MYOPIC CORPORATE BEHAVIOUR WITH OPTIMAL MANAGEMENT INCENTIVES*

GERALD T. GARVEY,† SIMON GRANT‡ AND STEPHEN P. KING§

Existing models in which stock markets lead to corporate 'short-termism' rely on an exogenously imposed objective for top managers. This paper endogenizes both managers' concern for short-term stock prices and the resulting distortions. We show that when the manager can trade on her own account on the stock market in a way that is observable to market participants but which is not verifiable in court, shareholders will choose an incentive contract which induces a bias towards short-term returns. Consistent with recent evidence, the short-term bias is greater when the optimal contract provides low-powered management incentives.

1. INTRODUCTION

RECENT DEVELOPMENTS in the economics of information provide a theoretical basis for the popular notion that the 'short-term' price movements associated with active stock markets can misguide corporate decisions. The possibility that managers who seek to increase their firms' short-term stock price can reduce overall shareholder wealth has been demonstrated in numerous models. However, models of corporate myopia invariably impose an objective function for managers which gives weight to short-term stock prices as well as the company's long-term fundamental value. As pointed out by Dybvig and Zender [1991] and John and John [1993] in related contexts, the weights must be exogenously imposed because shareholders would generally prefer weights that mitigate or eliminate any myopic behaviour. Simply put, if short-term stock prices are a misleading guide to corporate decisions, then rational shareholders

* We would like to thank two anonymous referees, the editor Morten Hviid, Jerry Feltham, Mike Fishman, Rohan Pitchford and participants at the ANU theory and UBC Accounting workshops for their useful comments. The usual disclaimer naturally applies.
† Authors' affiliations: Finance Division, Faculty of Commerce and Business Administration, University of British Columbia, Vancouver, BC, Canada V6T 1Z2.
email: gerald.garvey@commerce.ubc.ca
‡ Department of Economics, Faculty of Economics and Commerce, The Australian National University, Australia.
§ Department of Economics, The University of Melbourne, Australia.
2 Bebchuk and Stole [1993] make this assumption particularly explicit. Thakor [1990] and others make a similar assumption in positing that managers care only about the wealth of existing as opposed to prospective shareholders.

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want their managers to ignore such prices (see also Paul [1992]). And in fact, the average US CEO’s pay is not overly sensitive to stock price movements (Jensen and Murphy, [1990]) and shareholders have only limited ability to punish managers for poor share-price performance through takeovers, proxy fights, or dismissals by the board (Warner, Watts and Wruck, [1988]; Grundfest, [1990]). On the other hand, it is not true that managers are able to ignore their employers’ stock price (Haubrich, [1994]) and more importantly the linkage between managers and shareholders’ wealth varies across firms.

Clearly, the cause and effects of managers’ concern with short-term stock prices should be examined in a framework which endogenizes the use of such prices. Holmström and Tirole [1993] present one such model, in which a manager’s allocation of effort is followed by a round of trade in the firm’s shares. After this trade, the firm’s liquidating cash-flows are revealed. They show that the price generated by trade satisfies the Holmström [1979] informativeness criterion in that it tells shareholders something about the manager’s action that they could not extract from final cash-flow realizations.

We provide an alternative formulation which allows for the stock price to be truly ‘short-term’ in two important respects. Firstly, the price is established before the manager makes her effort choice. Secondly, the shareholders who set the manager’s compensation are solely concerned with long-term cash-flows. In section II, we show in a standard principal-agent setting that shareholders will only use the short-term stock price to insulate the manager from risk due to movements in this market. Essentially, she receives stock appreciation rights which pay her according to the firm’s excess returns accrued between the period the short-term and long-term stock prices are revealed. The manager is insulated from short-term market movements for the fundamental reason that such movements are unrelated to her actual effort choice.

However, the compensation scheme sketched above gives the manager a powerful incentive to trade in the short-term share market in order to reduce the risk she bears. This is true even when market participants correctly price-in the effect of the manager’s trades on her subsequent actions. While this basic result also appears in Admati, Pfleiderer and Zechner [1994], Bizer and DeMarzo [1992] and Garvey [1993; 1997], these papers overlook the fact that the short-term stock price now carries information about the manager’s trading behaviour. In Section III(i) we show that when the manager’s trades are not verifiable, shareholders will

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3 Some preliminary evidence of such variation is provided by Bizjak, Brickley, and Coles [1993] who find that managers of firms with a greater portion of intangible assets and more R&D expenditures receive more of their pay in the form of share ownership and out-of-the-money stock options than in the form of bonus payments linked to short-term share prices.

choose a compensation scheme which places *greater* weight on the short-term stock price than on the longer-term performance of the firm. Such compensation induces exactly the objective function that is exogenously imposed in the existing literature. Furthermore, effort incentives are substantially diluted because a large amount of stock appreciation rights gives the manager a greater incentive to trade, which must be countered by the costly measure of linking her pay still more tightly to the short-term stock price. The results also show how managers' stock-based incentives should be related to the liquidity of the market for the firm's shares. Consistent with recent evidence presented in Milbourn [1997] and Garvey, McCorry and Swan [1998], we predict that managers' long-term incentives should be stronger, and her short-term incentives relatively weaker, when it is more costly to trade the firm's stock.

In Section IV we analyze a special case which highlights the large quantitative effect of the trading problem on the manager's effort incentives. We are also able to characterize explicitly the manager's equilibrium short-term bias in the well-known model of Stein [1989]. Our results provide an explanation for the recent empirical finding that long-term investments such as R&D and capital expenditures as a fraction of total assets tend to be lower in firms where managers are sheltered from shareholder demands in the form of takeovers or proxy fights (Mahoney et al. [1997] and Muelbroek et al. [1990]). In our model, the manager's short-term bias is endogenous and is greater in exactly those circumstances where the overall linkage between managers' and shareholders' wealth is optimally weak. A more appropriate test of short-termist incentives would allow both incentives and managerial investment behaviour to be determined by the exogenous variables that we highlight.

