Short-termism, Managerial Talent, and Firm Value*

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Abstract

This paper examines how the firm's choice of investment horizon interacts with rent-seeking by privately-informed, multi-tasking managers and the labor market. There are two main results. First, longer investment horizons allow managers to extract higher rents from firms, so short-termism involves lower agency costs and is value-maximizing for some firms. Second, when firms compete for managers, and the market has some firms that practice short-termism, and others that practice long-termism. Firms practicing short-termism are able to attract better managerial talent and invest more.

Keywords: Short-termism, Managerial Talent, Wage Contracting, Capital Budgeting, Project Choice, Labor Markets

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1 Introduction

How do firms choose the investment horizons of their projects? This question has attracted considerable attention because this choice affects not only the values of the projects firms invest in (e.g. Barton and Weisman (2014)), but also the nature of these projects (e.g. Barrot (2016)), and the earnings firms report (e.g. Stein (1989)). For example, many have argued that short-termism—the corporate practice of preferring (lower-valued) short-term projects over (higher-valued) long-term projects—is myopic and ill-advised, leading to excessive risk-taking and underinvestment.[1]

This paper proposes a simple multi-tasking model of delegated project management that addresses the question above. The model has implications for how the firm's choice of investment horizon affects managerial rents and the talent of managers the firm attracts. In the model, there are two time periods, and an agent (i.e. a manager, and henceforth referred to as such) is hired in each period by the principal (referred to as the "firm"), and asked to search for a good project. The investment horizon (short or long) of the project is set by the firm, and the manager must expend costly search effort to find the project. Long-horizon projects, which span two periods, have higher innate values than short-horizon projects, which span one period. If search effort fails to find a good project, the manager can choose to not ask for funding or request funding for a bad project that is always available.

The firm cannot tell whether funding is requested for a bad project or a good project. Moreover, the manager can be talented or untalented—the good project of a talented manager succeeds with a higher probability than that of an untalented manager. Each manager is privately informed about his type. The outcome of the short-horizon project is revealed at the end of the period, whereas only a noisy (but informative) signal of the outcome of

[1]See, for example, Barton, Bailey, and Zoffer (2017). For empirical evidence on the effect of short-termism on R&D investment, see Budish, Roin, and Williams (2015) and Cremers, Pareek, and Sautner (2016). Bebchuk and Fried (2010) attribute excessive risk taking during the financial crisis to the short-term incentives induced by executive compensation. Rappaport and Bogle (2011) assert that short-termism may represent "a danger to capitalism".

the long-horizon project is available.[2] Firms design optimal wage contracts to offer in each period, and these contracts depend on project investment horizons as well as prior performance.

The model is first analyzed without explicit competition amongst firms for managerial talent. Here, the main result is that firms hire both talented and untalented managers, and the manager gets efficiency wages with both the long-horizon and short-horizon projects, but earns higher rents with the long-horizon project.[3] Thus, the *manager* strictly prefers long-term horizons, but the firm prefers short-termism if the innate value difference between the long-horizon and short-horizon project is not too large; the firm prefers long-termism if this value difference is large.

At the heart of the model are two key informational frictions: (i) dual incentive problems—motivating the manager to work hard to find a good project and also to not propose a bad project if he fails to find a good project; and (ii) asymmetric information about managerial talent and the greater speed with which information about this talent is revealed through the success or failure of a short-horizon project relative to that of a long-horizon project. Since incentives for managers to search for and propose funding for *good* projects must be provided through wages that are paid before long-horizon project outcomes are unambiguously revealed, performance signals that matter for managerial incentives are noisier for long-term projects than for short-term projects. The firm must thus provide steeper incentives for observed success versus failure for long-term projects in order to induce search effort. But this creates another incentive problem—the higher "performance wage" makes it more attractive for the manager to gamble by proposing a bad project when he does not find a good one. This requires the firm to pay a higher wage to the manager for *not* requesting funding, leading to efficiency wages and a rent for the manager that is higher with a long-

[2]The idea that short-term information is of higher quality than long-term information has been used before. See, for example, Gümbel (2005).

[3]See Katz (1986) for a review of the efficiency wage literature. See also Zhu (2018), which provides a microfoundation for the use of efficiency wage contracts.

term project than with a short-term project.[4] Managerial rents are an agency cost for the firm, so the main benefit to the firm of adopting short-termism is to reduce this agency cost via more efficient contracting.

While the model has a specific structure to generate this result, the intuition behind it is very general. The greater noise in performance assessment with the long-horizon project leads to higher agency costs and thus induces some firms to prefer short-termism. However, this is *not* for the usual reason in contracting models with agent risk aversion (e.g. Holmstrom (1979)) where greater output noise forces the principal to make the contract less steep in output. Here the agent is risk neutral, so sacrificing risk sharing with steeper incentives is not a concern. Rather, as is shown later, the key is that the greater noise in performance assessment with the long-horizon project leads the firm to have to pay the manager more for achieving a favorable outcome (signal) at $t = 1$ in order to motivate him to expend search effort. Since this exacerbates the problem of the manager wanting to request funding for a bad project, the manager must also be paid more for not requesting funding, producing managerial rents at the expense of firm value. Hence, agency costs are always higher with the long-horizon project than with the short-horizon project.

The base model is then extended by allowing firms to compete for managers. Firms now design contracts to attract the highest-quality pool of managers, and short-termism affects the pool quality in equilibrium. Although the value of the short-term project is the same for all firms, the value of the long-term project varies in the cross-section of firms. Thus, there is heterogeneity among firms, both in terms of whether they are choosing short-termism or not, and the value of the long-term project if they are choosing long-termism. The additional result is that, on average, firms that practice short-termism attract a *higher-quality* pool of managers. The intuition behind this result is also very general. With lesser performance-

[4]There are models in which managers make choices for "signal jamming" reasons in order to delay revelation of true quality. For example, in Goldman and Strobl (2013), the manager does this by increasing the complexity of investments. In Acharya, Pagano, and Volpin (2016), the manager does this by switching employers. The result here is completely different—while the untalented manager would benefit from the long-term project for signal-jamming, the talented manager benefits from the short-term project which reveals his type more efficiently. Yet I show that *both* types of manager prefer long-termism.

assessment noise, the short-horizon firms can design cream-skimming contracts to attract only the talented managers more effectively than the long-horizon firms can. The analysis illuminates how this happens when both types of firms are competing for the best managers and the managers are rationally anticipating the probabilities of receiving offers, which are different across the short-horizon and long-horizon firms.

Overall, this analysis shows that informational frictions bias firms' investment horizons *without* any discounting-related time horizon effects (such as those in Laibson (1997)), that short-termism is value-maximizing for some firms because it leads to lower agency costs, and that the firm's choice of investment horizon affects the managerial talent it hires.[5]

This paper is related to numerous strands of the literature. The first is the literature on short-termism. There is survey evidence that short-termism is practiced widely (e.g. Graham and Harvey (2001)). The existing theoretical explanations for short-termism rely on stock market pressure to deliver short-term earnings at the expense of long-term value (e.g. Bolton, Scheinkman, and Xiong (2006a)) when blockholder monitoring is not there to prevent it (Edmans (2009)), shareholder-manager conflicts arising from managerial career concerns that sacrifice firm value (e.g. Narayanan (1985a)), and lack of managerial sophistication.[6] However, the empirical evidence has cast doubt on whether short-termism has negative economic outcomes (Kaplan (2017), Roe (2018), and Fried and Wang (2018)). Moreover, it appears to be used *more* in firms with stronger corporate governance (Gianetti and Yu (2016)), and is not used exclusively by incompetent or unsophisticated managers (Graham and Harvey (2001)).[7]

This paper differs in numerous significant respects from the previous literature on short-

[5]This 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...[i]t makes no sense for brick-and-mortar retailers, say, to invest long-term in new stores if their sector is likely to have no future because it will soon become a channel for Internet selling."

[6]Edmans (2009) develops a model in which blockholders, by trading on their private information, cause prices to reflect fundamentals, thereby encouraging managers to abandon short-termism.

