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The Disciplinary Role of Takeovers

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This paper presents a theory of the disciplinary role of takeovers based on an explicit model of managerial incentive problems stemming from asymmetric information. It is argued that an informed raider can reduce incentive problems by making managerial compensation more sensitive to information unavailable to shareholders. The paper also highlights the importance of specifying the source of contractual inefficiencies when analyzing the effect of takeovers on incentives.

1. INTRODUCTION

Economists have long argued that the rigours of competition in product, labour, and capital markets discipline self-interested corporate managers. This paper focuses on how one form of capital market competition, the takeover threat, mitigates managerial incentive problems. According to Manne (1965), an early commentator on takeovers, “Only the takeover scheme provides some assurance of competitive efficiency among corporate managers and thereby affords strong protection to the interest of vast numbers of small, non-controlling shareholders”. More recently, Easterbrook and Fischel (1981) have used this argument to support a ban on defensive tactics by management. And, in *Edgar vs. MITE Corp.*, Justice Byron White of the United States Supreme Court argued along similar lines to prevent the state of Illinois from blocking a hostile tender offer.

Despite the prominence of these arguments, there has been virtually no formal analysis of the disciplinary role of takeovers. One important exception is Grossman and Hart (1980). They argue that when a firm’s environment changes, the contracts that initially govern the relationship between shareholders and management become outdated. This gives managers the opportunity to take inefficient actions and to divert some of the firm’s value to themselves. Takeovers improve efficiency by enabling a third party (a “raider”) to take control of the firm and institute a more efficient contract, one better suited to the firm’s new environment. Thus, the takeover mechanism is an indirect means for shareholders to renegotiate their contract with management. The disciplinary value of takeovers stems from the effect of such renegotiation on managerial behaviour: managers will be more reluctant to take self-serving actions that lower firm value and increase the probability of a takeover.

Absent from Grossman and Hart’s paper is a model of the source of contractual inefficiencies; they assume that at some point the contract simply becomes outdated and inefficient. However, in their model shareholders need not rely on the raider to discipline management; a managerial incentive contract performs just as well as, or even better than, the threat of a takeover.

The contribution of this paper is to explicitly model the source of contractual inefficiencies and to explore the conditions under which the takeover threat plays a genuine role (beyond incentive contracts) in disciplining management. The focus is on asymmetric information between shareholders and management as a source of contractual inefficiency. Although initially shareholders and management may both be informed

about the firm's environment, over time the manager becomes better informed. Thus, the contract will be incomplete because it cannot be conditioned on the private information that becomes available to the manager. As amply shown in the literature on contracting under asymmetric information, this results in managerial inefficiency. (See, for example, Harris and Raviv (1979)).

In the particular model explored here, shareholders cannot determine whether firm value is low because the manager shirked or simply because the firm's environment was unfavourable. Were they able to make this distinction, they would penalize shirking, but insure the risk-averse manager against an unfavourable environment. However, the contract can only be conditioned on firm value, not the state of the world. Thus, for insurance purposes, the manager is not penalized severely when firm value is low. This creates an incentive for the manager to shirk when the environment is favourable. Insurance is weighed against incentives, and in the end neither is fully provided.

A raider who is informed about the firm's environment can mitigate this inefficiency. If firm value is low because the manager shirked, the probability of a takeover is high; shareholders tender their shares at a low price because they perceive the value of the firm to be low, while the raider knows that the value of the firm (if run properly) is high. In contrast, if firm value is low simply because the environment is unfavourable, the probability of a takeover is low; shareholders still tender their shares at a low price, but the raider does not value the firm as highly. Thus, the takeover mechanism provides a means of penalizing the manager precisely when he should be penalized—when firm value is low because the manager shirked and not because the environment was unfavourable. Takeovers are beneficial because they make compensation depend not just on managerial performance, but also on the privately observed state of the world.

This basic mechanism is explored in Sections 2 through 4. Section 4 also highlights one of the limitations of the takeover mechanism. If, in addition to monitoring the firm's environment, raiders can implement improvements in the firm, then shareholders will try to capture some of this surplus through provisions in the corporate charter that lead to higher (but less frequent) takeover bids. Thus, socially desirable takeovers may not occur, and the disciplinary value of takeovers is reduced. In this case, actions aimed at increasing shareholder value may reduce social welfare.

