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Managerial Incentives for Short-term Results

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ABSTRACT

Of late, concern has been expressed that American managers tend to make decisions that yield short-term gains at the expense of the long-term interests of the shareholders. In this paper, we have attempted to investigate managerial incentives for such decisions. We find that, when the manager has private information regarding his or her decisions, there exist situations wherein the manager has incentives to make decisions which yield short-term profits but are not in the stockholders best interests. This incentive for suboptimal decisions arises because the manager, by taking decisions yielding short-term profits, hopes to enhance his reputation earlier, thus boosting his wages. We also find that this incentive is inversely related to her experience, the duration of her contract, and the risk of the firm.

OF LATE, THERE SEEMS to be some concern about what is called the short-term profit goal of managers in this country. Managers have been accused of working for short-term profits at the expense of the long-term interests of their firms. Several explanations have been offered for this suboptimal behavior (see [1], [8]). Some have blamed the business schools which, they claim, give undue importance to current balance sheet results as a measure of managerial effectiveness. Others have faulted the influence of portfolio managers under pressure to show short-term profits in order to attract and retain clients. The power of the portfolio managers to influence the share price of the firms, in turn, puts pressure on the corporate managers to show short-term profits. A third argument that is advanced is that the short-term bias is reinforced by wage schemes which base executive bonuses on annual profits. These explanations of the short-term bias of managers seem to fall into two categories. One, the stockholders want quick profits, and their short-term view is reflected in the managerial decisions. Two, profit sharing by the managers, i.e., making either whole or part of their pay contingent on performance, tends to make them "quick-profit"-oriented.

In this paper we investigate, within a rigorous economic framework, whether the reasons stated above could result in managerial incentives for short-term results. We show that even when the manager's future wage is based on current and past performance and the stockholders demand short-term profits, the manager does not necessarily make decisions that are short-term profit-oriented, as long as any information the manager has is common knowledge. On the other hand, if the manager possesses some private information which is unavailable to

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the investors, the manager *might* make decisions which yield short-term profits at the expense of the long-term interests of the firm. Moreover, he will make such suboptimal decisions even if the investors do not want profits every period.

Our explanation is based on the following model. The ability of the manager is unknown to all, including himself. The manager's labor is the only factor of production and the labor market is competitive; so, after paying the manager, the firm cannot make positive expected profits. The output of the firm depends on the manager's ability, the state of nature, and the decisions made by the manager. Since the manager's ability is unknown, the stockholders base her wage on output (past and present). Using these outputs, they update their prior on the manager's ability. The stockholders cannot observe the manager's choice of project. By selecting a project that yields short-term profits, the manager can expect to improve the perception about her ability early and hence earn higher wages.[1] In some cases, this potential advantage to the manager might outweigh the fact that from the long-term point of view the project is not the best available, i.e., it is not the one with the highest net present value.

We also investigate how the manager's decisions are affected by his experience, the risk of the firm's cash flows, and also the duration of the manager's contract. We find that the more experienced the manager, the lower the probability that he would opt for short-term profits. The more experienced the manager, the better the precision with which his ability is known; this, in turn, reduces the manager's incentive to choose quicker-return projects since the potential benefit from such a strategy is lower. We also find that the incentive for short-term results is inversely related to the risk of the projects. When the firm's projects are riskier, only a smaller proportion of the deviations from the expected cash flows will be attributed to the manager's ability, and this reduces his incentives for sacrificing the long-term interests of the firm for short-term profits. Finally, we find that the longer the duration of the manager's contract, the lower the probability that he will choose quicker-return projects that are suboptimal. The longer the duration of the contract, the more the benefit to the manager from future cash flows, and hence the less his incentive for sacrificing these long-term benefits for short-term ones.

The paper is organized as follows. In Section I, we set up the model and derive the optimal wage policy for the manager. In Section II, we show that, when the

[1] This line of reasoning also suggests why managers use the payback method for evaluating investment projects. By using the payback method, the managers are putting more emphasis on short-term profits than is warranted by the time value money. Narayanan [10] uses the managerial concern for their reputation to provide an economic rationale for the use of the payback criterion as a capital budgeting tool. That paper argues, using a very similar model to ours, that when two projects have the same net present value the manager always has the incentive to pick the one which provides a quicker payback. While the underlying model and arguments in this paper are quite similar to that of Narayanan [10], the objective of the two papers are different. The focus of this paper is the investigation of the conditions under which the manager would sacrifice the interests of the shareholders for quick results and how this perverse incentive is influenced by his experience, the risk of the firm, and the length of the contract. By doing so, it also attempts to prescribe remedies to prevent, or at least mitigate, such incentives. The purpose of the paper by Narayanan [10], on the other hand, is limited to providing a rationale for the use of payback. Therefore, to some extent, this paper may be considered as an extension to that of Narayanan.

manager has private information, there exist situations wherein he would make decisions which result in short-term profits but are detrimental to the stockholders' interests. In Section III, we discuss how his incentives for short-term goals are influenced by his experience, the firm's risk, and the duration of his contract.