[7]Moreover, if stock market pressure results in value-decreasing short-termism, then removing that pressure should improve firm performance. However, the evidence is that going private does not appear to improve the performance of public firms (e.g. Cohn, Mills, and Towery (2014)). Evidence that governance affects corporate investment appears in Billett, Garfinkel, and Jiang (2011).

termism. First, the firm's preference for short-termism is independent of any stock market pressures, in sharp contrast to earlier research (e.g. Bolton, Scheinkman, and Xiong (2006a,b) and Stein (1989)), the risk that long-term projects may have their financing cut off (von Thadden (1995)), or lack of managerial sophistication.[8] Second, it is the managers with career concerns who dislike short-term projects, which is the *opposite* of Narayanan (1985a,b) and Stein (1989), where managers dislike long-term projects even when the firm's owners prefer them.[9] Third, in contrast to Narayanan (1985a,b), short-termism in my model persists despite optimal payoff-contingent contracting that could be used to align manager-shareholder preferences. Fourth, in my model the firm is not raising external financing, so short-termism is not preferred because it lowers external financing costs (Thakor (1990), Whited (1992), and Milbradt and Oehmke (2015)).[10] Finally, I consider the interaction between short-termism and managerial talent allocation, and the impact of labor market liquidity and competition on short-termism, unlike the previous literature.

Also relevant is the literature on dynamic models with managerial short-termism. Edmans, Gabaix, Sadzik, and Sannikov (2012) develop a multi-period model of optimal compensation in which time-dependent vesting is used to deter short-termism. Marinovic and Varas (forthcoming) examine optimal CEO contracts when managers can manipulate their performance measures, and they characterize the dynamics of managerial short-termism under the optimal dynamic contract.[11] There are two key differences between this literature and this paper. One is that, in these papers, it is the *manager* who has a preference for short-termism, which shareholders attempt to deter via optimal contracting. In this paper,

[8]Graham and Harvey (2001) found that 56.7% of the firms in their sample used payback and noted, "This is surprising given that financial textbooks have lamented the shortcomings of the payback criterion for years." See also Lefley (1996) for evidence from U.K. firms.

[9]Darrough (1987) shows that optimal incentive contracts can eliminate the equilibrium in Narayanan (1985a,b). Jeon (1991) shows that Stein's (1989) effect can at most be transient if stock prices reflect the manager's strategic behavior.

[10]Other related papers are Grenadier and Wang (2005) who use a real options framework to show that managers value the option-to-wait-to-invest more than owners, and Hackbarth, Rivera, and Wong (2017) who develop a model in which short-termism is ex post optimal for the shareholders in a levered firm due to a shareholder-bondholder conflict.

[11]See also Zhu (2013) for a dynamic optimal contracting model with shirking.

managers prefer long-termism. Second, unlike this literature, this paper focuses on the impact of labor market competition on short-termism, and the impact of short-termism on talent attraction.

This paper is also related to the literature on the effect of competition in the labor market when agents are multi-tasking. For example, Benabou and Tirole (2016) show that competition for the most talented workers leads to an increasing reliance on performance-pay and other high-powered incentives, shifting effort away from less-contractable tasks such as long-term investments. In this paper as well, labor market competition affects optimal compensation contracts, but it leads to a decrease in short-termism.

Finally, there is a related literature on competition and matching that examines the allocation of talent across firms and its effect on managerial contracts. For example, Gabaix and Landier (2008) develop and calibrate a model in which CEOs have different talents and are matched to firms competitively. In equilibrium, the best CEOs manage the largest firms. The model explains that the intertemporal rise in CEO compensation is an efficient equilibrium response to the increase in firm market values. Edmans, Gabaix, and Landier (2009) use this competitive talent assignment model to generate predictions about the relationship between incentives and firm size under optimal contracting. This paper differs from this literature in that the matching of managerial talent to firms is not along the size dimension, but rather the project investment horizons chosen by firms.

The rest of this paper is organized as follows. Section 2 develops the base model. Section 3 contains the main results. Section 4 examines the extension in which managers privately know their types. Section 5 concludes. All proofs are in the Appendix.

2 Model

In this section, I describe the basic model. In the basic model, firms do not compete for managers. In Section 4, interfirm competition for managers is introduced.

2.1 Preferences

All agents are risk neutral and the riskless interest rate is zero. There are three dates: $t = 0, 1, 2$. All firms are unlevered, and have funds to invest in projects. The firm (principal) hires a penniless manager. The firm maximizes its value and the manager maximizes expected utility over consumption at dates $t = 1$ and $t = 2$. The manager's utility is:

$$V(c_1, c_2) = c_1 + \delta c_2 \tag{1}$$

where $\delta \in (0, 1)$ is a consumption discount factor, and c_t is consumption at date t. All consumption is financed by wages.

2.2 Investment Opportunity

There are two time periods, the first beginning at $t = 0$ and ending at $t = 1$, and the second beginning at $t = 1$ and ending at $t = 2$. There are $N > 1$ firms, and each firm can invest in a project in each period requiring a \$1 investment. At $t = 0$, the firm can choose between a short-horizon project, S, that pays off at $t = 1$, and a long-horizon project, L, that pays off at some distant future date $t > 2$ beyond the planning horizon of the model.[12] A noisy but informative signal, ϕ, of the eventual payoff is available at $t = 1$. In the second period, the firm can invest only in a short-horizon project that pays off at $t = 2$.

The firm must approve (or deny) funding for the project in each period if the manager requests funding. In addition, the firm can also decide whether to allow the manager to propose either L or S at $t = 0$ or to limit the manager to S in each period. Limiting the manager's choice to S in each period is "short-termism".

At $t = 0$, given the decision to search for L or S, the manager unobservably chooses effort

[12] This can be interpreted as the project paying off at a time that is beyond the manager's tenure at the firm. 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. For example R&D investments by drug companies have payoff horizons typically exceeding 10 years. Similarly, companies (like AT&T) that build telecommunication networks have payoff horizons exceeding 15 years.

$e \in \{0, 1\}$ to search for a good (G) project. The private cost of effort for the manager is

$$\psi(e) = \begin{cases} \overline{\psi} > 0 & \text{if } e = 1 \\ 0 & \text{if } e = 0 \end{cases} \tag{2}$$

Regardless of whether the manager searches for L or S, effort $e = 1$ allows the manager to find a good project with probability $p \in (0.5, 1)$, and effort $e = 0$ means the probability of finding a good project is 0. If a good project is not found, the manager always has a bad (B) project available. At $t = 1$, the manager searches for S and can again choose $e \in \{0, 1\}$. With $e = 1$, he finds a good project with probability p in the second period, and with $e = 0$ the probability of a good project is 0. In each period, the manager can decide whether to request funding for a project or to do nothing.

2.3 Managerial Ability and Project Payoff Distributions

There is a total of M ($> N$) managers.[13] The manager's ability affects the payoff distributions of projects. Let τ represent the manager's ability, with $\tau \in \{T, U\}$. If $\tau = T$, it means the manager is "talented", and if $\tau = U$, it means the manager is "untalented". The good L project pays off $R_L > 1$ at some $t > 2$ with probability $\tilde{q}(\tau)$ (that depends on the manager's ability) and pays off 0 with probability $1 - \tilde{q}(\tau)$, with

$$\tilde{q}(\tau) = \begin{cases} 1 & \text{if } \tau = T \\ q \in (0.5, 1) & \text{if } \tau = U \end{cases} \tag{3}$$

The first-period good S project pays off $R_S \in (1, R_L)$ at $t = 1$ with probability $\tilde{q}(\tau)$ and 0 with probability $1 - \tilde{q}(\tau)$, and the second-period good S project has the same payoff distribution at $t = 2$. The $\tilde{q}(\tau)$ for the S project is also described by (3). This means that

[13]The assumption that there are more managers than firms means that firms will design contracts to minimize the rents they provide managers, subject to managerial participation constraints. Nonetheless, managers will earn rents as firms compete for talented managers.

L is higher-valued than S.

Each manager knows whether he is type T or type U, but no one else does. Others share the common prior belief that $\Pr(\tau = T \text{ at date } t) = \theta_t \in (0,1)$. Thus, at $t = 0$ the prior probability that the manager is T is θ_0, which can be viewed as the manager's initial reputation. Define $\overline{q}_0 \equiv \theta_0 + [1-\theta_0]\, q$. The bad S project pays off R_S with probability $b \in [0.5, q)$ and zero with probability $1-b$, regardless of managerial ability.[14] Similarly, the bad L project pays off R_L with probability b and 0 with probability $1-b$. It is assumed that

$$\overline{q}_0 R_S - \overline{\psi} > q R_L - \overline{\psi} \tag{4}$$

This condition means that the expected net present value of S at the prior beliefs about managerial ability is positive in the first-best case, and the expected net present value of even the L project managed by the untalented manager is negative.[15] For later use, define

$$\theta_1^n \equiv \frac{[1-p]\theta_0}{[1-p]\theta_0 + 1 - \theta_0} \tag{5}$$

Furthermore, it is assumed that $M_T \equiv \theta_0 M > N$, where M_T is the (expected) number of talented managers. This means there are enough talented managers to fully staff all firms.