The model of takeovers in Section 4 unrealistically assumes that ex-ante, shareholders can commit to selling the firm for a price that depends on firm performance. Section 5.1 presents a more realistic model of takeovers along the lines of Grossman and Hart's model. Shareholders do not commit themselves to prices, but base their tender decision on information available at the time of the bid. In this model as well, takeovers have disciplinary value. An important feature of the equilibrium is that when shareholders observe low firm value they believe that the environment is unfavourable. This guarantees that, were the manager to shirk when the environment is favourable, shareholders would tender their shares even if the bid is low.

Section 5.2 illustrates the importance of this equilibrium feature in a model in which the state is observable but cannot be contracted upon (perhaps because the state it is too difficult to describe ex ante). In this model, takeovers have no disciplinary value. Unlike the case where the state is privately observed, if firm value is low, shareholders know why. Hence, if the manager shirks, they insist on a high price for their shares because they know the value of the firm under the raider's control is high. This free-rider problem eliminates the disciplinary value of takeovers; the takeover mechanism no longer penalizes inefficient behaviour with disproportionately higher probability.

Section 5.3 exhibits that management resistance to a takeover bid has similar negative effects on incentives. If management itself can offer to buy the firm in response to a hostile bid, this puts a floor on the price at which shareholders would tender their shares. If the manager shirks when the state is favourable, shareholders no longer tender at a low price; the manager bids up the price to reflect the fact that the state is favourable. Again the takeover mechanism does not penalize inefficient behaviour with disproportionately higher probability.

Finally, Section 5.4 emphasizes that the raider must be informed about the firm's environment for takeovers to be disciplinary. If the raider is not, the takeover mechanism simply provides a means of renegotiating an ex post inefficient contract. But, as Laffont and Tirole (1986) and Baron and Besanko (1985) have shown, in models with asymmetric information such renegotiation has negative incentive effects ex ante.

Concluding remarks are contained in Section 6.

2. THE MODEL

The focus of the model is a publicly-held corporation owned by atomistic, risk-neutral shareholders and run by a single manager. At an initial date 0, shareholders offer the manager a contract which he accepts or rejects.¹ He accepts if his expected utility from signing the contract exceeds his reservation utility which is set equal to zero.

Initially, both parties are symmetrically informed about the firm's environment, but over time the manager becomes better informed. At date 1, the manager privately observes a change in the firm's environment which alters the mapping between managerial actions and firm value. At date 0, neither party knows precisely how the environment will change.

The function relating firm value (gross of managerial compensation), v , to managerial actions (effort), $a \in [0, \infty)$, and the environment, θ , takes a simple additive form:

$$v = \theta + a.$$

For simplicity, $\theta \in \{\theta_1, \theta_2\}$, where $\theta_1 < \theta_2$. At date 0, the shareholders and manager have the same priors about θ : $\theta = \theta_i$ with probability q_i . Firm value is observable and verifiable, so a contract can be made contingent on it. Effort is privately observed by the manager.

The manager's utility function is $U(I - h(a))$, where I is income and $h(\cdot)$ is strictly increasing and convex. To incorporate managerial risk aversion in a tractable way, the function $U(\cdot)$ is assumed to take the following special form:

$$U(I - h(a)) = \begin{cases} I - h(a) & \text{if } I - h(a) \geq 0 \\ -\infty & \text{if } I - h(a) < 0 \end{cases}$$

The manager is infinitely risk averse with respect to net income, $I - h(a)$, below zero.² The results generalize to any concave function $U(\cdot)$, but the calculations are tedious and unilluminating. They also generalize to the case considered by Sappington (1983) in which the manager is risk-neutral, but protected by limited liability.

The final agent in the model is a "raider" who observes θ costlessly at date 1.³ If the raider controls the firm, the value of the firm in state θ is given by:

$$v = \theta + a + \varepsilon$$

where ε is a synergistic gain or loss from change of control, net of the transaction costs of a takeover. The variable ε is observed privately by the raider and has a distribution function, $G(\varepsilon)$, and density function, $g(\varepsilon)$, on support $[\underline{\varepsilon}, \bar{\varepsilon}]$. The lower bound $\underline{\varepsilon}$ may be negative and the upper bound $\bar{\varepsilon}$ is positive; the raider may be more or less efficient

at running the firm. The raider's utility is also defined over net income $I - h(a)$. Because the raider's income is deterministic, no assumption is made concerning her aversion to risk.