Section V concludes and a generalization of our key result is provided in the appendix.

II. THE CHOICE OF CONTRACTS WHEN THE MANAGER CANNOT TRADE

We adopt the following standard principal-agent assumptions. A risk-averse manager is hired by risk-neutral shareholders to take an action on their behalf. Competition between prospective managers ensures that the manager selected receives her reservation certainty equivalent income, denoted $\bar{Y}$. The manager's action is denoted by $a$ and is an element of the set $IR_+$. The certainty equivalent income cost of any action $a$ to the manager is given by $c(a)$. We assume that $c'$ and $c''$ are both strictly positive and normalize $c(0) = 0$ and $c'(0) = 0$.

While we depart from the existing literature on corporate myopia by endogenizing the relative weight given to long and short-term stock prices, in the main body of the paper we focus on the popular linear-exponential case (see Holmström and Milgrom [1987] and Paul
In an appendix which is available on this Journal’s web-site http://haas.berkeley.edu/~jindec, we generalize our key results about short-termism to allow for more general managerial utility functions and incentive contracts. As usual with principal-agent problems, we are only able to establish general results about the relative weighting of the short-term and long-term stock price and are unable to provide a robust characterization of the optimal functional form for the manager’s pay. A useful extension would be to examine the optimality of simpler non-linear contracts such as stock options, since in this case the manager’s exposure to short-term stock price movements could be controlled by indexing the exercise price to market movements. For now, the manager’s utility is assumed to be exponential (that is, exhibits constant absolute risk aversion) in income with \( u(Y) = -\exp(-\theta Y) \). Shareholders choose the extent to which her compensation, denoted \( m(\cdot) \), is based on short-term versus long-term stock prices. For now we will restrict our attention to linear contracts.

The firm’s long-run revenue including payments to the manager is denoted \( V_L \) and will always be assumed observable and verifiable. Revenues are an additive function of the manager’s action and the realization of two independent random shocks, denoted \( s \) and \( z \), where \( s \sim N(0, \sigma_s^2) \) and \( z \sim N(0, \sigma_z^2) \). Although \( s \) will always be assumed to be observable to all market participants, its realization is not directly verifiable. Rather, we assume that there is an active market for claims on the firm’s profit stream which is open after \( s \) is realized and before the manager’s action is chosen. This stock market will produce a ‘short-term stock price’ \( p_s = V_s - E(m/s) \) which is verifiable (and so therefore is \( V_s \)).

Since the price is revealed before the manager chooses her action, it cannot contain any useful information about her action in the standard principal-agent sense. Rather it must be based on the market’s expectation of the manager’s action, which we denote by \( a^e \). The shock \( z \) is realized after the manager has chosen her action. Our notation is as follows:

\[
\begin{align*}
V_s &= a^e + s \\
V_L &= a + s + z \\
m(V_L - V_s, V_s) &= \alpha(V_L - V_s) + \beta V_s + \gamma \\
&= \alpha(a - a^e + z) + \beta(a^e + s) + \gamma \\
p_s &= E_{a^e,s}[V_L] - E_{a^e,s}[m(V_L - V_s, V_s)] \\
&= (1 - \beta)(a^e + s) - \gamma
\end{align*}
\]

\(^4\)To simplify matters, we assume that \( s \) is freely observable to the market. Similar results would be obtained if \( p_s \) were observed only by a set of informed traders as in Grossman and Stiglitz [1980] or Kyle [1985].
\[ p_L = V_L - m(V_L - V_s, V_s) \]
\[ = (1 - \alpha)(a - \alpha' + z) + (1 - \beta)(a' + s) - \gamma \]

Notice that \( E_{s(\alpha')}[p_s] = p_s \). Subtracting (4) from (5) we obtain
\[ p_L - p_s = (1 - \alpha)(a - \alpha' + z) \]

From (6), (4) and (3) it is straightforward to see that the linear contract \( m(V_L - V_s, V_s) \) can be expressed as the following linear function of the short-term stock price, \( p_s \), and the long-term stock price appreciation, \( p_L - p_s \):
\[ m(V_L - V_s, V_s) \equiv \left( \frac{\alpha}{1 - \alpha} \right)(p_L - p_s) + \left( \frac{\beta}{1 - \beta} \right)p_s + \frac{\gamma}{1 - \beta} \]

For convenience we shall use (3) rather than (7) in the algebraic derivations that follow. It is obviously a straightforward operation to convert from a revenue based remuneration scheme to the share-price based equivalent. As we can see from (7), the manager effectively places a weight of \( \alpha/(1 - \alpha) \) on long-term fundamentals and a weight of \( (\beta - \alpha)/[(1 - \alpha)(1 - \beta)] \) on the short-term stock price. Translated into investment incentives, the manager would select a project which returns one dollar in the short-run over one which produces \( 1 + x \) dollars in the long-run provided that \( (1 + x) < (\beta - \alpha)/(\alpha(1 - \beta)) \). Since the market discount rate is zero, the manager exhibits a short-term bias whenever she would turn down a long-term project with \( x > 0 \). We therefore characterize the manager’s short-term bias under linear contracts as follows:

**Definition 1** The manager’s contract induces a short-term bias if \( \beta > \alpha \), no bias if \( \beta = \alpha \), and a long-term bias if \( \beta < \alpha \).