I. The Model[2]

Consider an all-equity firm run by a professional manager. Let the market consist of a large number of such identical firms. All these firms produce the same consumption good using one factor of production—the labor supplied by the manager. Firms are assumed to have infinite lives while managers live for a finite number of periods, T. The output of the firm depends on the manager's ability, n, and a random disturbance term, e. The output produced by a manager of ability, n, in period t is given by the equation

$$y_t = n + e_t \tag{1}$$

where e_t is the realization of the random disturbance in period t.

When a manager is first hired, her ability n, is not known with certainty either to the stockholders or the manager herself. On the basis of some information which is common knowledge, the stockholders and the manager hold the same prior beliefs about n. The information on which the prior is based may be the education of the manager if she has no previous job experience or, may be the output produced by the manager in previous jobs. This information is available to all participants in the market, and all of them have the same prior distribution on n which is assumed to be normal with mean m_0 and precision, h_0.[3] The e_t's are assumed to be distributed independently and normally with mean zero and precision, r. The realizations of e_t are not observable. Only the output, y_t, is observable.

The shareholders are assumed to hold well-diversified portfolios. Therefore, with respect to the fortunes of any given firm, which represent only a small part of their wealth, they are assumed to be risk-neutral. The managers are also assumed to be risk-neutral. This assumption is not needed to show the central result of this paper, but it simplifies the analysis to a great extent. It can be shown that even if the manager is risk-averse, she would prefer short-term gains (see footnote 8). Therefore, the utility for intertemporal consumption $c^t \equiv (c_1, c_2, \cdots, c_t)$ of both the manager and the stockholders is given by

$$u(c^T) \equiv \textstyle\sum_{t=1}^{T} b^t c_t, \qquad b \leq 1. \tag{2}$$

Without any loss of generality, we can assume that $b = 1$.

The firms are permitted to make binding contracts with the manager but the manager is under no such commitment. She can leave a firm anytime to accept a better job with a different firm. Note that the firm, after paying the manager's wages, cannot make positive expected profits in any period since the labor market

[2] The model is borrowed from Harris and Holmstrom [4].

[3] The regularity conditions, $|m_0| < \infty$ and $h_0 > 0$ are assumed to be satisfied.

is competitive and there are no other factors of production. Therefore, the maximum expected profit the stockholders can make is zero.

Prior beliefs are updated on the basis of all the previous outputs produced by the manager. Consider time, t, when outputs $y_1, y_2, \cdots, y_t$ have been observed. It follows from (1) that $(y_1, y_2, \cdots y_t)$ is a random sample from a normal distribution with mean, n, and precision, r. Since the prior distribution of n is normal with mean, m_0, and precision, h_0, the posterior distribution of n at time t is normal with mean, m_t, and precision, h_t, given by (see [2])

$$m_t = [h_0 m_0 + r(y_1 + y_2 + \cdots + y_t)]/(h_0 + tr) \tag{3}$$

$$h_t = h_0 + tr. \tag{4}$$

The above equations may be written in recursive form as,

$$m_{t+1} = (h_t m_t + r y_{t+1})/(h_t + r) \tag{5}$$

$$h_{t+1} = h_t + r. \tag{6}$$

From (1), it follows that in period t, the expected next period output is equal to m_t, the mean perceived ability of the manager in period t. Equation (5) implies that the m_t follows a random walk with declining variance, while it is clear from Equation (6) that the precision, h_t, moves deterministically over time, independent of the output. Equation (5) also implies that the history $m^t \equiv (m_0, m_1, \cdots, m_t)$ is equivalent to the history $y^t \equiv (y_0, y_1, \cdots, y_t)$.

The manager is hired in period zero. He comes in with an expected ability of m_0 and precision, h_0. He is offered a state-contingent wage policy, d, which is defined as a sequence of wage payments $\{w_t(m^t)\}_{t=0}^{T-1}$, where $w_t(m^t)$ is the wage offered in period t. He is paid at the beginning of each period based on the history up to that period and before that period's output is observed. For example, he is paid his first wage, w_0, at the beginning of the first period based on the history up to that period, m_0. After the first period output, y_1, is observed, he is offered his second wage, w_1, based on the history y^1 (or equivalently m^1), and so on (see [6] and [7] for similar contractual models). As mentioned before, this wage policy is binding on the firm. The fact that firms may make binding contracts is usually defined on grounds of reputation (see [5]).

The solution to the following optimization program gives the optimal wage policy:

$$\max_d E_0\left[\sum_{t=0}^{T-1} w_t\right]$$

subject to

$$E_s\left[\sum_{t=s}^{T-1} (m_t - w_t)\right] \leq 0, \qquad \forall m^s \equiv (m_1, m_2, \cdots, m_s),$$

$$\text{and} \quad s = 0, 1, 2, \cdots, T-1. \tag{7}$$

$$E_0\left[\sum_{t=0}^{T-1} (m_t - w_t)\right] = 0. \tag{8}$$

The program above maximizes the manager's expected total wages subject to two constraints on the firm: the competitive labor market constraint and the rationality constraint represented by Equations (7) and (8), respectively. For each s, Equation (7) states that the total expected profits (suitably discounted) at time s, given all the available information, m^s, up to that time, should be less than or equal to zero. Moreover, the weak inequality should hold for all possible histories (or all possible states of the world) up to that time. This condition merely reflects the competitive nature of the managerial labor market, and the fact that the manager is free to move if the firm makes positive expected profits. Equation (8) says that the expected profit at time zero, given the information at that time, m^0, is zero. This condition is required to make the contract efficient. It states that the stockholders want the maximum possible (i.e., zero) expected profits when the contract is signed.[4,5]

The following lemma characterizes the optimal wage policy.

