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by

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ABSTRACT

We analyze the effects of insider trading on insiders' effort decisions. We consider a situation in which the final output of a firm and the productivity of managerial effort will depend on whether the firm is in a good or a bad state. When the state is not verifiable, the managerial contract cannot be made explicitly contingent on it; consequently, a contract that does not allow for insider trading would lead to the insiders' facing the same incentives in good and bad times. Under a contract that allows for insider trading, however, insiders will buy shares on receiving (ahead of the market) good news and will sell shares on receiving bad news; consequently, they will end up facing different incentives in good and bad times. Whether this effect is desirable depends on how the marginal productivity of managerial effort in good times compares with that in bad times. In particular, we show that allowing insider trading may improve managers' effort decisions and consequently may increase corporate value and benefit shareholders.

I. INTRODUCTION

The legal rules of the United States, as well as those of other advanced market economies, substantially limit, but do not prohibit, trading by corporate insiders. There is a long and intensive public debate on whether insider trading is harmful and should be constrained or eliminated altogether.

In evaluating the desirability of insider trading, one important issue to consider concerns the effects of such trading on insiders' ex ante management decisions. Does the possibility of trading lead insiders to make management decisions that are closer to, or further away from, the value–maximizing decisions?[1]

This paper analyzes the effect of insider trading on managerial effort.[2] In particular, we focus on how trading by insiders on good and bad news may change the incentives they face to exert effort. We show that allowing insider trading may result in improved effort levels and may thus raise ex ante corporate value and benefit shareholders.

To obtain a sense of the issues to be analyzed, consider the following simple

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[1]Most of the substantial work that economists have done on insider trading in recent years has been devoted to modelling the effects of insider trading on the trading process itself; these works have studied how the possession of inside information enables insiders to make profits, how it gets incorporated eventually into the market price, and whether it improves the accuracy of this price. See for example Glosten and Milgrom (1985), Kyle (1985), Laffont and Maskin (1990), and Mirman and Samuelson (1989). Three recent papers, Ausubel (1990), Manove (1989) and Fishman and Hagerty (1989), have analyzed certain important ex–ante effects of insider trading (on investment decisions and information acquisition), but they have also abstracted from the agency problems on which our project focusses. Finally, a notable exception to the general disregard of the effects of insider trading on agency costs is Dye (1984), who considers whether shareholders can draw useful information (for the managers' compensation packages) from the managers' trades (assuming these trades are observable); Dye does not consider, however, how insider trading affects management decisions.

[2]In other works (Bebchuk and Fershtman (1991, a,b)) we analyze the effect of insider trading on managers' project choice and on managers' reaction to opportunities to waste corporate value.

situation concerning a firm run by managers. Suppose that the firm's output and the productivity of the managers' effort depend on whether the firm will be in a "good" or "bad" state. Suppose also that the state is not known when the managers' incentive scheme is designed, and that the state is not subsequently verifiable so that the managerial contract cannot be made contingent on it. To take a concrete example, suppose that the chosen managerial contract provides the managers with 10% of the firm's shares. Accordingly, in the absence of insider trading, the managers will make their effort decision — in both the good and the bad states — in light of their 10% holding.

Now suppose that insider trading is allowed and that managers learn ahead of the market, and prior to the time that the effort decision must be made, whether the state is good or bad. And, suppose again that the managers' contract provides them with 10% of the firm's shares. (This example is of course simplistic, as the managers' contract may well be different if insider trading is allowed, a point that will be taken into account in our model). Given that insider trading is allowed, assume that the managers will buy an extra 5% of the firm's shares in the good state and will sell 5% of the shares in the bad state. Accordingly, in the good state the managers' effort decision level will be made in light of their holding 15% of the shares, whereas in the bad state their effort decision will be made in light of their holding only 5% of the shares. Thus, the trading by the insiders leads them to change the initial incentive scheme and to end up with different incentives in the good and bad states. The question, of course, is whether this effect is desirable or not; as will be seen, the answer turns out to depend on how the marginal productivity of insider effort in the good state compares with the marginal productivity of insider effort in the bad state.