In Section IV(ii) we illustrate the consequences of such a bias by allowing the manager to shift cash-flows between periods as in Stein [1989]. Since our focus is on the existence of myopia when managers’ incentives are endogenous, we now turn to the determination of her compensation contract. In the simplest case where managers are unable to trade on the stock market, the problem for risk neutral shareholders is to write a contract that solves the familiar program:
\[ \max_{(\alpha, \beta, \gamma, \alpha')} E[V_L - m(V_L - V_s, V_s)] = (1 - \beta)E_s[\alpha'] - \gamma \]

\[ ^5 \text{We have already subsumed in the program the 'rational expectations of the market' constraint, i.e. } \alpha'(s) = \alpha(s) \text{ for all } s. \]
subject to:

- (Ex ante) Participation constraint

\[ \beta E_0[a'] + \gamma - \frac{\theta}{2} \beta^2 (\text{VAR}[a'] + \text{COV}[a', s] + \sigma_s^2) - \frac{\theta}{2} \alpha^2 \sigma_s^2 - E_0[c(a')] \geq \hat{Y} \]

- (Ex interim) Incentive constraint

\[ a'(s) \in \arg \max_a \alpha(a - a'(s)) + \beta(a'(s) + s) + \gamma - \alpha^2 \sigma_s^2 \theta/2 - c(a) \text{ for all } s \]

The participation constraint (8) simply states that the ex ante certainty equivalent of the contract is at least as much as \( \hat{Y} \), the manager’s ex ante reservation certainty equivalent income. The (ex interim) incentive constraint (9) states that, given the realization of \( s \) and the determination of the short term stock price (which itself is conditioned on the market’s belief that the manager will choose \( a'(s) \)), choosing action \( a'(s) \) is indeed an optimal choice for the manager.

We can simplify the analysis considerably by exploiting the fact that the marginal product of the manager’s effort is independent of the short-term stock price. This allows us to characterize the market’s rational expectation of the manager’s effort choice by:

**Result 1** \( a'(s) = a^* \) for all \( s \).

**Proof.** Fix \( \alpha, \beta \) and \( \gamma \). The first order condition for (9) is

\[ \alpha - c'(a(s)) = 0 \]

which has a unique solution given assumptions \( c', c'' > 0 \). □

Result 1 simply shows that the manager’s effort choice is not contingent on the signal \( s \) (or equivalently, the short-term stock price \( p_s \)) since it contains no information about the manager’s effort choice or the relevant parameters of the shareholder’s problem. We can now establish the key features of the shareholder’s preferred contract for the case where the manager cannot trade on the short-term share market.

**Result 2** The cost-minimizing contract that implements any arbitrary action \( a = \hat{a} \) involves setting \( \beta = 0 \).

**Proof.** Assume \( (\hat{a}, \hat{\beta}, \hat{\gamma}, \hat{a}) \) is an expected cost minimizing contract that satisfies (8) and (9) with \( \hat{\beta} > 0 \). If we now reduce \( \hat{\beta} \), by (10) \( \hat{a} \) is still implemented by the contract. We can express (8) as

\[ E[\hat{m}(V_L - V_s, V_0)] - \frac{\theta}{2} \hat{\beta}^2 \sigma_s^2 - \frac{\theta}{2} \hat{\sigma}^2 \sigma_s^2 - c(\hat{a}) \geq \hat{Y} \]

where \( E[\hat{m}(\cdot, \cdot)] = \hat{\beta} \hat{a} + \hat{\gamma} \). Notice that as \( \hat{\beta} \) is reduced, \( \frac{\theta}{2} \hat{\beta}^2 \) falls which

means that we are free to adjust \( \hat{\gamma} \) in such a way that \( E[\hat{m}(V_L - V_s, V_s)] \) falls with (8) still holding.

Hence \( E[V] - E[\hat{m}(V_L - V_s, V_s)] \) rises which means that \( (\hat{\alpha}, \hat{\beta}, \hat{\gamma}, \hat{\alpha}) \) could not have been an expected profit maximizing contract for the shareholders.

Result 2 reflects the fact that the short-term stock price is simply noise from the perspective of evaluating the manager's performance. By setting \( \beta \) to zero, shareholders insulate the manager from such noise and she is paid only according to the degree to which the long-term stock price exceeds the short-term price. We now show that this result depends critically on the assumption that the manager is somehow directly prevented from trading on the short-term share market.

III. THE CHOICE OF INCENTIVES WHEN THE MANAGER CAN TRADE ON THE SHORT-TERM MARKET

III(i). How the Possibility of Trade Leads to Short-Term Incentives

In our model, as in most principal-agent settings, the manager bears risk so long as she has any incentive component to her contract. We now introduce the possibility that she can trade with parties who have a comparative advantage in bearing the risk. The key assumption is that securities markets are sufficiently rich and liquid that the manager's participation in such markets cannot be perfectly controlled by firm shareholders. The literature on illegal insider trading (see, for example, Muelbroek [1992]) provides evidence in favor of this assumption, in that managers' trades in their own firms' securities were only prosecuted when there was testimony from parties who knew the managers personally. Even if managers were prevented from trading on the primary stock market, Bolster, Chance and Rich [1996] document that some executives have effectively sold their claim on the firm's residual cash-flows by using a derivative instrument known as an 'equity swap'. In an equity swap, a corporate manager pays his share in the return on his employer's stock to an investment or commercial bank, and the bank pays the manager the return from an investment such as a fixed-income or market-indexed security. While the SEC moved to mandate disclosure of such transactions in September 1994, Bolster, Chance and Rich [1996] point out that shareholders and analysts rarely have the resources to extract the relevant information from what is disclosed. In particular, management equity swap transactions need only be reported as a code on SEC Form 4, a document which is not fully covered by the electronic document delivery systems used by analysts who track insider trading activity. The above represent only the documented means by which managers can unilaterally change their exposure to their firm's fortunes.
In principle, managers could also evade direct restrictions on trade by means such as trading by other family members or trusts, or by using securities other than equity swaps to hedge the risk and incentives embodied in the compensation contract.

