

A Theory of Efficient Short-termism

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Abstract

This paper develops a theory in which the shareholders pursue short-termism in project choice to limit managerial rent-seeking behavior. Unlike in previous theories, a short-term bias in investment horizons maximizes firm value in the second-best case, whereas managers themselves prefer long-horizon projects. Short-termism benefits the firm because it limits managerial rent extraction by preventing investments in long-term bad projects that produce managerial private benefits but delay information revelation about project quality and managerial ability, thereby obstructing more efficient subsequent decisions. This result does not depend on any stock mispricing or managerial desire to manipulate stock prices. The likelihood of short-termism is higher when corporate governance is stronger, and at lower levels of the corporate hierarchy, and it may affect maturity transformation in banks. Numerous testable predictions of the analysis are discussed.

Keywords: Short-termism, Internal Governance, Payback, Capital Budgeting, Project Choice

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“Critics need to acknowledge that short-term thinking often makes sense for U.S. businesses, the economy and long-term employment.” —Roe (2015)

1 Introduction

One of the most widely-studied topics in corporate investment policy is “short-termism”, which is the practice of preferring lower-valued short-term projects over higher-valued long-term projects. It is asserted by many that short-termism is responsible for numerous ills, including excessive risk-taking, underinvestment in R&D, and the recent financial crisis, and that it may even represent a danger to capitalism itself.¹ Yet, short-termism continues to be widely practiced (e.g. Narayanan (1985a), Lefley (1996), Pike (1996), and Chen (2009)), exhibits no correlation with firm performance, and does not appear to be used only by incompetent or unsophisticated managers (e.g. Graham and Harvey (2001)).²

Why is short-termism so prevalent? The theoretical literature has offered explanations that fall primarily into two groups. One is that it is because the stock market puts pressure on firms to deliver short-term results (see, for example, Stein (1989)).³ As an example of this, in Dell’s recent decision to go private, one of the reasons provided by some observers was that Dell could pursue more long-term-oriented investment strategies if it did not face the pressure from the stock market to deliver short-term results. Such concerns about the value-depleting

¹Bebchuk and Fried (2010) state: “...standard executive pay arrangements were leading executives to focus on the short term, motivating them to boost short-term results at the expense of long-term value. The crisis of 2008-09 has led to widespread recognition that pay arrangements that reward executives for short-term results can produce incentives to take excessive risks.” Recently, evidence of short-termism has even been provided for private investments in cancer research—Budish, Roin, and Williams (2015) document that these investments are distorted away from long-term projects. Also, see Rappaport and Bogle (2011) for a discussion of how short-termism may represent a danger to capitalism.

²An example of short-termism is the frequent use of the payback criterion in capital budgeting. A project’s payback period is the length of time it takes for project cash flows to add up to the initial investment. Graham and Harvey (2001) found that 56.7% of the firms in their survey almost always used payback; they note: “This is surprising given that financial textbooks have lamented the shortcomings of the payback criterion for decades”. Pike’s (1996) evidence that, during 1975-1992, 4-14% of companies in the U.K. used payback as their *only* capital budgeting criterion suggests that payback is decision-relevant. Anecdotal evidence, in the form of examples of CEOs making statements that they have well-understood guidelines in their firms about the maximum permissible project payback periods, are also consistent with this.

³For example, Stein (1989) states: “In an effort to mislead the market about their firms’ worth, managers forsake good investments so as to boost current earnings.”

pressure on public firms to deliver short-term results have been voiced in other contexts too. For example, Polsky and Lund (2013) state: “First, short-termism could be the result of myopic shareholder preferences for current results...Second, short-termism could be the result of poorly-designed compensation arrangements.” This reasoning has led many to suggest that reforming executive compensation can improve outcomes (e.g. Pozen (2014)). The other group of theories that rationalizes short-termism relies on managerial self-interest, arguing that an agency problem between managers and shareholders leads managers to pursue short-term projects even though shareholders prefer long-term projects (e.g. Narayanan (1985a,b)).

This paper challenges the notion that short-termism is inherently a misguided practice, and asks whether there are circumstances in which it is economically efficient. I highlight two main findings related to this question. First, there are circumstances in which the *owners* of the firm prefer short-term projects in the (constrained) second-best case, even though long-term projects have higher first-best values. There are other circumstances in which the firm’s owners prefer long-term projects in the second best. Moreover, this is independent of any stock market inefficiencies or pressures. This result stands in sharp contrast to earlier research in which short-termism incentives emanate from stock market frictions (e.g. Bolton, Scheinkman, and Xiong (2006a) and von Thadden (1995)). Second, it is the managers with career concerns who dislike short-term projects, even when the firm’s owners prefer them. This is the *opposite* of the results in Narayanan (1985a,b) and Stein (1989), that managers like short-term projects even though the firm’s owners prefer long-term projects. In this paper, managerial career concerns distort outcomes by inefficiently inclining them towards *long-term* horizons, and short-termism is a way to reduce this distortion.⁴

These results are derived with a two-period model of internal governance and project choice, with career concerns and moral hazard distorting managerial project choices in firms. There is a top executive (called a “CEO”), who maximizes firm value in the base model.⁵

⁴Moreover, unlike in Holmstrom (1999), where career concerns reduce agency costs, in my model they increase agency costs. In this respect the model is similar to Holmstrom and Ricart i Costa (1986) where career concerns lead to investment distortions, albeit of a different sort.

⁵The idea here is that executive compensation is designed to align the CEO’s interest with that of the

Reporting to the CEO is a lower-level divisional manager (“manager” henceforth) who requests funding for (and manages) projects in two time periods. The manager receives ideas for projects in each period with variable quality—they can be good (positive NPV) or bad (negative NPV) projects. The manager knows project quality, but the CEO does not. Regardless of quality, the project can be (observably) chosen to be short-term or long-term, and a long-term project has higher intrinsic value.⁶ The success probability for any good project depends on managerial ability, which is *ex ante* unknown to everybody.

In the first-best case, the manager requests funding only for the long-term version of a good project. However, when the manager has private information about project quality, he may request funding for a bad project by misrepresenting it as a good project because he enjoys private benefits from investing.⁷

Now consider the manager’s problem. In the second period, the manager always proposes a short-term project because there is only one period left. In the first period, the manager has a choice. But if he gets a bad project, he prefers to nonetheless request funding, and do this for the long-term version of the project. Project approval allows the manager to enjoy the private benefit from first-period investment. Moreover, because the first period reveals nothing about his ability, he also obtains funding and private benefits in the second period. So, even a manager who invests in a bad first-period project enjoys private benefits in both

shareholders. In a generalized version of this preference function, the CEO also cares about the utility of a manager who reports to her, which introduces an additional agency problem.

⁶One can think about the long-term and short-term projects concretely through examples. For an appliance manufacturer, investing in modifying some feature of an existing appliance, say the size of the freezer section in a refrigerator, would be a short-term project. By contrast, building a plant to make an entirely new product—say a high-technology blender that does not exist in the company’s existing product portfolio—would be a long-term project. The long-term project will have a longer gestation period, with not only a longer time to recover the initial investment through project cash flows, but also a longer time to resolve the uncertainty about whether the project has positive NPV in an *ex post* sense. In a bank, loans can have either short or long maturities. There may also be industry differences that determine project duration. For example, long-distance telecom companies (e.g. AT&T) will typically have long-duration projects, whereas consumer electronics firms will have short-duration projects.

⁷These private benefits can be thought of as managerial quasi-rents in the perquisites-consumption framework of Jensen and Meckling (1976). There are many papers that assume managers enjoy private benefits from certain projects, and have an incentive to over-invest because of the private benefits. For example, see Aghion and Bolton (1992). Stein (2003) provides an excellent review.

periods, as long as the project is long-term.⁸ I call this the “incentive problem”.

The CEO recognizes the manager’s incentive, and may thus impose a requirement that any first-period project must be a *short-term* project. This makes investing in a bad project in the first period more costly for the manager because adverse information is more likely to be revealed early about the project and hence about managerial ability, with a loss of his second-period private benefit. The manager’s response may be to not request first-period funding if he has only a bad project. Such short-termism generates another benefit—it speeds up the firm’s learning about the manager’s *a priori* unknown ability, and it also permits conditioning its second-period investment on this learning. I refer to this as the “learning problem”.

I show that there are circumstances in which, because of the benefit of short-termism in resolving the incentive and learning problems, the firm’s owners will wish to insist on projects whose cash flows reveal information early rather than late, and a CEO may stipulate that only short-term projects will be approved. With only short-term good projects being selected in the first period, firm value goes up even though the short-term good project has lower value (in the first-best case) than the long-term good project. The analysis also implies that not all firms will practice short-termism. With general preferences, firms in which CEOs care about both firm value and managerial utility but put relatively low weights on firm value, or firms in which the gap in value between the long-term and short-term project is very large, will prefer the long-term project, so not all firms will display short-termism. Even though such firms will suffer from larger agency problems, their long-term projects may be sufficiently more valuable than the short-term projects of firms that practice short-termism, and thus short-termism and firm value may display little correlation in the cross-section. By the same token, short-termism may be associated with either better or worse firm performance. Thus, tests of the predictions of the theory developed here need to focus on dimensions other than cross-sectional differences in firm performance; these issues are discussed in Section 4.

⁸Of course, a long-term bad project will convey unfavorable information about managerial ability at the end of the second period, but the manager does not care about that because it is the end of the game.

I compare capital budgeting short-termism to contracting on managerial private benefits as a solution to the incentive problem. Because wage contracting can resolve the incentive problem (at a cost), but does not produce the learning benefit of short-termism, the analysis reveals insights about when firms will rely on short-termism and when they will rely on contracting on private benefits. Since *both* the learning and incentive problems are resolved by short-termism, firms may choose short-termism if *either* of these two problems is present. Thus, even in well-performing firms known to have high-ability managers—where the learning problem is of minimal importance—short-termism may be used to resolve incentive problems.

Since short-termism prevents lower-level managers from investing in bad projects, its use should be greater for managers who typically propose “routine” projects and less for top managers (like the CEO) who would typically be involved in strategic projects.⁹ Although the analysis is conducted with managerial risk neutrality and private benefits, I discuss the effect of replacing private benefits with managerial risk aversion and the limitations of this approach in explaining all the stylized facts the model explains.

The analysis assumes that the manager’s wage in any period is paid at the start of the period. I examine what would happen if payoff-contingent wage contracting was permitted. I characterize the conditions under which one would still encounter short-termism, but observe that payoff-contingent contracting reduces the attractiveness of short-termism. I then extend the model to allow for the influences of other employees (besides the manager) on the performance of the project, and assume that the CEO observes these influences but the manager does not. This kind of ex post asymmetric information makes payoff-contingent wages for the manager infeasible because the CEO has an incentive to act strategically. Short-termism thus resurfaces as a result. Since the problem of isolating an individual em-

⁹By “routine” projects, I mean projects that are less strategic and are on a smaller scale—essentially projects that would affect overall firm value less than strategic projects that influence the firm’s business portfolio mix. Some might argue that learning about managerial ability is not much of a concern for routine projects, so one should expect little need for short-termism. However, routine projects are typically analyzed by managers who subsequently get promoted and are replaced by managers with unknown abilities, and even routine projects may have payoff distributions that depend on managerial ability. Moreover, even if the learning benefit of short-termism was absent, the firm may still want to use a payback constraint to deal with the incentive problem.

ployee's impact on a project payoff is greater at lower levels of the hierarchy, this suggests that the firm is more likely to impose a short-termism constraint on lower-level managers.

Another issue is whether interim information about the payoff on the long-term project may be available before the payoff is realized. While it is possible that some information is available, its reliability may be an issue. For example, for a new product introduction, market research to get initial customer feedback may provide clues about the eventual success of the product, but such feedback may prove to be unreliable. McDonald's market research indicated that its low-fat McLean burger would be a hit with customers, but it flopped when introduced. Chrysler had negative feedback when it showed potential customers concept drawings of its minivan, but the product was a success. To examine this issue, I introduce costly CEO "attention" to acquire interim information about the long-term project (and hence the manager), as in the recent Halac and Prat (2016) model. This analysis reveals conditions under which short-termism still emerges.

I then turn to the implications for financial institutions. Much has been written about the harmful effects of short-termism in financial institutions, as it has been identified as a possible cause of the recent financial crisis. In this context, I discuss how incentive frictions within the bank can affect maturity transformation. Emphasizing short-term projects is akin to shortening loan maturity, so maturity transformation is reduced. But I argue that insisting on short-termism may also limit "ever-greening". I also discuss the role VaR can play in financial institutions in the context of the model.

Overall, the most robust result from this analysis is that informational frictions bias the investment horizons of firms without any discounting-related time horizon effects (e.g. such as those in Laibson (1997)), and that the bias towards short-termism may, in fact, be value-maximizing in the presence of such frictions. This means that castigating short-termism as well as the rush to regulate CEO compensation to reduce its emphasis on the short term may be worth re-examining.¹⁰ Indeed, *not* engaging in short-termism may signal an inability

¹⁰This is in line with Roe (2015), who states: "Critics need to acknowledge that short-term thinking often makes sense for U.S. businesses, the economy and long-term employment...it makes no sense for brick-and-

on the CEO's part to resolve intrafirm agency problems and thus adversely affect the firm's stock price. This is not to suggest that short-termism is always a value-maximizing practice, since it may sometimes be used only to boost the firm's stock price. The point of this paper is that *some* short-termism reduces agency costs and benefits the shareholders.

The remainder of the paper is organized as follows. Section 2 develops the model. Section 3 contains the analysis. Section 4 discusses the robustness of the results to relaxing key assumptions, including allowing payoff-contingent wage contracting, assuming that an interim signal on the performance of the long-term project can be acquired at a cost by the CEO, having more than two time periods, and the implications of the analysis for maturity transformation in banks. This section also discusses empirical implications. The related literature is discussed in Section 5. The paper is concluded in Section 6. All proofs are included in the Appendix.

2 The Model

In this section, the model is described. This section begins by describing the main players in the game and their preferences. It then describes the projects and the order in which events occur. This is followed by a description of who knows and does what, and when. The nature of the moral hazard and internal governance are described next. The section ends with a summary of the main assumptions and the time line.

2.1 Agents and Preferences

Consider a publicly-traded firm with a manager at the top, called the Chief Executive Officer (the "CEO") and a lower-level divisional manager (the "manager") reporting to him. There may be, say, $n > 1$ such managers who all report to the CEO, but the analysis will focus on a representative manager. For simplicity, the firm is financed entirely with equity, and starts out with \$2 that it can invest or keep idle.

mortar retailers, say, to invest in long-term in new stores if their sector is likely to have no future because it will soon become a channel for Internet selling."