2.4 The Cross-Sectional Distribution of Firms

Each firm's R_L is drawn from $[R_L^{min}, R_L^{max}]$, and the distribution function η can be expressed as $\eta\left(\hat{R}_L\right)$ = number of firms with $R_L \leq \hat{R}_L$. It will be assumed throughout that R_S is close to but less than R_L^{min}, e.g. $R_L^{min} = R_S + \varepsilon$ where $\varepsilon > 0$ is a small positive number, and that R_L^{max} is an arbitrarily large number. That is, $[R_L^{min}, R_L^{max}]$ has large measure.

[14]This means that the bad project is worse than the good project managed by the untalented manager. $q > 0.5 \leq b$ is a technical sufficiency condition used in the proof of Proposition 5.

[15]Condition (4) will later be replaced by a stronger condition (see (8)) to ensure positive NPV in the second best.

2.5 Summary of Informational Assumptions

I now consolidate the key informational assumptions of the model.

(A.1) While the manager knows his own ability (T or U), others update their beliefs about it symmetrically based on additional information revealed at every date.

(A.2) If the manager requests funding, the firm can see whether the manager searches for an L or an S project, based on the firm's directive.

(A.3) The manager's search effort choices at $t = 0$ and $t = 1$ are privately known only to the manager.

(A.4) The manager privately observes whether he found a good project or not, and he also privately observes whether the project for which funding is requested is good or bad.

(A.5) The payoff on the first-period S project, $y_1 \in \{R_S, 0\}$ is observed by all at $t = 1$, and the payoff on the second-period S project, $y_2 \in \{R_S, 0\}$, is observed by all at $t = 2$. The payoff on L, $Y \in \{R_L, 0\}$ is realized at some $t > 2$ and not observed at any $t \in \{0, 1, 2\}$, but a signal, ϕ, of this payoff is observed at $t = 1$ (with no further information at $t = 2$), with:

$$\Pr(\phi = h \mid Y = R_L) = \Pr(\phi = l \mid Y = 0) = \beta \in (0.5, 1) \tag{6}$$

Here $\phi = h$ means the signal says the outcome will be $Y = R_L$ and $\phi = l$ means the signal says the outcome will be $Y = 0$.

Assumption (A.5) captures a key difference between short and long horizon projects, with respect to when accurate information about the success or failure of the project is available. With short-horizon projects—say a new consumer electronics product introduction such as a TV or smartphone—the firm knows within a couple of years whether the project is successful.

With long-horizon projects—say a telecommunications infrastructure project with a 15-year payback period—the eventual success of failure of the project may be revealed only at a date long beyond the manager's planning horizon; in the interim, only noisy signals of the final outcome are available.

(A.6) It is assumed that ϕ is a sufficiently informative signal of the long-horizon project outcome, i.e., β is large enough:

$$\beta \in \left(\frac{b[2p+1]}{4pb-1}, 1 \right) \tag{7}$$

(A.7) q is not too large.[16]

This restriction means that the good project is not very attractive to a manager who knows he is untalented. In the subsequent analysis, this is sufficient for a type-U manager to choose not to search for a good project.[17]

2.6 Wage Contracts

The manager's wage in each period can only be based on what is observable at the end of the period. Let x_t denote the payoff observed at $t \in \{1, 2\}$. For the L project (which can only be chosen in the first period), the manager receives a contract at $t = 0$ stipulating that he will receive at $t = 1$ a wage $W_L^{x_1}$,where $x_1 \in \{n, \phi\}$ is the only observable outcome and it occurs at $t = 1$, with n designating that no project was selected and $\phi \in \{h, l\}$ the signal observed at $t = 1$ if an L project was selected at $t = 0$. For the S project, the wage on the project selected in the first period and paid at $t = 1$ is $W_{S1}^{x_1}$, where the project outcome at $t = 1$ is $x_1 \in \{n, h, l\}$, with h indicating $y_1 = R_S$ and l indicating $y_1 = 0$ at $t = 1$. The wage on the S project selected in the second period and paid at $t = 2$ is $W_{S2}^{x_2}(x_1)$, where the project outcome at $t = 2$ is $x_2 \in \{n, h, l\}$. Thus, the second-period wage potentially depends

[16]This is made precise in the Appendix, where an upper bound on q is provided.
[17]This restriction is used only in the proof of Proposition 6.

on both the first-period and second-period outcomes.

All wages are constrained to be non-negative (limited liability for managers) and there is *no precommitment* by the firm to any future contract as part of a long-term arrangement. The firm asks the manager to report his type and then offers him a contract, with no precommitment to a report-contingent contract menu. That is, all wage contracts have to be subgame perfect (even within the subgame following the manager's report).

2.7 The Choices at $t = 0$ and $t = 1$

At $t = 0$, the firm:

1. Asks the manager to report his type and then makes the manager a take-it-or-leave-it offer of a possibly type-dependent wage contract, $W_L^{x_1}(\tau)$ or $W_{S1}^{x_1}(\tau)$, depending on whether the manager is being asked to search for L or S. The contract stipulates how the manager will be paid based on the observed outcome, x_1, at $t = 1$.

2. If the manager is hired, the firm instructs the manager to search for either L or S.

At $t = 1$, the firm:

1. Decides whether to retain the manager for the second period or fire him.

2. If the manager is retained, the firm makes a take-it-or-leave-it offer of a second-period contract $W_{S2}^{x_1}(x_1)$ which stipulates how the manager will be paid based on the observed outcome x_2 of S at $t = 2$.

3. If the manager is fired, a new manager is asked to report his type and is then given a take-it-or-leave-it offer of a possibly type-dependent contract $W_{S2}^{x_1}(\tau)$ and step 1 at $t = 0$.

2.8 Manager's Reservation Utility and Firm's Firing Cost

The manager's reservation utility in each period is 0. In each period, the manager takes the firm's offered contract if it satisfies his participation constraint.

It costs the firm $\zeta > 0$ to fire and replace the manager.[18] This is meant to reflect the transactions costs of searching for and hiring a new manager. To ensure that it makes sense for the firm to both replace a manager who experienced $y_1 = 0$ with a new manager at $t = 1$, and to continue in the second period with a manager who proposes no project at $t = 0$, the following sufficiency condition is assumed:

$$\theta_1^n [R_S - 1] - \overline{\psi} [A_1 + b] [A_1 \delta]^{-1} - \zeta > 0 \tag{8}$$

where

$$A_1 \equiv p [1 - b] \tag{9}$$

We will see later that the expected cost of compensating the manager under the optimal contract is bounded from above by $\overline{\psi} [A_1 + b] [A_1 \delta]^{-1}$. In the analysis of the base model, it will be assumed that ζ is sufficiently small. This assumption is intuitive to ensure that ζ is not a deterrent to firing the manager, or if firing is optimal, then to ensure that ζ is not large enough to induce the firm to avoid S.

2.9 Equilibrium

In the game between the firm and the manager in the absence of interfirm competition for managerial talent, I focus on Bayesian perfect equilibria, i.e., in each period the firm asks the manager to report his type and then makes a take-it-or-leave-it wage contract offer, where

[18]The firm makes its firing decision based solely on the cash flow observed at the end of the first period. This is different from Edmans (2011), who allows shareholders to determine the cause of the first-period project performance through monitoring and fire the manager only if he is believed to be untalented. Debt leads to equity concentration and encourages shareholder monitoring, which leads to skilled managers not being deterred from investing in long-term projects with low short-term cash flows.

contracts are designed to maximize firm value over the remaining time horizon. The firm takes the choice of S in the first period and solves for optimal wage contract for the first and second periods that will be offered to the manager. Similarly, the firm takes the choice of L in the first period and solves for the optimal wage contracts to offer the manager in both periods. In each case, the firm rationally anticipates the manager's choices of search effort and decisions about when to request funding, as well as the firm's own decision about when the manager will be replaced for the second period. The firm then compares the values of the firm (net of managerial wages) in the two cases and decides whether to impose a short-termism constraint. The equilibria will also be shown to survive refinements.

3 Results with the Base Model

In this section, the model without interfirm competition for talent will be analyzed. The main results proved in this section about the second best are as follows:

(1) The equilibrium in offered wage contracts is pooling. Both types of managers get the same contract, but it induces the type T managers to work hard ($e = 1$) and the type U managers to shirk ($e = 0$).

(2) Second-period wage contracts have a 0-1 property—the manager is either fired at $t = 1$ or retained, but if the manager is retained, the second-period contract is the *same* regardless of the first-period outcome.

(3) Second-period wage contracts generate rents for both types of managers.