In our model, the manager's trades will affect her subsequent effort choice and therefore the firm's terminal cash-flows. Rational market participants will attempt to gain information about managerial trading, and there is reason to believe that they are successful in doing so. Muelbroek [1992] documents that the stock market responds to insider trades which are not formally disclosed, and the bank that takes the other side of an equity swap certainly knows they are trading with the manager. In this paper we focus on the extreme case where market participants are able to observe the manager's trades exactly. That is the manager's trades are observable but not verifiable. Equilibrium short term stock prices will be set 'rationally' in that both the market professionals and the manager recognize the informational limitations of the share market and the short term price will reflect the incentives facing the manager given her contract and the market's ability to make inferences about managerial trading.

If the manager does not engage in any trading then her long-term exposure to risk and to the value consequences of her effort choice, is given by $x$. It is convenient to measure her trading activity by its effect on this exposure. Specifically, we denote the extent to which the manager sells her contract by $\lambda$, where $\lambda = x$ corresponds to the manager selling out completely, $\lambda = 0$ corresponds to no trade and $\lambda < 0$ corresponds to the manager buying additional shares. The market price adjusts to reflect the true level of managerial trading.\(^6\)

The manager will then determine her optimal trade given her contract, recognizing that as she chooses a higher $\lambda$ the short-term stock price will fall as the market perceives her reduced effort incentives. Given any contract, the manager will trade according to:

$$\max_\lambda (\alpha - \lambda)(\alpha^*(\lambda) - \alpha^*(s, \lambda)) + \beta(\alpha^*(s, \lambda) + s) + \gamma - (\alpha - \lambda)^2 \sigma_z^2 \theta / 2 - c(\alpha^*(\lambda))$$

(11)

where $\alpha^*(\lambda)$ is the solution to the managers optimal effort choice problem given that she has sold $\lambda$ of her contract:

$$\alpha^*(\lambda) = \arg\max_a (\alpha - \lambda)[a - \alpha^*(a, \lambda)] + \beta(\alpha^*(a, \lambda) + s) + \gamma - (\alpha - \lambda)^2 \sigma_z^2 \theta / 2 - c(a)$$

(12)

\(^6\)We assume that the market always predicts managerial effort choice rationally in that the manager is expected to choose effort to maximize her utility.

By rational expectations $a^* = a^*$ so that from (12) the manager will choose effort so that $c'(a^*) = \alpha - \lambda$. We denote the manager's optimal trade by $\lambda^*$. 

To streamline the analysis, we now show that shareholders can effectively restrict attention to contracts where the manager subsequently chooses not to trade. In the absence of trading costs, any contract that induces managerial trade can be replaced by a contract that has equivalent action incentives but involves no trade. Such a contract simply adjusts the value of $\alpha$ to mimic the contract with trade, and is a special case of the revelation principle (see for example Myerson [1991]).

**Result 3** There is no loss of generality in restricting the set of managerial contracts to those where $\lambda^* = 0$ in equilibrium.

**Proof.** Consider any contract $\alpha^0(\nu_L - \nu_S) + \beta^0\nu_S + \gamma^0$, that induces trading $\lambda^*$ and action $a^0$ in equilibrium, where $c'(a^0) = \alpha^0 - \lambda^0$. From (11), $\lambda^0$ must solve

$$
(\beta - c') \frac{\partial a^0}{\partial \lambda} + (\alpha - \lambda^0)\sigma^2 \theta = 0
$$

Note that as $c'(a^0) = \alpha^0 - \lambda^0$, $(\partial a^0)/(\partial \lambda) = -1/c''$ which only depends upon $\lambda$ indirectly through $a$. The shareholders' net expected return from this contract is given by $c'(x^0 - \lambda^0) - \gamma^0 a^0 - \gamma^0$. 

Now consider a new contract $\tilde{\alpha}(\nu_L - \nu_S) + \beta^0\nu_S + \gamma^0$ where $\tilde{\alpha} = \alpha^0 - \lambda^0$. If the manager chooses not to trade in equilibrium given this contract then the action chosen by the manager will remain $a^0$. In this case, both $c'$ and $(\partial a^0)/(\partial \lambda)$ are unchanged and $\lambda = 0$ is a solution to (13). But this means that $\lambda = 0$ is a solution for (11), so that the new contract does in fact implement $a^0$ with no trade. Furthermore, the net expected return to the shareholders from implementing $a^0$ under the new contract is identical to their return under the original contract. Consequently, for any contract that involves managerial trade in equilibrium, there exists an alternative contract that implements the same equilibrium action by the manager with no trade and no change in cost to the shareholders. 

The ability of the manager to trade simply adds an additional constraint to the shareholders problem, which requires that the equilibrium level of managerial trade, $\lambda^*$ must equal zero.

- **Additional no trade constraint**

$$
\lambda^* = 0
$$

We now present the main result of the paper. To facilitate the comparison with the previous section, we identify contract choices in the
absence of trading opportunities with the subscript $N$ and choices in the presence of such opportunities with the subscript $T$.

**Result 4** The solution to the shareholders' program that satisfies the no-trade constraint, as well as the usual participation and incentive constraints, must set $\beta_T > \alpha_T > 0$ so the manager exhibits a short-term bias.