All players are assumed to be risk neutral, and for simplicity the risk-free interest rate is normalized to zero. The CEO’s job is to design the capital budgeting system, which includes the rules by which capital is allocated for projects. The manager’s job is to search for project ideas and request capital from the CEO. The manager enjoys private benefits, represented as a utility gain $\beta \in (0, 1)$, from investing in projects, i.e., he likes “empire building”.¹¹ This is a private benefit that does not produce any benefit for the firm’s shareholders.¹² The preferences of the CEO and the manager are described later. For now, it is useful to note that the manager cares about his wages and private benefits, and the CEO cares about firm value and the manager’s welfare (utility). The manager is penniless, i.e., lacks the financial resources to buy out the firm or the project from the shareholders.

The manager has some skill that is unknown to all at the beginning. However, because this skill can affect project cash flows (this is described later in this section), beliefs about the manager’s skill will be revised on the basis of observed cash flows. It is assumed that there are two types of managers: Talented (T) and Untalented (U). Let θ_t be the commonly-assigned probability at date t that the manager is type T . Then, the prior probabilities attached to the manager’s skill (talent) at $t = 0$, which are common knowledge, and represented by: $\Pr(\text{type} = T) = \theta_0 \in (0, 1)$, and $\Pr(\text{type} = U) = 1 - \theta_0$. That is, it is assumed that the manager does not know his own type and there are common prior beliefs about this type.¹³

2.2 Sequence of Events and Projects

There are three dates in the model ($t = 0$, $t = 1$, and $t = 2$) and thus two time periods, the first period ($t = 0$ to $t = 1$) and the second period ($t = 1$ to $t = 2$). Projects available

¹¹This is related to the “free cash flow” problem proposed by Jensen (1986), and it has been studied in various contexts in many papers, e.g. Aghion and Bolton (1992). One interpretation of this assumption is in the spirit of the perquisites-consumption assumption in Jensen and Meckling (1976). Being in control of a bigger asset base allows the manager to consume more perquisites. This is also similar to “managerial entrenchment”, as described by Shleifer and Vishny (1989).

¹²In other words, the shareholders do not adjust the manager’s wage downward when he invests to account for the private benefit he enjoys from investing. While this is not formally justified within the analysis, there are many reasons why real-world wage contracts may not have such features. The main reason is that it can create strong incentives to not invest (e.g. Holmstrom and Ricart i Costa (1986)).

¹³This is similar to Holmstrom and Ricart i Costa (1986) and it avoids signaling complications that can arise if the manager knows more about his own type than do others.

to the manager differ in two dimensions: their value (NPV) and their cash-flow duration (or payback). This produces four types of projects that will be described below. A project in any period needs an initial \$1 investment that the manager must request from the CEO, so the firm will use \$2 if it invests in projects in both periods.

On the value dimension, a project can be good (G) or bad (B), with G having positive NPV, and B having negative NPV. On the duration dimension, a project can be long-term (L) or short-term (S). An L project requires an investment at $t = 0$ and delivers its cash flow at $t = 2$. An S project requires an investment at $t = 0$ and delivers its cash flow at $t = 1$ (or alternatively it may require an investment at $t = 1$, and deliver its cash flow at $t = 2$). This means that in the first period the manager can choose either L or S , but in the second period only S .

A good, long-term project (call it L_G) pays off $R_L > 1$ with probability 1 at $t = 2$ if the manager is of type T , but it pays off R_L with probability $q \in (0, 1)$ and 0 with probability $1 - q$ at $t = 2$ if the manager is of type U . If investment occurs at $t = 0$, a good, short-term project (call it S_G) pays off $R_S > 1$ with probability 1 at $t = 1$ if the manager is of type T , but it pays off R_S with probability q and 0 with probability $1 - q$ at $t = 1$ if the manager is of type U . The short-term project has the same type-dependent payoff distribution at $t = 2$ if investment occurs at $t = 1$.

A bad, long-term project (call it L_B) pays off 0 with probability 1, regardless of the manager's type. Similarly, a bad, short-term project (call it S_B) pays off 0 with probability 1, irrespective of the manager's type.

Table 1 summarizes the type-dependent payoff distributions of projects:

[Insert Table 1 Here]

Regardless of project type, the manager enjoys a utility of β if investment occurs in any period. Project availability is stochastic. It is assumed that, regardless of the manager's type, the probability that the manager will receive a G project idea in any period is $p \in (0, 1)$.

The manager almost surely (with probability 1) has access to a B project in any period. Moreover, once he receives a project idea, it can be structured as either a long-payback (L) project or a short-payback (S) project.

Some restrictions on the exogenous parameters are now presented so that the analysis can focus on the main cases of interest:

$$R_L > 1. \tag{1}$$

This means that L_G is a positive-NPV (socially efficient) project when run by a talented (T) manager. Further:

$$\beta + qR_L < 1. \tag{2}$$

This means that an L_G project is both negative-NPV (since $qR_L < 1$) and socially inefficient (since $\beta + qR_L < 1$) when run by a type- U manager. It also follows that:

$$1 < R_S < R_L. \tag{3}$$

This means that the S_G project has positive NPV (and is socially efficient), but it has lower value than the L_G project. Define $\Delta \equiv R_L - R_S$ as the difference in values of the L_G and S_G projects. The expected value of Δ , evaluated at the prior beliefs about the manager's type, is $\bar{\Delta}_0 \equiv \theta_0 [R_L - R_S] + [1 - \theta_0] q [R_L - R_S]$. From (2) and (3), it follows that:

$$\beta + qR_S < 1. \tag{4}$$

So, the S_G project is socially inefficient and has negative NPV when run by a type- U manager. The L_B project gives a total payoff of β (since the payoff of the B project is 0 with probability 1, but the manager also receives a private benefit β) has negative NPV (the project payoff is 0) and is socially inefficient (since $\beta < 1$). It also directly follows that the

S_B project also has negative NPV and is socially inefficient. Finally, it is assumed that:

$$\theta_0 R_L + (1 - \theta_0) q R_L > 1, \quad (5)$$

$$\theta_0 R_S + (1 - \theta_0) q R_S > 1, \quad (6)$$

and

$$p \{ \theta_0 R_S + (1 - \theta_0) q R_S \} > 1. \quad (7)$$

Inequalities (5) and (6) represent a sensible restriction since, if these did not hold, the CEO would never approve any project that the manager proposed at the beginning (with prior beliefs about type). (7) is assumed since, without it, a CEO who puts enough weight on firm value would not approve any project at $t = 1$ if an L project was started at $t = 0$ (since with an L project, θ_1 , the posterior belief at $t = 1$ that the manager is type T , equals the prior belief at $t = 0$, θ_0).

In the first period, the manager requests \$1 in funding if he wishes to invest. If funded, the project yields a (possibly random) payoff at $t = 1$ if it is a short-term project. Based on this, beliefs are revised from θ_0 to θ_1 . If it was a long-term project, then nothing is observed at $t = 1$, so $\theta_0 = \theta_1$. The manager then requests funding for his second-period project. The game ends at $t = 2$.

2.3 What the Players Know and Do, and When

The manager knows the value of the project (G or B) for which he is requesting funding, as well as whether it is short-term (S) or long-term (L). The CEO can observe whether the project is S or L , but not the value (G or B). As in Holmstrom and Ricart i Costa (1986) and Holmstrom (1999), it is assumed that the manager is paid his wage at the beginning of the period. So he is paid a first-period wage of w_0 at $t = 0$, and a second-period wage of \tilde{w}_1 (which is random) at $t = 1$. The second-period wage is random because the perception of the manager's skill at $t = 1$ generally depends on the project cash flow at $t = 1$, and this cash

flow is random. Let $w_1^+ \in \mathbb{R}$ (the real line) be the manager's wage if the first-period project has a positive cash flow and the posterior belief that he is type T is therefore higher than the prior belief, and let it be $w_1^- \in \mathbb{R}$ if the first-period cash flow is zero and this posterior belief is therefore lower than the prior belief. It is thus the case that $w_1^+ > w_1^-$. A wage is paid in any given period regardless of whether there is investment in a project in that period.

Now let w^T be the wage of a manager of type T and w^U be the wage of a manager of type U ; also set $w^U \equiv 0$ without loss of generality. As in Holmstrom and Ricart i Costa (1986) and Holmstrom (1999), assume that wages are increasing in perceived managerial talent, and that wages are linear in perceived managerial talent. Let $\theta_1^+ \equiv \Pr(\text{manager's type is } T \mid \text{success at } t = 1)$ and $\theta_1^- \equiv \Pr(\text{manager's type is } T \mid \text{failure at } t = 1)$. We then have that:

$$w_0 = \theta_0 w^T + (1 - \theta_0) w^U = \theta_0 w^T, \quad (8)$$

$$w_1^+ = \theta_1^+ w^T + (1 - \theta_1^+) w^U = \theta_1^+ w^T, \quad (9)$$

and

$$w_1^- = \theta_1^- w^T + (1 - \theta_1^-) w^U = \theta_1^- w^T. \quad (10)$$

Hence, the actual wage is a convex combination of the wages of the type- T and type- U managers, and is dependent on the prior and posterior beliefs of the respective types. w^T and w^U can be viewed as the reservation wages of talented and untalented managers, respectively, and similarly w_0 , w_1^+ , and w_1^- can be viewed as the reservation wages conditional on the labor market's beliefs about the manager's type at $t = 0$ and $t = 1$. All wages, as well as whether the firm has adopted a short-termism restriction on project choice, are publicly observable at $t = 0$. Since wages are based on publicly-available outcomes, the CEO effectively has no control over the manager's wage; it is market-determined in the base model in which there is no adverse selection in the labor market.

2.4 The Utilities of the Players

For the core results of the model, assume that the CEO maximizes firm value. A more general specification is one in which the CEO maximizes the following utility function:

$$U_{CEO} = \alpha_1(\text{firm value}) + \alpha_2 U_M, \quad (11)$$

where U_M is the utility of the manager, and α_1 and α_2 are positive exogenous weights. The value-maximizing preference is a special case with $\alpha_2 = 0$. The inclusion of the manager's utility in (11) could reflect a variety of considerations, such as cronyism within the firm, internal politics, and alliances.¹⁴ The idea is that in general a CEO will not necessarily be indifferent to the welfare of subordinates. This concern need not be altruistic—it may simply represent a practical concession to the need to build an effective working relationship.

Let $\omega \equiv \frac{\alpha_2}{\alpha_1}$. The parameter ω has numerous possible interpretations. One is that it represents the degree of ownership of the firm by the CEO—the larger the degree of ownership, the lower is ω . Another interpretation is that the higher the value of ω , the worse the internal governance in the firm, leading to lower firm value.

The manager maximizes the following utility function:

$$U_M = w_0 + \mathbb{E}(\tilde{w}_1) + \sum_{t=0}^1 \beta_t \mathbf{1}_{\{x=1\},t}(x), \quad (12)$$

where w_0 is the manager's wage at $t = 0$, $\mathbb{E}(\tilde{w}_1)$ is the expected value of the manager's wage at $t = 1$, and $\mathbf{1}_{\{x=1\},t}(x)$ is the indicator function at date t , where $x = 1$ if the manager invests and $x = 0$ if the manager does not invest. β_t is the manager's private benefit at time

¹⁴It may also reflect a common emotional disposition called “avoidance of unfavorable occasions”; see Elster (1998) for a discussion. It says that human beings have a dislike for getting into situations that they anticipate will trigger negative emotions. Having to say no to a direct report who requests funding for a long-term project and thereby creating a confrontational situation is one example. A simple way to capture the effect of avoidance of unfavorable occasions is to put some weight on the manager's welfare in the CEO's utility. Of course, it is also possible that the reason the CEO puts weight on the manager's utility is her own preferences is that the manager is a protege of the CEO and makes the CEO genuinely care about the well-being of the manager as a fellow employee.

$t = 0$ and $t = 1$, and $\beta_t = \beta \forall t$. Thus, the manager aims to maximize his expected wage at $t = 1$, given that he receives a private benefit for investing in a project.

2.5 The Nature of Moral Hazard and Internal Governance

The moral hazard in this model arises from the manager's private information about project quality and his over-investment incentives due to his private benefits. This gives the manager an incentive to invest in a negative-NPV project if a good project is unavailable. However, if it is a short-term project, it carries a danger for the manager—it may produce a poor outcome at $t = 1$, lowering perception of the manager's ability and hence his second-period wage. A longer-term project does not reveal the manager's ability before the terminal date, and therefore insures against a downward revision in the perception of his ability. Of course, since beliefs form a martingale (with Bayesian revision), the *expected value* of the manager's posterior ability is the same as the prior value. Hence, possible future wage revisions associated with revisions in ability perceptions will not affect the risk neutral manager's ex ante choices because his expected future wage will be the same as his current wage. This is where his private benefits come into play, as will be explained later.

The internal governance mechanism comes from the CEO's ability to approve projects. Given that the CEO knows moral hazard in project choice, she can enforce an internal governance mechanism that conditions project approval on project duration.

2.6 Summary of Assumptions and Timeline

The following is a summary of the key assumptions:

- A1. (*Private Benefits*) The manager has a private benefit from investing in a project, but lacks the financial resources to buy out the project from the firm.
- A2. (*Observability*) The project duration (its payback) is commonly observable, but project quality is only observable to the manager. Regardless of project quality, the long-term project has higher value than the short-term project.

- A3. (*Managerial Types*) The manager's type (Talented or Untalented) is not known by either the CEO or the manager, and is inferred from project outcomes. Later the manager is allowed to know more about his type than others.
- A4. (*Non-appropriability*) All of the NPV from a project cannot be given to the manager. The firm always appropriates some of the project rents. In other words, the agency problem (due to the fact that the manager gets only a part of the rent) cannot be eliminated.

Assumption A2 that the long-term project has a higher (first-best) value than the short-term project may not be true in practice for all projects in the firm. If the short-term project has a higher first-best value, then short-termism arises trivially from the specified project technology. The interesting situation is when the long-term project has higher first-best value, so some efficiency is sacrificed in the practice of short-termism. The crucial defining attribute that separates a long-term project from a short-term project is that information about the value of the former is released more slowly over time. In the base model, the only signal of project value is its cash flow, so it is the timing of the cash flow that determines the speed of information revelation. This is often the case with real-world projects.

Figure 1 summarizes the main actions and events that are possible at each point in time:

[Insert Figure 1 Here]

3 Analysis of the Base Model

In this section, I analyze the base model and its implications. Section 3.1 analyzes the first-best. Section 3.2 describes the second-best. Section 3.3 examines whether imposing a short-termism constraint to force early revelation of information can improve firm value.

Section 3.4 compares the efficiency of approving only short-term projects to that of the contracting regime in which contracts can be explicitly written on managerial private benefits.

3.1 First-Best Case

In the first-best, shareholders and the CEO can observe project choice and the project's payoff. The "first-best" refers to any choice that maximizes the value of the firm because shareholders can dictate this choice. In this case, the manager will request funding only if he receives a good project and the CEO will then fund the project.