(4) When the manager is asked to search for a short-horizon project in the first period, he requests funding only for the a good project and is reained if the project succeeds and fired if it fails. He is also retained at $t = 1$ if he did not request funding only for a good project and is retained at $t = 1$ regardless of the project signal ϕ.

(5) With the optimal wage contracts for S and L, the manager strictly prefers to search for the long-horizon (L) project.

(6) Agency costs are higher for the firm with L than with S. So when the intrinsic value difference between L and S is not large, the firm prefers to instruct the manager to search for S in the first period (short-termism), and when this value difference is sufficiently large, the firm instructs the manager to search for L.

3.1 First Best

In the first best case, the manager's ability is known, his search effort is observable, and the quality of the project is observable to the firm. Thus, given (4) and (5), it is clear that the firm will hire only a type T manager, instruct the manager to choose $e = 1$, pay him a fixed wage of $\overline{\psi}$, and ask him to search for a good L project at $t = 0$. If the manager finds a good project, funding is provided; otherwise, no investment is made at $t = 0$. Then at $t = 1$, the manager is again paid a fixed wage of $\overline{\psi}$, instructed to choose $e = 1$ and search for a good S project.[19] Funding is provided only if the manager finds a good project.

3.2 Second Best Contracts when Manager Searches for a Good S Project at $t = 0$:

Now the manager's search effort choice, talent (T or U), and the quality of the project for which funding is requested are not observable. The model is solved by backward induction. So first the optimal wage contract offered at $t = 1$ for the second period is solved for.

3.2.1 Firm's Preference for Talent

If the firm could observe the manager's talent, it would only hire a talented manager, as indicated in Section 3.1. The following lemma shows that it is impossible to have separating

[19] As long as effort is observable, the manager is always paid a fixed wage $\overline{\psi}$—since effort disutility is not ability-dependent—and asked to choose L.

contracts at $t = 0$ that result in type T managers taking one type of contract and type U managers taking another type of contract.

Lemma 1: *Suppose the contract designed for the type T has a rent for the manager even if the manager requests no funding. Then no manager will ever report himself as a type U manager.*

The reason why separating contracts are infeasible is the lack of precommitment by the firm. Given (4), the firm has no desire to hire an untalented manager since the project has negative NPV with such a manager. So any manager who reports his type as U will find that the firm will not extend him a wage offer. Anticipating this, the type-U manager will choose the contract designed for the type T manager; this contract has a rent, so it is preferable to the zero utility associated with not being hired.[20] Note that the type U manager can earn a rent by taking the type T contract, choosing $e = 0$, and not requesting funding. This means that the firm will design wage contracts at $t = 0$, knowing that these will be taken by both type T and type U managers who will report themselves as type T.

Next we have:

Lemma 2: *A firm that wants its manager to search for the S project at $t = 0$ as well as one that wants its manager to search for the L project at $t = 0$ will design wage contracts to induce type T managers to choose search effort $e = 1$ at $t = 0$ and at $t = 1$ and propose only good projects for funding. The contracts will induce type U managers to choose $e = 0$ in both periods and not request any funding for projects.*

The intuition is that even a good project chosen by the untalented manager has negative NPV, so eliciting costly search effort from such a manager is inefficient. Thus, the firm designs its wage contract to elicit search effort only from the talented managers. Given such a contract, the untalented manager strictly prefers not to search for a project or request funding for it, since searching for a good project is less profitable for the untalented manager.

[20]It will be shown later that equilibrium wage contracts generate rents for both types of managers.

3.2.2 Second-period Contract

At $t = 1$, the posterior belief that the manager is T is given by θ_1. If there was no investment at $t = 0$, then clearly $\theta_1 = \theta_0$. If there was investment and the first-period S project failed, then the posterior belief is:

$$\theta_1^l = \Pr(\tau = T \mid y_1 = 0) = 0 \tag{10}$$

Given (4), we see that (10) implies that the manager will be fired and replaced with a new manager if $y_1 = 0$. If $y_2 = R_S$, then the posterior belief is

$$\begin{aligned} \theta_1^h &= \Pr(\tau = T \mid y_1 = R_S) \\ &= \frac{\theta_0}{\theta_0 + [1 - \theta_0]\, q} \end{aligned} \tag{11}$$

Thus, conditional on $y_1 = R_S$, the manager is retained and his wage contract is a triplet $\left\{W_{S2}^n(h), W_{S2}^h(h), W_{S2}^l(h)\right\}$, where $W_{S2}^n(h)$ is what the manager is paid if he does not request second-period funding, $W_{S2}^h(h)$ is his wage if a project is invested in and it pays off R_S at $t = 2$, and $W_{S2}^l(h)$ is his wage if the project pays off 0. This contract must satisfy two incentive compatibility (IC) constraints and a managerial participation constraint.

The first IC constraint is that the type T manager prefers to choose $e = 1$:

$$\delta p \left\{W_{S2}^h(h)\right\} + \delta [1 - p]\, W_{S2}^n(h) - \overline{\psi} \geq \delta W_{S2}^n(h) \tag{12}$$

The second IC constraint is that the type U manager prefers to choose $e = 0$:

$$\delta p \left\{q W_{S2}^h(h) + [1 - q] W_{S2}^l(h)\right\} + \delta [1 - p]\, W_{S2}^n(h) - \overline{\psi} \leq \delta W_{S2}^n(h) \tag{13}$$

The third IC constraint is that if the manager does not find a good project, he will not request funding:

$$bW_{S2}^{h}(h) + [1-b]W_{S2}^{l}(h) \leq W_{S2}^{n}(h) \tag{14}$$

The type T manager's participation constraint is:

$$\delta p \left\{ W_{S2}^{h}(h) \right\} + \delta [1-p] W_{S2}^{n}(h) - \overline{\psi} \geq 0 \tag{15}$$

A property of the optimal wage contract in the second period is given below.

Lemma 3: *Second-period contracts have a 0-1 property. The manager is either fired at $t = 1$ or retained, and if he is retained, he receives the same second-period contract regardless of the project outcome that led to retention.*

When the manager is retained in the second period, he receives the same contract regardless of whether he requested funding and experienced $y_1 = R_S$ or he did not request funding. This is despite the fact that the firm's posterior belief about the manager's talent is different in these cases—$\Pr(\tau = T \mid y_1 = R_S) = \theta_1^h > \theta^0$ as given by (11), and $\Pr(\tau = T \mid \text{no funding}) \equiv \theta_1^n = \frac{[1-p]\theta_0}{[1-p]\theta_0 + 1 - \theta_0} < \theta_0$. The reason is that contracts are designed to induce appropriate investment only by the type T manager, so the firm uses the contracts that would be offered if only the type T manager was in the labor pool.

Note also that the decision to fire the manager when $y_1 = 0$ is observed at $t = 1$ is subgame perfect and not just a precommitment for incentive reasons, as in Stiglitz and Weiss (1983). The next result describes the second period contracts when the manager is retained.

Lemma 4: *If the manager searched for a short-horizon project in the first period that was funded and had $y_1 = 0$, he is fired. If it had $y_1 = R_S$ at $t = 1$, or no funding was requested for it at $t = 0$, then the optimal second-period wage contract is:*

$$W_{S2}^{h} = W_{S2}^{h}(n) = W_{S2}^{h}(h) = \frac{\overline{\psi}}{p[1-b]\delta} \tag{16}$$

$$W_{S2}^{l}=W_{S2}^{l}\left(n\right)=W_{S2}^{l}\left(h\right)=0 \tag{17}$$

$$W_{S2}^{n}=W_{S2}^{n}\left(n\right)=W_{S2}^{n}\left(h\right)=\frac{b\overline{\psi}}{p\left[1-b\right]\delta} \tag{18}$$

The type T manager chooses $e=1$ and the type U manager chooses $e=0$. For each type of manager, the participation constraint is slack. The type T manager earns a rent equal to W_{S2}^{n} with (utility) value of δW_{S2}^{n}.

Three points are worth noting. First, it is clear that the higher $W_{S2}^{l}\left(h\right)$ is, the more costly it is for the firm to ensure satisfaction of the IC constraint (12). So, given the zero lower bound constraint on wages, it is efficient to set $W_{S2}^{l}\left(h\right)=0$. Second, to ensure satisfaction of the IC constraint (14), the manager must be paid a wage even when he does not request project funding. Absent this wage, the manager will request funding even for a bad project. This multi-tasking—investing effort to find a good project and then deciding whether or not to propose a bad project—generates a rent for the manager. Third, because second-period contracts, conditional on the manager being retained, are the same for all $x_1\in\{n,R_S\}$, the notational dependence of these contracts on the first-period outcome, x_1, will be removed henceforth.