At date 1, if the raider controls the firm, she chooses effort, a , to maximize $\theta_i + a + \varepsilon - h(a)$ in state θ_i . (The raider could also hire a manager to implement the optimal action.) The optimal effort level, which is the same in both states, is the solution to $h'(a^*) = 1$. Thus, firm value gross of utility (or compensation) costs is $\theta_i + a^* + \varepsilon$. Firm value net of these costs is $y_i^* + \varepsilon$, where $y_i^* \equiv \theta_i + a^* - h(a^*)$ is net firm value excluding the synergistic gain or loss ε .

Were takeovers not possible, a contract would simply specify payments to the manager conditional on realized firm value. The Revelation Principle implies that without loss of generality we need only focus on incentive compatible contracts, i.e. contracts that induce the manager to report his private information truthfully. Thus, if the manager reports θ_i , firm value is required to be v_i , and the manager is paid I_i .⁴

With the possibility of a takeover, the contract is more complicated. As will be discussed below, the price at which shareholders sell the firm can depend on the manager's report. Managerial compensation in the event of a takeover can also depend on the manager's report. Claim 2 of the Appendix shows that, for incentive reasons, shareholders optimally set this compensation as low as possible, i.e. zero. Thus, to simplify notation, takeover compensation is assumed to be zero from the outset.

The analysis begins by analyzing a highly stylized model of takeovers, and later considers more realistic extensions. In addition to specifying v_i and I_i , the contract specifies a price, p_i , at which a raider can buy the firm if the manager reports θ_i . This price commits shareholders to selling the firm for no less than p_i , and prevents them from holding out for more than p_i .⁵

Taken at face value, this model is unrealistic; however, it captures an important phenomenon discussed by Grossman and Hart. They argue that if the value of controlling shares (held by a raider) and non-controlling minority shares are equal, no takeovers would occur in equilibrium. If a takeover increases firm value, no minority shareholder would ever tender his shares at a price below the firm's post-takeover (per share) value: a shareholder could always hold on to his shares and realize the capital gain. Thus, if there are transaction costs, a raider loses money on any successful bid.

If, instead, the expected value of a minority share is less than the expected value of a controlling share, then shareholders will tender their shares for less than their expected post-takeover value. Provided the bid is greater than the share price of the firm as an independent entity, it is a dominant strategy for each shareholder to tender his shares at any price greater than the expected post-takeover value of a minority share. Regardless of whether other shareholders tender, each shareholder is better off tendering. Thus, provided the expected value of minority share is sufficiently less than the expected value of a controlling share, and provided takeover costs are not too large, raiders will profit from a successful bid. If shareholders wish to encourage value-increasing takeovers, they have an incentive to "dilute" (in Grossman and Hart's terminology) the value of a minority share. The greater the degree of dilution, the lower is the bid price, and the greater is the frequency of takeovers. If shareholders can choose the level of dilution, they weigh these two competing effects against each other. This is similar in many respects to choosing a price at which to sell the firm.

Grossman and Hart argue that, within limits, shareholders have control over the extent of dilution through provisions in the corporate charter. For example, the corporate charter can affect the ability of a parent corporation to divert value from

minority shareholders of a subsidiary. Or voting provisions (like a supra-majority voting requirement for the removal of directors) may affect the price at which the raider can acquire shares from minority shareholders after the takeover.

Yarrow (1985) argues, in contrast, that the level of dilution is difficult to control with any precision. And, as Bebchuk (1985) points out, the value of minority shares is determined in large part by corporate law. Shareholders can, however, affect bid prices in other ways. Given a level of dilution, shareholders can affect takeover premia through various defensive tactics and anti-takeover charter amendments. Thus, instead of modelling a particular way in which shareholders affect takeover premia, this paper adopts a reduced-form formulation in which shareholders can set the takeover price. Later, it is shown that even if shareholders have no control over price, takeovers can have a disciplining effect.

In this simple model, if the manager reports θ_j in state θ_i , a takeover occurs provided

$$y_i^* + \varepsilon \geq p_j.$$

Hence, in this case there is a takeover with probability $1 - G_{ij}$, where $G_{ij} \equiv G(p_j - y_i^*)$.

