerial learning follow qualitatively the same properties as investment as stated in Proposition 1. The proofs of these additional results are available from authors upon request.

III. Private Partnerships and Public Firms

Comparing the private (rolling) partnership where each CEO sells the firm to the manager to the publicly governed firm, where both have myopic CEOs, we obtain that

Proposition 5: *For external governance β sufficiently close to one and CEO's contribution to cash flows δ also sufficiently close to one , we have $k^*(\beta) > k^{CE}$, $s^*(\beta) > s^{CE}$, and $CF^*(\beta) < CF^{CE}$, that is, the externally governed firm invests more, exerts employees more and produces a smaller steady-state cash flow compared to a rolling partnership (the constrained efficient case).*

Proof: We focus the analysis when $\beta \to 1$ and the claim in the proposition will follow by continuity in the range for which β is sufficiently close to one. Recall that when $\beta \to 1$, the CEO incurs no private cost of investment and hence investment is determined by the participation constraint of the manger that the next period cash flow net of rental payment on capital is only enough to cover their cost of learning in the current period. That is,

$\frac{1}{1+r}\left(CF^* - rk^*\right) = s^*$, where in the steady state, we have $CF^* = \theta\left(k^*\right)^{\gamma}\left[f\left(s^*\right) + g\left(s^*\right)\right]$. In other words, we can rewrite the steady state capital as given by the implicit condition

$k^* = \frac{1}{r}\left(CF^* - (1+r)s^*\right)$, where s^* is given by the managerial first order condition:

$$\frac{\theta}{1+r}\left(k^*\right)^{\gamma} f'\left(s^*\right) = 1.$$

Now, under our specializing assumptions, the fraction of tasks assigned to the CEO is δ. The CEO's contribution to cash flows is $f(s) = \delta h(s)$, and the manager's contribution is $g(s) = (1-\delta)h(s)$. We set $h(s_t) = \frac{1}{b-1}(a + bs_t)^{\frac{b-1}{b}}$ with $a \geq 0$ and $b > 1$. To ensure

convergence to steady state, we will assume $1-\gamma b>0$. Under these assumptions, we obtain that

$h'(s_t)=(a+bs_t)^{\frac{-1}{b}}$ and $h''(s_t)=\frac{-1}{b}(a+bs_t)^{\frac{-1}{b}-1}$ so that $\frac{h'(s_t)}{h''(s_t)}=-(a+bs_t).$

Then, we obtain from manager's first order condition that $a+bs^*=\left[\frac{\theta\delta}{(1+r)}\left(k^*\right)^{\gamma}\right]^b$,

which when substituted in the participation constraint yields the equation for steady state capital of the public firm whose external governance is perfect ($\beta\to 1$):

$$k^*=\frac{1}{r}\left(CF^*-(1+r)s^*\right)=\frac{1}{r}\left[\frac{\theta^b\delta^{(b-1)}\left(k^*\right)^{\gamma}}{b(b-1)(1+r)^{b-1}}\left(\delta+(1-\delta)b\right)+\frac{a(1+r)}{b}\right].$$

As we showed earlier in Section II of this online appendix, under the same assumptions, the steady state capital for the constrained efficient case is given by

$$k^{CE}=\left[\frac{\gamma}{r}\frac{\theta^b\delta^{(b-1)}}{(b-1)(1+r)^{b-1}}\left(1+(b-1)(1+r)(1-\delta)\right)\right]^{\frac{1}{1-\gamma b}}.$$

While the rest of the proof can be shown more generally for *a* ≥ *0* for sake of transparency of the argument, we set *a = 0.* In this case, the equation for steady state capital in the perfectly governed firm yields an explicit solution:

$$k^*=\left[\frac{1}{r}\frac{\theta^b\delta^{(b-1)}}{b(b-1)(1+r)^{b-1}}\left(\delta+(1-\delta)b\right)\right]^{\frac{1}{1-\gamma b}}.$$

The steady state capital stock under perfected governed firm and constrained efficient case are both zero when CEO does not contribute to cash flows (δ =0) and are both increasing in the CEO's share δ. Comparing them yields the ratio:

$$\frac{k^*}{k^{CE}}=\left[\frac{1}{\gamma b}\frac{\left(\delta+(1-\delta)b\right)}{\left(1+(b-1)(1+r)(1-\delta)\right)}\right]^{\frac{1}{1-\gamma b}}.$$

Now, if the CEO's share of cash flow, δ, is one, this ratio exceeds one since $\gamma b < 1$. In fact, a (weak) sufficient condition for the ratio to exceed one is that $\delta > \left(1 - \frac{1}{r(b-1)}\right)$. However, in general, there exists a range of δ in [0,1) such that for δ sufficiently small, the ratio $\frac{k^*}{k^{CE}}$ may be smaller than one.

This relation between steady state capital in perfectly governed and constrained efficient cases carries over to managerial learning *s* and cash flows *CF*. The details are available upon request.

Q.E.D.