The manager's rent stems from the need to motivate him to both work hard to find a good project and also not request funding for a bad project. Thus, the combination of the manager's private information about his own effort choice *and* the quality of the project for which he is requesting funding generates an efficiency wage that provides an informational rent for him.

3.2.3 First-period Contract

The first-period contract is a triplet $\left\{W_{S1}^{n},W_{S1}^{h},W_{S1}^{l}\right\}$. Using the logic used in proving Lemma 3, it can be shown that $W_{S1}^{l}=0$. Thus, this contract is one that minimizes the firm's expected wage bill subject to two IC constraints and one participation constraint. Henceforth, the IC constraint that the type U manager will choose $e=0$ is dropped since it is always true that the type T manager's effort constraint binds in equilibrium, so the type U manager will never choose $e = 1$ under the optimal contract.

The first IC constraint is that the type T manager chooses $e = 1$ at $t = 0$:

$$p\left[W_{S1}^{h} + \delta W_{S2}^{n}\right] + [1-p]\left[W_{S1}^{n} + \delta W_{S2}^{n}\right] - \overline{\psi} \geq W_{S1}^{n} + \delta W_{S2}^{n} \tag{19}$$

In writing this constraint, it is recognized that the manager is maximizing his expected utility over two periods in making his first-period choice and that he will get fired at $t = 1$ if $y_1 = 0$, so there is no second-period rent for him to extract in this case. The second IC constraint is that the manager will not request funding for a bad project:

$$b\left[W_{S1}^{h} + \delta W_{S2}^{n}\right] \leq W_{S1}^{n} + \delta W_{S2}^{n} \tag{20}$$

The type T manager's participation constraint is that:

$$p\left[W_{S1}^{h} + \delta W_{S2}^{n}\right] + [1-p]\left[W_{S1}^{n} + \delta W_{S2}^{n}\right] - \overline{\psi} \geq 0 \tag{21}$$

This leads to the following result:

Proposition 1: *The optimal first-period wage contract is as follows:*

$$W_{S1}^{h} = \frac{\overline{\psi}}{p\,[1-b]} - \delta W_{S2}^{n} \tag{22}$$

$$W_{S1}^{l} = 0 \tag{23}$$

$$W_{S1}^{n} = \frac{b\overline{\psi}}{p\,[1-b]} - \delta W_{S2}^{n} = 0 \tag{24}$$

With this wage contract, the type T manager chooses $e = 1$ to search for S in the first period, the type U manager chooses $e = 0$, both managers request first-period funding only if they find a good project, and each is retained in the second period if he requested first-period funding *for S and experienced $y_1 = R_S$ or if he did not request first-period funding. If the manager is retained in the second period, the wage contract he receives is described in Lemma 3.*

This result shows that the first-period contracts anticipate the second-period rent the manager will earn and adjust accordingly.

3.3 Second-Best Contracts when Manager Searches for a Good L Project in the First Period

3.3.1 Second-Period Contract

We again solve the model backward by solving first for the optimal second-period contract when it is known that the manager searched for L in the first period. At $t = 1$, the firm observes the signal ϕ of the eventual payoff on L. The second-period contract in this case is a triplet $\left\{W_{S2}^n, W_{S2}^h, W_{S2}^l\right\}$. As before, the dependence of the second-period contract on the first-period outcome is dropped, and we can show that $W_{S2}^l = 0$ in the optimal contract. The following result can now be proven:

Lemma 5: *The firm does not fire the manager at $t = 1$, regardless of the observed ϕ. The optimal second-period contract is:*

$$\hat{W}_{S2}^h = \frac{\overline{\psi}}{p\left[1-b\right]\delta} \tag{25}$$

$$\hat{W}_{S2}^l\left(\phi\right) = 0 \tag{26}$$

$$\hat{W}_{S2}^n = \frac{b\overline{\psi}}{p\left[1-b\right]\delta} \tag{27}$$

If the manager did not request first-period funding, the second-period contract is that stated in Lemma 4.

The intuition for why the manager is not fired at $t = 1$ when he invests in L at $t = 0$ and $\phi = l$ at $t = 1$ is that the actual outcome on L is not observed at $t = 1$ and ϕ is a noisy signal. Moreover, along the path of play, only the type T manager invests in L at $t=0$, so the firm knows that, regardless of ϕ, the manager is type T. This explains the second-period contracts offered to the manager.

3.3.2 First-Period Contract

Turning now to the first-period contract, it can be written as a triplet $\left\{W_L^n, W_L^h, W_L^l\right\}$. The firm designs the contract to minimize its expected wage bill subject to the two IC constraints and participation constraint considered earlier. The first IC constraint is that the type T manager chooses $e=1$:

$$p\left\{\left[\beta\left[W_L^h+\delta\hat{W}_{S2}^n\right]+[1-\beta]\delta\hat{W}_{S2}^n\right]\right\}+[1-p]\left[W_L^n+\delta W_{S2}^n(n)\right]-\overline{\psi}\geq W_L^n+\delta W_{S2}^n(n) \quad (28)$$

where $W_{S2}^n(n)$ is given in (18) and we set $W_L^l=0$ as before. As before, the IC constraint that the type U manager will choose $e=0$ will hold if (28) holds. The second IC constraint is that the manager does not request funding for a bad project if he does not find a good project:

$$\begin{aligned} & b\left\{\beta\left[W_L^h+\delta\hat{W}_{S2}^n\right]+[1-\beta]\delta\hat{W}_{S2}\right\} \\ & +[1-b]\left\{\beta\delta\hat{W}_{S2}^n+[1-\beta]\left[W_L^h+\delta\hat{W}_{S2}^n\right]\right\}\leq W_L^n+\delta W_{S2}^n \end{aligned} \quad (29)$$

The type T manager's participation constraint is:

$$p\left\{\left[\beta\left[W_L^h+\delta\hat{W}_{S2}^n\right]+[1-\beta]\delta\hat{W}_{S2}^n\right]\right\}+[1-p]\left[W_L^n+\delta W_{S2}^n\right]-\overline{\psi}\geq 0 \quad (30)$$

Proposition 2: *The optimal first-period wage contract for L is as follows:*

$$W_L^h=\frac{\overline{\psi}}{p\,[1-b]\,[2\beta-1]} \quad (31)$$

$$W_L^l = 0 \tag{32}$$

$$W_L^n = \frac{A_2\overline{\psi}}{p\,[1-b]\,[2\beta-1]} \tag{33}$$

where

$$A_2 \equiv b\beta + [1-b][1-\beta] \tag{34}$$

With this wage contract, the type T manager chooses $e = 1$ to search for L in the first period, and requests first-period funding only if he finds a good project. The type U manager chooses $e = 0$ *and does not request funding, and the manager is retained in the second period regardless of the signal ϕ. The manager's second-period wage contract is as described in Lemma 5.*

The next result describes the manager's preference for L versus S at $t = 0$.

Proposition 3: *With the optimal wage contracts, the type T manager strictly prefers to search for L.*

The intuition is that L gives the manager rents that exceed the rents he can get by searching for S at $t = 0$. The reason for this is that the signal of project performance at $t = 1$ is more noisy with L. Thus, a bad L project is less likely to be detected at $t = 1$ than a bad S project. Moreover, with S, the manager can get fired at $t = 1$ if the project fails, which denies him his second-period rent. This does not happen with L.

This means that the manager's incentive to work hard at $t = 0$ to find a good project is weaker with L than with S, all else equal, i.e. agency costs are higher with L. So the firm is forced to make the incentives in the wage schedule steeper with L by paying the manager more for a good performance signal at $t = 1$. But this creates another incentive problem—it induces the manager to gamble and propose a *bad* project, so he can get the high performance bonus with a positive probability. To counter this, the firm must increase the efficiency wage, which the manager earns for doing nothing (no funding request). This gives the manager a rent.

This leads to the next result.

Proposition 4: *As long as $\triangle \equiv R_L - R_S <$ some $\overline{\triangle}$, the firm strictly prefers that the type T manager search for S in the first period, so the firm imposes a short-termism constraint to limit the manager's first-period choice to S, using the optimal contracts described in Proposition 1 and Lemma 3. For $\triangle \geq \overline{\triangle}$, the firm instructs the manager to search for L in the first period, using the optimal contracts described in Lemma 4 and Proposition 2. In the case of project S, the out-of-equilibrium belief when project failure is observed at $t = 1$ is that the manager is type U, and the equilibrium survives the universal divinity refinement of sequential equilibrium.*[21]

The intuition is as follows. From Proposition 3 we know that the manager earns higher rents when he chooses L than when he chooses S at $t = 0$. Thus, the firm's agency cost is higher with L than with S. When $\triangle$ is not too large, this also leads to a lower total profit to the firm with L than with S. This is the benefit of limiting the manager to S at $t = 0$. The benefit of L is that it has a higher first-best value, since $R_L > R_S$. So when the difference $\triangle$ is not too large, the firm will prefer short-termism.