The model of this paper analyzes the points raised by the above example. We examine how insider trading affects insiders' effort levels. Based on this analysis, we consider how insider trading, through its impact on the allocation of effort, affects the firm's expected output and ex ante shareholder value. The main result of the model is that, as far as the allocation of effort is concerned, allowing insider trading as part of the managerial compensation scheme may raise ex ante shareholder value and benefit shareholders.

2. FRAMEWORK OF ANALYSIS

The sequence of events in the model is as follows. In period 0, the firm is formed and the managerial contract is specified. In period 1, the managers get information about the state of the world. Trading in the firm's shares take place, and the managers participate in it if their contract allows them to do so. In period 2, the managers invest effort in the firm's project. In Period 3, the final period, the project's results are realized. Our assumptions concerning each of the elements of the model are described below.

Period 0: The company is formed and a contract is made between the managers and the shareholders (or, equivalently, between the managers and the entrepreneur who sets up the company and sells its shares to the shareholders). The contract provides the managers with a fixed salary D and with a fraction α of the firm's shares. Note that the fixed fraction of the shares implies that the managerial salary scheme is linear in the firm's output and final value.[3] The contract between the managers and the shareholders also

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[3]We limit our attention to linear schemes for the sake of tractability, in order to focus on the effects of insider trading. For a similar assumption in a similar context, see Holmstrom and Tirole (1990). For an analysis of the conditions under which linear

specifies whether insider trading is allowed. We refer to contracts that allow insider trading as IT contracts and denote a given IT contract as (D, α, I).

Similarly, we refer to contracts that prohibit insider trading as NT contracts and denote any given NT contract as (D, α, N).

For an IT contract (D, α, I), we will denote by π_{IT} the managers' expected insider trading profits. The initial value of the firm is denoted by V_0 and will be endogenously determined, depending on the manager's contract.

The Firm's Production Function. The firm's expected final output W is a function of both managerial effort e and the state of the world θ, $W(e, \theta)$. We make the standard assumption that output is increasing and concave in effort: $W_e > 0$, $W_{ee} < 0$. With regard to the state of the world, we assume for simplicity that there are two states θ_1 and θ_2, each of which occurs with probability 0.5, and we denote $W(e, \theta_i)$ by $W_i(e)$. We let θ_2 be the "good" state and θ_1 the "bad" state, and we assume that $W_2(e) > W_1(e)$ for any e. We further assume that θ is not verifiable, so that the managerial contract cannot be made contingent on it. The actual final output is $W(e,\theta) + \epsilon$, where ϵ is a noise term satisfying $E(\epsilon) = 0$.

Although we use the general production function $W_i(e_i)$ for part of our analysis, it will at times be useful to consider a specific functional form. Thus, throughout the paper we will make use of the following logarithmic production function:

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contracts are optimal, see Holmstrom and Milgrom (1987).

$$W_1(e_1) = A_1 \ln e_1$$
$$W_2(e_2) = A_2 \ln e_2 + B,$$

where $A_1, A_2, B > 0$ are given constants.

Period 1: Trading. At the beginning of this period, the managers (but not others) learn θ. Trading in the firm's shares takes place with the following participants: liquidity–motivated sellers, a market maker (specialist) who sets the price, and, if the managerial contract permits, the informed managers. The liquidity sellers are initial shareholders who cannot defer realizing the value of their shares until the final period. It is assumed that ex ante all the initial shareholders face the same probability of having to liquidate their holdings during the trading period.

There is no need to model the trading process itself in this paper as the process has been extensively analyzed in the literature (see, for example, Kyle (1985) and Glosten and Milgrom (1985)). As the literature has shown the insiders can make expected profits equal to some, but not all, of the gap between the pre–trading value $- V_0$ and the expected final value given the managers' private information $- V_f$. The insiders can make some profits because, at least initially, the market maker will not be able to tell for sure whether the insiders are buying or selling. The insiders cannot capture the full gap between V_0 and V_f, because, among other things, as they trade more shares, their information will become reflected in the prices set by the market maker. We capture these essential features of the trading process by assuming that when $\theta = \theta_2$ the insiders can purchase a fraction β of the firm's shares before their information is fully reflected in the price, and that when $\theta = \theta_1$ the insiders can sell a fraction β of the firm's shares before their information is fully reflected in the price.[4] Because the market price will change gradually as the managers trade, the managers' trading profits of π_{IT} will be smaller than $\beta|V_f - V_0|$. Of course, the insider trading profits, π_{IT}, all come at the expense of the liquidity sellers, as the market maker is assumed to make zero expected profits. Thus, because each of the initial shareholders faces ex ante the same probability of having to liquidate his holdings in period 1, the initial shareholders expect to bear the costs of the insiders' trading profits as much as they expect to bear the costs of other elements, of the insiders' compensation scheme.