Whether the first-best project at $t = 0$ is the L or the S version of the G project requires some discussion. On the one hand, L has a higher value since $R_L > R_S$. But on the other hand, by investing in S , the firm can make a second-period investment decision at $t = 1$ that is conditional on what is learned in the first period about managerial ability. It will be shown that the posterior belief on managerial ability will be high enough conditional on success at $t = 1$ to guarantee second-period funding for the manager, and low enough conditional on failure at $t = 1$ to guarantee denial of second-period funding if the CEO puts sufficiently high weight on firm value (ω is low). Since the prior probability of success for a G project is $\theta_0 + (1 - \theta_0)q$ (where θ_0 is the probability that the manager is T and succeeds almost surely, and $1 - \theta_0$ is the probability that the manager is U and succeeds with probability q), a conditional investment policy results in second-period investment with probability $\theta_0 + (1 - \theta_0)q$, whereas an unconditional policy (associated with investing in L at $t = 0$) results in second-period investment with probability 1.

This means that, conditional on having a G project at $t = 0$, the condition for L to be the value-maximizing choice in the first-best case is:

$$\bar{\Delta}_0 + p(1 - \theta_0)[1 - q]qR_S \geq p[1 - \theta_0][1 - q], \quad (13)$$

recalling that $\bar{\Delta}_0 \equiv \theta_0 [R_L - R_S] + [1 - \theta_0] q [R_L - R_S]$. In (13), the left-hand side represents the amount by which the expected value of L exceeds that of S , plus the expected value

of the second-period short (S) project, qR_S , that is available with an untalented manager (probability $1 - \theta_0$) who receives a G project idea (probability p) but fails with a short-term project in the first period (probability $1 - q$). This follows since investment in the second period is always available with a long-term investment in the first period (because nothing is revealed about the manager's ability), but *not* with a short-term investment in the first period that fails. The right-hand side is the expected saving in second-period investment due to the conditional (second-period) investment associated with choosing S in the first period rather than the unconditional investment associated with choosing L in the first period, accounting for the probability of receiving a G project. Since only the incentive problem is eliminated in the first-best, the learning benefit of the short-payback project remains, so (13) essentially says that the relative gain in intrinsic value from L exceeds the relative learning benefit of S (the right-hand side of (13)).¹⁵ The following assumption (stronger than (13)) will be assumed to hold throughout:

$$\bar{\Delta}_0 + p(1 - \theta_0)[1 - q][qR_S - 1] \geq 2\beta, \quad (14)$$

which is sufficient for the first-best to be socially efficient. We now have:

Lemma 1: *In the first-best case, at $t = 0$, the manager requests funding only if a G project arrives. In this case, the manager proposes only L_G and it is funded.*

Now at $t = 1$, there is only one period left, so the manager can propose only an S project. He will thus only request funding in the first-best case if it is G .

Lemma 2: *In the first-best case, at $t = 1$ the manager requests funding only if he finds an S_G project.*

¹⁵The condition for L to be the socially efficient choice is $\{\theta_0 + (1 - \theta_0)q\}(R_L - R_S) + p[(1 - \theta_0)(1 - q)qR_S + p\beta(1 - \theta_0 - (1 - \theta_0)q)] \geq p[1 - \theta_0 - (1 - \theta_0)q]$.

3.2 Second-Best Case

The second-best case refers to the case in which the shareholders delegate project approval to the CEO (because they cannot directly control the internal project choice and approval process) and the CEO can observe whether it is an L or an S version of the project being proposed by the manager, but not whether it is G or B . To analyze the second-best case, I proceed using backward induction from the second period to the first. At $t = 1$, there are two scenarios in the second-best case:

1. The manager receives a G project. He proposes S_G and gains utility $\tilde{w}_1 + \beta$, where \tilde{w}_1 is his wage at $t = 1$, which depends on the outcome at $t = 1$.
2. The manager does not receive a G project. If he does not propose a project, his utility is \tilde{w}_1 . If he proposes an S_B project and it is accepted, his utility is $\tilde{w}_1 + \beta$.

Thus, the manager will propose S_G if it is available, or S_B if it is not (he has no incentive to propose S_B if he has S_G). While the manager will always prefer to seek funding, whether he gets funding at $t = 1$ depends on θ_1 , the posterior belief about his type, and hence the expected project payoff as viewed by the CEO. We thus have:

Lemma 3: *In the second period (at $t = 1$), the manager will always propose a project as an S project regardless of its quality (G or B). The funding policy that maximizes firm value is as follows. If the manager invests in L at $t = 0$, he gets funding for sure at $t = 1$. Assuming that the manager's equilibrium strategy is to invest in S_G (but never S_B) at $t = 0$ if he chooses S , then the policy that maximizes firm value is to give a manager who invests in S at $t = 0$ the requested additional funding at $t = 1$ if his first period project succeeds but to deny additional funding if his first period project fails (the project payoff is 0). A CEO who maximizes firm value (or with a sufficiently low ω) will follow this policy. A CEO with a sufficiently high ω will provide the manager unconditional funding at $t = 0$ and $t = 1$.*

The economic intuition is as follows. If the manager invests in L at $t = 0$, there is no information revelation about his type at $t = 1$, so the belief about his type stays at its prior value and the manager receives additional funding at $t = 1$ (since he received funding at $t = 0$ with prior beliefs about his type).¹⁶ If he invests in S at $t = 0$, then given the equilibrium strategy of choosing S_G , the CEO's posterior probability that the manager is type T is higher than the prior if there is success at $t = 1$, and lower than the prior if there is failure at $t = 1$. Thus, the value-maximizing policy is to give the manager additional funding at $t = 1$ following success. Failure lowers the posterior belief about the manager's type so much that the NPV of letting him manage a second-period project is negative, so funding is denied. It is straightforward to see that a CEO with a low enough ω will do what maximizes firm value. However, the firm's owners will face moral hazard in the form of a distorted investment policy if the CEO has a high ω .

I now analyze what happens at $t = 0$, deriving the conditions under which the manager chooses only G in the first period. First, suppose the CEO funds both L and S projects. Will the manager propose S or L ?

Proposition 1: *At $t = 0$, the manager always proposes an L project, regardless of whether the project is G or B .*

The economic intuition is that with a short-term project, there is a possibility that the project might fail at $t = 1$ even if it is G (since the manager does not know his own type), in which case the manager will not get a second project with its associated private benefit if the CEO has a low ω . If the CEO has a high ω , the manager is guaranteed funding, so he will choose L at $t = 0$ because it has higher value with G and the same values as S with B . Therefore, the manager prefers the long-term project at $t = 0$ in all circumstances.

The manager also prefers proposing a long-term project to proposing no project because of the private benefit of investing. Of course, if the project is B , then proposing S_B is even

¹⁶The assumption that the manager receives project funding with prior beliefs about his type is necessary since the funding would never start at $t = 0$ without this assumption.

worse since it would pay off zero with probability one in the next period, and his wage would be revised downward almost surely. This is avoided with the long-term project.

Thus, regardless of the project quality at $t = 0$, the manager will always want to invest and structure the project as a long-term project. Furthermore, from Lemma 3, at $t = 1$, the manager will always request funding for a short-term project regardless of its quality, and he will receive funding since he invested in a long-term project at $t = 0$.

To see the combined intuition for these results, note that the manager cares about both his wages and his private benefits. A manager who cared only about his wages would be indifferent between structuring a good project as either short-term (S) or long-term (L) because beliefs form a martingale and the expected value of his future wages would be the same regardless of whether the project is S or L . But private benefits create an asymmetry.¹⁷ An upward revision in managerial ability at the interim date due to project success assures the manager of a private benefit in the second period, but so does *no* revelation of ability at the interim date (which is achieved with the long-term project). By contrast, a short-term project may cause a downward revision of ability and loss of his private benefit. That is, investing in a short-term project is equivalent to the manager writing an option on his human capital and private benefit and giving it to the firm. This option is valuable to the firm because it can allow it to condition its second-period investment decision on revealed managerial ability at the end of the first period. But giving the firm this option is also costly to the manager because by exercising the option, the firm can deny him his second-period private benefit in one state. Investing in a long-term project denies the firm this option and guarantees second-period private benefit to the manager almost surely. Note that the option is worthless to the firm in the first-best case because the manager's ability is known. With no learning benefit associated with the short-term project, the firm would prefer to invest in the higher-valued long-term project in the first period and then a short-term project in the second period. So the real value of the option to the firm and its cost to the manager both

¹⁷That is, the incentive problem arises because wages form a martingale but investment does not, and managerial private benefits are linked to whether investment occurs.

come from the same thing—interim learning about managerial ability.

3.3 Can the Shareholders Do Better by Imposing a Short-termism Constraint?

Given the self-interested behavior of the manager described in the previous sub-section, can firm value be improved by using capital budgeting to constrain the manager's choice? Since the inefficiency is created by the manager always choosing a long-term project to defer detection of his choice of a bad project (as well as early revelation of information about his type), a natural capital-budgeting restriction is to require that the project duration be no more than one period. This may discipline managers, as shown below.

Lemma 4: *Suppose that L projects are banned, and the second-period funding policy maximizes firm value. Then, the manager will only propose an S project at $t = 0$ if he receives a G project.*

This lemma states that a constraint that no long-term projects be proposed improves project choice efficiency. The next proposition shows that this kind of constraint may be used by the firm. Before getting to that, the following expressions are useful.

If the firm approves a short-term project proposed by the manager and follows a policy that maximizes firm value, then its total expected (fundamental) value is given by:

$$\begin{aligned} \bar{V}_S = & p \{ \theta_0 [R_S + pR_S] + [1 - \theta_0] q [R_S + pqR_S] \} + [1 - p] p [\theta_0 + q [1 - \theta_0]] R_S \\ & + \{ p [1 - \theta_0] [1 - q] + [1 - p] \} \{ 1 \} - 2w_0. \end{aligned} \quad (15)$$

To interpret (15), consider the first term: $p \{ \theta_0 [R_S + pR_S] + [1 - \theta_0] q [R_S + pqR_S] \}$. Here p is the probability that the divisional manager will have a G project. If the manager is type T (probability θ_0), then the first-period project pays off R_S with probability 1, a G project arrives with probability p in the second period and pays off R_S with probability 1. This explains the first term inside the braces, $\theta_0 [R_S + pR_S]$. If the manager is type U

(probability $1 - \theta_0$), then the probability is q that the first-period project pays off R_S , and second-period funding is available only if the first-period project succeeds (Lemma 3) and investment in G in the second-period occurs in this case only if G arrives (probability p). This explains the term $[1 - \theta_0] q [R_S + pqR_S]$ in the braces.

Now consider the second term in (15): $[1 - p]p[\theta_0 + q[1 - \theta_0]] R_S$. When a G project does not arrive in the first period (probability $1 - p$), the manager will not request project funding, so there is no first-period cash flow (Lemma 4). But if G arrives in the second period (probability p), then the expected payoff is R_S if the manager is type T (probability θ_0) and qR_S if the manager is type U (probability $1 - \theta_0$). The second-last term in (15) is merely the probability that \$1 will remain idle due to no investment in either the first or the second period (note that with a short-term project an investment occurs in the first period only if a G project arrives). With probability p , a G project arrives in the first period and investment occurs, but the manager is type U (probability $1 - \theta_0$) and his first-period project fails (probability $1 - q$), so there is no second-period funding, resulting in \$1 being idle in the second period; with probability $1 - p$ the G project did not arrive in the first period, so the manager did not request first-period funding and \$1 stayed idle in the first-period, but then second-period funding occurred with probability 1. This probability is multiplied with \$1, the amount that stays idle. Note that the probability that the entire \$2 available at $t = 0$ will remain idle is zero, since the second-period project is funded with probability one if no investment occurs in the first period. The last term in (15) is the total expected wage paid to the manager over two periods. The manager's first-period wage is clearly w_0 , and since wages are paid regardless of whether investment occurs, we need to calculate his *expected* second-period wage, which is also w_0 because beliefs form a martingale.

Now, if the firm approves a long-term project in the first period and follows a value-

maximizing policy, then its total fundamental value is given by:

$$\begin{aligned}\bar{V}_L &= p\{\theta_0 R_L + [1 - \theta_0]qR_L\} + p\{\theta_0 R_S + [1 - \theta_0]qR_S\} - 2w_0 \\ &= p\{\theta_0 [R_L + R_S] + [1 - \theta_0][qR_L + qR_S]\} - 2w_0.\end{aligned}\tag{16}$$

Since with a long-term project, the manager is guaranteed funding in both periods with probability 1, the interpretation of (16) is straightforward—observe that $p\{\theta_0 R_L + [1 - \theta_0]qR_L\}$ is the expected payoff on the first-period project and $p\{\theta_0 R_S + [1 - \theta_0]qR_S\}$ is the expected payoff on the second-period project.

It will be assumed that p is not too high, so the following condition will be satisfied if $\bar{\Delta}_0 > 0$ is sufficiently small:

$$2[1 - p]p^{-1} > \theta_0 [R_L - R_S] + [1 - \theta_0]q\{R_L - R_S[pq + 1 - p]\}.\tag{17}$$

This leads to the following result:

Proposition 2 (Short-termism): *Given that the CEO aims to maximize firm value, it may be in the best interests of the CEO to ban L projects and insist on S projects when (17) holds. If (17) does not hold, the value-maximizing policy may permit L to be funded at $t = 0$. Only a CEO with a sufficiently low ω will ban L projects.*

According to this proposition, provided that the values of the long-term good project and the short-term good project do not diverge significantly ($\bar{\Delta}_0$ is small), firm value is maximized by short-term projects. This rationalizes short-termism in capital budgeting by some firms. When $\bar{\Delta}_0$ is high, however, the long-term project is too valuable to ban and the shareholders and the CEO will both prefer to eschew short-termism. Thus, Proposition 2 identifies circumstances in which CEOs will embrace short-termism—when corporate governance is strong so that the CEO’s interests are highly aligned with maximizing firm value and when the value loss from choosing the short-term project is not too large.

Corollary 1: *If the project is being proposed by the CEO rather than the manager, shareholders will have no interest in a no constraint that only an S project can be submitted for approval, as long as ω is low.*

The intuition can be seen as follows. Since a low- ω CEO's interests are aligned with the shareholders' interests, she will never propose a bad project. Moreover, since a long-term good project is worth more than a short-term good project, the CEO should be free to invest in a long-term project. The shareholders or the Board of Directors thus have no reason to insist on short-term projects for proposals being made directly by a low- ω CEO.

This result also has an implication for the firm's decision with respect to the size of its internal capital market. When the board of directors is unsure of whether the CEO will effectively handle the agency problem with respect to the manager (i.e. ω is high), and monitoring the payback periods of projects the CEO approves is too costly for the board, then the board may wish to watch over the firm's cash level, and insist on special repurchases or dividends when that level exceeds what is needed for operating purposes. The reason is that when cash is available internally, the CEO can allow the manager to invest in long-term projects, something that the board and the shareholders do not want. Not having enough cash forces the CEO to seek board approval for external financing, which gives the board an opportunity to ask for information about the projects being funded with that financing, and stop investments in long-term projects. Thus, having a policy of not having excess cash lying around permits the board to engage in selective capital rationing in order to improve internal governance.¹⁸

One interesting implication of this result is that firms are less likely to practice short-termism or impose a payback constraint for "strategically important" projects that are created by the CEO. Projects may be constrained to be of short duration if they are initiated by lower-level managers.