The analysis assumes that the manager is not fired at $t = 1$ with L, regardless of the signal ϕ. However, it can be shown that the main result of higher agency costs with L holds even if the manager is fired at $t = 1$ for some ϕ. It turns out that the possibility of firing with L reduces the manager's rent with L, but it is nonetheless the case that L has higher agency costs than S.[22] The reason is that the greater noise in assessing the manager's performance at $t = 1$ with L is a source of managerial rent.

3.3.3 Inefficiency of Wage Deferral

Until now, it has been assumed that deferring the manager's wage that is payable at $t = 1$ until $t = 2$ is not allowed. It will be shown now that such a deferral is inefficient.

[21] See Banks and Sobel (1987) for the universal divinity refinement criterion.
[22] The details of this analysis are available upon request.

Lemma 6: *Deferring the manager's compensation at* $t = 1$ *until* $t = 2$ *is inefficient.*

The intuition is as follows. Suppose the manager was asked to search for L at $t = 0$. If the manager's wage is paid at $t = 2$ instead of $t = 1$, then there are two possibilities. One is that the deferred wage is simply added to the manager's second-period wage in each state, in which case it has no impact on the manager's incentives on either the first-period project or the second-period project. In this case, the deferral is simply inefficient because the manager prefers consumption at $t = 1$ over consumption at $t = 2$, all else being equal. Further, the wage deferral cannot improve on the incentives provided by the optimal contract derived for L in the previous analysis, since that is the least-cost contract to incentivize the manager to work hard and propose only the good project; such a contract cannot be improved upon by making the manager's payoff contingent on a future project.

So deferral can only improve second-period incentives. But any optimal contract requires that the manager be paid nothing for a failed project. Thus, all of the wage deferral must be spread out over the manager's second-period wage for success on the second-period project or his wage for not proposing a second-period project. However, this cannot improve incentives on the second-period project since we solved for the optimal contract with a zero payoff for project failure. Therefore, wage deferral fails to improve incentives and leads to a higher wage cost.

4 Competition for Managerial Talent

The preceding analysis examines what happens when a single firm contracts with a single manager who is privately informed about his type. It turns out that the firm offers the contract it would if it knew that the manager was type T. This contract is taken by both types of managers, but the type U manager taking this contract chooses $e = 0$ in both periods. Thus, the firm's lack of knowledge of the manager's type forces it to give a rent to a type U manager who does nothing in both periods. However, this is better than trying to induce such a manager to choose $e = 1$.

4.1 Matching Managers to Firms

We now introduce interfirm competition for managers. This leads to issues related to how managers are matched with firms. Project choices of firms and the matching of managers and firms proceed as follows. Each firm decides on whether it wants its manager to search for an S project or an L project at $t = 0$, and announces this. Managers then decide which firms they wish to apply to and report their types, based on which firms decide whether they want to hire them and what wage contracts they want to include in take-it-or-leave it offers. All decisions made by firms maximize their own values. Thus, this is the same process as in the previous section, except that managers can choose whether to apply to S-project or L-project firms.

The core intuition underlying the analysis in this section is as follows. Because managers earn higher rents with the L-project firms, they will all flock to these firms, leaving the S-project firms possibly unstaffed. By designing contracts to offer *only* the type T managers higher rents than they get with the wages offered by these firms when they are not competing with the L-project firms, the S-project firms can poach some of the talent away from the L-project firms. I show that this is not possible in equilibrium for the L-project firms. Consequently, the S-project firms end up with a richer mix of talented managers than the L-project firms, and as a consequence they also invest more.

Recalling that there are N firms and M managers, the next result shows that the solution characterized in Proposition 4 does not work when firms are competing for managers.

Lemma 7: *When firms are competing for managers, given the contracts in Proposition 4, with $N/M \in (0, 1)$ sufficiently large, all managers will strictly prefer to apply only to firms that want their managers to search for L projects.*

Since working for an L-project firm gives both types of managers a higher rent (see

Proposition 3), they all flock to those firms as long as the *expected* rent from applying to such a firm is higher than from applying to an S-project firm. The difference between the rents offered by the L-project and S-project firms is increasing in the effort cost $\overline{\psi}$. Moreover, N/M is the probability of being employed by a firm if all N firms are L-project firms and all M managers apply to those firms. Of course, if firms expect managers to only apply to L-project firms, all firms will choose to be L-project firms. It will be assumed henceforth that the conditions in Lemma 7 hold.

The following result can be shown.

Proposition 5: *Suppose there are some firms that declare that they will ask their managers to search for S in the first period, and some firms declare that they will ask their managers to search for L in the first period. Assume that the probability that a manager will be matched with a firm is the same regardless of whether the manager applies to an S-project firm or an L-project firm. Then:*

(a) If the type T managers strictly prefer to apply to the L-project firms, both the type T and type U managers will apply only to the L-project firms.

(b) If the type T managers strictly prefer to apply to the S-project firms, it is possible for the type U managers to strictly prefer the L-project firms, but this can never be an equilibrium; and

(c) If the type T managers are indifferent between the contracts offered by the two types of firms, type U managers strictly prefer the L-project firms.

The intuition is as follows. A manager's preference for a particular firm comes from the rent he earns, and this rent in any period is exactly equal to the efficiency wage. Thus, (a) follows from the fact that both managers enjoy the same rent from the L-project firms. As for (b), given Lemma 7, the only way an S-project firm can create a strict preference for it is by offering higher wages than in Proposition 4. Since it is possible to provide part of the higher wage for success on the first-period project, the firm can generate a rent for the type

T manager that is unavailable to the type U manager who does not invest in equilibrium. Consequently, the type T manager can strictly prefer the S-project firm, whereas the type U manager prefers the L-project firm. But this cannot be an equilibrium because the L-project firms would never hire just managers who report themselves to be type U. The logic for (c) is similar, but this can be an equilibrium due to the randomization by the type T managers that can provide the L-project firms with a pool of both types of managers.

From Lemma 7 and Proposition 5, we see why designing its wage contract to induce the type T managers to be indifferent between the S-project and L-project firms may be value-maximizing for the S-project firms. If all managers prefer the L-project firms, then the S-project firms are unstaffed and have a value of zero. If R_L^{min} is close enough to R_S, then it may pay for some low-R_L firms to pursue the S project and raise wages to attract (only some of) the type T managers, with all type T managers being indifferent between the S-project and L-project firms. This leads to the final result.

Proposition 6: *Suppose there is an $R_L^* \in [R_L^{min}, R_L^{max}]$ such that firms with $R_L \leq R_L^*$ instruct their managers to search for S projects in both periods, and firms with $R_L > R_L^*$ instruct their managers to search for L projects in the first period and S projects in the second period. Then the equilibrium must be such that each type T manager asks to join an S-project firm with probability $\xi \in (0,1)$ and an L-project firm with probability $1-\xi$. Type U managers strictly prefer the L-project firms. There is an equilibrium in which a manager applying to an S-project firm has a probability $e_S \in (0,1)$ of being hired and a manager applying to an L-project firm has a probability $e_L \in (0,1)$ of being hired. S-project firms invest more in expected value than L-project firms.*

Assuming that both the S-project and L-project firms are in the same market, this proposition states that in equilibrium the firms that want their managers to search for S projects in both periods have to provide them with more rents when they are competing with firms that are instructing their managers to search for L projects in the first period.

The additional rents make the type T managers indifferent between the two types of firms. However, any rent that makes the talented managers indifferent between the two types of firms will make the untalented managers strictly prefer the L-project firms (Proposition 5). The S-project firms are therefore able to attract a talent pool of managers that is better on average than that of the L-project firms. This increases each S-project firm's value, so the outcome in which all managers strictly prefer the L-project firm cannot be an equilibrium. The S-project firms therefore are chosen by talented managers, but not by any untalented managers. Consequently, the probability of investment in S-project firms is also higher since the type U managers never request funding.

The L-project firms cannot improve their talent pool by raising wages because a higher wage only makes them more attractive to the untalented managers. And these firms cannot make the talented managers strictly prefer them because that would only induce the type-S firms to raise their wages until the talented managers were indifferent. So the equilibrium must involve the offered wage contracts being such that the talented managers are indifferent between the two types of firms, and the untalented managers strictly prefer the L-project firms.