3. THE OPTIMAL CONTRACT WHEN θ IS PUBLICLY OBSERVABLE AND VERIFIABLE

If θ is observable to all parties (including the courts), v , I , and p can be made contingent on θ . The optimal state-contingent or first best contract, $\{v_i^*, I_i^*, p_i^*\}$, maximizes

$$\sum_i q_i \{G_{ii}(v_i - I_i) + (1 - G_{ii})p_i\}$$

subject to

$$(IR1) \quad I_1 - h(v_1 - \theta_1) \geq 0$$

$$(IR2) \quad I_2 - h(v_2 - \theta_2) \geq 0$$

where $h(v_i - \theta_i)$ is the effort required to generate gross firm value, v_i , in state θ_i . The individual rationality constraints (IR1) and (IR2) guarantee that the manager's net income is non-negative in both states, and hence that he agrees to sign the contract.

At an optimum, $v_i^* = \theta_i + a^*$. (Recall that the raider also chooses a^* when she takes over.) In addition, at an optimum, constraint (IR1) is binding; $I_1^* = h(a^*)$, so the manager's net income is zero. Likewise, shareholders set compensation in the event of a takeover equal to zero. Thus, the manager's net income is simply his reservation income level, and he receives no surplus. Finally, the first-order condition for p_i^* is

$$g_{ii}^*[y_i^* - p_i^*] + [1 - G_{ii}^*] = 0 \tag{1}$$

where $g_{ii}^* = g(p_i^* - y_i^*)$, $G_{ii}^* = G(p_i^* - y_i^*)$, and $y_i^* = \theta_i + a^* - h(a^*)$.

The shareholders' pricing problem is isomorphic to a monopolist's. An increase in p_i increases proceeds from a takeover but lowers the probability that it occurs. A takeover is socially desirable provided total value increases in state i , i.e. when $\varepsilon > 0$. If takeovers occur only when $\varepsilon > 0$, p_i^* must equal y_i^* . However, the first-order condition for p_i^* (1) evaluated at y_i^* is positive, since by assumption $G(0) < 1$. Provided the second-order conditions are satisfied, $p_i^* > y_i^*$; the price is set above the socially optimal level, and there are too few takeovers.⁶

4. THE OPTIMAL CONTRACT WHEN THE STATE IS PRIVATELY OBSERVED BY THE MANAGER

If the state is not publicly observable, the contract cannot be made contingent on the state. However, the contract can be structured to induce the manager to report θ truthfully. If the manager reports that the state is θ_j in state θ_i , his expected utility is $G_{ij}U(I_j - h(v_j - \theta_i))$; with probability G_{ij} there is no takeover and his utility is $U(I_j - h(v_j - \theta_i))$, and with probability $1 - G_{ij}$ there is a takeover and his utility is zero.

An incentive compatible contract must therefore satisfy,

$$(IC1) \quad G_{11}U(I_1 - (v_1 - \theta_1)) \geq G_{12}U(I_2 - h(v_2 - \theta_1))$$

and

$$(IC2) \quad G_{22}U(I_2 - h(v_2 - \theta_2)) \geq G_{21}U(I_1 - h(v_1 - \theta_2)).$$

In the absence of a takeover threat ($G_{ij} = 1$, for all i, j), the first-best contract is not incentive compatible. To see this, note that since $I_i^* = h(a^*)$, the manager's utility from truth-telling is zero. But, if he reports θ_1 in state θ_2 , his utility is

$$I_1^* - h(v_1^* - \theta_2) = h(v_1^* - \theta_1) - h(v_1^* - \theta_2) > 0;$$

there is an incentive for the manager to report that the state is worse than it really is. Or, equivalently, the manager shirks, i.e., chooses effort below the first best level, a^* . For insurance reasons, the payment for poor performance is not low enough to deter the manager from shirking in the bad state.

Under the threat of a takeover, however, the first-best contract may be incentive compatible. If $G_{21}^* = 0$, there is always a takeover when the manager underreports θ , and the manager never receives the surplus $h(v_1^* - \theta_1) - h(v_1^* - \theta_2)$. Although the manager benefits from shirking if he retains control of the firm, it also makes the firm more vulnerable to a takeover; the raider only pays p_1^* if the manager shirks, while her valuation of the firm is $y_2^* + \varepsilon$.

If $G_{21}^* > 0$ (a takeover does not occur with certainty if the manager shirks), the first-best contract cannot be implemented because when the manager shirks he receives the surplus $h(v_1 - \theta_1) - h(v_1 - \theta_2)$ with positive probability. Analysis of the optimal contract in this case, as in many similar contracting problems, is simplified by observing that only the downward incentive constraint, (IC2), and the individual rationality constraint, (IR1), are binding. Claim 1 of the Appendix establishes that (IC1) and (IR2) are indeed slack at an optimum.