¹⁸See Malenko (2012) for an analysis of how firms can optimally design internal capital markets.

3.4 Using Explicit Wage Contracting Instead of a Short-termism Constraint

In this model, the manager’s wage at any date is simply equal to the wage he would receive in an alternative job given the (common) belief about his ability at that date. That is, wages are optimal in the sense that they are the unique outcomes of binding participation constraints at different dates. However, wages have not been explicitly made dependent on private benefits and have not been relied upon to solve the incentive problem of inducing the manager to not invest in the B project at $t = 1$. I now do this to compare the short-termism solution analyzed earlier to a wage contracting solution, focusing on the policy that maximizes firm value. The maintained assumption from the base model is that the manager’s wage is paid at the beginning of the period, so the wage cannot be explicitly conditioned on the cash flow realization at the end of the period.

The wage contracting solution has to satisfy the manager’s participation constraints at dates $t = 0$ and $t = 1$. That is, the wage, w_t , at date $t \in \{0, 1\}$ must satisfy: $w_0 \geq \theta_0 w^T$ at $t = 0$ and $\tilde{w}_1 \geq \tilde{\theta}_1 w^T$ at $t = 1$.¹⁹ Moreover, the wage contract should satisfy the incentive compatibility constraint that the manager will choose G at $t = 0$. That is, a manager who is allowed to choose L must be dissuaded from a B project at $t = 0$. This requires that his expected utility is the same whether he proposes B or rejects it. This can be achieved with a wage contract that pays him w_0 at $t = 0$ if he invests in a project and $w_0 + \beta$ if he does not invest.²⁰ This means that to achieve incentive compatibility, the manager’s participation constraint on the wage at $t = 0$ will have to be slack.

¹⁹The reason why the dynamic individual rationality constraint (IR) becomes a sequence of one-period participation constraints is that in each period, the manager’s wage is paid at the start of the period. To see this, note that the dynamic IR constraint at the beginning of the first period is $w_0 + \mathbb{E}[\tilde{w}_1] \geq \theta_0 w^T + \mathbb{E}[\tilde{\theta}_1] w^T$, where w^T is the reservation wage of a type- T manager (see Section 2.3). But since beliefs follow a martingale, $\mathbb{E}[\tilde{\theta}_1] = \theta_0$. Moreover, in the second period, the ability of the agent to switch jobs (“quitting constraint”) means that $\tilde{w}_1 \geq \tilde{\theta}_1 w^T$ must be honored. This implies $\mathbb{E}[\tilde{w}_1] \geq w^T \theta_0$. The dynamic constraint thus reduces to $2w_0 \geq 2\theta_0 w^T$.

²⁰Operationally, this may be achieved by basing the manager’s compensation on the free cash flow of his division. By avoiding investment, the manager increases free cash flow and collects a larger bonus for himself, which would be the analog of being paid β to not invest.

The second-period wage structure is the same as before: the manager gets a wage conditional on the first-period outcome. Given the earlier analysis, it follows that the manager will invest in L (rather than S) if he has a type- G project at $t = 0$. If he has a type- B project, there is no reason for him to invest in L since his first-period payoff, $w_0 + \beta$, is the same whether he invests or not, and he invests in the second-period project at the same wage regardless of whether he invests in the first period. It is also clear that he will not invest in an S project of type B at $t = 0$ since this yields a first-period utility of $w_0 + \beta$ but a lower second-period utility, i.e., a lower total utility than that from not investing.

The value of the firm with this wage contract, net of the wage and the investment, is:

$$p\{\theta_0 R_L + (1 - \theta_0)qR_L - 1\} - w_0 + (1 - p)(-\beta) + p\{\theta_0 R_S + (1 - \theta_0)qR_S\} - w_0 - 1, \quad (18)$$

where p is the probability that the manager will have a type- G project. To understand (18), consider initially the first three terms. The first is $p\{\theta_0 R_L + (1 - \theta_0)qR_L - 1\}$, which is the expected NPV of the L project of type G (with the expectation taken over managerial type) multiplied by the probability, p , of having a G project. The second term is the subtraction of the wage w_0 paid to the manager regardless of whether he invests, and the third term is the subtraction of the extra wage β paid to him if he does not invest. Now consider the next three terms, $p\{\theta_0 R_S + (1 - \theta_0)qR_S\} - w_0 - 1$, which represent the expected value of the second-period project (which is $\theta_0 R_S + (1 - \theta_0)qR_S$ if it is a G project, an event with probability p , and zero if it is a B project) minus wage w_0 and the investment of 1.

The expected value of the firm, net of wages and investments, with short-termism is:

$$p\{\theta_0 R_S + (1 - \theta_0)qR_S - 1\} - w_0 + p\{\theta_0 R_S + (1 - \theta_0)q^2 R_S\} - [\theta_0 + (1 - \theta_0)q]\{w_0 + 1\}. \quad (19)$$

The interpretation of (19) is as follows. $p\{\theta_0 R_S + (1 - \theta_0)qR_S - 1\} - w_0$ represents the expected value of the first-period project net of the managerial wage and investment. The term $p\{\theta_0 R_S + (1 - \theta_0)q^2 R_S\}$ represents the expected value of the second period project,

recognizing that the manager will be able to invest only if he experiences first-period success, and the term $[\theta_0 + (1 - \theta_0)q] \{w_0 + 1\}$ represents the expected wage and investment in the second period (which takes into account the fact that the probability of second-period investment is $\theta_0 + (1 - \theta_0)q$).

Comparing (18) and (19) leads to the following result:

Proposition 3: *Assume that both the incentive and learning problems matter in the sense that p and θ_0 are both in the interior of $(0, 1)$ and are not too high or too low. Then, if the initial project investment (\$1), the manager's date-0 wage (w_0), and his private benefits (β) are large relative to the difference between the payoffs in the success states of the long and short G projects, Δ , then short-termism leads to a higher firm value than using wages to induce the manager to avoid investing in the bad project at $t = 0$. In addition:*

1. *If the incentive problem is eliminated ($p = 1$), then, assuming that q is low enough, the short-termism restriction is preferred for a sufficiently low value of the prior probability, θ_0 , that the manager is type T , and the wage contracting solution is preferred by the shareholders for a sufficiently high value of θ_0 .*
2. *If the value of learning is eliminated ($\theta_0 = 1$), then the short-termism restriction is preferred by the shareholders if the probability of getting a G project, p , is sufficiently low, and the wage contracting solution is preferred if p is sufficiently high.*

The intuition is as follows. The benefit of short-termism relative to the wage contracting resolution is that it allows the firm to learn about the manager's talent by observing the first-period project outcome, so that the cost of paying the manager's second-period wage and investing in the second-period project can be made conditional on this learning. When the required project investment and managerial wage are high, this relative benefit is also high. Moreover, another relative benefit of short-termism is that it enables the firm to avoid paying the manager β in the first period to compensate him for his lost private benefit in

the no-investment state. Again, the larger the β , the greater is the relative advantage of short-termism.²¹

This proposition also clearly highlights the intuition related to the two economic functions served by short-termism: resolving the *incentive problem* related to the manager's inclination to invest in the B project, and the *learning* made possible by observing the outcome of a short project at $t = 1$ before deciding whether to invest in another project. When the incentive problem is absent ($p = 1$), the only value of short-termism is learning. Clearly, the value of learning about the manager's talent decreases as θ_0 increases, and in the limit as θ_0 approaches 1 (the manager is almost surely talented), short-termism has no value. Thus, the wage contracting resolution dominates for θ_0 high enough. By contrast, when learning is eliminated entirely ($\theta_0 = 1$) but the incentive problem is resurrected ($p \in (0, 1)$), short-termism is preferred if the incentive problem is severe enough (p is low enough) because in this case the expected cost of compensating the manager in the no-investment state is high. Thus, short-termism is preferred to the wage contracting resolution either when the value of learning is sufficiently high and/or the incentive problem is sufficiently severe.²²

All of this presumes that wage contracts can be written on private benefits. This is a strong assumption. In practice, private benefits may be large and difficult to estimate for contracting purposes. Moreover, paying managers to *not* invest may be inefficient if they also have to be motivated to expend effort to generate project ideas. Thus, there may be numerous reasons why wage contracting as a substitute for short-termism may be infeasible or inefficient.

²¹Note that the incentive benefit of short-termism, namely the elimination of the manager's investment in the bad project in the first period, is symmetrically available with the wage contracting resolution as well, so it does not show up in a comparison of the two approaches.

²²Recall that short-termism is predicted to be more likely for routine projects. To interpret Proposition 3, it should be noted that both the value of learning and the severity of the incentive problem can vary in the cross-section. The value of learning can vary cross-sectionally for routine projects due to differences in managerial turnover, and the severity of the incentive problem can vary cross-sectionally due to differences across firms in managerial private benefits.

4 Model Robustness and Empirical Implications

In this section, two main issues are discussed. The first is the role of the key assumptions and model robustness. The second is the set of empirical implications that emerge from the analysis.

4.1 Key Assumptions and Robustness

There are six key assumptions that drive the main results. The first is that the manager's type is unknown at the beginning. This leads to managerial career concerns that generate inefficiencies in capital budgeting, which then rationalizes value-maximizing short-termism. An alternative assumption is that the manager knows more about his type than the CEO. In this case, more talented managers will have an incentive to separate themselves via the early revelation associated with short-term projects, whereas less talented managers prefer delayed revelation. Thus, asymmetric information will strengthen the short-termism result.²³

The second key assumption is that when the manager proposes a project, the CEO knows whether it is a short-duration or long-duration project, but is unaware of its NPV. Asymmetric information about project quality ensures that there is a meaningful moral hazard problem involving the manager being able to misrepresent project quality. Symmetry about project-duration information is necessary to enable short-termism to be implemented in capital budgeting. This is realistic in that the firm should be able to determine with reasonable accuracy whether the manager is proposing a short-term or a long-term project, even though determining project quality may be difficult.

The third key assumption is that the manager enjoys private benefits from investing. This assumption should be viewed quite broadly. It could mean that the manager has a preference for "empire building". It could also be because increasing investment allows the manager to enjoy greater perquisites consumption.²⁴ Without this assumption, there is no agency

²³These details are not provided here, but are available upon request.

²⁴For example, investment in a project may mean more purchases from suppliers who may shower the manager with more gifts to get the business.

problem, so the issues studied in this paper disappear. In the next section, I discuss how the analysis would be affected if managerial private benefits were replaced by risk aversion.

A fourth assumption is that the manager's wage is a fixed amount paid at the start of the period, and is conditioned on all available information about the manager's talent. This precludes payoff-contingent contracting. In Section 4.3, I show how the analysis would change if the firm designed a mechanism using the Revelation Principle (e.g. Myerson (1983)) in which the manager reports the type of project he is requesting funding for and receives a payoff-contingent compensation contract from a menu that the firm pre-commits to. I examine a richer information structure in Section 4.4 in which this scheme breaks down.

A fifth assumption is that it is assumed that no interim information is available about the long-term project at $t = 1$. In Section 4.5, I introduce an informative interim signal about the payoff on the long-term project and examine its effect on short-termism.

The final key assumption has to do with the two-period structure of the model. In Section 4.6, I discuss whether short-termism would survive in a richer time-structure.

4.2 Managerial Private Benefits versus Risk Aversion

Since the manager's preference for a long-term project in this model arises from his desire to delay revelation of information about his ability, an interesting question is whether managerial risk aversion can replace private benefits in the analysis to generate the same managerial preferences. The answer is yes. To see this, suppose the divisional manager was risk averse, but there was *no* private benefit associated with investing in a project. In that case, if the manager chooses the short-payback project, his second-period wage is stochastic, either w_1^+ or w_1^- , depending on whether the first-period project succeeds or fails. If he chooses the long-term project, his second-period wage is the expected value of w_1^+ and w_1^- . A risk-averse manager will always strictly prefer the expected value of w_1^+ and w_1^- to a stochastic wage, and hence the long-term project will be preferred to the short-term project.²⁵

²⁵One advantage of the risk aversion assumption is that the manager would prefer the long-term project even if investments were a martingale.

However, even though the risk-aversion can explain managerial concern with project duration, this assumption has a major limitation relative to the model examined here. Specifically, it cannot explain investment inefficiencies with risk aversion, the manager would not prefer to invest in a (long-term) *bad* project in the first period over not investing at all in that period. This is because he receives the expected value of w_1^+ and w_1^- as his second-period wage in both cases, so he is indifferent between the two choices, and standard convention would choose the no-investment outcome. And if there was any ex-post compensation adjustment associated with ability revelation at $t = 2$, the manager would have a strict preference to not invest (see also Holmstrom and Ricart i Costa (1986)). Absent any investment distortion associated with the manager’s preference for a long-term project, the firm would have no reason to adopt short-termism in project selection. Hence, risk aversion can explain why managers would prefer long-term projects, but not why firms would try to prevent them from doing so by imposing a short-termism constraint.²⁶

4.3 Information-Eliciting Payoff-Contingent Compensation and Short-termism

The model analyzed here has relied on the kind of career concerns model developed by Holmstrom and Ricart i Costa (1986) in which wages are paid at the beginning of each period. However, it is worth exploring the implications of relaxing this assumption.²⁷ So, suppose we design a revelation game in which the manager is asked to directly report at each date $t \in \{0, 1\}$ to the firm (CEO) his private information about the project and then, conditional on the report r_t at date t , receives an up-front wage $w_t(r_t)$ plus a bonus $c_t(\tilde{R}, r_t)$ that is a function of the random project payoff \tilde{R} . That is, the reporting game is a function $\psi_t : \{G, B\} \rightarrow \mathbb{R}^2$, where \mathbb{R} is the real line. The focus of the analysis is on a linear $c_t(\tilde{R})$

²⁶Recall the specification that, despite the learning afforded by the short-payback project, the long-payback project is first-best. This is the only specification that makes sense if “short-termism” is viewed as a distortionary practice, or a deviation from first-best that needs to be explained.