**Proof.** It follows directly from (12) that the manager will choose effort so that $c'(a) = \alpha_T - \lambda$. Thus, $a^*(\lambda)$ is strictly decreasing in $\lambda$ for $\lambda < \alpha - c'(0)$ and $a^*(\lambda) = 0$ for $\lambda \geq \alpha - c'(0)$. In fact $\partial a^*/\partial \lambda = -1/c''(a^*(\lambda))$ for $\lambda$ in $(0, \alpha - c'(0))$. Noting that $a = a^*$ for all $\lambda$, from (11) the manager will set $\lambda^*$ to solve:

\[(\beta_T - c')\frac{\partial a^*}{\partial \lambda} + (\alpha_T - \lambda^*)\sigma_T^2 \theta = 0\]

For $\lambda^* = 0$ to hold therefore requires

\[-\frac{\beta_T}{c''(a_T)} + \frac{\alpha_T}{c''(a_T)} \left(\frac{1}{c''(a_T)} + \sigma_T^2 \theta\right) = 0\]

\[
\frac{\beta_T}{\alpha_T} = 1 + \sigma_T^2 \theta c''(a_T)
\]

and $\alpha_T = c'(a_T)$

As $c'$, $c''$ and $\theta$ are all positive, the result follows.

Equation (15) reflects the incentives to trade that face the manager. If the manager does not trade and chooses action $\hat{a}$ then she faces both the individual cost of that action, given by $c(\hat{a})$, and the uncertainty associated with the random variable $z$. If $\beta$ were 0 then the manager's stock appreciation right $\alpha_T$ would encourage her to trade. To see why, notice that since the share market is rational and can observe the manager's trading behaviour, the expected difference between the short and long term share price is zero. Hence by trading out of her contract the manager can secure the payment of $\gamma$ for certain with a zero effort choice (that is rationally anticipated by the market in its setting of the short term share price). The only verifiable change induced by the manager's trade is that the short-term stock price will be lower. As a consequence, the shareholders can induce the manager not to trade and choose $\hat{a}$ by rewarding her for a higher short-term stock price. As reflected by (15), the reward must be sufficient to compensate the manager for the costs of not trading and choosing action $\hat{a}$.

The above argument explains why $\beta_T$ must be positive, but not why it must actually exceed $\alpha_T$ and induce a short-term bias. Admati, Pfleiderer and Zechner [1994] and Garvey [1993] implicitly restrict the manager's
contract to have neither a short nor a long-term bias (so that $x = \beta$) and show that the manager will always trade out of such a 'balanced' contract. To motivate the manager and prevent her from trading, the contract must go beyond balance to implement a strict short-term bias.

A key assumption in the above analysis is that trade can occur at low cost. If there are significant transactions costs associated with trade then the severity of the trading problem will be reduced. For example, suppose that trade involves a proportional transactions cost, $t$, so that the manager's certainty equivalent income is reduced by $t \lambda$. For low values of $t$, it is easy to show that the optimal value of $x$ is increasing in $t$ while the optimal value of $\beta$ is decreasing in $t$. In other words, an increase in transactions cost will tend to reduce the need to rely on the short-term stock price to prevent trade. If the transaction cost is sufficiently large then the trading problem, and the rationale for linking the manager's pay to the short-term stock price, disappears.

III(ii). **Assessment of the Result**

The analysis is thus far cast in terms of the standard principal-agent framework, where the manager directly affects expected firm value through a single effort choice. In the next section, we consider the case where the manager can also choose from a menu of mutually exclusive projects which differ as to the timing of their returns. We show that the manager's compensation scheme biases her against high-valued projects which pay off only in the longer-term. The case where the manager exerts effort on multiple projects is more complex. In this case, the share price would be a weighted average of the projects' returns, and as shown by Paul [1992] the weights generated in an efficient stock market are generally inappropriate for incentive compensation purposes. In an efficient stock market the returns that are most informative about future profits have the largest effect on the stock price. Paul [1992] shows that these are generally the returns that are the least informative about the manager's value-added, as desired for incentive compensation. Thus, with multiple projects, share prices aggregate information with weights that are almost the opposite of the weightings of signals in an optimal incentive contract. To overcome this problem it may be desirable to use direct, accounting measures of the returns to the individual projects. This will in turn affect the manager's effective time-horizon, and will exacerbate the short-termism problem to the extent that accounting numbers underweight longer-term returns as argued by, for example, Bizjak et al. [1993].

Clearly, managing a 'portfolio' of projects involves more complicated incentive contracts and may generate additional distortions. Our point remains that the incentive contract that is chosen is itself an asset that has a market value and trading out of it will dilute the incentive effects. If
the market is liquid, the manager still needs to be rewarded for the
performance of the short-term share price in order to dissuade her from
trading out of her contract.

There is some evidence that trading of stocks is associated with the use
of the price in compensating managers. Several recent empirical studies
have documented a strong link between managers' incentives and the
liquidity of the market for the firm's shares. The most obvious example is
the management buy-out phenomenon of the 1980's, in which firms' shares
were taken off the public markets entirely. As Jensen and Murphy [1990]
point out, the managers of such firms also received incentives that were at
least an order of magnitude stronger than those they had when the firm
was publicly traded. While there are many alternative explanations for
why private firms provide stronger incentives to their managers, the
observation is certainly consistent with our model since trading costs are
of course radically increased by making the firm private. More systematic
evidence of a link between market liquidity and executive incentives is
provided by Milbourn [1997] and Garvey, McCorry and Swan [1998], who
document that the overall linkage between managers' pay and the stock
price is greater for firms in which the cost of transacting is greater,
controlling for firm size, riskiness and industry effects. Unfortunately,
these studies are not able to reliably distinguish between long-term and
short-term incentives. Some additional suggestive evidence is provided by
Garvey et al. [1998] who separately examine CEO incentives due to salary
and bonus changes, option value changes, and changes in the value of the
executive's stockholdings. Salary and bonus incentives are computed as a
linear regression of an executive's pay on that year's stock price
performance, and are thus relatively short-term in nature. Our theory
suggests that such incentives should become less important relative to the
others (i.e., \( \alpha \) should fall relative to \( \beta \)) when trading costs increase. Garvey
et al.'s [1998] evidence on the three separate components of CEO
incentives is broadly consistent with our model in that option and stock
ownership incentives are strongly positively related to trading costs while
there is essentially no effect with salary and bonus incentives. In addition,
there is some evidence that salary and bonus incentives become more
important when the firm's shares are more thickly traded, as measured by
annual dollar turnover divided by the market value of equity. This is
consistent with the model in that firms in more liquid markets need to use