LEMMA 1. *For the above optimization program, any feasible wage policy is optimal.*

Proof: From (8), we know that $E_0[\sum_{t=0}^{T-1} w_t]$ = the objective function = $E_0[\sum_{t=0}^{T-1} m_t]$. Hence, any wage schedule $\{w_t\}$ that is feasible is also optimal. Q.E.D.

One feasible (and hence, optimal) wage policy is $w_t = m_t$, $\forall t$; i.e., the manager is paid her mean perceived ability in every period. This means that the manager's wage will follow a random walk over time. The reason such a wage policy is optimal is the risk-neutrality of the manager. She is indifferent to the temporal variations in her wages caused by the uncertainty in the output.[6] It is clear from the above lemma that irrespective of the wage policy chosen from the set of feasible ones, the expected wage of the manager is $E_0[\sum_{t=0}^{T-1} m_t]$.

II. Managerial Incentives for Short-Term Results

In the previous section, the firm's output was a function of the manager's ability and a random factor. In order to model the manager's penchant for short-term

[4] The subscripts to the expectation operators indicate the time period at which the expectations are taken.

[5] Note that the stockholders are committing themselves to a long-term wage contract and that they do not expect maximum profits (zero profits) in each period. The way the contract is written, they tolerate negative expected profits in some periods as long as the expected profits from the entire contract period is zero, which is the maximum possible. This may be considered as a long-term outlook by the stockholders.

If we want to model the stockholders as having short-term profit goals, we can replace constraints (7) and (8) by

$$E_s[\textstyle\sum_{t=s}^{T-1} (m_t - w_t)] = 0, \quad \forall m^s \equiv (m_1, m_2, \cdots, m_s) \quad \text{and } s = 0, 1, 2, \cdots, T-1.$$

It is easy to show that this constraint implies that the expected one-period profit in each period is zero: i.e., stockholders are seeking maximum profits from each period's operations.

[6] If the manager was risk-averse, she would prefer a downward rigid wage policy where the wage is never revised downwards. She will be willing to take a wage lower than her mean perceived ability, in effect, paying an insurance premium, to obtain a guarantee of downward rigidity (see [4] for details).

results, in this section we define the firm's output as a function of the ability, the random factor *and* a decision that the manager makes.[7] Specifically,

$$y_t = n + e_t + D_t(z), \quad t = 1, 2, \cdots, T - 1. \tag{9}$$

As before, n is the manager's ability and e_t's are random terms independently and normally distributed with mean zero and precision r. $z \in Z$ represents an element of his decision set Z and D_t: $Z \rightarrow R^1$ are functions that represent the cash flow outcomes of the managerial decision. The decision, z, is taken at time zero.

Let us now consider the simplest decision set and decision functions that are needed to illustrate our point. Let $Z = \{A, B\}$, i.e., the manager has a choice between decision A or B. Let

$$\begin{aligned} D_t(A) &= k, && t = 1 \\ &= 0, && t > 1 \\ D_t(B) &= 0, && t = 1 \\ &= 1, && t = 2 \\ &= 0, && t > 2. \end{aligned}$$

In other words, decision A results in k additional dollars in period 1, while B results in 1 additional dollar in period 2. After period 2, both decisions produce identical (zero) cash flows. Thus, when $k < 1$, decision A produces higher cash flows in period 1 but, from the long-term view, is inferior. Our purpose is to investigate whether conditions exist wherein the manager has incentives to take decision A.

A. The Symmetric Information Case

In order to highlight the effect of asymmetric information on the equilibrium managerial decision, we will first consider the managerial decision under symmetric information, i.e., under the assumption that all the information that is available to the manager is also available to the stockholders (of all the firms). In particular, the stockholders can observe the manager's decision.

If the manager's decision is A, the stockholders will evaluate his performance by the following set of equations:

$$\begin{aligned} y_1^A - k &= n + e_1 \\ y_t^A &= n + e_t, \quad t = 2, 3, \cdots, T - 1. \end{aligned} \tag{10}$$

In other words, the stockholders would deduct from the output the portion which

[7] Unlike in conventional principal-agent models where the manager's effort contributes to the output, here it is the manager's decision that partly determines the output. Apart from the semantics, the major difference between the models is that while effort involves disutility, decision-making has no direct impact on the manager's welfare. As stated by Holmstrom and Costa [7], it is likely that stockholders are more worried about their managers' capacity to make good decisions than their industriousness, and hence models like this are more relevant in dealing with managerial incentive problems than conventional principal-agent models.

was clearly not the result of the manager's ability. Similarly, if the manager's decision is B, his performance will be evaluated by the following equations:

$$y_t^B = n + e_t, \qquad t = 1, 3, \cdots, T-1$$
$$y_2^B - 1 = n + e_2. \tag{11}$$