²⁷The analysis that follows is along the lines of Osband and Reichelstein’s (1985) analysis of information-eliciting compensation schemes.

function:

$$c_t(\tilde{R}, r_t) = \begin{cases} \gamma_t [\tilde{R} - \mu_G(\mathbb{E}(T_t))] & \text{if } r_t = G \\ 0 & \text{if } r_t = B \end{cases}, \quad (20)$$

where $\gamma_t > 0$ is a parameter whose value is endogenously determined, \tilde{R} is the actual random payoff on the project, and $\mu_G(\mathbb{E}(T_t))$ is the expected payoff on the G project given the manager's expected talent at date t . Also set

$$w_t(r_t) = w_1 \in \{w_1^-, w_1^+\} \forall r_t. \quad (21)$$

Now, working backwards, consider the last period. At $t = 1$, only an S project can be chosen. Given a posterior belief of θ_1 about the manager's type, we can write:

$$\mu_G(\mathbb{E}(T_1)) = \theta_1 R_S + [1 - \theta_1] q R_S. \quad (22)$$

Consider a manager who has received a G project at $t = 1$. His expected utility from truthful reporting is:

$$\begin{aligned} U(G | G) &= w_1 + \beta + \gamma \left[\mathbb{E}(\tilde{R} | G, \mathbb{E}(T_1)) - \mu_G(\mathbb{E}(T_1)) \right] \\ &= w_1 + \beta. \end{aligned} \quad (23)$$

A manager who has a G project at $t = 1$ but reports $r_1 = B$ would get a utility of

$$U(B | G) = w_1, \quad (24)$$

since no funding would be provided for a B project, but the manager would still receive a wage of $w_1 = w_1^+$ or w_1^- , depending on the first-period project outcome. Now clearly,

$$U(G | G) > U(B | G), \quad (25)$$

so a manager with G will always report truthfully.

Suppose the manager has only B at $t = 1$. If he reports truthfully, his utility is

$$U(B | B) = w_1, \tag{26}$$

and if he reports $r_1 = G$, his expected utility is

$$U(G | B) = w_1 + \gamma_1 [0 - \mu_G (\mathbb{E} [T_i])] + \beta. \tag{27}$$

We need

$$U(B | B) \geq U(G | B), \tag{28}$$

for incentive compatibility (IC). That is, the IC constraint will be satisfied if:

$$\gamma_1 \geq \frac{\beta}{\theta_1 R_S + [1 - \theta_1] q R_S}. \tag{29}$$

It is straightforward to show that the firm's payoff will be maximized by setting

$$\gamma_1 = \frac{\beta}{\theta_1 R_S + [1 - \theta_1] q R_S}. \tag{30}$$

The following result follows immediately from the above.

Lemma 5: *If the firm can use a reporting game like the one described above in the second period, it will produce a strictly higher second-period firm value than if the firm simply chooses to pay the manager only an up-front wage at the start of the second period.*

The intuition is that, in equilibrium, the manager always reports truthfully, so the expected bonus paid to the manager is zero. Thus, the only wage the firm pays to each manager is the same as that with the policy of only paying the manager an up-front wage that was considered earlier. However, in the previous analysis (see Lemma 3), we saw that the policy

of only paying an up-front wage leads to the manager seeking second-period funding even for a B project. This leads to a lower second-period firm value than with the reporting mechanism in which the manager never seeks funding for a B project.

Now consider the firm's choice at $t = 0$. The following lemma can be proved:

Lemma 6: *Taking as given the second-period reporting game, at $t = 0$, the firm can adopt the policy of asking the manager to invest in either the L or the S version of the project the manager has and truthfully report the type (G or B) of the project to the firm. The reporting game involves the manager being paid an up-front wage of w_0 at $t = 0$ regardless of his report. He is denied funding if he reports B . If he reports G , he receives funding and a bonus c_0 that is conditional on the first-period project outcome:*

$$c_0^L = \frac{\beta}{\theta_0 R_L + [1 - \theta_0] q R_L} \text{ if the manager proposes an } L \text{ project,} \quad (31)$$

$$c_0^S = \frac{\beta[1 - p]}{\theta_0 R_S + [1 - \theta_0] q R_S} \text{ if the manager proposes an } S \text{ project.} \quad (32)$$

This lemma essentially verifies that the direct reporting mechanism can also be used in the first period. The next question that is addressed is whether short-termism should be expected in an environment in which output-contingent wage contracting in a reporting game framework is feasible.

Proposition 4: *Suppose*

$$p\bar{\Delta}_0 + p[1 - \theta_0][p - q]qR_S > p[1 - \theta_0][1 - q] - [1 - p][4p - 1]. \quad (33)$$

Then the firm always prefers to instruct the manager to invest in the L version of the project at $t = 0$, i.e., there is no short-termism. If θ_0 , $\bar{\Delta}_0$, and q are sufficiently small (so that the inequality in (33) is reversed), then the firm will prefer to practice short-termism.

Given that (14) holds, (33) will hold if p is not too small.²⁸ Thus, output-contingent contracting reduces the attractiveness of short-termism. The intuition is as follows. Because output-contingent contracting ensures that the manager avoids proposing B even with the L version of the project, one of the *relative* benefits of short-termism—the resolution of the incentive problem—is lost since this problem is resolved with wage contracting. Of course, the learning benefit of short-termism still remains. However, (14) and (33) essentially say that the learning benefit is small compared to the intrinsic-value gain from investing in the L version of G compared to investing in the S version. When this is true, resolving the incentive problem does not suffice for short-termism to be adopted. But when $\bar{\Delta}_0$, the intrinsic-value gain from investing in the L rather than the S version of G , is small and θ_0 and q are small as well, it is possible for the inequality in (33) to be reversed and short-termism to re-emerge. This is intuitive since a reduction in $\bar{\Delta}_0$ makes it possible for the learning benefit of short-termism to overcome the loss in value from eschewing the L version of G .

Corollary 2: *When the value of learning is eliminated ($\theta_0 = 1$), there is no short-termism when output-contingent wage contracting is possible in a contracting framework.*

This result is consistent with a similar result in Proposition 3. Because output-contingent wage contracting resolves the incentive problem, short-termism has no relative advantage if the learning benefit is eliminated.

4.4 Ex-post Cash Flow Unobservability and Short-termism

Numerous papers have made the assumption that cash flows may be observable ex post to one of the contracting parties but *not* to others, or that cash flows may be observable to all but not verifiable for contracting purposes. In these circumstances, it is impossible to make wage (or other) contracts contingent on realized profit or cash flow.²⁹

²⁸Given (14), it is clear that (33) holds for $p = 1$ and hence by continuity for p high enough.

²⁹For example, Bolton and Scharfstein (1990) assume that the firm's profit is privately observed by the firm, but cannot be observed by its creditors, in which financial constraints emerge endogenously to mitigate incentive problems. Hart and Moore (1998) assume that the ex post cash flows of a project cannot be verified

In the setting here, it is natural to assume that the CEO can observe the *total* cash flows of the project, but the divisional manager (who requests funding for it) cannot. One reason for this may be that the cash flow of the project is affected by many other employees of the firm, and the actual impact of each employee on the realized cash flow may not be public. That is, each employee sees only his own impact on the cash flow, but not the impact of others, thereby hiding from his view the total realized cash flow. The CEO, however, has access to information about each component of the total cash flow as well as the total cash flow. Higher-level executives in most firms have access to more information than lower-level managers. Indeed this differential information access based on the employee's level in the hierarchy is codified in most firms through explicit access rules.³⁰

Formally, suppose ν represents the sum of the effects that *other* employees in the firm have on the project cash flow. Let $\nu \in \Lambda$, a subset of the real line. Thus, if x is the impact of the manager requesting the funding, then the total project cash flow is:

$$y = x + \nu. \tag{34}$$

The project-dependent and manager-type-dependent cash flow distribution of x is as it was described earlier. It is assumed that, conditional on G , $\mathbb{E}(x\nu) = \mathbb{E}(x)\mathbb{E}(\nu)$. Let f be the density function of ν , with $\text{supp}(f) = \{\nu \in \Lambda \mid f(\nu) \neq 0\}$, and let g be the density function of y , with $\text{supp}(g) = \{\nu \in \Lambda \mid g(\nu) \neq 0\}$.

Now suppose $\text{supp}(f) = [-R_L, R_L]$ for the L version of G , and $\text{supp}(f) = [-R_S, R_S]$ for the S version of G . Then $\text{supp}(g \mid \tau \in \{T, U\}, L) = [-R_L, 2R_L]$ and $\text{supp}(g \mid \tau \in$

by a court, so the entrepreneur can steal these cash flows. The paper goes on to examine the role of debt in this setting. DeMarzo and Sannikov (2006) develop a continuous-time model of optimal capital structure in which the agent may conceal or (unobservably) divert cash flows for his own consumption.

³⁰As another example, it is not uncommon for store managers of a retail corporation to not be able to actively track their own store's profits, since it depends on not only the store's sales, but also the company's overhead costs (which are not directly observable to the manager).

$\{T, U\}, S) = [-R_S, 2R_S]$, where τ denotes the manager's type. If we assume that

$$\int_{-R_S}^{R_S} \nu f(\nu) d\nu = \int_{-R_L}^{R_L} \nu f(\nu) d\nu = 0, \quad (35)$$

then it follows that x is an unbiased predictor of y , i.e.,

$$\int_{-R_L}^{2R_L} y f(y) dy = R_L \text{ if } G \text{ is selected,} \quad (36)$$

and

$$\int_{-R_S}^{2R_S} y f(y) dy = R_S \text{ if } G \text{ is selected.} \quad (37)$$

Now, suppose only the CEO can observe x and ν individually, and hence y as well.³¹ The manager proposing the project can only observe x . None of the cash flows can be verified by a third party (like a court) ex post, i.e., x , ν , and y are unverifiable for contracting. The following result is straightforward, but worth noting as a benchmark.

Lemma 7: *If the CEO can credibly precommit to truthfully revealing y ex post, then the output-contingent wage scheme in the reporting game described in Proposition 4 can be implemented.*

The problem, of course, is that such precommitment will usually be difficult. If we assume that the CEO's utility is given by (11), with $\alpha_2 = 0$, then the CEO will have an incentive to misrepresent y ex post, as indicated in the result below.

Proposition 5: *Suppose the CEO's utility is given by (11) with $\alpha_2 = 0$ and the bonus scheme described in Lemma 6 is used for projects proposed at $t = 0$. Then, regardless of the realized y , the CEO will always report a y ex post that justifies paying the manager an ex post bonus $c_0^L = 0$ at $t = 2$ with the L version of the project. However, if the S version of the G project is sufficiently valuable in the sense that $[\theta_0 + [1 - \theta_0]q]R_S$ is high enough, the*

³¹The analysis is unchanged if it is assumed that the CEO can only observe y , whereas each employee can observe only his contribution to y , but not y itself.

CEO will report y truthfully at $t = 1$ and pay the agreed-upon bonus c_0^S at $t = 1$ if the realized x warrants it. At $t = 2$, however, the CEO will again report a y ex post that justifies paying the manager an ex post bonus $c_1^S = 0$ on the second-period project chosen at $t = 1$.

The intuition can be understood by examining the CEO's incentive to maximize firm value due to her utility function. Because $0 \in \text{supp}(f)$, the CEO can always claim that $y = 0$ regardless of the x that the manager reports observing. The lack of verifiability of the actual realizations of x , ν , and y means that the CEO can claim that she also observed $x = 0$, in which case the manager is not entitled to a bonus. This makes output-contingent contracting infeasible at $t = 0$ for the L version of the project since the manager will anticipate this behavior on the CEO's part at $t = 2$, making the bonus useless.

Interestingly, the CEO does not have the same misrepresentation incentive at $t = 1$ if the S version of the project is funded at $t = 0$. The reason is that observing $x = y = 0$ should rationally lead the CEO to deny any second-period funding for the manager. However, if $x = R_S$ is truly observed by the CEO (or inferred from the realization of y), then it is subgame perfect for the CEO to fund the manager's second-period project request. Of course, this now reveals the CEO's private information, so the manager will have to be paid the bonus $c_0^S > 0$ despite the lack of verifiability of x and y . If $[\theta_0 + [1 - \theta_0]q] R_S$ is high enough, the CEO will not mind paying the manager's bonus in order to capture the value of the second-period (short) project. In other words, short-termism emerges once again.

Implications of the Analysis

When the analyses in Sections 4.3 and 4.4 are combined, one implication that is evident is that short-termism has greater economic value to the firm when the manager's specific contribution to the project is more difficult to verify for contracting purposes. This situation is more likely to be encountered with lower-level managers. As one moves up the management hierarchy, the manager's span of control increases and it becomes easier to assign accountability for verifiable outcomes to the manager. When one gets to the top of the hierarchy,

the CEO can be assigned accountability for the entire firm’s performance and tying her compensation to the firm’s stock price makes sense.

This implication yields the empirical prediction that the short-termism constraint imposed by the firm will weaken as one moves up the corporate hierarchy and compensation contracts become more performance-sensitive. This is a within-firm prediction. A related prediction is that in the cross-section of firms, there will be an inverse relationship between pay-for-performance sensitivity and the use of short-termism.

4.5 Interim Signal of Cash Flow of Long-term Project

Suppose that at $t = 1$ the CEO could observe an informative but noisy signal $\phi \in \{0, R_L\}$ of the cash flow of the long-term project at $t = 2$. The probability distribution of ϕ is:

$$\Pr(\phi = i \mid x = i) = \lambda \in [0.5, \bar{\lambda}] \subset [0.5, 1), \quad i \in \{0, R_L\}, \quad (38)$$

where x is the cash flow at $t = 2$ and $\bar{\lambda} \in (0.5, 1)$. The cost to the CEO of generating a signal with precision λ is $\varphi(\lambda)$, with $\varphi(0.5) = 0$, $\varphi' > 0$, $\varphi'' > 0$, and the Inada conditions $\varphi'(0.5) = 0$ and $\varphi'(\bar{\lambda}) = \infty$. This is similar to the idea in Halac and Prat (2016), that the boss may have to make a costly investment in “attention technology” to recognize good worker performance. The analysis below does not examine the dynamic aspects of their model, but focuses on the static implications.

Now, based on the previous analysis, it is clear that at $\lambda = 1$ the manager would never choose a B project at $t = 0$, even if it were a long-term project. In this case, imposing a short-termism constraint is unnecessary. On the other hand, at $\lambda = 0.5$ the interim signal is uninformative, so the manager will behave as in the base model and short-termism enhances firm value. By continuity, this means that there exists $\lambda^* \in (0.5, 1)$ such that the manager will avoid the L_B project if the λ chosen in equilibrium is at least as big as λ^* . The following result is now evident:

Lemma 8: *Suppose $\bar{\lambda} < \lambda^*$. Then for p low enough, short-termism is value maximizing in the second-best case.*

The intuition is that if the interim signal is not informative enough to resolve the incentive problem, the firm prefers short-termism. Note that the condition that p is not too high is similar to (17) in the base model; p is essentially a measure of the severity of the incentive problem, given the equilibrium behavior of the manager—the lower the p , the more severe the incentive problem.

4.6 A Richer Time Structure

The intuition emerging from the two-period analysis carries over to a structure that has more than two periods, as long as the manager cares about his human capital—how his ability is perceived—at dates *prior* to all the project payoffs being realized. That is, the analysis captures the idea that the tenure of the typical manager in a given job is often shorter than the payoff horizons of long-term projects. The Bureau of Labor Statistics reports that the median number of years that wage and salary workers had been in their present jobs was 4.6 years, a time period much shorter than the duration of the typical long-term project in many industries.³² As an example of this, it is not uncommon for a manager to enter a job with the intention or expectation of finding a new job within a few years. The analysis then suggests that the manager would rather not jeopardize future employment opportunities by allowing (potentially risky) project outcomes to be revealed in the short-term, instead preferring that those outcomes be revealed at a time when the manager need not be concerned about the result (i.e. in a different job).