Let $\{\hat{v}_i, \hat{I}_i, \hat{p}_i\}$ be the optimal second-best contract, \hat{a}_i the effort level in state θ_i , and \hat{V} be the firm's ex ante value. The individual rationality constraints imply that in (IC2) and (IR1) net incomes are all positive. Therefore, these binding constraints can be substituted into the objective function. The constrained maximization problem can now be written as the following unconstrained problem:

$$\text{Maximize}_{v_i, p_i} V = \sum_i q_i \{G_{ii}(v_i - h(v_i - \theta_i)) + (1 - G_{ii})p_i\} - q_2 G_{21} \{h(v_1 - \theta_1) - h(v_1 - \theta_2)\}, \quad (2)$$

The first bracketed expression in (2) is just the maximand in the first-best problem. The second expression can be understood as follows. The term, $G_{21}[h(v_1 - \theta_1) - h(v_1 - \theta_2)]$, is the expected surplus the manager receives from underreporting θ . To induce the manager to report θ_2 rather than θ_1 , I_2 must be increased by this amount above the first-best level of I_2 . Since this amount is distributed to the manager with probability q_2 , the expression $q_2 G_{21}[h(v_1 - \theta_1) - h(v_1 - \theta_2)]$, represents the loss to shareholders relative

to the first-best. Note that the manager is strictly better off when θ is unobservable because he receives this surplus with positive probability.

It is now straightforward to show that the optimal second-best effort, firm value, and takeover price are all below their first-best levels in state θ_1 , but equal to their first-best levels in state θ_2 . Differentiating (2) with respect to v_1 , yields the following condition for \hat{v}_1 :

$$\partial V/\partial v_1 = q_1 G_{11}[1 - h'(\hat{v}_1 - \theta_1)] - q_2 G_{21}[h'(\hat{v}_1 - \theta_1) - h'(\hat{v}_1 - \theta_2)] = 0. \quad (3)$$

Since $h(\cdot)$ is convex and $\theta_2 > \theta_1$, at an optimum, $h'(\hat{v}_1 - \theta_1) < 1$. Thus, $\hat{v}_1 < v_1^*$ and $\hat{a}_1 < a_1^*$. Differentiating with respect to p_1 , yields the condition

$$\partial V/\partial p_1 = q_1 \{g_{11}[v_1 - h(\hat{v}_1 - \theta_1) - \hat{p}_1] + (1 - G_{11})\} - q_2 g_{21}[h(\hat{v}_1 - \theta_1) - h(\hat{v}_1 - \theta_2)] = 0. \quad (4)$$

Evaluating (4) at $\hat{p}_1 = p_1^*$,

$$\partial V/\partial p_1 = q_1 g_{11}^*(\hat{y}_1 - y_1^*) - q_2 g_{21}^*[h(\hat{v}_1 - \theta_1) - h(\hat{v}_1 - \theta_2)] < 0, \quad (5)$$

because $\hat{y}_1 < y_1^*$. Thus, provided the second-order conditions are satisfied, $\hat{p}_1 < p_1^*$. Finally inspection of (2) reveals that the first-order conditions for \hat{v}_2 and \hat{p}_2 are the same as in the first best solution. These results are summarized in Proposition 1.

Proposition 1. *At a second-best optimum,*

(i) $\hat{v}_1 < v_1^* < v_2^* = \hat{v}_2$

(ii) $\hat{p}_1 < p_1^* < p_2^* = \hat{p}_2$;

firm value, effort, and the takeover price are lower than their first-best levels in state θ_1 and equal to their first-best levels in state θ_2 .

Part (i) of the proposition is a standard result in the literature on contracting under asymmetric information. (See, for example, Sappington (1983).) A reduction in v_1 below v_1^* (a second-order effect) enables shareholders to lower the payment I_2 needed to induce truth-telling (a first-order effect).

Part (ii) of the proposition that $\hat{p}_1 < p_1^*$ holds for two reasons. First, the net value of the firm in state θ_1 , $\hat{v}_1 - \hat{I}_1 = \hat{v}_1 - h(\hat{v}_1 - \theta_1)$, is lower in the second-best, and hence the opportunity cost of transferring control is lower. And second, a reduction in \hat{p}_1 relaxes the incentive constraint by increasing the probability of a takeover when the manager shirks.