Moreover, given the equilibrium wage schedules, no S-project firm will wish to deviate by offering a lower wage, because doing so would cause its probability of hiring a manager to drop to zero.

In this analysis, it was assumed that some firms were L-project firms and some were S-project firms. In an extended version of this analysis, I derive conditions under which that occurs in equilibrium. Details are available upon request. The basic idea is that some firms prefer short-termism to minimize agency costs, whereas others prefer long-termism because their long-horizon projects are valuable enough to overcome the higher agency costs.

5 Conclusion

This paper has developed a theory of the choice of investment horizon by firms that relies on the interaction between investment horizon, innate project value, managerial rent extraction, and managerial talent selection. The analysis shows that optimal wage contracts generate efficiency wages, leading to informational rents for privately informed managers that are higher when they invest in intrinsically higher-valued long-horizon projects. The manager's rent is an agency cost for the firm. To limit this agency cost, the firm chooses to limit the manager's choice to short-horizon projects in the interest of its shareholders when the innate value difference between long-horizon and short-horizon projects is not large. Short-termism is eschewed when the long-horizon project is intrinsically much more highly valued than the short-horizon project. When firms compete for managerial talent, short-termism enables firms to attract better talent.[23] The model thus generates numerous testable predictions.

[23] To the extent that short-termism boosts current reported earnings, the analysis implies that it may be in the best interest of shareholders.

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Appendix

Restriction on q in Base Model (see (7)):

$$q < \left\{ \frac{b}{1-b} + 1 \right\} \left\{ 1 + \frac{b}{1-b} + \frac{A_3 - A_1[2\beta - 1]}{[1-b][2\beta-1]\,[b + A_1]} \right\}^{-1} \tag{A.1}$$

Proof of Lemma 1: Suppose, counterfactually, that the type U manager reports himself as type U. Then the firm will not wish to hire him, so no contract will be offered. This gives the manager a utility of zero. Thus, the type U manager would be strictly better off reporting himself to be a type T manager and collecting the rent the type T earns for *not* requesting funding. This holds even if a manager not requesting funding in the first period is fired at $t = 1$, since in that case the manager's second-period utility is zero, but the manager earns a rent on the first-period contract. ■

Proof of Lemma 2: The proof follows from the fact that incentivizing the type-U manager to expend search effort (choose $e = 1$) is inefficient, given (5), i.e., it reduces firm value and cannot occur in equilibrium. Thus, in case the firm does end up with a type-U manager, it is efficient to not have the manager choose $e = 1$ and also to not propose a bad project. However, it is efficient to incentivize the type-T manager to choose $e = 1$ (see (4)) and propose only a good project, in that this increases firm value. Thus, it is part of the equilibrium. ■

Proof of Lemma 3: We know that if $y_1 = 0$, then $\Pr(\tau = T \mid y_1 = 0) = 0$, so the firm knows that the manager is type U with probability 1 and fires him. If the manager is retained, then by Lemma 2 we know that second-period contracts will be designed to induce the type T manager to choose $e = 1$ and the type U manager to choose $e = 0$. Given this, the second-period contracts do not depend on the firm's belief about the manager's type. Hence, second-period contracts, conditional on retention, are unaffected by the first-period. ■

Proof of Lemma 4: As argued in the text, it is optimal to set $W_{S2}^{l}(h) = 0$. Next, note that (12) and (14) will be binding in equilibrium. Solving these simultaneously yield (16) and (18). With this solution, (15) is clearly satisfied. From Lemma 3, we also know that the manager will be fired if $y_1 = 0$. What remains to be shown is that the manager will be retained if he did not request funding at $t = 0$ or if $y_1 = R_S$ at $t = 1$. Suppose the manager did not request funding at $t = 0$. Then

$$\Pr(\tau = T \mid x_1 = n) = \theta_1^n \tag{A.2}$$

where θ_1^n is defined in (5). Thus, the expected firm value from retaining the manager in the second period is

$$\theta_1^n \{R_S - \mathbb{E}[\text{compensation cost} \mid \tau = T] - 1\} - [1 - \theta_1^n] W_{S2}^n \tag{A.3}$$

where we use the fact that a type U manager (the probability of the manager being type T is $1-\theta_1^n$) chooses $e = 0$ and does not invest. Here

$$\mathbb{E}[\text{compensation cost} \mid \tau = T] = pW_{S2}^h + [1-p]W_{S2}^n \tag{A.4}$$

Substituting (A.4) into (A.3) yields:

$$\begin{aligned}
&\theta_1^n R_S - \theta_1^n p W_{S2}^h - \{\theta_1^n[1-p] + 1 - \theta_1^n\} W_{S2}^n - \theta_1^n \\
=&\theta_1^n R_S - \theta_1^n p W_{S2}^h - \{1 - \theta_1^n p\} W_{S2}^n - \theta_1^n \\
=&\theta_1^n R_S - \theta_1^n p \frac{\overline{\psi}}{p[1-b]\delta} - \frac{[1-\theta_1^n p]\, b\overline{\psi}}{p[1-b]\delta} - \theta_1^n \\
=&\theta_1^n [R_S - 1] - \frac{\overline{\psi}\,[\theta_1^n p + b - \theta_1^n p b]}{p[1-b]\delta} - \theta_1^n \\
=&\theta_1^n [R_S - 1] - \overline{\psi}\,[b + \theta_1^n A_1]\,[A_1\delta]^{-1}
\end{aligned} \tag{A.5}$$

recalling that $A_1 \equiv p[1-b]$. Given (8), we know that the expression in (A.5) is strictly positive.

Now suppose $y_1 = R_S$. Then the expected firm value is

$$\theta_1^h [R_S - 1] - \overline{\psi}\left[b + \theta_1^h A_1\right][A_1\delta]^{-1} \tag{A.6}$$

which is also strictly positive given (8). Thus, the manager will be retained if no funding was requested at $t = 0$ or $y_1 = R_S$. The result that $W_{S2}^h = W_{S2}^h(n) = W_{S2}^h(h)$, $W_{S2}^l = W_{S2}^l(n) = W_{S2}^l(h)$ and $W_{S2}^n = W_{S2}^n(n) = W_{S2}^n(h)$ follows from Lemma 3.

Finally, it will be proven that the firm will hire a replacement manager when it fires the first-period manager following $y_1 = 0$. The expected firm value in the second period from firing the first-period manager and hiring a new manager is:

$$\begin{aligned} &\theta_0 \left\{R_S - \mathbb{E}\left[\text{compensation cost} \mid \tau = T\right] - 1\right\} - \left[1 - \theta_0\right] W_{S2}^n - \zeta \\ =&\theta_0 \left[R_S - 1\right] - \overline{\psi} \left[b + \theta_0 A_1\right] \left[A_1 \delta\right]^{-1} - \zeta \end{aligned} \tag{A.7}$$

which is strictly positive given (8) since $\theta_0 > \theta_1^n$.

Proof of Proposition 1: $W_{S1}^l = 0$ follows from earlier arguments. (22) and (24) are obtained by solving (19) and (20) as simultaneous equations because both constraints are binding at the optimum. ■

Proof of Lemma 5: Along the path of play, the type U manager never chooses $e = 1$ and never requests funding, which means the firm knows that it is the type T manager in charge of the project about which the signal ϕ is observed. As long as $\beta < 1$, any observed value of ϕ is consistent with the project choice having been made by a type T manager, and hence that value of ϕ is an equilibrium outcome. Given this, the firm does not fire the manager for any $\phi \in \{h, n, l\}$. The derivation of contracts (25)–(27) follows exactly the same steps as in previous proofs and all contracts are the same as in Lemma 4. ■

Proof of Proposition 2: $W_L^l = 0$ is clear from earlier arguments. Moreover, since (28) and (29) are binding in equilibrium, we can treat (28) and (29) as simultaneous equations and recognize that $\hat{W}_{S2}^n = W_{S2}^n$ (see (18) and (27)) to obtain (31) and (33). Clearly, (30) holds with (31) and (33). The rest of the proof follows in a straightforward manner. ■