³²For example, the project horizon for a beer brewery is typically 15-20 years. Similarly, R&D investments by drug companies have payoff horizons typically exceeding 10 years. Term loans by banks may have maturities of 5-7 years.

4.7 Empirical Implications

The previous analysis allows one to draw out some empirical implications, which are discussed in this section.

At a broad level, the analysis implies that since short-termism is value-maximizing in the second-best and hence desired by the owners of the firm in some circumstances, we should find that it takes the form of upper management telling divisional managers that the firm will not fund projects with payback periods or project durations exceeding some upper bound. This seems to be consistent with the evidence in Graham and Harvey (2001) and Lefley (1996). What the analysis here adds is that this practice is likely to be encountered only in *specific* circumstances, so that sharper empirical tests can be designed. The predictions below focus on linking empirical tests to these circumstances.

First, given that managers like long-term projects and shareholders like short-term projects, a firm that is run more consistently in the interest of shareholders will place a stronger emphasis on short-termism. This means that firms in which CEOs have greater ownership of the firm will be *more* short-term oriented (see Graham and Harvey’s (2001) evidence). Moreover, small firms and private firms also typically have larger ownership stakes held by the CEO, so these firms should also display short-termism.³³ In other words, switching from public to private ownership is *not* necessarily the “solution” for reducing short-termism. Further, if better internal governance means a stronger shareholder-value emphasis and the qualities of external governance (monitoring of the CEO by the Board) and internal governance (monitoring of divisional managers by the CEO) are positively correlated, then the prediction is that there will be a stronger emphasis on short-termism in firms with better (external) corporate governance. A recent paper that provides evidence somewhat consistent with this implication is Gianetti and Yu (2016), which documents that firms with more short-term institutional investors—that are ostensibly more short-term focused—have better long-term performance in dynamic economic environments.

³³This is what Graham and Harvey (2001) find.

Another way to test the prediction would be to first regress ΔS_t , the change in sales in period t , against $CAPEX_t$ and $CAPEX_{t-1}$, the capital expenditures of the firm in periods t and $t - 1$, controlling for industry and firm size for each firm. Taking the slope coefficients from this regression, the estimated value of $\frac{\mathbb{E}(\Delta S_t) + \mathbb{E}(\Delta S_{t+1})}{CAPEX_t}$ can be computed. The higher this asset-turnover ratio, the shorter the payback period of the firm’s projects. This ratio can then be regressed on some measure of corporate governance (e.g. the Gompers, Ishi and Metrick (2003) governance index). The prediction is that higher-quality governance should be associated with a higher asset-turnover ratio.³⁴ To deal with endogeneity issues, one could consider an exogenous shock to governance and examine its effect on short-termism. For example, inclusion of a firm in the S&P 500 can be viewed as a quasi-natural experiment that causes an increase in institutional ownership and an improvement in governance. Appel, Gormley, and Keim (2014) show that an increase in ownership by even passive institutions is associated with an improvement in governance.

Second, short-termism is more likely for routine projects than for strategic projects. This is consistent with the evidence in Lefley (1996), that short payback periods are more likely to be imposed on routine projects (likely to be proposed by lower-level managers) than for more “strategic” projects proposed by senior managers.

Third, within a firm, the short-termism constraint on project choice is more likely to be imposed on lower-level managers, and in the cross-section of firms it will be negatively correlated with managerial pay-for-performance sensitivity.

Fourth, short-termism is likely to be greater in industries in which the loss in value from insisting on short-term projects to discipline managers is not excessive (see condition (20)). Examples are traditional manufacturing firms like appliances and automotive parts. Short-termism should be lower in knowledge-based, R&D-intensive industries like bio-tech and pharmaceuticals. This prediction has yet to be empirically tested.

Finally, to the extent that there is heterogeneity among firms in the efficiency with which

³⁴The idea that the quality of governance affects corporate investments is consistent with the evidence in Billett, Garfinkel, and Jiang (2011) that poor governance is associated with overinvestment.

they resolve internal governance problems, there will be some firms that invest more in short-term projects and some that invest more in long-term projects. The firm that invests more in long-term projects owns a series of two-year (real) call options, whereas the firm with more short-term projects owns a series of one-year call options. Hence, the stock return volatility of the firm that invests more in long-term projects should be higher.

4.8 Application to Financial Institutions

In a bank, there are loans of varying maturities. A long-maturity loan is like a long-term project in the model, and a short-maturity loan is like a short-term project. An important consideration for a bank in choosing (and pricing) loan maturity is that the bulk of its liabilities are short term, so lengthening loan maturity creates a bigger maturity mismatch and higher risk for the bank. This limits how long a loan maturity the bank is willing to accept and hence the extent of the bank's maturity transformation. What the analysis here shows is that the incentive frictions that generate a preference for short-termism induce the bank to shorten loan maturity below the level that it would choose based solely on the inherent risk in maturity transformation. And this effect will be stronger in banks with stronger governance. While one may view this as possibly detrimental to the maturity transformation function of banks, it may also be useful in diminishing "ever-greening", which is the practice of the bank extending additional funds to delinquent borrowers and thereby extending loan maturities for borrowers whose loans should be written off. A short-termism constraint would restrict this practice.

Another implication has to do with Value at Risk (VaR). The use of VaR requires the manager to share his information about the performance of the activity he is engaged in. In the context of the model, this can be viewed as the ultimate short-termism since VaR may be monitored over very short time intervals. An implication of the model is that there will be a stronger insistence on VaR in financial institutions with better governance.

5 Related Literature

This paper is related to two important strands of literature: short-termism in investments, and the role of managerial career concerns in capital budgeting.

Papers that examine investment short-termism include Stein (1989) and Narayanan (1985a,b). In these papers, managers boost short-term earnings through hidden actions in order to positively influence the stock price or perceptions of managerial ability, and sacrifice long-term earnings in the process.³⁵ The market is rational and correctly anticipates this signal-jamming behavior, so the earnings inflation is properly “discounted” in the determination of the stock price. But given that the market expects earnings to be inflated, firms are “trapped” in the Nash equilibrium in which not inflating earnings would lead to a lower valuation than what the firm is worth. Darrrough (1987) shows that the equilibrium identified by Narayanan (1985a,b) disappears if the shareholders use an appropriate incentive scheme. In these models, managers like short-term projects but shareholders prefer long-term projects. In sharp contrast, in my model it is the owners of the firm who prefer short-termism.³⁶ In this sense, my analysis also differs from von Thadden (1995), where myopic firm behavior is caused by the fear of early project termination by outside investors. Since shareholders prefer long-term investments even in the second-best case (with incentive constraints), investor monitoring is shown to be able to overcome investment myopia.

There are also papers where managerial investment myopia is induced by stock mispricing. In Bolton, Scheinkman, and Xiong (2006a,b) current shareholders are willing to sacrifice long-

³⁵See also Stein (1988), where the manager faces a takeover threat from a hostile raider and recognizes that temporarily low earnings may cause the firm’s stock price to become undervalued. Therefore, the manager may choose to signal by inflating current earnings to reduce the likelihood of a takeover at an unfavorable price.

³⁶Models in which external financing is more costly than internal financing predict a preference for a faster generation of internal cash for investments. For example, in Whited (1992), the presence of external financing constraints enhances the shadow value of internal funds. In Thakor (1990), informational frictions open up a wedge between the costs of internal and external financing, which then creates a preference for short-payback projects. While this approach sheds light on payback use in certain kinds of firms, it cannot explain why payback use is not empirically observed to be greater among financially-distressed or capital-constrained firms (Graham and Harvey (2001)). By contrast, the theory in this paper predicts a preference for payback even in the absence of financial constraints.

term value in order to take advantage of short-term speculative profits. These profits arise due to the deviation of stock prices from fundamentals in the presence of the option that current shareholders with short horizons have to sell their stock in the future to potentially overoptimistic investors. The similarity between the Bolton et al (2006a,b) papers and this paper is that, in all three papers, short-termism is due to the wishes of the shareholders rather than to enable rent extraction by the manager. The key difference is that the investment horizon distortion here has nothing to do with stock market inefficiency or even stock market trading. Thus, it can be expected to persist even in private firms and in public firms trading in efficient stock markets.³⁷

On the issue of managerial career concerns in capital budgeting, an important paper is Holmstrom and Ricart i Costa (1986). The problem there is that risk-averse managers with unknown abilities and career concerns never wish to invest, so they have to be given wage contracts with option-like features.³⁸ This then causes over-investment, and capital rationing by headquarters becomes necessary. However, unlike in this paper, that paper does not focus on short-termism. Other related capital budgeting papers include Berkovitch and Israel (2004), which shows that the NPV criterion may not work well when managers have private benefits and are privately informed about investment projects, and Malenko (2012), who examines the optimal design of a capital allocation process in a dynamic setting in which the division manager has private benefits of investing, as in this paper. However, Malenko's (2012) focus is on endogenizing a threshold division of authority for project approval. The allocation of control, which is taken as a given in my paper, is also endogenized in a different

³⁷This also distinguishes this paper from Gumbel (2005), who shows that investors may want managers to trade on short-term information in part because performance observations under long-term informed trading are contaminated by noise in stock prices. Assuming that short-term information is of higher quality than long-term information, Gumbel (2005) shows that investors may want fund managers to trade on short-term information. Thus, while that paper also notes the learning benefit of short-termism, it is about the trading behavior of fund managers rather than about short-termism in corporate investments. Moreover, it does not deal with a central issue in this paper—short-termism as a solution to the incentive problem.

³⁸The reason why a risk-averse manager does not want to invest is that beliefs about the manager's ability form a martingale (the expected posterior belief equals the prior belief), so, relative to not investing, the expected wage benefit from investing in a project whose future risky cash flows will noisily reveal ability is zero, which means its incremental expected utility impact is negative. See Holmstrom (1999) for a multiperiod career concerns analysis.

setting (involving disagreement) in Van den Steen (2010). Papers like Holmstrom (1999) argue that the career concerns that arise in dynamic settings can strengthen the agent’s effort incentives and reduce agency costs relative to a single-shot game. In contrast, managerial career concerns *distort* outcomes and increase agency costs in my model.

This paper also has something in common with papers on governance that focus on how governance structures influence corporate behavior. For example, Levit and Malenko (2012) examine how the interaction between the labor market for directors and the reputational concerns of directors affects corporate governance. More closely in line with this paper, Acharya, Myers, and Rajan (2010) develop a model of internal governance in which the self-serving behavior of the CEO is limited by the possible reaction of the subordinate. While this paper also focuses on internal governance, the moral hazard problem here is *inverted* compared to Acharya, Myers, and Rajan (2010)—it is the subordinate’s self-interested behavior that the CEO is trying to limit through short-termism.³⁹

6 Conclusion

Short-termism in corporate behavior has been the subject of much research and public debate. The thrust of the research until now has been that a short-term orientation in project choices sacrifices long-term value and is an undesirable consequence of managerial self-interest or stock market pressure to engage in earnings management, coming perhaps from (impatient) short-horizon investors.

This paper has challenged this idea and argued that short-termism may be good for firm value. Were firms not to insist on short-term results that lead to early revelation of information about project quality and managerial ability, managers would be tempted to choose projects that benefit them personally at the expense of firm value, and firms would

³⁹Another related paper is Grenadier and Wang (2005), which examines investment timing and agency conflicts related to contracting problems between managers and owners. Using a real options framework, they find that managers have an incentive to wait longer than owners to invest in projects, since they have a more valuable option to wait than owners. They then generalize their model to allow for greater impatience and “empire building” on the part of managers to explain their preferences for choosing projects with quicker paybacks, consistent with Narayanan (1985a).

learn less efficiently about managerial abilities. Pushing the revelation of information about such activities further into the future is an effective way for managers to protect themselves against the outcome of their rent-seeking being misinterpreted as evidence of low ability, which enables rent extraction to last longer. This makes short-termism a valuable tool of internal governance. Thus, it is the guardians of firm value, like investors, who want short-termism, and it is self-interested managers who like long-term projects. This approach produces many empirical predictions, some of which are in line with the existing evidence, and some are new predictions.

The theory in this paper does not rely on debt playing a role. In the analysis here, it does not matter whether external financing is raised through debt or equity, as long as debt maturity plays a passive role in the analysis, i.e. it is long-maturity debt. However, short-term debt may create an additional reason for information revelation to occur early rather than late, as bondholders would find this information useful in *repricing* debt. This will reinforce the effect modeled here.

Appendix

This appendix contains proofs of all of the earlier results, in the order in which they were presented.

Proof of Lemma 1: In the first-best case, project choice can be observed by the shareholders, so it maximizes firm value. It will first be shown that the funding will occur only if he has a G project. With a G project, since $1 - \theta_0$ is the probability that the manager is type U and thus receives a project payoff of 0 with probability $1 - q$, the net expected project payoff across the two types of managers will be $\theta_0 R_T + (1 - \theta_0)qR_T - 1$ where $T \in \{L, S\}$ if the manager does not know his type, and the expected social value will be $\theta_0 R_T + (1 - \theta_0)qR_T + \beta - 1$. Now, if the manager does not invest, net social surplus and the net expected project payoff are both 0, so the CEO accepts the project in the first-best case. Now if the manager does not receive a G project, then he has a B project which pays off 0 regardless of his type. In the first-best case, there is no investment in the project since the NPV < 0 and also the sum of his private benefit and project NPV is $\beta - 1 < 0$. Next, it will be established that (13) is a necessary and sufficient condition for L_G to have higher value for the firm than S_G . Suppose the firm invests in L_G in the first period. Its expected net payoff after the first period is $\theta_0 R_L + (1 - \theta_0)qR_L - 1$. At the beginning of the second period, no information is revealed about the manager's type since an L project was undertaken at $t = 0$, so $\theta_1 = \theta_0$. The manager receives a G project with probability p , which then gives an expected net payoff of $\theta_0 R_S + (1 - \theta_0)qR_S - 1 > 0$. If the manager proposes a B project, the expected net payoff is -1 , and if the manager does not invest, the payoff is 0. Thus, the manager will only propose a G project, and its expected net payoff across the two periods is:

$$\{\theta_0 R_L + (1 - \theta_0)qR_L - 1\} + p\{\theta_0 R_S + (1 - \theta_0)qR_S - 1\} \quad (\text{A.1})$$