Period 2: The managers choose the level of effort e. We will denote by e_1 their choice when $\theta = \theta_1$ and by e_2, their choice, when $\theta = \theta_2$.

Period 3: In this period, the final output W is realized, and the managers' salary is paid. The final value of the shares is thus $V_f = W - D$. The curtain now goes down.

The Managerial Labor Market Constraint. Managers are assumed to be risk neutral, with a utility function that is separable and linear in payoffs and effort: $U(Y, e) = Y - e$. Since both shareholders and managers are assumed to be risk neutral we avoid the complexities associated ith risk sharing. The managers have alternative employment that yields utility

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[4]It will be apparent to the reader that our analysis can easily be extended to situations in which the fraction of the shares that can be bought at θ_2 differs from the fraction that can be (short) sold at θ_1.

For simplicity, we will also assume that $\beta < \alpha$ and that $\beta + \alpha < 1$ (so that the managers' information is fully reflected in the price before they purchase all of the firm's shares).

level $\overline{C}$. Thus, the managers' participation constraint is $EU(Y,e) \geq \overline{C}$.

We assume that managers have limited initial wealth; this requires $D \geq D_0$ for some $D_0 < 0$.

The First–Best. Our main interest in this paper is how the possibility of insider trading affects ex–ante shareholder value. From the perspective of the initial shareholders (or the entrepreneur who sets up the company and sells the shares to the initial shareholders) it is desirable to maximize

$$E_0 = (1-\alpha)V_0.$$

This ex ante value of E_0 is equal to the firm's expected output minus managers' total expected compensation, including any insider trading profits. (As explained above, the initial shareholders bear all the elements of the insiders' compensation package, including the insiders' trading profits if such profits exist.)

Clearly the first–best value is the value that would be obtained if managers could be induced, with a compensation package worth $\overline{C}$, to choose (e_1, e_2) satisfying $W_i'(e_i) = 1$. Not surprisingly neither NT contracts nor IT contracts can produce this first–best value. The interesting question, however, is which type of contract does better.

III. BEHAVIOR AND VALUE UNDER NT AND IT CONTRACTS

A. NT Contracts

Let us first examine how, given an NT contract (D, α, N), the insiders will choose their effort level. Once managers observe the state of the world θ_i, they will choose e_i to maximize their expected utility

$$(1) \qquad EU(Y, e) = D + \alpha W_i(e_i) - e_i.$$

Letting $e_1^N(\alpha)$ and $e_2^N(\alpha)$ denote the optimal effort levels in states θ_1 and θ_2 respectively, maximizing (1) yields the following incentive compatible condition:

$$(2) \qquad \alpha W_1'(e_1^N(\alpha)) = \alpha W_2'(e_2^N(\alpha)) = 1 .$$

Condition (2) implies, of course, that, as long as $\alpha < 1$, shareholders cannot achieve the first–best outcome. Now, given the managers' choice of effort, the expected final output, denoted by $\overline{W}(D, \alpha, N)$, is

$$(3) \qquad \overline{W}(D,\alpha,N) = \tfrac{1}{2} W_1[e_1^N(\alpha)] + \tfrac{1}{2} W_2[e_2^N(\alpha)] .$$

As insider trading is not allowed under NT contracts, liquidity sellers do not expect to bear any trading losses. This implies that $V_0^N = EV_f$, where V_0^N is the firm's initial value under the given NT contract. Specifically:

$$(4) \qquad V_0^N = \overline{W}(D,\alpha,N) - D.$$

B. **IT Contracts**

Let us now examine managers' effort decisions under a given IT contract (D, α, I). When the managers will observe the good state θ_2, they will purchase a fraction β of the firm's shares. Note that in our model this purchase takes place prior to the choice of effort. Thus, when θ_2 is observed, the managers will choose e_2 to solve:

(5) $$\max_{e_2}[D + (\alpha+\beta)V_f(e_2, \theta_2) - e_2]$$

Maximizing (5) and substituting for $V_f(e_2, \theta_2)$, we obtain that the optimal effort level e_2^I is defined by:

(6) $$(\alpha + \beta)W_2'(e_2^I) = 1 .$$

By similar analysis for the bad state θ_1, in which managers (short) sell a fraction β of the firm's shares, we conclude that e_1^I satisfies:

(7) $$(\alpha - \beta)W_1'(e_1^I) = 1 .$$

Given the managers' effort level in the two states, (e_1^I, e_2^I), the final values of the firm are $V_f^1 = W_1(e_1^I) - D$ and $V_f^2 = W_2(e_2^I) - D$ respectively. The initial value of the firm when insider trading is allowed, denoted by V_0^I, is the expected final value minus the expected insider trading profits:

(8) $$V_0^I = \overline{W}(D,\alpha,I) - D - \pi_{IT} .$$

IV.COMPARING IT AND NT CONTRACTS WITH THE SAME SALARY SCHEME

Let us now compare behavior and value under an IT contract (D, α, I) and an NT contract (D, α, N), i.e., two contracts that offer the same salary scheme and differ only in whether insider trading is allowed. Thus the scenario we consider in this section is one in which there is a specific NT contract and insider trading is then allowed without any adjustment in the salary scheme.

A. Variability of Output

Proposition 1: For a given (D, α), allowing insider trading increases the variability of the effort level and the final output: $e_1^I(\alpha) < e_1^N(\alpha)$ and $e_2^I(\alpha) > e_2^N(\alpha)$; $W_1^I < W_1^N$ and $W_2^I > W_2^N$.

Proof: Comparing (2) with (6) and (7) and using thc concavity of the production function $W_i(e)$, $i = 1,2$, gives the above result. □

As Proposition 1 indicates, if insider trading is allowed without any change in managers' salary schemes, managers will increase their effort in the good state, thus further increasing output in the good state, and will decrease their effort in the bad state, thus further decreasing output in the bad state.

B. The Expected Output

As we have seen, allowing insider trading increases effort and thus output in the good state of the world and decreases effort and output in the bad state. The overall effect of insider trading on expected output depends on which effect is dominant and thus, as will be shown below, may be either positive or negative.

The overall effect of insider trading on expected output can be calculated for any functional form of the production function. We now examine this effect in the case of our logarithmic production function $W_1(e_1) = A_1 \ln e_1$; $W_2(e_2) = A_2 \ln e_2 + B$.

PROPOSITION 2: The expected output under an IT contract (D, α, I) is higher than under an NT contract (D, α, N) if and only if A_2, the marginal productivity of effort in the good state, is sufficiently larger than A_1, the marginal productivity of effort in the bad state. Specifically, there exists $k(\alpha,\beta) > 1$ such that the expected output is higher under the IT contract iff $A_2 > k(\alpha,\beta)A_1$.

PROOF: Using (2), the managers' effort levels in the two states under the NT contract are

(10) $$e_1^N = \alpha A_1; \; e_2^N = \alpha A_2 .$$

Similarly, (6) and (7) imply that the effort levels under the IT contract are

(11a) $$e_1^I = (\alpha - \beta)A_1$$

(11b) $$e_2^I = (\alpha + \beta)A_2 .$$

Substituting the effort levels in (10) and (11a,b) into the production functions shows that the NT contract yields a higher expected output if and only if

$$(12)\quad A_1 \ln \alpha A_1 + A_2 \ln \alpha A_2 + B \geq A_1 \ln(\alpha-\beta)A_1 + A_2 \ln(\alpha+\beta)A_2 + B,$$

which, after simplification, yields the inequality

$$(13)\qquad \ln \alpha \geq \frac{A_1}{A_1 + A_2} \ln(\alpha-\beta) + \frac{A_2}{A_1 + A_2} \ln(\alpha+\beta).$$

When $A_1 = A_2$, the concavity of the ln function implies that (13) holds. As $\ln(\alpha+\beta) > \ln \alpha > \ln(\alpha-\beta)$, standard analysis of (13) shows that when $\frac{A_2}{A_1 + A_2}$ is close enough to 1, the inequality in (13) is reversed, so that the IT contract yields a higher expected output. Using standard continuity arguments, there is $\eta \in (0,1)$ such that the IT contract yields a higher expected output iff $\frac{A_2}{A_1 + A_2} > \eta$. Letting $k(\alpha,\beta) = \eta/(1 - \eta)$ concludes the proof.