Proof of Proposition 3: Since second-period contracts are identical for a first-period project choice of either L or S, the manager's preference will depend solely on a comparison of his utility with L to his utility with S in the first period. Moreover, since the manager chooses $e = 1$ in both cases and experiences the same effort disutility cost $\overline{\psi}$, we can simply compare the manager's expected first-period compensation with L to that with S. With S, the type T manager's expected compensation is

$$\mathbb{E}\left[c_S\right] = pW^h_{S1} + [1-p]W^n_{S1} \tag{A.8}$$

and substituting for W^h_{S1} and W^n_{S1} from Proposition 1 and for W^n_{S2} from Lemma 4 gives us:

$$\mathbb{E}\left[c_S\right] = \frac{p\overline{\psi}[1-b]}{p[1-b]} \tag{A.9}$$

Using Proposition 2 for a similar exercise with L, we have:

$$\mathbb{E}\left[c_L\right] = pW^h_L + [1-p]W^n_L \tag{A.10}$$

and substituting from Proposition 2 for W^h_L and W^n_L yields:

$$\begin{aligned} \mathbb{E}\left[c_L\right] =& \frac{p\overline{\psi}}{p[1-b][2\beta-1]} + \frac{[1-p]A_2\overline{\psi}}{p[1-b][2\beta-1]} \\ =& \frac{\overline{\psi}\left[p+[1-p]A_2\right]}{p[1-b][2\beta-1]} \end{aligned} \tag{A.11}$$

So comparing (A.9) and (A.11), we see that the manager's expected compensation is higher with L than with S if (A.11) exceeds (A.9), i.e., if

$$p + [1-p]A_2 > p[1-b][2\beta-1] \tag{A.12}$$

which is true since $b < 1$ and $2\beta - 1 < 1$. Thus, the manager strictly prefers L. ■

Proof of Proposition 4: The firm's preference depends on its expected profit over two periods. Again, since the firm invests in S in the second period with the same contracts regardless of its first-period choice, we can make a comparison of the firm's profits from L and S in the first period in order to determine its choice. The firm's expected first-period profit with S is:

$$\begin{aligned}\pi_S &= \theta_0 p R_S - \theta_0 \left\{ p W_{S1}^h + [1-p] W_{S1}^n - [1-\theta_0] W_{S1}^n \right\} \\ &= \theta_0 p \left[R_S - \frac{\overline{\psi}[1-b]}{p[1-b]} \right]\end{aligned} \tag{A.13}$$

Its expected profit with L is:

$$\begin{aligned}\pi_L &= \theta_0 p R_L - \theta_0 \left\{ p W_L^h + [1-p] W_L^h \right\} - [1-\theta_0] W_L^n \\ &= \theta_0 p \left[R_L - \frac{\overline{\psi} \left\{ \theta_0 p + [1-\theta_0 p] A_2 \right\}}{p[1-b][2\beta-1]} \right]\end{aligned} \tag{A.14}$$

Comparing (A.13) and (A.14), we see that

$$\frac{\overline{\psi}[1-b]}{p[1-b]} < \frac{\overline{\psi} \left\{ \theta_0 p + [1-\theta_0 p] A_2 \right\}}{p[1-b][2\beta-1]} \tag{A.15}$$

Thus, if $\triangle \equiv R_L - R_S$ is small enough, then $\pi_S > \pi_L$, and if $\triangle$ is large enough then $\pi_S < \pi_L$. Let $\overline{R}_L \in \left(R_L^{\min}, R_L^{\max} \right)$ be such that

$$\pi_S = \pi_L \left(\overline{R}_L \right) \tag{A.16}$$

and define

$$\overline{\triangle} \equiv \overline{R}_L - R_S \tag{A.17}$$

Then the firm prefers L in the first period if $\triangle \geq \overline{\triangle}$ and S if $\triangle < \overline{\triangle}$.

Now suppose project failure is observed with S at $t = 1$. This is an out-of-equilibrium event, but according to the universal divinity criterion, the firm must have the posterior belief that the manager is type U, which results in the manager being fired. Given this, no type U manager ever asks for project funding. ■

Proof of Lemma 6: Suppose $\delta = 1$, and assume that the manager is paid $\left\{ W_L^h, W_L^l, W_L^n \right\}$ described in Proposition 2 at $t = 2$ instead of $t = 1$. Given that $W_L^l = 0$, one possibility for the firm is to implement the deferral scheme by paying the manager $\hat{W}_{S2}^h(x_1) + W_L^{x_1}$ if the second-period project succeeds, $\hat{W}_{S2}^l(x_1) + W_L^{x_1}$ if the second-period project fails, and $\hat{W}_{S2}^n(x_1) + W_L^{x_1}$ if the manager did not request funding for the second-period project. It is clear that doing this will have no effect on the manager's incentives with respect to either the first-period or the second-period project. Of course, to maximize the effectiveness of incentives, we know that the manager should be paid 0 at $t = 2$ if the second-period project fails. However, we derived the cheapest way to incentivize the manager to choose $e = 1$ and propose only the good project in the second period when we solved for the subgame-perfect second-period contract. So we cannot improve on second-period incentives by paying the manager more. Further, the manager's incentives on the first-period contract also cannot be improved by this deferral since beliefs follow a martingale and the manager's choices on L at $t = 0$ do not affect the success probability of S chosen at $t = 1$.

Thus, with $\delta = 1$, wage deferral cannot improve on the outcome with the wage paid at $t = 1$. This means that with $\delta < 1$, wage deferral leads to a strictly higher expected wage cost (with no improvement in incentives). ■

Proof of Lemma 7: Now suppose all firms are L-project firms and all managers apply to L-project firms. Then the probability a manager will be hired is N/M. The claim that both types of managers will strictly prefer to apply to the firms with the L projects is true if $(N/M)\mathbb{E}[c_L] > \mathbb{E}[c_S]$, where $\mathbb{E}[c_S]$ and $\mathbb{E}[c_L]$ are defined in (A.9) and (A.11), respectively. Since $\mathbb{E}[c_L] > \mathbb{E}[c_S]$, this inequality will hold for N/M large enough. Thus, it is a Nash equilibrium for all managers to flock to type-L firms and for all firms to be type-L firms. ■

Proof of Proposition 5: The proof is similar to the arguments outlined in the text. Part (a) follows from Lemma 1, which implies that the type U manager will always choose to mimic the type T manager, and Proposition 3 which indicates that the type T manager earns a rent with his equilibrium contract. As for (b), Lemma 1 has established that a separating equilibrium is not possible. As for (c), the only way for a type T manager to strictly prefer the S project firm is if it offers a higher wage than needed to incentive compatibility, i.e.,

$$\tilde{\tilde{W}}_{S1}^{h} = W_{S1}^{h} + \alpha \tag{A.18}$$

where $\alpha > 0$ and from (22), we have $W_{S1}^{h} = \overline{\psi}/p$. Since in equilibrium the type-U manager does not propose a project, the additional rent α is not available to such a manager, so it is possible that the type-T manager strictly prefers the S-project firm or is indifferent between S-project and L-project firms, and the type-U manager strictly prefers the L-project firm. ■

Proof of Proposition 6: Given the assumption that some firms are pursuing S projects and some are pursuing L projects, it is clear that the S-project firms are offering a higher rent to the type-T managers in their offered wage contracts than that provided by the contracts in Lemma 4 and Proposition 1. From Proposition 5, we know that the offered contracts cannot be such that the type-T managers still strictly prefer the L-project firms (part (a) in Proposition 5), because in this case the S-project firms would be unstaffed, contradicting the premise that these firms are in the market. From (b) in Proposition 5, it can also not be the case that the type-T managers strictly prefer the S-project firms. Thus, part (c) is the only possibility. Given the indifference between the type-L and type-S firms on the part of the type-T managers, each will randomize applying across the two types of firms, with the probability ξ stipulated in the lemma. From Proposition 5, we know that in this case the type-U managers strictly prefer the L-project firms.

There will thus be $\eta\left(R_L^*\right)$ S-project firms and $N-\eta\left(R_L^*\right)$ L-project firms. A (type-T) manager applying to an S-project firm has a probability of

$$e_S = \frac{\eta\left(R_L^*\right)}{\xi\theta_0 M} \tag{A.19}$$

of being hired and a manager who applies to an L-project firm has a probability

$$e_L = \frac{N-\eta\left(R_L^*\right)}{\left[1-\theta_0\right]M+[1-\xi]\theta_0 M} \tag{A.20}$$

of being hired. It is clear that $e_S > 0$, $e_L > 0$. Moreover, since e_S and e_L are probabilities, it also follows that $e_S \leq 1$ and $e_L \leq 1$. Now by choosing $\xi = \eta\left(R_L^*\right)/\theta_0 M < 1$, which is allowed in equilibrium, it is possible to make $e_S = 1$. Substituting this ξ in (A.20) yields

$$e_L = \frac{N-\eta\left(R_L^*\right)}{M-\eta\left(R_L^*\right)} < 1 \tag{A.21}$$

Thus, $e_S \in (0,1)$ and $e_L \in (0,1)$ is an equilibrium. It is straightforward that the probability of investment is higher in an S-project firm since the type U manager in the L-project firm never requests funding. $\blacksquare$