From (10) and (11), it is obvious that $y_1^A - k = y_1^B$; $y_2^A = y_2^B - 1$; and $y_t^A = y_t^B$, $t = 3, 4, \cdots, T-1$. Thus, the manager's wages would be based on identical histories irrespective of his decision. Hence, the manager will be indifferent between decisions A and B. However, if $k \neq 1$, the stockholders will not be indifferent between A and B. Since they can observe the decision of the manager, they can presumably force him to make the one they prefer (such provisions could be incorporated in the manager's contract without affecting his wage policy since the manager is indifferent between the decisions). If $k > 1$, they will want him to choose A. In other words, they will want him or her to take the decision which results in the highest net present value. This result is consistent with the conventional corporate finance result that net present value is the correct capital budgeting criterion.

It is clear from the above line of reasoning that the absence of managerial incentives for short-term results is independent of the wage policy involved. Therefore, the result is independent of the assumptions based on which our wage policy was derived. Specifically, even if the stockholders were short-term profit oriented (footnote 5) and/or if the manager was risk-averse, the manager would not have any incentives for short-term results. Thus, as stated in the introduction, the key to the manager's bias towards short-term results is private information.

B. Managerial Incentives for Short-term Gains Under Asymmetric Information

Now we consider the situation where only the manager knows the decision that he has taken. Given the competitive labor market equilibrium, the wage policy is chosen by the optimization program in Section I. The total expected wage of the manager will be the sum of his expected mean perceived abilities m_t, $t = 0, 1, \cdots, T-1$ (lemma 1). Since the manager's decision is not observed by the stockholders, their valuation of the manager's ability (i.e., the m_t's) will depend on their estimate of the manager's decision. This is a game-theoretic situation. It is a two-person variable-sum game in which the players move simultaneously, i.e., ignorant of each other's move. The decision variable for the manager is the decision A or B, and the decision variable for the stockholders is the basis on which to assess the manager's performance. The stockholders can base their wage policy on the assumption that the manager's decision is A or B. The equilibrium concept we use is the special case of the Nash equilibrium, the dominant strategy equilibrium. The following definitions introduce the concept.

Let S_m and S_s be the set of strategies for the manager and the stockholders, respectively. $S_m = \{A, B\}$, where the letters inside the braces represent the manager's decision; $S_s = \{A, B\}$, where the letters inside the braces represent the decision, on the basis of which the stockholders will evaluate the manager. Let $W(s_m, s_s)$ denote the manager's total expected wages and $V(s_m, s_s)$ denote the stockholders' total expected profits if the manager's strategy is s_m and the stockholders' strategy is s_s, where $s_m \in S_m$ and $s_s \in S_s$. Then, s_m is a *strictly dominant strategy* for the manager if $W(s_m, s_s) > W(S_m - s_m, s_s)$, for $s_s = A, B$; similarly, s_s is a strictly dominant strategy for the stockholders if $V(s_m, s_s) > V(s_m, S_s - s_s)$, for $s_m = A, B$, where $(S_i - s_i) \cup s_i = S_i$, $i = m, s$. $\{s_m, s_s\}$ is a *strictly dominant strategy equilibrium* if s_m and s_s are the strictly dominant strategies for the manager and the stockholders, respectively. Clearly, the strategies of the participants depend on the value of k. We shall show that, depending on the value of k, either $\{A, A\}$ or $\{B, B\}$ is the dominant strategy equilibrium.

We shall first show that the manager's decision depends only on the value of k and not on the stockholders' basis of valuation, i.e, given k, the manager has a dominant strategy. To do this, let us first assume that the stockholders' strategy is A, i.e., they evaluate the manager on the basis of decision A. If the manager chooses decision A, her mean perceived abilities (by the stockholders) are

$$m_1^A = \frac{h_0 m_0 + (y_1^A - k)r}{h_0 + r} \tag{12}$$

and,

$$m_t^A = \frac{h_0 m_0 + (\sum_{s=1}^{t} y_s^A - k)r}{h_0 + tr}, \qquad t = 2, 3, \cdots, T - 1, \tag{13}$$

where the superscripts indicate the manager's decision. If she chooses decision B, her mean perceived abilities are

$$m_1^B = \frac{h_0 m_0 + (y_1^B - k)r}{h_0 + r} \tag{14}$$

and,

$$m_t^B = \frac{h_0 m_0 + (\sum_{s=1}^{t} y_1^B - k)r}{h_0 + tr}, \qquad t = 2, 3, \cdots, T - 1. \tag{15}$$

Using relationships $y_1^A = y_1^B + k$ and $y_2^A = y_2^B - 1$, we get,

$$m_1^B = m_1^A - \frac{kr}{h_0 + r} \quad \text{and,} \tag{16}$$

$$m_t^B = m_t^A + \frac{(1 - k)r}{h_0 + tr}, \qquad t = 2, 3, \cdots, T - 1. \tag{17}$$