□

The intuition behind the result of proposition 2 is as follows. Recall that the allowing insider trading increases managerial effort in the good state while reducing it in the bad state. If the marginal productivity in the good state is sufficiently higher than that in the bad state, then the increase in output in the good state more than compensates for the reduction in output in the bad state.

Table 1 presents some numerical simulations in which $k(\alpha, \beta)$ is calculated for given values (α, β).

α	.03	.03	.04	.05	.02
β	.01	.02	.01	.01	.01
$k(\alpha,\beta)$	1.41	2.15	1.29	1.22	1.71

Table 1

C. **Corporate Value**

The shareholders' interest is to maximize $E_0 = (1-\alpha)V_0$. Thus, in examining whether or not the contract (D,α,N) is preferred by the shareholders to the contract (D,α,I), we must compare the initial value under the NT type contract, V_0^N, with the initial value under the IT contract, V_0^I. Our first observation is that if $\bar{W}(D,\alpha,N) \geq \bar{W}(D,\alpha,I)$, then the NT contract is superior: $V_0^N = \bar{W}(D,\alpha,N) - D > V_0^I = \bar{W}(D,\alpha,I) - D - E\pi_{IT}$. Thus, the IT contract yields a higher initial value than the NT contract only if $\bar{W}(D,\alpha,I) > \bar{W}(D,\alpha,N)$ and the difference more than offsets the trading losses borne by shareholders under the IT contract — that is, $\bar{W}(D,\alpha,I) - \bar{W}(D,\alpha,N) > \pi_{IT}$. Note that since $\pi_{IT} < \beta \mid V_f - V_0 \mid$, a sufficient condition for V_0 to be higher under the IT contract than under the NT contract is that the difference in $\bar{W}$ under the two contracts exceeds $\beta \mid V_f - V_0 \mid$.

$$V_0^I - V_0^N \geq \bar{W}(D,\alpha,I) - \bar{W}(D,\alpha,N) - \frac{\beta}{2}\Big[(V_f^2 - V_0^I) + (V_0^I - V_f^1)\Big] =$$

$$= \Big[(1-\beta)W_2(e_2^I) + (1+\beta)W_1(e_1^I) - W_2(e_2^N) - W_1(e_1^N)\Big]/2.$$

For any specific functional form of the production function, one can calculate the managerial effort and insider trading profits under the IT and NT contracts in order to determine which contract yields a higher initial value. To illustrate, we now return to our logarithmic production function, for which

$$(14) \qquad V_0^I - V_0^N \geq \Big[(1-\beta)A_2 \ln((\alpha+\beta)A_2) - A_2 \ln(\alpha A_2) - \beta B + (1+\beta)A_1 \ln((\alpha-\beta)A_1) - A_1 \ln(\alpha A_1)\Big]/2.$$

Consider now the following numerical simulation where $\alpha = .05$; $D = 0$; $\beta = .03$ and $A_1 = 40$; table 2 specifies initial values as a function of A_2. We calculate V_0^I under the assumption that the insiders' expected trading profits are $\beta|V_f - V_0|$.

A_2	20	40	60	80	100	120	150	200
V_0^N	13.8	27.7	46.8	69.3	94.3	121.3	165	244.1
V_0^I	7.0	23.9	45.9	71.2	99.1	128.8	176.5	262.3

Table 2

As demonstrated by Table 2, when $A_1 = 40$ and A_2 is between 80 to 200, then $V_0^I > V_0^N$. We can thus conclude the following:

PROPOSITION 3: Starting with a given NT contract (D, α, N), if insider trading is then allowed without any change in the managerial salary scheme, then the firms' and shareholders' ex ante value may increase.