Note that there is nothing in the analysis to rule out the possibility that $\hat{p}_1 < \hat{v}_1 - \hat{I}_1$; shareholders may wish to set a price below the ex-post value of the firm in state θ_1 . Such a strategy has value because of its incentive effects. It is shown in Section 5 that, in a more realistic takeover model, such a strategy will be infeasible.

The central result of the paper is that the existence of a raider results in greater managerial efficiency. To see this, consider the first-order conditions for v_1 in the absence of a takeover threat, i.e. when $G_{ij} = 1$, for all i and j . Let v_1^0 be the optimal gross firm value in this case. v_1^0 solves:

$$\partial V/\partial v_1 = q_1[1 - h'(v_1^0 - \theta_1)] - q_2[h'(v_1^0 - \theta_1) - h'(v_1^0 - \theta_2)] = 0. \quad (5)$$

Evaluating (3) when there is a raider ($G_{ij} < 1$) at v_1^0 yields

$$\partial V/\partial v_1 = q_2[h'(v_1^0 - \theta_1) - h'(v_1^0 - \theta_2)][G_{11} - G_{21}]. \quad (6)$$

By the convexity of $h(\cdot)$ and $G_{11} > G_{21}$, (6) is positive. Hence, v_1 is greater in the presence of a takeover threat. This result is summarized in Proposition 2.

Proposition 2. *Firm value and effort in state θ_1 are greater when there is a raider who monitors the firm.*

Takeovers improve incentives because they penalize the manager for poor performance due to inefficient behaviour rather than due to an unfavourable environment; they are a means of discriminating among the alternative sources of poor performance.

The proof also establishes that shareholders could not achieve this allocation in the absence of the raider. The crucial feature of the model is that $G_{11} > G_{21}$; the probability of a takeover depends both on the manager's action and the state of the world. Were shareholders to threaten to replace the manager if he reported low firm value was low, this would have no effect on incentives because the decision to remove the manager is independent of the true state, i.e. $G_{11} = G_{21}$.⁷

Although different in context, the result is similar to a result independently derived by Sappington, Demski, and Spiller (1987). They consider a model of an incumbent supplier with private information about its costs, and a potential second supplier whose costs are correlated with the incumbent's. The purchaser's contract-design problem is aided by the existence of the second supplier, in much the same way as the existence of a raider aids the contract design problem considered here: the threat of switching to the second supplier (the raider), should the first supplier (the manager) report high costs (low θ), is an added inducement to report true costs (θ).

Given the disciplinary effect of takeovers, and the potential synergies that can be gained by transferring control to the raider, it is clear that the expected value of the firm is greater in the presence of a raider. To see this formally, consider a contract that sets the takeover price in state θ_i equal to net firm value in state θ_i absent a takeover threat. Then, the first expression in (2) is the same with and without a takeover threat. However, the second expression, representing the loss in ex-ante firm value due to the incentive problem, is greater when there is no takeover threat. This follows from the fact that $G_{21} = 1$, absent a takeover threat, and $G_{21} < 1$ if there is a takeover threat. This result is recorded below.

Proposition 3. *The expected value of the firm is greater when there is a raider who monitors the firm.*

5. EXTENSIONS OF THE MODEL

5.1. A more realistic takeover model

The previous section analysed the disciplinary effect of takeovers using an extremely stylized model of the takeover process. This section establishes that this basic effect generalizes to more realistic models of takeovers.

The particular model explored here is due to Grossman and Hart. As discussed earlier, in the absence of dilution in the value of a minority share, the takeover mechanism breaks down: shareholders never tender their shares in anticipation of a capital gain once the raider takes control.

Let ϕ be the extent to which a post-takeover minority share is less valuable than a share in the controlling block. One might think of ϕ as the maximum amount that can be transferred from minority shareholders to the raider after the takeover. For the moment, suppose ϕ is exogenous. A successful takeover bid, b , must exceed $x - \phi$, where x is the pro-rata expected value of the firm given shareholders' beliefs. If b is also greater than z , the value of a share in the absence of a takeover, it is a dominant strategy for

shareholders to tender and the takeover bid will succeed; regardless of whether other shareholders tender, each shareholders is better off tendering. If, however, $b < z$, the bid may succeed or fail. If a shareholder conjectures that all others will tender, his payoff from tendering is b , whereas if he does not tender, his payoff is $x - \phi < b$. If, however, he conjectures that all others do not tender, he receives $z < b$. Because takeover bids below the firm's independent value are rarely observed, it is assumed, following Grossman and Hart, that all successful bids exceed the firm's independent value.