Now, let us assume that the stockholders use strategy B. Using the same notation as before

$$m_1^A = \frac{h_0 m_0 + y_1^A r}{h_0 + r} \tag{18}$$

and,

$$m_t^A = \frac{h_0 m_0 + (\sum_{s=1}^{t} y_s^A - 1)r}{h_0 + tr}, \qquad t = 2, 3, \cdots, T - 1. \tag{19}$$

$$m_1^B = \frac{h_0 m_0 + y_1^B r}{h_0 + r} \tag{20}$$

and,

$$m_t^B = \frac{h_0 m_0 + (\sum_{s=1}^{t} y_s^B - 1)r}{h_0 + tr}, \qquad t = 2, 3, \cdots, T - 1. \tag{21}$$

It is easy to show that Equations (16) and (17) again hold. Therefore, irrespective of the stockholder strategies, the relationship between the manager's perceived abilities under both her decisions is the same. Thus, the manager's decision is independent of the stockholder strategy. The reason that the manager has a dominant strategy is obvious from Equations (16) and (17). These equations hold irrespective of the stockholders' strategies; therefore, the difference between the manager's mean perceived abilities ($m_t^A - m_t^B$), $t = 1, 2, \cdots, T - 1$, and hence the difference between her total expected wages under decisions A and B depend only on k and not on the stockholders' strategy.

This result can be intuitively explained in the following manner. The manager never loses in the first period by choosing A, irrespective of the stockholders' strategy. If the stockholders choose to evaluate him on the basis of B, he gains in the first period by the amount $(kr/(h_0 + r))$, since the extra k dollars are attributed to his ability. If the stockholders evaluate him on the basis of A, he does not actually gain anything, but would have lost the same amount $(kr/(h_0 + r))$ had he chosen B, since the absence of anticipated extra k dollars would have been attributed to his lack of ability. The positive effect of the extra k dollars from decision A lingers on in subsequent periods since the manager's perceived ability is a function of all observed outputs. However, the impact of this positive effect decreases over time as his ability is estimated with better precision. This impact is given by $(k/(h_0 + tr))$ for period t. From period 2 onwards, however, the positive effect of decision A on the manager's mean perceived ability is tempered by the impact of the extra one dollar that decision B produces in period 2. As before, this impact is also independent of the stockholders' strategy. The incremental effect of the extra one dollar from B in any period, $t \geqq 2$, is given by $(1/(h_0 + tr))$. Hence, the net advantage of decision A over B to the manager in any period, t, after the first period is given by $(k - 1)/(h_0 + tr)$ and is independent of the stockholders' strategy. Thus, the difference in his mean perceived abilities in each period from choosing A over B, or vice versa, is independent of the stockholders' strategy and dependent only on k. Since his wage in any period is his mean perceived ability in that period the incremental advantage of decision A over B to the manager is given by (from (16) and (17)),

$$\delta_k \equiv W(A, s_s) - W(B, s_s) = \left[\frac{k}{h_0 + r} - (1 - k) \sum_{t=2}^{T-1} \frac{1}{h_0 + tr}\right] r \tag{22}$$

for $s_s \in \{A, B\}$. For $r \neq 0$, the manager's dominant strategy is A if $\delta_k > 0$ and B if $\delta_k < 0$. If the basis of evaluation of the manager turns out to be correct, i.e., if $s_s = s_m$, the manager's total expected wage will be the same as in the symmetric case. Let W_0 be the manager's total expected wage in the symmetric case. Then,

$$W(A, A) = W(B, B) = W_0. \tag{23}$$

From (22) and (23), $W(A, B) = W_0 + \delta_k$ and $W(B, A) = W_0 - \delta_k$. Moreover, $V(A, A) = k$ and $V(B, B) = 1$, i.e., if the stockholders evaluate the manager on the basis of his actual decision, they stand to gain the extra dollars that result from that decision. Since the manager's gain (loss) is the stockholder's loss (gain), $V(A, B) = k - \delta_k$ and $V(B, A) = (1 + \delta_k)$. It is quite obvious that the stockholders too have a strictly dominant strategy: it is A if $\delta_k > 0$ and B if $\delta_k < 0$. In other words, the stockholders would evaluate the manager on the basis of the manager's dominant strategy. Therefore, if $\delta_k > 0$, the dominant strategy equilibrium is $\{A, A\}$ and if $\delta_k < 0$ it is $\{B, B\}$.

Let k^* be the value of k for which the manager is indifferent between decisions A and B. To find k^*, we set $\delta_k = 0$ and obtain

$$k^* = \frac{(h_0 + r) \sum_{t=2}^{T-1} \dfrac{1}{h_0 + tr}}{1 + (h_0 + r) \sum_{t=2}^{T-1} \dfrac{1}{h_0 + tr}}. \tag{24}$$

For all $k \geq k^*$, the manager's choice would be decision A and for $k < k^*$ it would be decision B.

From (24), it is obvious that $k^* < 1$. This is the central result of the paper.[8] As we shall see below, it is because of this result that we encounter situations wherein the manager has incentives for short-term results at the expense of the long-term interests of the stockholders. The reason that k^* is less than 1 lies in the fact that an extra dollar in the first period is worth more to the manager than an extra dollar in the second period. This is because the manager's wage in any period is based on the total output till that period. Therefore, a project with an extra dollar in the first period results in higher wage in the first period than a project with an extra dollar in the second period; however, in all subsequent periods, the wages under both projects are the same (given the stated cash flows). Since an extra dollar in the first period is worth more to the manager than an extra dollar in the second period, she requires less than a dollar in the first period to compensate for the extra dollar in the second period.