\[ \text{Jensen and Murphy [1990] maintain that private firms are less subject to political and}
\text{publicity concerns which, they allege, are the primary forces which dampen the pay-
\text{performance relationship in public companies.}
\]

\[ \text{These effects hold under a wide variety of transaction costs measures, including the}
\text{percentage bid-ask spread and the extent to which a trade of a given size is executed at a price}
\text{different from the previously prevailing price.}
\]

more short-term stock price incentives to prevent their managers from trading.

While the above evidence does not cleanly distinguish between long and short-term managerial incentives, it certainly establishes that incentives are correlated with the stock trading environment. To gauge the quantitative importance of the trading problem on the manager’s effort choice and decision making horizon, we now solve explicitly for a special case of the model.

IV. THE CASE OF QUADRATIC EFFORT COSTS

IV(i). The Manager’s Long and Short-Term Stock-Based Incentives

Suppose that the certainty equivalent income cost of any action $a$ to the manager is given by $c(a) = a^2/(2\phi)$. From Result 2 we know that $\beta_N = 0$. Hence, from Result 1 and (8), we have:

$$\gamma = \bar{Y} + \frac{\phi \alpha_N^2}{2} + \frac{\theta \sigma_N^2 \sigma_i^2}{2}$$

and the shareholders’ objective is simply:

$$\max_{\alpha_N} \phi \alpha_N - \gamma.$$  

Differentiating (17) with respect to $\alpha_N$ and rearranging yields:

$$\alpha_N = \frac{\phi}{\phi + \theta \sigma_i^2}.$$  

When the manager can trade, shareholders must choose $\alpha_T$ and $\beta_T$ to satisfy (15) for $\lambda^* = 0$. Noting that by (12), $a = \phi (\alpha - \lambda)$, we obtain

$$\beta_T = \frac{\alpha_T [\theta \sigma_i^2 + \phi]}{\phi} = \frac{\alpha_T}{\alpha_N}$$

From (8) we have

$$\gamma = \bar{Y} + \frac{(a^*)^2}{2\phi} + \frac{\theta}{2} [\beta_T \sigma_i^2 + \alpha_i^2 \sigma_i^2] - \beta a^*$$

So the shareholders’ objective is:

$$(1 - \beta_T)(a^*) - \gamma = a^* - \bar{Y} - \frac{(a^*)^2}{2\phi} - \frac{\theta}{2} [\beta_T \sigma_i^2 + \alpha_i^2 \sigma_i^2]$$

$$= \alpha_T \phi - \bar{Y} - \frac{\alpha_T^2 \phi}{2} - \frac{\theta \sigma_i^2 \sigma_i^2}{\phi^2} \left[\frac{(\theta \sigma_i^2 + \phi)^2 \sigma_i^2}{\phi^2} + \sigma_i^2\right]$$

$$= \alpha_T \phi - \bar{Y} - \frac{\alpha_T^2 \phi}{2} \left(\theta \sigma_i^2 + \phi\right) - \frac{\alpha_T^2 \theta (\theta \sigma_i^2 + \phi)^2 \sigma_i^2}{2\phi^2}.$$
The first order condition is thus
\[ \phi - \alpha_T(\theta \sigma_r^2 + \phi) - \frac{\alpha_T \theta(\theta \sigma_r^2 + \phi)^2}{\phi^2} \sigma_r^2 = 0 \]

Rearranging we get
\[ \alpha_T = \frac{\phi^3}{(\theta \sigma_r^2 + \phi)[\phi^2 + \theta(\theta \sigma_r^2 + \phi)\sigma_r^2]} \]

Thus,
\[ \alpha_T = \alpha_N \frac{\phi^2}{[\phi^2 + \theta(\theta \sigma_r^2 + \phi)\sigma_r^2]} \]

and, by equation (19),
\[ \beta_T = \frac{\phi^2}{[\phi^2 + \theta(\theta \sigma_r^2 + \phi)\sigma_r^2]} \alpha_N \alpha_T \]

The extent to which the trading problem dilutes the manager's optimal incentives is primarily a function of \( \sigma_r^2 \), the exogenous variability in the short-term stock price. As \( \sigma_r^2 \) falls, the short-term stock price becomes an increasingly reliable indicator of the manager's trade. This reduces the cost of preventing trade and hence the overall costs of providing robust (trade-proof) effort incentives.

If \( \sigma_r^2 = 0 \), the short-term stock price presents a costless solution to the trading problem with \( \alpha_T = \alpha_N \). However, it is still necessary to make the payment contingent on the short-term stock price. With linear contracts, this requires that \( \beta_T \) is set arbitrarily close to unity. More generally, when \( \sigma_r^2 = 0 \) the shareholders can write a forcing contract based on the short-term stock price.