Now, suppose that the firm invests in S_G in the first period. Its expected net payoff after the first period is $\theta_0 R_S + (1 - \theta_0)qR_S - 1$. At the beginning of the second period, posterior beliefs about the manager's type are updated from θ_0 to θ_1 via Bayes' Rule, based on the outcome of the first-period project. In the case where the first-period project fails, then beliefs are revised to:

$$\begin{aligned} \theta_1 &= \Pr(\text{manager's type} = T \mid \text{failure at } t = 1) \\ &= \frac{\Pr(\text{failure} \mid \text{type} = T) \Pr(\text{type} = T)}{\{\Pr(\text{failure} \mid \text{type} = T) \Pr(\text{type} = T) + \Pr(\text{failure} \mid \text{type} = U) \Pr(\text{type} = U)\}} \\ &= 0 \equiv \theta_1^-, \end{aligned} \quad (\text{A.2})$$

where “failure” means that the first period project payoff is 0, and “success” means that the payoff is R_S . In this case, the expected net payoff of proposing a G project at $t = 1$ is $\theta_1 R_S + (1 - \theta_1)qR_S - 1 =$

$qR_S - 1 < 0$ from (4). The net payoff of proposing a B project is -1 , and the payoff of not investing is 0. Thus, given failure at $t = 1$, the manager will choose to not invest in the second period in the first-best. In the case where the first-period project succeeds, beliefs are revised to:

$$\begin{aligned}
\theta_1 &= \Pr(\text{manager's type} = T \mid \text{success at } t = 1) \\
&= \frac{\Pr(\text{success} \mid \text{type} = T) \Pr(\text{type} = T)}{\{\Pr(\text{success} \mid \text{type} = T) \Pr(\text{type} = T) + \Pr(\text{success} \mid \text{type} = U) \Pr(\text{type} = U)\}} \\
&= \frac{\theta_0}{\theta_0 + q(1 - \theta_0)} \equiv \theta_1^+, \tag{A.3}
\end{aligned}$$

and

$$1 - \theta_1 = \Pr(\text{manager's type} = U \mid \text{success at } t = 1) = \frac{q(1 - \theta_0)}{\theta_0 + q(1 - \theta_0)} \equiv 1 - \theta_1^+. \tag{A.4}$$

In this case, the expected payoff of proposing a G project at $t = 1$ is $\theta_1^+ R_S + (1 - \theta_1^+) q R_S - 1$. Since the first-period project succeeds with probability $\theta_0 + (1 - \theta_0)q$, the manager receives second-period funding only if he receives a second-period G project and succeeds in the first-period, and the manager receives a G project at $t = 1$ with probability p , the expected net payoff across the two periods when the firm invests in S_G is:

$$\begin{aligned}
&\{\theta_0 R_S + (1 - \theta_0) q R_S - 1\} + p [\theta_0 + (1 - \theta_0) q] \left\{ \left[\frac{\theta_0}{\theta_0 + q(1 - \theta_0)} \right] R_S + \left[\frac{q(1 - \theta_0)}{\theta_0 + q(1 - \theta_0)} \right] q R_S - 1 \right\} \\
&= \{\theta_0 R_S + (1 - \theta_0) q R_S - 1\} + p \{\theta_0 R_S + (1 - \theta_0) q^2 R_S - \theta_0 - (1 - \theta_0) q\}. \tag{A.5}
\end{aligned}$$

Now, for L_G to be value maximizing, the expression in (A.1) should exceed that in (A.5). This comparison yields (13). ■

Proof of Lemma 2: At $t = 1$, only an S project is available. From Lemma 1, the manager at $t = 0$ only requests funding for an L_G project. Then no information is revealed about the manager's type at $t = 1$, so $\theta_1 = \theta_0$ (this will also be the case if no project was proposed at $t = 0$). Since we know that $R_S > 1 > \beta$, it is thus the case that the expected project payoff for a G project is $\theta_0 R_S + (1 - \theta_0) q R_S > 1$. If the manager requests funding, then the net social surplus is $\theta_0 R_S + (1 - \theta_0) q R_S > 1$. The expected project payoff for a B project is 0, so the net social surplus will be $\beta - 1 < 0$ (and the value to the firm will be -1). If the manager does not invest, net social surplus will be 0. Therefore, in the first best case at $t = 1$, the manager will only propose S_G , and he will receive funding for it. ■

Proof of Lemma 3: First, I show that the manager will always seek funding at $t = 1$. Suppose the manager did not propose a project at $t = 1$. Then his utility at $t = 1$ is $U_{M,t=1}(\emptyset) = \tilde{w}_1$. Now, if the manager does propose a project at $t = 1$, and he gets funding for it, then his utility is $U_{M,t=1}(S_G) = U_{M,t=1}(S_B) = \tilde{w}_1 + \beta$, which does not depend on G or B . Clearly $U_{M,t=1}(S_G) = U_{M,t=1}(S_B) > U_{M,t=1}(\emptyset)$, so the manager will propose a project at $t = 1$.

Now, suppose that a policy of maximizing firm value is in place. Then, at $t = 1$, the manager will get funding if the expected payoff of the project as viewed by the CEO (given that the CEO cannot see whether he received a G project or not) exceeds 1. Thus, the manager gets funding at $t = 1$ if $p\{\theta_1 R_S + (1 - \theta_1)qR_S\} + [1 - p]0 = p\{\theta_1 R_S + (1 - \theta_1)qR_S\} > 1$. The funding decision thus depends on θ_1 , the posterior belief at $t = 1$. Now, if the manager invested in an L project at $t = 0$, then $\theta_1 = \theta_0$ (so there is no information revealed about the manager's type at $t = 1$). Since we have that $\theta_0 R_S + (1 - \theta_0)qR_S > 1$ from (6), it follows that the manager will get funding at $t = 1$ if he invests in an L project at $t = 0$. Now suppose that the manager invested in S at $t = 0$. Then there are two possibilities: S fails at $t = 1$ or S succeeds at $t = 1$. Belief revision now depends on what equilibrium choices were made at $t = 0$. Given the equilibrium in which the manager only invests in S_G (not S_B) at $t = 0$, posterior beliefs are obtained using Bayes' Rule as in the proof of Lemma 1. That is, $\Pr(\text{manager's type} = T \mid \text{failure at } t = 1) = \theta_1^- = 0$, and $\Pr(\text{manager's type} = T \mid \text{success at } t = 1) = \theta_1^+ = \theta_0 [\theta_0 + q(1 - \theta_0)]^{-1}$, where "failure" means that the first period project payoff is 0, and "success" means that the payoff is R_S . Thus, we see that when the manager only invests in S_G at $t = 0$, so that: $\theta_1 = \theta_1^+$ if there is success in the first period (given by (A.3)), and $\theta_1 = \theta_1^- = 0$ if there is failure in the first period (given by (A.2)). Therefore, for the manager to get funding at $t = 1$ conditional upon the success of the first-period project, it must be the case that:

$$p\{\theta_1^+ R_S + (1 - \theta_1^+)qR_S\} > 1. \quad (\text{A.6})$$

Note that, (A.6) directly follows from (7) and the fact that $\theta_1^+ > \theta_0$ (which clearly follows from (A.3)). The interpretation of this is that at $t = 1$ we know that the manager will invest in S_G in the second period if he has a G project, and in S_B if he does not have a G project. We know that $\Pr(G) = p$ and $\Pr(B) = 1 - p$, and also that the payoff the manager gets with B is 0. Therefore, in (A.6), p (the probability that the manager has a G project) is multiplied with the expected payoff of a G project with managerial type uncertainty (the expectation is taken over the manager being T or U).

It is also clear that if there is failure at $t = 1$ that the manager will never get funding at $t = 1$, since $\theta_1^- = 0$ and thus that the expected payoff is $pqR_S < 1$ (as a result of (4)). ■

Proof of Proposition 1: Suppose first that the manager has a G project. If he proposes S_G (the good short project), his expected utility will be:

$$\begin{aligned}
U_{M,t=0}(S_G) &= w_0 + \beta + \theta_0(w_1^+ + \beta) + [1 - \theta_0] \{q(w_1^+ + \beta) + [1 - q]w_1^-\} \\
&= w_0 + \beta + [\theta_0 + (1 - \theta_0)q] (w_1^+ + \beta),
\end{aligned} \tag{A.7}$$

where q is the probability that an untalented manager will succeed, w_1^+ is the upward-revised wage given that the manager succeeds (see (9)), and w_1^- is the downward-revised wage given that the manager fails in the first period (see (10)). Since $\theta_1^- = 0$, we see that $w_1^- = 0$. Thus, the manager's expected utility at $t = 0$ from an S_G project is a function of his initial wage, his private benefit from taking on the project, and the probability weighting of his type (and how likely he is to succeed given that he is untalented). Similarly, if the manager proposes L_G (the good long project), his expected utility will be:

$$U_{M,t=0}(L_G) = w_0 + \beta + (w_0 + \beta), \tag{A.8}$$

where in (A.8) $w_1 = w_0$ since there is no new information about the manager's type at $t = 1$, and therefore his wage will not be revised. We want to verify whether $U_{M,t=0}(L_G) > U_{M,t=0}(S_G)$, ie whether it is the case that:

$$w_0 + \beta > [\theta_0 + (1 - \theta_0)q] (w_1^+ + \beta). \tag{A.9}$$

Comparing term by term, since $[\theta_0 + (1 - \theta_0)q] < 1$ we have $\beta > [\theta_0 + (1 - \theta_0)q] \beta$. It thus only remains to compare the terms w_0 and $[\theta_0 + (1 - \theta_0)q] w_1^+$. Now, using (8) and (9) we have:

$$\theta_0 w_1^+ = \theta_0 \theta_1^+ w^T = \left[\frac{\theta_0}{\theta_0 + q(1 - \theta_0)} \right] \theta_0 w^T = \left[\frac{\theta_0}{\theta_0 + q(1 - \theta_0)} \right] w_0 \tag{A.10}$$

Thus,

$$w_0 = [\theta_0 + (1 - \theta_0)q] w_1^+. \tag{A.11}$$

From (A.11), it follows that (A.6) holds, and that $U_{M,t=0}(L_G) > U_{M,t=0}(S_G)$. Thus, the manager will always propose L when he has G . Finally, we need to show that the manager will prefer to propose L over the option to propose nothing at all. To see this, note that the utility from proposing L is $U_{M,t=0}(L_G) = w_0 + \beta + (w_0 + \beta)$ and the utility from proposing nothing is $U_{M,t=0}(\emptyset) = w_0 + (w_0 + \beta)$. Thus $U_{M,t=0}(L_G) > U_{M,t=0}(\emptyset)$, so the manager will prefer to propose L .

Now suppose that the manager has a B project. His expected utility at $t = 0$ from an S_B project is:

$$U_{M,t=0}(S_B) = w_0 + \beta. \tag{A.12}$$

And the expected utility from an L_B project is:

$$U_{M,t=0}(L_B) = w_0 + \beta + (w_0 + \beta). \quad (\text{A.13})$$

It is clear that $U_{M,t=0}(L_B) > U_{M,t=0}(S_B)$, so L is better for the manager, given that he has only B . In addition, suppose that the manager proposes nothing at $t = 0$ with B . This would give him utility $U_{M,t=0}(\emptyset) = w_0 + (w_0 + \beta)$ versus proposing L_B , which gives utility $U_{M,t=0}(L_B) = w_0 + \beta + (w_0 + \beta)$. It is clear that $U_{M,t=0}(L_B) > U_{M,t=0}(\emptyset)$, so the manager would prefer to propose L when he only has a B project. ■

Proof of Lemma 4: If the manager has a B project that has a short payback, then his expected utility will be $U_{M,t=0}(S_B) = w_0 + \beta$ from (A.12). If the manager proposes nothing at $t = 0$, then his utility will be $U_{M,t=0}(\emptyset) = w_0 + (w_0 + \beta)$, since he will retain access to the second-period funding. We see now that $U_{M,t=0}(\emptyset) > U_{M,t=0}(S_B)$, so the manager would rather not propose anything than propose a short-term B project. On the other hand, if the manager has a short-term G project, then proposing it at $t = 0$ leads to $U_{M,t=0} = w_0 + \beta + [\theta_0 + (1 - \theta_0)q](w_1^+ + \beta)$ from (A.7). From (A.9) we had that $w_0 + \beta > [\theta_0 + (1 - \theta_0)q](w_1^+ + \beta)$. To show that $U_{M,t=0}(S_G) > U_{M,t=0}(\emptyset)$, we need to show that:

$$w_0 + \beta + [\theta_0 + (1 - \theta_0)q](w_1^+ + \beta) > w_0 + (w_0 + \beta). \quad (\text{A.14})$$

Now, from (A.11) we know that $[\theta_0 + (1 - \theta_0)q]w_1^+ = w_0$. We thus see that (A.14) is satisfied as long as $\beta > 0$, which holds by assumption. ■

Proof of Proposition 2: The proof requires comparing the NPV from choosing S with the NPV from choosing L . Note that this can be done independently of calculating the dilution in ownership, y , for current shareholders, since a strategy that maximizes fundamental value will also minimize y . The NPV from choosing S (denoted by \bar{V}_S^{NPV}) is given by \bar{V}_S minus the unconditional expected investment costs (since the manager may not invest in a short-term project in each period), which are given by $p\{1 + \theta_0 + q[1 - \theta_0]\} - [1 - p]\{1\}$. We can write this as:

$$\begin{aligned} \bar{V}_S^{NPV} &\equiv \bar{V}_S - p\{1 + \theta_0 + q[1 - \theta_0]\} - [1 - p]\{1\} \\ &= p\{\theta_0[R_S + pR_S] + [1 - \theta_0]q[R_S + pqR_S]\} + [1 - p]p[\theta_0 + q[1 - \theta_0]]R_S \\ &\quad + \{p[1 - \theta_0][1 - q] + [1 - p]\}\{1\} - 2w_0 - p\{1 + \theta_0 + q[1 - \theta_0]\} - [1 - p]\{1\} \\ &= -2w_0 + p\{\theta_0[R_S + pR_S] + [1 - \theta_0]q[R_S + pqR_S] + [1 - p][\theta_0 + q(1 - \theta_0)]R_S\} \\ &\quad + p[1 - \theta_0][1 - q] + [1 - p] - p\{1 + \theta_0 + q[1 - \theta_0]\} - [1 - p] \\ &= -2w_0 + p\{\theta_0[R_S + pR_S + [1 - p]R_S] + [1 - \theta_0]qR_S[1 + pq + 1 - p]\} \\ &\quad - p[1 + \theta_0 + [1 - \theta_0][2q - 1]]. \end{aligned} \quad (\text{A.15})$$

The NPV from choosing L (denoted by \bar{V}_L^{NPV}) is given by $\bar{V}_L - 2$, since the manager will invest in a project in both periods for sure. Thus, \bar{V}_L^{NPV} is given by:

$$\begin{aligned}\bar{V}_L^{NPV} &\equiv \bar{V}_L - 2 \\ &= p\{\theta_0[R_L + R_S] + [1 - \theta_0][qR_L + qR_S]\} - 2w_0 - 2.\end{aligned}\tag{A.16}$$