When $k \geq 1$, the manager's decision is not in conflict with the interests of the stockholders because the manager's decision (A) results in the highest net present value. Similarly, for $k < k^*$, the manager's decision (B) does not conflict with the

[8] We had indicated in Section I that the assumption that the manager is risk-neutral is not necessary for this result. If the manager is risk-averse, the optimal wage policy would be a downward rigid policy (see [4]). To find k^*, we need to equate the expected utilities of the manager under both decisions, i.e., when $k = k^*$,

$$E[\textstyle\sum_{t=0}^{T-1} u\{w_t^A(k^*)\}] = E[\textstyle\sum_{t=0}^{T-1} u\{w_t^B(k^*)\}]$$

where the superscripts represent the manager's decision and $u(\cdot)$ is her utility function. Given the rigid wage policy derived in Harris and Holmstrom [4], it can be shown that the k^* obtained from the above equation is strictly less than 1. We would be happy to furnish the detailed proof to anyone who is interested.

stockholder's interests, as in this case decision B maximizes stockholder's wealth. But for $1 > k \geq k^*$, the manager's decision (A) is not in the best interests of the stockholders, who would have liked her to take decision B which maximizes their wealth. In other words, if the relative cash flows resulting from the decisions are such that the new present value of one is very much greater than that of the other, the manager will make the decision which results in the higher net present value, and this, in turn, maximizes the shareholders' wealth. This happens when k is greater than 1 or less than k^*. Thus, under such conditions, asymmetric information does not result in decisions that are detrimental to the shareholders' interests. However, when the differential between the net present values of the two decisions is not very high, the manager has incentives to choose the latter over the former (this is the case when $1 > k \geq k^*$), thus sacrificing the long-term interests of the shareholders for short-term profits. Such incentives would not exist if $k^* = 1$.

Clearly, the allocation resulting out of the equilibrium decision choice when $1 > k \geq k^*$ is not Pareto optimal. To see this, suppose the manager had chosen decision B. The cash flow from this decision is higher than that from decision A by $(1 - k)$ which is positive. This excess could be shared by the manager and the stockholders to make both better off. But the problem lies in making the manager choose decision B. Since the stockholders cannot observe which decision is chosen, they cannot enforce their preference regarding the decision on the manager. The loss of efficiency, i.e., suboptimality, results from the asymmetry of information.

We have shown that there exist situations wherein the manager takes decisions which provide immediate cash flows but are not in the best interests of the stockholders. These situations arise only when the stockholders cannot observe the decisions of the manager. The motivation behind the manager's preference for short-term results is straightforward. It gives her the opportunity to increase her perceived ability earlier in time; also the impact of an extra dollar on her perceived ability is higher during the earlier periods since her ability is known with less precision. Of course, she does not actually gain anything in equilibrium since rational stockholders anticipate her actions. Although the manager does not gain anything in equilibrium, she cannot afford to deviate from the optimal decision, since it would only make her worse off.

III. Effect of Experience, Risk, and Contract Duration on Managerial Incentives for Short-term Gains

We saw in the previous section that for some values of k, the manager makes decisions which are suboptimal. We might characterize the extent or degree of suboptimality by the range of k for which the managerial decision is nonoptimal (or, for which the equlibrium decision of the manager is at odds with the net present value criterion). We have seen that outside the range $[k^*, 1)$, the equilibrium decision is optimal. Hence, the smaller this range, the less are the chances of finding a k that falls in this range. Also, even if k does fall in this range, the loss of efficiency is small. Hence, we might say that the smaller the range of k for which the equilibrium choice is nonoptimal, the smaller the degree of suboptimality. The upper bound of this range is fixed (because the additional cash flow from decision B is a fixed one dollar) while the lower bound k^* is a function of the period zero precision of beliefs of managerial ability h_0, and the precision, r, of the random disturbance, e_t. Differentiating the lower bound k^* partially with respect to h_0 and r, we find that $\partial k^*/\partial h_0 > 0$, $\partial k^*/\partial r < 0$, and $\partial^2 k^*/\partial h_0^2 < 0$ [see Equations (A1) to (A3) in the Appendix].

$\partial k^*/\partial h_0 > 0$ implies that, for all finite values of h_0, the suboptimal range and hence, the degree of suboptimality, decreases with increasing h_0. This means that the higher the precision of the prior distribution of the manager's ability, the lower the degree of suboptimality and the lower the chances that any particular decision taken by the manager will be suboptimal. In our model, we have not specified how the prior distribution is arrived at. The parameters of the prior distribution, i.e., m_0 and h_0, could be functions of the manager's previous education, experience, etc. Consider two managers with the same education and possessing, to an identical degree, all other factors that might contribute to the determination of the parameters of the prior distribution of their ability; however, let one manager have more experience than the other. While both managers might have started out with the same priors, the one with more experience will have a higher h, i.e., her ability will be "known" with better precision. This would happen independent of the realizations of e_t, as the precision of beliefs about the manager's ability increases deterministically over time. Thus, we can say that, everything else remaining the same, a manager with more experience will have less tendency to make decisions that are suboptimal. This does seem to conform to conventional wisdom, but we do not know whether it is an empirical fact. It seems, however, to be an interesting problem to study.