To characterize the results more fully, suppose that the 'total' variance of the firm's cash flows is \( \sigma_T^2 \) with \( \sigma_r^2 = \rho \sigma_T^2 \) and \( \sigma_T^2 = (1 - \rho) \sigma^2 \), where \( 0 \leq \rho \leq 1 \). Table I succinctly characterizes the effect of the trading problem on the endogenous contract weights.\(^{11}\)

\(^9\) If the manager is risk neutral (\( \theta = 0 \)) then the trading problem disappears.

\(^{10}\) \( \beta \) cannot be set equal to unity or else the short term share price would be invariant with regards to expected effort.

\(^{11}\) By substitution, noting that \( [\theta \sigma_r^2 + \phi = \phi/\alpha_N] \) and \( [\phi = \alpha_N \theta \sigma_r^2/(1 - \alpha_N)] \), we have
\[ \alpha_T = \alpha_N \left[ \frac{\sigma_T^2 \left( \frac{\phi}{\alpha_N} \right)}{\sigma_T^2 \left( \frac{\phi}{\alpha_N} \right) + \sigma_r^2} \right] \]
so that \( \alpha_T \) depends on only \( \alpha_N \) and \( \rho \).
MYOPIC CORPORATE BEHAVIOUR

TABLE I
CONTRACT CHOICE WHEN THE MANAGER CAN AND CANNOT TRADE

<table>
<thead>
<tr>
<th>$\alpha_N$</th>
<th>$\rho = \sigma_t^2/(\sigma_t^2 + \sigma_s^2)$</th>
<th>$\alpha_T/\alpha_N$</th>
<th>$\beta_T/\alpha_T$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>0.75</td>
<td>0.00030</td>
<td>100</td>
</tr>
<tr>
<td>0.01</td>
<td>0.5</td>
<td>0.00010</td>
<td>100</td>
</tr>
<tr>
<td>0.01</td>
<td>0.25</td>
<td>0.00003</td>
<td>100</td>
</tr>
<tr>
<td>0.1</td>
<td>0.75</td>
<td>0.0333</td>
<td>10</td>
</tr>
<tr>
<td>0.1</td>
<td>0.5</td>
<td>0.0011</td>
<td>10</td>
</tr>
<tr>
<td>0.1</td>
<td>0.25</td>
<td>0.0037</td>
<td>10</td>
</tr>
<tr>
<td>0.5</td>
<td>0.75</td>
<td>0.6</td>
<td>2</td>
</tr>
<tr>
<td>0.5</td>
<td>0.5</td>
<td>0.33</td>
<td>2</td>
</tr>
<tr>
<td>0.5</td>
<td>0.25</td>
<td>0.14</td>
<td>2</td>
</tr>
</tbody>
</table>

For example, if $\alpha_N = 0.1$ and $\rho = 0.5$, so that the variability of short and long-term shocks is identical, then the contract used in the presence of managerial trading places ten times as much weight on the value of the short-term stock price as it does on the long term managerial value added. Furthermore, as $\alpha_T/\alpha_N = \alpha_T/\alpha_N$, the action implemented in the presence of trading is only 0.11 percent of that chosen when there is no possibility of managerial trading. The ability of the manager to trade drastically changes the structure of the optimal contract. Firstly, it shifts a substantial proportion of the payment onto the unadjusted short-term stock price. Secondly, it substantially reduces the optimal effort level to be implemented by the shareholders.

IV(ii). The Manager’s Equilibrium Short-Term Bias

Stein [1989] imposes a management incentive contract that provides the manager with a short-term bias, and shows how this can induce the manager to manipulate the earnings flow of the firm. Effectively, she will bring forward future earnings to boost current earnings, either by selecting shorter-term projects or by liquidating longer-term projects, even though such action is undesirable for the overall value of the firm. To incorporate this possibility into our model, let us assume that the market interest rate is zero but that before the realization of the short-term shock $s$, the manager can boost short-term cash flows at the expense of long-term cash flows. In particular suppose that if the manager ‘borrows’ $d$ to boost current cash flow then tomorrow’s cash flow is reduced by $d + rd^2$ so that any such borrowing is strictly inefficient.

The firm's short-term and long-term revenues now may be expressed as:

\begin{align}
V_s &= a + d - d^* - r(d^*)^2 + s \\
V_L &= a - rd^2 + s + z
\end{align}

where $d^*$ is the market's (rational) expectation of the manager's diversion of cash-flows from the future. The manager's contract becomes:

\begin{equation}
m(v_L - V_s, V_s) = \alpha((a - a^*) - (d - d^*) - r(d^2 - (d^*)^2) + z) \\
+ \beta(a^* + (d - d^*) - r(d^*)^2 + s) + \gamma
\end{equation}

We identify contract choices in the presence of manipulation of earnings flow by the manager with the subscript $S$. The program for risk neutral shareholders thus becomes:

\[
\max_{(\alpha_S, \beta_S, \gamma_S, d'_S, a'_S)} E[V_L - m(V_L - V_s, V_s)] = (1 - \beta_S)[a'_S - r(d'_S)^2] - \gamma_S
\]

subject as before to: (i) the participation constraint, (ii) the 'no-trade' constraint that guarantees the manager chooses $\lambda = 0$. and (iii) the (ex interim) incentive constraint that guarantees that the manager chooses $a = a^*$. In addition, however, the program must also satisfy the 'manipulating cash-flow incentive constraint' which requires that, before $s$ is realized, the manager must have the incentive to 'borrow' an amount to boost current cash flow equal to the amount the market rationally expects the manager to borrow. Formally, we have:

- **Manipulating cash-flow incentive constraint**

\[
d'_S \in \arg\max_d \alpha_S((a - a'_S) - (d - d'_S) - r(d^2 - (d'_S)^2)) \\
+ \beta_S(a'_S + (d - d'_S) - r(d'_S)^2 + s) + \gamma_S - \frac{\theta}{2} (\beta_S^2 \sigma_s^2 + \alpha_S^2 \sigma_s^2) - \frac{\alpha^2}{2\phi}
\]

This yields the first order condition

\[-\alpha_S(1 + 2rd) + \beta_S = 0\]

From the natural analogs of (13) and of (12) we have

\[
\beta_S = c'(a'_S)[1 + \sigma_s^2 \theta c''(a'_S)] \\
\alpha_S = c'(a'_S)
\]

and hence

\[
d'_S = \frac{\beta_S - \alpha_S}{2r\alpha_S} = \frac{\sigma_s^2 \theta c''(a'_S)}{2r} = \frac{\sigma_s^2 \theta}{2r\phi}.
\]

Thus, for the case of quadratic effort costs, $d'_S$ is not a function of $\alpha$. 

or \( \beta \) so that the incentive contract is unchanged in that \( \alpha_s = \alpha_T \) and \( \beta_s = \beta_T. \)

The expression for \( d_e \) also indicates that this manipulation should be more pronounced in firms where the underlying management incentive problem is more severe in that the firm's fundamentals are more volatile (high \( \sigma_f^2 \)), effort is more costly (low \( \phi \)), and the manager is more risk-averse (high \( \theta \)). The preceding two equations confirm that such short-termism is also associated with relatively low overall stock-based incentives for the manager. These observations provide an explanation for some recent empirical findings which tend to contradict the original Stein [1989] paper. Specifically, both Mahoney et al. [1997] and Muelbroek et al. [1990] document that long-term investments such as R&D and capital expenditures as a fraction of total assets tend to be lower in firms where managers are sheltered from either takeover threats (through antitakeover charter amendments) or from active shareholders (through diffuse shareholdings). This evidence fails to support the Stein model in which higher takeover barriers and passive shareholders represent an exogenous reduction in the manager's concern with the short-term stock price, with everything else (including the manager's concern with long-term stock prices) being equal. An interpretation which is consistent with our model, is that takeover barriers and passive shareholders arise endogenously and are more likely when there is less benefit to linking the manager's pay to the stock price (see Demsetz and Lehn [1985] on the endogeneity of stock ownership structure). As stated above, the equilibrium amount of short-term manipulation is greater when it is less desirable to link the manager's pay to the stock price (\( \sigma_f^2 \theta \) is greater) or when the manager's effort is relatively costly or ineffective (\( \phi \) is lower). An appropriate test of short-termist incentives would need to allow both incentives and managerial investment behaviour to be determined by deeper exogenous variables.

---

\[^{12}\] If we let \( V(a') \) denote the value of the firm for the shareholders' program (where \( \alpha, \beta, \gamma \) and \( d' \) are set to satisfy the four constraints), applying the envelope theorem for more general cost functions we have,

\[
V(a') = (1 - \beta(a'_f))(a'_f - r[d'(a'_f)])^2
\]

\[
V'(a') = -(1 - \beta(a'_f))r \frac{d}{da} [d'(a'_f)] - \beta'(a'_f)(a'_f - r[d'(a'_f)])^2
\]

\[
= -(1 - \beta(a'_f))\left[ (\sigma_f^2 \theta)^2 (a'_f) \right] \frac{c''(a'_f)}{2r} \\
- c'(a'_f)(1 + \sigma_f^2 \theta (c'(a'_f) + c''(a'_f))(a'_f - r[d'(a'_f)])^2)
\]

Thus if \( c'' > 0 \) then \( V'(a'_f) < 0 \). In this case, the Stein manipulation problem would entail a dilution in all the incentive terms so that \( \alpha_s < \alpha_T, \beta_s < \beta_T. \)
This paper shows why shareholders may choose to tie corporate executives’ pay to the short-term stock price, even though this price has nothing to do with their productive inputs. If the shareholders wish to provide the manager with strong effort incentives they will have to link her pay tightly to the short-term stock price to ensure that the manager’s consumption stream and effort choices are consistent with the intended high-powered contract. Indeed, they will have to do so to such an extent that the manager exhibits a short-term bias in equilibrium. Our model includes a fully rational stock market in which key participants know who is behind observed order flow, so that any attempt by the manager to trade her contract will lead to a fall in the short-term stock price. Thus, while the short-term stock price contains no information about the manager’s past effort decisions (as in the standard principal-agent framework), it does reveal something about the manager’s future effort incentives.

The example presented in Section IV shows that the potential for trade greatly lowers the level of managerial effort incentive. More importantly, we showed that earnings manipulation can occur even when the weighting of long-term and short-term stock price is endogenous. Such equilibrium manipulation is more prominent in firms whose fundamentals are more volatile and where the manager’s effort is less important.

Our model implies that managers’ pay should be more tilted towards short-term stock prices, and should be more likely to exhibit myopic behaviour, when (i) the ratio of short-term to long-term stock price volatility is smaller, (ii) the manager is more risk-averse, and (iii) when her efforts are less productive. An ideal empirical test would separately measure the manager’s short-term bias and incentives, and link them to these three exogenous features. A less ambitious approach, which would circumvent the need to identify manager’s specific features such as her risk-aversion, would relate the extent of short-term bias to the extent to which the manager’s wealth is tied to the firm’s stock price. Our model implies that managers facing ‘high-powered’ incentives should actually exhibit less short-term bias. While this result is counter to the intuition that short-termism is reduced by insulating managers from stock market concerns, it is consistent with the available evidence.

REFERENCES