We want $\bar{V}_S^{NPV} > \bar{V}_L^{NPV}$, so we want (A.15) to exceed (A.16). That is, after re-arranging terms, we want:

$$\begin{aligned}2 - p[[1 - \theta_0][2q - 1] + 1 + \theta_0] &> p\{\theta_0[[R_L + R_S] - [R_S + R_S] +]\} \\ &\quad + p\theta_0[[1 - \theta_0]q\{[R_L + R_S] - (R_S + R_S[pq + 1 - p])\}]\end{aligned}\tag{A.17}$$

Now, note that the left-hand side in (A.17) is:

$$\begin{aligned}1 - p + 1 - p[\theta_0 + (1 - \theta_0)(2q - 1)] &> 1 - p + 1 - p \\ &= 2(1 - p).\end{aligned}\tag{A.18}$$

where the inequality follows since $\theta_0 + (1 - \theta_0)(2q - 1) < 1$. So, for (A.17) to hold it is sufficient that

$$2[1 - p] > p\{\theta_0(R_L - R_S) + (1 - \theta_0)q[R_L - R_S[pq + 1 - p]]\},\tag{A.19}$$

which is guaranteed by (17). The proof of the remaining part of the proposition follows trivially. ■

Proof of Corollary 1: Given that the CEO attempts to maximize firm value (as she will with a low ω), the asymmetric information problem disappears, taking us back to the first-best case. Following from Lemmas 1 and 2, the CEO (who is now proposing the project instead of the manager) will only propose a project if it is G . At $t = 0$, if he receives a G project, he will structure it as an L project. Therefore, a constraint that the project must have a short payback is suboptimal. ■

Proof of Proposition 3: For the short-termism constraint to be preferred to the wage contracting solution, we need the expression in (19) to exceed that in (18). This comparison yields the inequality:

$$(1 - p)\beta + (w_0 + 1)[1 - \theta_0 - (1 - \theta_0)q] > p\{\theta_0 + (1 - \theta_0)q\}[R_L - R_S] + (1 - q)(1 - \theta_0)pqR_S.\tag{A.20}$$

Clearly, the left-hand side (*LHS*) of (A.20) is increasing in β , w_0 , and the initial investment, whereas the right-hand side (*RHS*) is increasing in $[R_L - R_S]$. Moreover, if $p = 1$, then:

$$LHS = (w_0 + 1) [1 - \theta_0 - (1 - \theta_0)q], \quad (\text{A.21})$$

$$RHS = \{\theta_0 + (1 - \theta_0)q\} [R_L - R_S] + (1 - \theta_0)(1 - q)qR_S, \quad (\text{A.22})$$

and $\frac{\partial LHS}{\partial \theta_0} < 0$. Moreover, $\frac{\partial RHS}{\partial \theta_0} > 0$ at $q = 0$ and hence by continuity $\frac{\partial RHS}{\partial \theta_0} > 0$ for q small enough. Moreover, comparing (A.21) and (A.22), we see that at $\theta_0 = 1$, the $RHS = R_L - R_S > 0 = LHS$. Thus, short-termism is dominated at $\theta_0 = 1$. At $\theta_0 = 0$, $LHS = (w_0 + 1)(1 - q)$ and $RHS = q[R_L - qR_S]$. Thus, $LHS > RHS$ for $q = 0$ and hence inequality (A.20) holds for q small enough by continuity, so short-termism dominates at $\theta_0 = 0$. Since $\frac{\partial LHS}{\partial \theta_0} < 0$, $\frac{\partial RHS}{\partial \theta_0} > 0$, short-termism dominates at $\theta_0 = 0$, and wage contracting dominates for $\theta_0 = 1$, it has been proven that short-termism dominates for θ_0 low enough and wage contracting dominates for θ_0 high enough. Now set $\theta_0 = 1$. Then,

$$LHS = (1 - p)\beta \quad (\text{A.23})$$

and

$$RHS = p[R_L - R_S]. \quad (\text{A.24})$$

At $p = 1$, $LHS = 0$ and $RHS = R_L - R_S$, so short-termism is dominated. At $p = 0$, $LHS = \beta$ and $RHS = 0$, so short-termism dominates. Now, $\frac{\partial LHS}{\partial p} < 0$. Further, $\frac{\partial RHS}{\partial p} > 0$, and it follows immediately that $LHS > RHS$ at $p = 0$, $LHS < RHS$ at $p = 1$, and the two curves intersect at $p \in (0, 1)$ such that short-termism dominates if p is low enough and wage contracting dominates if p is high enough. ■

Proof of Lemma 5: Given the payoff-contingent wage contract with the γ_1 given in (30) the manager never proposes a B project. Thus, the value of the second-period project is $\mu_G(\mathbb{E}(T_1))$ (see (22)). With just an up-front wage, the value is $p\mu_G(\mathbb{E}(T_1))$ since the manager will propose B if he does not have G . It follows that $\mu_G(\mathbb{E}(T_1)) > p\mu_G(\mathbb{E}(T_1))$ since $p \in (0, 1)$. ■

Proof of Lemma 6: Let $U^i(j | k)$ be the expected utility of the manager at $t = 0$ if he proposes the i version of the project with $i \in \{L, S\}$, has a type k project with $k \in \{G, B\}$, and reports $j \in \{G, B\}$. Suppose first that the manager is proposing an S project. Then

$$\begin{aligned} U^S(G | G) &= w_0 + c_0^S \left\{ \mathbb{E}(\tilde{R}) - \mu_G(\mathbb{E}(T_0)) \right\} + \beta, \\ &\quad + \{\theta_0 + q[1 - \theta_0]\} p \{w_1^+ + \beta\} \end{aligned} \quad (\text{A.25})$$

where w_0 is the up-front wage at $t = 0$, c_0^S is the payoff-contingent bonus term, β is the first-period private benefit, $\theta_0 + q[1 - \theta_0]$ is the probability of success of the G project given the prior belief θ_0 ,

p is the probability of having G in the second period, w_1^+ is the wage if the manager's second-period project is funded (which only happens if the first-period project succeeds), and β in the $\{w_1^+ + \beta\}$ term is the second-period private benefit. Since $\mathbb{E}(\tilde{R}) = \mu_G(\mathbb{E}(T_0))$, (A.25) simplifies to:

$$U^S(G | G) = w_0 + \beta + \{\theta_0 + q[1 - \theta_0]\} p \{w_1^+ + \beta\}. \quad (\text{A.26})$$

Similarly,

$$U^S(G | B) = w_0 - c_0^S \mu_G(\mathbb{E}(T_0)) + \beta + w_0, \quad (\text{A.27})$$

since $\mathbb{E}(\tilde{R}) = 0$ on B . Further,

$$U^S(B | B) = w_0 + p\beta + w_0, \quad (\text{A.28})$$

since the manager receives no first-period funding when he reports B at $t = 0$, so there is no first-period bonus or private benefit (only the up-front wage w_0). If he receives G in the second-period (probability p), he requests funding and hence a private benefit β . Given that we are taking the second-period reporting game as given, the incentive compatibility is assured and the manager does not ask for funding with B . Since $\mathbb{E}(\tilde{R}) = \mu_G(\mathbb{E}(T_1))$ in the second period, the bonus term drops out as in (A.26). The second-period up-front wage w_0 is paid unconditionally at $t = 1$.

Incentive compatibility requires that $U^S(B | B) \geq U^S(G | B)$, so we need

$$p\beta \geq -c_0^S \{\theta_0 R_S + [1 - \theta_0] q R_S\} + \beta, \quad (\text{A.29})$$

where $\mu_G(\mathbb{E}(T_0)) = \theta_0 R_S + [1 - \theta_0] q R_S$ has been substituted. Recognizing that the IC constraint is binding and solving (A.29) as an equation yields (32). It is easy to verify that with this c_0^S , $U^S(G | G) > U^S(G | B)$. The analysis of the L version of the project is exactly the same as the analysis in the text preceding Lemma 5. This is because no information is revealed at $t = 1$, so regardless of what the manager reports at $t = 0$, the outcome is the same at $t = 1$, which means the events at $t = 1$ have no effect on the analysis. This is why c_0^L in (31) is the same as γ_1 in (30).

■

Proof of Proposition 4: We can use (15) to write the value of the firm with S . The only difference is that, with payoff contingent contracting, the manager will never propose a B project, which means cash will idle in more states of the world relative to (15). Using V_i^* to designate the value of the firm with $i \in \{S, L\}$, we can write a modified version of (15):

$$\begin{aligned} V_S^* &= p \{\theta_0 [1 + p] R_S + [1 - \theta_0] q [1 + p q] R_S\} \\ &\quad + [1 - p] p \{\theta_0 + q [1 - \theta_0]\} R_S \\ &\quad + \{p [1 - \theta_0] [1 - q] + 1 - p\} + 2[1 - p]^2 - 2w_0. \end{aligned} \quad (\text{A.30})$$

In comparing this to (15), note that there is an additional term, $2[1 - p]^2$, which represents the

state in which \$2 idles (no funding in either period), the probability of which is $[1 - p]^2$. Similarly, adapting (16), we can write:

$$V_L^* = p \{ \theta_0 [R_L + R_S] + [1 - \theta_0] q R_L + q R_S \} + \{ [1 - p]p + p[1 - p] \} \{1\} + [1 - p]^2 \{2\}, \quad (\text{A.31})$$

where the last two terms represent the idle cash states. The probability that the manager will have G in only one period is $[1 - p]p + p[1 - p]$, and in this state \$1 idles. The probability that the manager will have G in neither period is $[1 - p]^2$, and in this state \$2 idles. Simplifying (A.31) yields:

$$V_L^* = p \{ \theta_0 [R_L + R_S] + [1 - \theta_0] q R_L + q R_S \} + 2 [1 - p^2]. \quad (\text{A.32})$$

By comparing (A.30) and (A.32) and recalling that $\bar{\Delta}_0 = \theta_0 [R_L - R_S] + [1 - \theta_0] q [R_L - R_S]$, it can be shown that $V_L^* > V_S^*$ if (33) holds. Note further that for the right-hand side of (33) to be positive, we need

$$p [1 - \theta_0] [1 - q] > [1 - p] [4p - 1]. \quad (\text{A.33})$$

Now, we ask if $p > [1 - p] [4p - 1]$ is true? This simplifies to verifying whether $0 > -[2p - 1]^2$, which clearly is true. Thus, by continuity, (A.33) will hold for θ_0 and q small enough. That is, with θ_0 and q small enough, the right-hand side of (33) will be positive. Consequently, if $\bar{\Delta}_0$, θ_0 , and q are small enough, the inequality in (33) will be reversed (note that the reversal occurs for $\bar{\Delta}_0 = \theta_0 = q = 0$, and hence occurs by continuity for $\bar{\Delta}_0$, θ_0 , and q small enough). ■

Proof of Lemma 7: The proof is straightforward, resulting from the discussion preceding the lemma and the previous analysis in Lemmas 5 and 6 and Proposition 4. ■

Proof of Proposition 5: If the CEO cares only about the value of the firm, then she will always want to minimize the firm's wage bill. Because $0 \in \text{supp}(f)$, the CEO can always claim that the realized y and x were both zero. If $x > 0$, the manager knows that the CEO is misrepresenting x , but lack of verifiability means that a positive bonus $c_0^L > 0$ cannot be enforced. Consequently, the CEO maximizes ex post firm value by paying $c_0^L = 0$ at $t = 2$. When S is chosen at $t = 0$ and the CEO observes a payoff of R_S at $t = 1$, she will find it subgame perfect to fund the manager's second-period project because this maximizes firm value. The willingness to fund the manager's second-period project perfectly reveals, however, that $x = R_S$ was observed by the CEO. Third-party verification can therefore rely on this inference and require the payment of $c_0^S > 0$ to the manager despite lack of direct observability of x . Given this, the CEO has no incentive to misreport x at $t = 1$. Of course, in the second period, this consideration is absent, so again the CEO will report at $t = 2$ an x that minimizes the firm's wage bill. ■

Proof of Lemma 8: Let the analog of (16) with a signal of precision λ be:

$$\hat{V}_L(\lambda) = p \{ \theta_0 R_L + [1 - \theta_0] q R_L \} + p \{ \theta_1^+(\lambda) R_S + [1 - \theta_1^+(\lambda)] q R_S \} - 2w_0 - \varphi(\lambda). \quad (\text{A.34})$$

where $\theta_1^+(\lambda)$ is the posterior belief the manager is type T after observing $\phi = R_L$. Note that it is subgame perfect for the CEO to fund the second-period project after observing $\phi = R_L$ since $\theta_1^+(\lambda) > \theta_0$. Comparing (A.34) to (15), we see that $\hat{V}_S > \hat{V}_L(\lambda)$ at $p = 0$ since the condition collapses to $1 > -\varphi(\lambda)$, which is true $\forall \lambda$. By continuity, therefore, it holds for p small enough. ■

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Table 1: Project Payoff Distributions

Project Type	Manager Type	Project Payoff
L_G	T	$R_L > 1$ with probability 1 at $t = 2$, with investment at $t = 0$.
L_G	U	$R_L > 1$ with probability q and 0 with probability $1 - q$ at $t = 2$, with investment at $t = 0$.
S_G	T	<ul style="list-style-type: none"> • $R_S > 1$ with probability 1 at $t = 1$, with investment at $t = 0$. • $R_S > 1$ with probability 1 at $t = 2$, with investment at $t = 1$.
S_G	U	<ul style="list-style-type: none"> • $R_S > 1$ with probability q and 0 with probability $1 - q$ at $t = 1$, with investment at $t = 0$. • $R_S > 1$ with probability q and 0 with probability $1 - q$ at $t = 2$, with investment at $t = 1$.
L_B or S_B	T or U	0 with probability 1

Figure 1: Timeline of Actions and Events

$t = 0$	$t = 1$	$t = 2$
<ul style="list-style-type: none"> • A G project arrives with probability p. Manager has access to a B project regardless. • The common prior belief is that the probability is θ_0 that the manager is type T. • Manager may propose an S or L project for the first period. • CEO either accepts or rejects proposed project. • Manager is paid a wage of w_0. 	<ul style="list-style-type: none"> • If an S project was proposed, it pays off 0 if it was B. If it was G, it pays off R_S with probability 1 if the manager is T, but with probability q (and 0 with probability $1 - q$) if the manager is U. • Beliefs about the manager's type being T are revised to θ_1. • If an L project was proposed, nothing is observed, and $\theta_1 = \theta_0$. • A G project arrives with probability p. Manager always has access to a B project. • Manager may propose an S project for the second period. • CEO either accepts or rejects proposed project. • Manager is paid a second-period wage of w_1^+ if $\theta_1 > \theta_0$, w_1^- if $\theta_1 < \theta_0$, or $w_0 = w_1$ if $\theta_1 = \theta_0$. 	<ul style="list-style-type: none"> • If an L project was proposed at $t = 0$, it pays off 0 if it was B. If it was G, it pays off R_L with probability 1 if the manager is T, but with probability q (and 0 with probability $1 - q$) if he is U. • If an S project was proposed at $t = 1$, it pays off 0 if it was B. If it was G, it pays off R_S with probability 1 if the manager is T, but with probability q if the manager is U. • The game ends.