As h_0 decreases, the degree of suboptimality increases, but it converges to a finite value. It is easily verified that as h_0 tends to zero, the lowest value the lower bound can take, irrespective of the value of r, is less than or equal to 1. The lower bound is also a concave function of h_0 for finite values of r and h_0.[9] The concavity of the lower bound in h_0 implies that the marginal "benefit" to the stockholders (in the form of lower degree of suboptimality) is a decreasing function of the manager's experience, everything else remaining constant.

The decrease in the degree of suboptimality with increasing h_0 has an intuitive explanation. As h_0 increases, the manager's ability is "known" with better precision. So, only a small fraction of the "extra dollar" that results in period 1 from choosing decision A is attributed to her ability. If her ability was "known" with less precision, then a larger fraction of the "extra dollar" will be attributed

[9] See Equation (A2) in the Appendix. When r is infinity, i.e., the project cashflows are certain, the ability of the manager and the project chosen by him or her can be verifiably deduced by the stockholders after two periods. Hence, the stockholders could write a wage contract in which they could stipulate that the manager take the decision preferrable to them, as they can verify whether he or she has done so after two periods. The manager has no incentive to cheat under these circumstances, and hence the degree of suboptimality is zero. When h_0 is infinity, the manager's ability is known with certainty. Then the stockholders will pay his or her marginal productivity, i.e., a fixed wage, which is the optimal wage policy. The manager is then indifferent between the decisions A and B and might as well take the decision the stockholder's prefer. So the degree of suboptimality is zero when the manager's ability is known with certainty.

to her ability. The only advantage of choosing decision A is that the manager's perceived ability (and hence, her wage) will be higher. That advantage is reduced as her ability is "known" with better precision. Hence, as she gets more experienced and her ability is "known" with better precision, the chances of making a suboptimal decision are reduced.

We now turn to the effects of r on the degree of suboptimality. As we have assumed that $1/r$ is the variance of all projects undertaken by the firm, we may take r as a measure of the riskiness of the firm (high r implies low risk). Since we are assuming a normal distribution for e_t, variance is a measure of risk. From (A3) in the Appendix, we see that the lower bound is a decreasing function of r, implying that the degree of suboptimality increases as the risk of the firm decreases. That is, managers of a less risky firm are more likely to make decisions which are suboptimal. The explanation for this lies in the fact that as r increases (i.e., the variation in output due to the random factor decreases), the variation in output is attributed more and more to the variation in ability. This increases the manager's incentive to make decisions which yield quicker returns even though this might result in a loss to the firm.[10]

The third variable that affects the degree of suboptimality is the length of the contract, T. k^* may be written as a function of T as

$$k^* = \frac{J(T)}{1 + J(T)},$$

where,

$$J(T) = (h_0 + r) \textstyle\sum_{t=2}^{T-1} \dfrac{1}{h_0 + tr}.$$

$J(T)$ is an increasing concave function of T. Therefore, k^* is an increasing concave function of T. It can be shown that $J(T)$ tends to infinity as T tends to infinity; therefore, $k^* \to 1$ as $T \to \infty$. For finite T, $k^* < 1$. This implies that for all finite period contracts there exists some degree of suboptimality. As the duration of the contract increases, the degree of suboptimality decreases and reduces to zero only for infinitely long contracts.[11] The intuition behind this result is straightforward. From Equation (22) and the definition of $J(T)$, we can see that the tradeoff for the manager while making his decision is an extra k dollars in period 1 if he chooses A against extra future amounts with present value $(1 - k)J(T)$ if he chooses B. The longer the horizon, the more valuable the extra future amounts. To compensate for this, he needs a higher extra amount k in period 1 from decision A. The result that long-term contracts reduce incentives for short-term suboptimal decisions seems to stand up to causal empiricism.

Incidentally, our model provides a possible explanation to a well-known empirical result in labor economics. Several authors (see, e.g., Medoff and Abraham [9]) have found that more experienced workers earn more on average even though their performance is not as highly rated as less experienced workers in the same

[10] I am grateful to Milton Harris for suggesting this explanation.