The timing of the model is as follows. At date 0, shareholders offer the manager a contract which he can accept or reject. At date 1, the manager publicly reports θ , and if there is no takeover bid, the manager and shareholders carry out the terms of the contract. If there is a bid, shareholders must decide whether to tender based on their beliefs concerning θ and ε (which determine the value of a minority share). These beliefs depend on both the manager's *equilibrium* reporting strategy and the raider's *equilibrium* bidding strategy. Formally, the manager's reporting strategy is a mapping from the observed state (its "type") into a report of $\theta \in \{\theta_1, \theta_2\}$. The raider's strategy is a mapping from the manager's report and the observed values of θ and ε (its type) into a bid, $b \in [0, \infty)$. Finally, a shareholder's strategy is a mapping from the manager's report and the raider's bid into an accept or reject decision, $\{0, 1\}$.

These strategies must form a perfect Bayesian equilibrium:

(E1) (i) The manager's reporting strategy is optimal given the other player's strategies; (ii) the raider's bidding strategy is optimal given the other players' strategies; (iii) each shareholder's strategy is optimal given their beliefs and given other players' strategies (including the other shareholders).

(E2) The beliefs in (E1)(iii) are derived from priors over θ and ε , the manager's strategy, and the raider's strategy using Bayes' rule.

If these conditions are met, the strategies form an equilibrium for an arbitrary contract. At date 0, shareholders choose the contract that maximizes expected firm value taking into account the equilibrium that evolves from that contract at date 1.

All possible equilibria at date 1 are not characterized. Instead, only separating equilibria are characterized, i.e. equilibria in which the manager reports θ truthfully. If the equilibrium at this point is separating, the same basic effect outlined in the previous section exists in this model as well. Although all the equilibria are not characterized, the analysis suffices to show that, even without commitment to takeover prices, takeovers can have disciplinary value.

In a separating equilibrium, if the manager reports θ_i , shareholders' believe the expected value of a minority share is the expectation of $y_i^* + \varepsilon + c - \phi$ conditional on the bid being profitable for the raider. (Note that in this formulation shareholders do not pay any of the transaction cost of the takeover.) We write this expectation as $E(y_i^* + \varepsilon + c - \phi | y_i^* + \varepsilon - b \geq 0)$. In state θ_i , the minimum successful bid, b_i , solves:

$$b_i = \min \{b | b \geq E[y_i^* + \varepsilon + c - \phi | y_i^* + \varepsilon - b_i \geq 0]\}. \quad (7)$$

Equation (7) provides the fixed point to a process whereby shareholders conjecture that all raiders with ε above some level will bid b_i , and only those raiders with ε above that level do indeed bid. A necessary, but not sufficient, condition for there to exist a solution to (7) is $\phi > c$; the level of dilution must exceed the cost of a takeover.⁸ Assume there is at least one value of b satisfying the first inequality in (7). For simplicity, also assume that the minimum b is greater than the value of the firm if there is no takeover.⁹ This amounts to assuming that the raider's improvements are not too small and the dilution level is not too large.

Now consider the implications of this model for the relevant probabilities of a takeover. If the manager truthfully reports that the state is θ_1 , the probability of a takeover is $1 - G(b_1 - y_1^*)$. If, however, he reports θ_1 when the state is really θ_2 , the probability of a takeover is $1 - G(b_1 - y_2^*)$; while the raider's valuation is $y_2^* + \varepsilon$, shareholders conjecture that the equilibrium is separating, believe the manager's report, and tender for b_1 . Thus, $G_{21} < G_{11}$, precisely the condition under which takeovers have disciplinary value.

This argument does not depend on shareholders' ability to set the level of dilution; ϕ is exogenous. However, suppose shareholders can control ϕ as a function of the manager's report. From (7), it follows that bids are declining in ϕ . Thus, shareholders can induce any bid price, b_i , greater than the value of the firm if there is no takeover, $v_i - I_i$. In this case, shareholders can replicate the incentive scheme in which they can commit to takeover prices.

The effectiveness of the takeover mechanism is further illustrated by the following simple example in which ϕ is exogeneous and yet the first-best can be implemented.