This result may be viewed as surprising since allowing insider trading without any adjustment of the managers' salary increases the overall managerial compensation. Allowing insider trading may increase the firms' expected output by more than is necessary to offset the increase in managerial compensation. By proposition 1, allowing insider trading leads managers to reduce their effort level in the bad state and increase it in the good state. If the marginal productivity of effort is sufficiently larger in the good state than in the bad state, then the increase in expected output brought about by the IT contract is large enough to more than compensate the shareholders' expected trading losses. In such a case, allowing insider trading increases both managerial compensation and the value of the firm.

V. COMPARING THE OPTIMAL NT AND IT CONTRACTS

The previous section has analyzed the consequences of allowing insider trading while retaining the same salary scheme (D, α). But when the shareholders choose to allow insider trading, they can simultaneously make adjustments in the managerial salary scheme to reflect managers' ability to extract additional compensation via insider trading. In this section we determine the NT and IT contracts that maximize the shareholders' ex ante value E_0 and we compare the performance of the optimal NT contract with that of the optimal IT contract.

In selecting the best NT contract, the shareholders solve the following problem:

$$\max_{D,\alpha}\{E_0^N = (1-\alpha)V_0^N = (1-\alpha)[\overline{W}(D,\alpha,N) - D]\} \tag{15}$$

s.t.

$$D + \alpha V_0^N - \bar{e}(D,\alpha,N) \geq \overline{C} \tag{16}$$

and the incentive compatibility condition (2), where $\bar{e}(D, \alpha, N)$ is the expected effort level given a contract (D, α, N).

We let (D_N, α_N, N) denote the optimal NT contract. Since $\frac{\partial E_0^N}{\partial D} \leq 0$ (< 0 for $\alpha < 1$), the shareholders will reduce D to the lowest level possible given the participation constraint (16). Thus $D = \bar{C} - \alpha V_0^N + \bar{e}(D,\alpha,N)$, which implies that

$$(1-\alpha)V_0^N = \bar{W}(D, \alpha, N) - \bar{C} - \bar{e}(D, \alpha, N).$$

Thus, maximizing E_0^N involves providing the standard "sell–out" scheme in which $\alpha = 1$. In our case, however, such a scheme implies $D = -\infty$, whereas the managers are assumed to have limited wealth, with D_0 being the lower bound for the fixed salary D. It is important to note that for any such bound, however low, it will be impossible to achieve the standard sellout scheme. The above discussion implies, however, that $D_N = D_0$, as the shareholders are better off compensating managers by increasing α, which induces higher levels of effort, than by increasing D, which does not affect managerial effort. We assume that is it not desirable to give managers more than the competitive salary.[5] Thus, α_N is that value of α which makes the participation constraint binding given $D = D_0$:

$$\alpha_N = \frac{\bar{C} - D_0 + \bar{e}(D_0,\alpha_N,N)}{\bar{W}(D_0,\alpha_N,N) - D_0}. \tag{18}$$

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[5]To guarantee that under the optimal compensation scheme managers do not receive compensation in excess of their alternative wage, we assume that $\left.\frac{\partial E_0}{\partial \alpha}\right|_{\alpha=\alpha_N} < 0.$

Let us now turn to the optimal choice of an IT contract. In making this choice, the shareholders solve the following problem:

$$\max_{D,\alpha} E_0^I = (1-\alpha)V_0^I = (1-\alpha)[\overline{W}(D,\alpha,I) - D - \pi_{IT}]$$

s.t.

$$D + \alpha V_0^I + \pi_{IT} - \bar{e}(D,\alpha,I) \geq \overline{C}$$

and the incentive compatibility conditions (6) and (7). We let (D_I, α_I, I) denote the optimal IT contract. As in the NT case, when there is no lower bound on D, the optimal scheme is when α is (arbitrarily close to) 1 and D is infinitely negative. But since we have assumed that (due to managers' limited wealth) D must exceed $D_0 < 0$, the first–best scheme is not feasible. As before, we assume that the optimal scheme is one in which the managers' participation constraint is binding, i.e.[6]