[11] This is similar to Fama's [3] result that full ex-post settling up takes place only with infinite planning horizon.

job category. Similarly, Pascal and Rapping [11] found that, for a given level of productivity, the earnings of major league baseball players increased with their experience. Harris and Holmstrom [4], using a model similar to ours, have explained this phenomenon. Their explanation is that, for one thing, the more experienced workers have had more chances for their wages to be bid up (because of the downward rigid wage policy resulting from the risk aversion of the manager). Second, the more experienced workers pay lower insurance premiums because their ability can be more precisely assessed, and they have fewer periods to remain in the market. In the context of our model, we provide a slightly different explanation. We have shown that the degree of suboptimality decreases with h_0. Since h_0 increases deterministically with age (or experience), we can say that the degree of suboptimality decreases with age or experience. This means that the chances of a manager making a suboptimal decision go down as his experience increases. Moreover, even if he makes a suboptimal decision, the loss incurred will be lower if he is more experienced. Note that these results hold good for all values of m, i.e., for all values of the perceived mean ability, or productivity, of the manager.[12] The stockholders might be willing to pay some premium for experience, as it reduces the probability of ending up with suboptimal projects which lower the value of the firm. (In our model, we have no provisions for such side or extra payments and therefore we have not explicitly modelled this.) Therefore, given the same level of productivity, the more experienced manager gets paid more on average. Our explanation does not depend (unlike that of Harris and Holmstrom) on either the fact that the more experienced manager has had more chances to have his wage bid up or the fact that he pays lower insurance premium. In fact, in our model, since he is risk-neutral, the manager pays no insurance premium and is willing to let his wage fluctuate randomly. Moreover, our explanation does not depend on the fact that the more experienced manager has fewer periods to remain in the market. The only fact that matters is that the more precisely his ability is assessed, the less incentive he has to choose suboptimal projects; and with experience, his ability can be assessed more precisely.

IV. Conclusions

We showed that when the manager has private information regarding the firm's decisions, she may have incentives to take decisions that result in short-term

[12] Consider two managers facing the same pair of decisions (i.e., k is the same). The managers are identical except that manager 1 has lower h because of less experience, and consequently lower k^*. Let k_i^* be the k^* of manager i. Further suppose that $k_1^* < k < k_2^*$ (this implies $k < 1$). Then, managers 1 and 2 will choose decisions A and B, respectively, and will be evaluated accordingly by the stockholders. The total expected wage of both managers will be W_0, the wage in the symmetric case [Equation (23)]. The total expected profits of the stockholders will be $V(A, A)$ if manager 1 is hired, and $V(B, B)$ if manager 2 is hired. But $V(A, A) = k$ and $V(B, B) = 1$. The stockholders gain $(1 - k)$ if manager 2 is hired. If k is either less than k_1^* or greater than k_2^*, both managers will choose the same project, and the stockholders will be indifferent between them. Thus, if the distribution of k is the same across both managers, the stockholders benefit by hiring manager 2, the more experienced one.

gains at the expense of the stockholders' welfare. These incentives exist even when she is offered long-term contracts. A recent article in *Fortune* magazine [8] essentially makes the same statement. It has been found that compensation based on long-term performance, while reducing the short-term incentives of managers, has not totally eliminated them. Typically, these long-term compensation schemes are based on three- to five-year moving averages of some performance measure, like earnings. The optimal wage in our model is also based on a similar measure: the "average" of *all* previous outputs. In fact, since we consider all previous performances our wage policy is a much better indicator of long-term performance than the three- to five-year averages used in practice. But even with such a compensation scheme, we have seen that we cannot totally eliminate short-term managerial incentives. Hence, it is not surprising that the long-term incentive plans used in the industry did not turn out to be the successes they were expected to be.

We also showed that the incentive for short-term results is inversely related to the manager's experience, length of his contract, and the risk of the firm's operations. These results suggest several methods by which firms can align managerial decisions to the long-term interests of stockholders. They can choose managers with experience to make major decisions. Also, experience is more important when cash flows are less risky. Another way to increase managerial loyalty to shareholder interests is to give him long-term contracts. This technique is used in Japanese firms with apparently successful results. In addition, the manager's task assignments should not be changed too frequently. If this happens, the manager's planning horizon, T, for any project becomes short and, as we have shown, the propensity for quick results increases. This is because the manager's subsequent reputation would usually depend only on his or her performance in his or her new assignment, and hence, he or she will be indifferent to the fate of his or her old assignment.

Appendix

Comparative Statics on k^*

Let $H(h_0, r) = (h_0 + r) \sum_{t=2}^{T-1} (1/h_0 + tr)$. Then Equation (24) can be written as $k^* = H/(1 + H)$. Therefore,

$$\partial k^*/\partial h_0 = H_1/(1 + H)^2, \tag{A1}$$

$$\partial^2 k^*/\partial h_0^2 = [H_{11}(1 + H) - 2H_1^2]/(1 + H)^3, \tag{A2}$$

and

$$\partial k^*/\partial r = H_2/(1 + H)^2, \tag{A3}$$

where,

$$H_1 \equiv \partial H/\partial h_0 = \textstyle\sum_{t=2}^{T-1} (t - 1)r/(h_0 + tr)^2 > 0,$$

$$H_2 \equiv \partial H/\partial r = \textstyle\sum_{t=2}^{T-1} (1 - t)h_0/(h_0 + tr)^2 < 0,$$

and

$$H_{11} \equiv \partial^2 H/\partial h_0^2 = -2 \sum_{t=2}^{T-1} (t-1)r/(h_0 + tr)^3 < 0.$$

Therefore, $\partial k^*/\partial h_0 > 0$, $\partial^2 k^*/\partial h_0^2 < 0$ and $\partial k^*/\partial r < 0$.

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