(19) $$D + \alpha V_0 + \pi_{IT} - \bar{e}(D,\alpha,I) = \overline{C}.$$

Substituting (19) into the initial value function (8) yields

(20) $$V_0 = \overline{W}(D,\alpha,I) - \overline{C} + \alpha V_0 - \bar{e}(D,\alpha,I)\,.$$

[6]To guarantee that the best (D_I, α_I, I) is such that the participation constraint is binding, we need to assume that $\left.\frac{\partial E_0}{\partial \alpha}\right|_{\alpha=\alpha_I} < 0$.

which implies

(21) $$E_0 = (1-\alpha)V_0 = \overline{W}(D,\alpha,I) - \overline{C} - \overline{e}(D,\alpha,I).$$

As before, the shareholders are better off compensating managers by increasing α rather than by increasing D, which implies that the optimal scheme is characterized by $D_I = D_0$ and

(22) $$\alpha_I = \frac{\overline{C} - D_0 + \overline{e}(D_0,\alpha_I,I) - \pi_{IT}(D_0,\alpha_I,I)}{\overline{W}(D_0,\alpha_I,I) - D_0 - \pi_{IT}(D_0,\alpha_I,I)}.$$

<u>PROPOSITION 4</u>: Under the optimal NT scheme (D_N, α_N, N) the managers initially get a higher share of the firm than under the optimal IT scheme (D_I, α_I, I), i.e., $\alpha_N > \alpha_I$.

PROOF: The proof is by contradiction. If $\alpha_I \geq \alpha_N$, then the managers with the IT contract could guarantee themselves compensation beyond $\overline{C}$. For example, by choosing the effort level that is chosen under the NT contract, they would enjoy both a larger share of the same output plus insider trading profits. □

Let us now compare the firms' initial value V_0 and the shareholders' initial value E_0 under the contracts (D_N, α_N, N) and (D_I, α_I, I). We have:

(23) $$V_0^N = \overline{W}(D_N,\alpha_N,N) - \overline{C} - \overline{e}(D_N,\alpha_N,N)$$

(24) $$V_0^I = \overline{W}(D_I,\alpha_I,I) - \overline{C} - \overline{e}(D_I,\alpha_I,I)\,.$$

For any specific production function it is possible to calculate and compare V_0^N and V_0^I. It turns out that both $V_0^N > V_0^I$ and $V_0^N < V_0^I$ are possible. To see this, observe that, using our previous cmparison of IT and NT contracts with the same compensation scheme (see proposition 3), it is possible to have a case in which (D_0, α_N, I) yields a higher initial value than (D_0, α_N, N). Now note that since $\alpha_N > \alpha_I$ (by proposition 4), the contract (D_0, α_N, I) does not violate the participation constraint and is thus feasible. But since (D_0, α_I, I) is the optimal IT contract, it yields a higher initial value than (D_0, α_N, I). Thus, in such a case $V_0^I > V_0^N$. Now note that since $\alpha_N > \alpha_I$, $V_0^I > V_0^N$ implies

$$E_0^I = (1-\alpha_I)V_0^I > (1-\alpha_N)V_0^N = E_0^N.$$

We can thus conclude the following:

Proposition 5: The optimal IT contract may be superior to the optimal NT contract.

CONCLUDING REMARKS

In examining the effects of trading based on inside information, we must recognize that trading by insiders on the basis of inside information — the trading on which this paper has focused — is quite different, and presents different policy issues, than trading by outsiders on the basis of inside information. The trading profits that insiders are expected to make, if any, can be taken into account when the insiders' salary scheme is set, and such trading profits can be thus viewed as an element of the insiders' compensation scheme. Furthermore, the ability of insiders to trade on the basis of inside information is likely to affect the insiders' management decisions. Thus, in assessing the treatment of trading by insiders, one must examine whether allowing such trading may be an element of an overall efficient compensation contract with the insiders. This paper has sought to contribute to the analysis of this question. To this end, we have examined the effect that insider trading has on managers' effort decisions. We have shown that, as far as these decisions are concerned, allowing insider trading may lead to more efficient decisions and thereby raise corporate value and benefit shareholders. This conclusion provides one necessary element for an overall evaluation of the desirable policy toward trading by corporate insiders.

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