Example 1. Suppose that ε can take one of two values, $\underline{\varepsilon} < \bar{\varepsilon}$, and that $\varepsilon = \underline{\varepsilon}$ with probability t . Also, $\bar{\varepsilon} > 0 > \underline{\varepsilon}$. Thus, absent incentive effects, a takeover is efficient only when $\varepsilon = \bar{\varepsilon}$. Below, it is shown that if $y_2^* - y_1^* > (1 - t)(\bar{\varepsilon} - \underline{\varepsilon})$, and $\phi - c \in [(\bar{\varepsilon} - \underline{\varepsilon}) - (y_2^* - y_1^*), t(\bar{\varepsilon} - \underline{\varepsilon})]$, the first best scheme, $\{v_i^*, I_i^*\}$ is implemented.

Suppose shareholders offer the first-best contract $\{v_i^*, I_i^*\}$, and at date 1 shareholders conjecture that the manager reports θ truthfully. The only equilibrium bidding strategy is for the raider to bid if and only if $\varepsilon = \bar{\varepsilon}$.¹⁰ To see that this is an equilibrium note that the minimum successful bid in this case is $y_i^* + \bar{\varepsilon} + c - \phi$. The $\bar{\varepsilon}$ -type raider's profit from such a bid is $\phi - c > 0$, whereas the $\underline{\varepsilon}$ -type raider's profit is $\phi - c - (\bar{\varepsilon} - \underline{\varepsilon})$ which is negative by assumption. Thus, if shareholders conjecture that only the $\bar{\varepsilon}$ -type raider bids, then only that type will indeed bid. It follows that a takeover occurs with probability t . If, however, the manager reports θ_1 and the true state is θ_2 , there will be a takeover for both values of ε , provided $\phi - c > \bar{\varepsilon} - \underline{\varepsilon} - (y_2^* - y_1^*)$, which has been assumed. Thus, $G_{21} = 0$, and the manager receives no surplus from shirking. Note that control is transferred only when it is efficient to do so, i.e. when $\varepsilon > 0$. In this example, the first-best solution is implemented although shareholders cannot commit ex ante to prices at which to tender their shares.

5.2. Observability of θ

The above analysis assumes that contracting problems arise because of private information observed by the manager. An alternative source of contracting problems is that while the state is observable by all parties at date 1, it is too complex or costly to describe ex ante.¹¹ Because contracts cannot be made contingent on θ , as before, the optimal contract is a direct revelation mechanism.¹² It is shown, however, that when θ is observable and the takeover process is as described in Section 5.1, takeovers have no disciplinary value.

If θ is publicly observable, regardless of the manager's report, the minimum acceptable bid in state θ_i is b_i given in (7); the manager's report cannot affect shareholders' beliefs concerning the value of a minority share ($G_{11} = G_{12}$, $G_{22} = G_{21}$). In addition, Claim 3 of the Appendix establishes that the probability of a takeover is the same in both states. The difference in the bid prices, $b_2 - b_1$, exactly equals the difference in the sum value of the firm to the raider, $y_2^* - y_1^*$; because of the free-rider problem, any perceived

increase in the mean value of the firm is fully captured by shareholders. Thus, $G_{21} = G_{22} = G_{11}$; if the manager reports θ_1 , the probability of a raid is the same regardless of the true state. It then follows that if θ is publicly observable, takeovers have no disciplinary value.

Example 2. Assume the conditions of Example 1 are met. The probability of a takeover is independent of the manager's report and equals t in both states. Thus, $G_{21} = G_{11}$, and takeovers have no disciplinary value.

This section illustrates the importance of identifying the source of contracting problems in determining whether takeovers have disciplinary value. If shareholders can observe the source of poor performance, the free-rider problem eliminates the disciplinary value of takeovers. If they cannot, the takeover mechanism can be an effective disciplinary device.

5.3. Management resistance

The above models ignore the possibility of management resistance to a hostile takeover. In practice, managerial resistance takes a number of forms. One frequently used resistance strategy is to restructure the firm in response to a takeover bid. For example, issuing large amounts of debt is one way of deterring a raid (Harris and Raviv (1987)). Simply implementing the changes that the raider is planning is another. Or, management can even offer to buy the firm. Indeed, Shleifer and Vishny (1987) present evidence suggesting that management buyouts in the United States are defensive responses to an actual bid or perceived takeover threat.

This restructuring phenomenon is modelled by supposing that the manager can bid for the firm if a raider makes a bid. The following example shows that such renegotiation can reduce the disciplinary effect of takeovers.

Example 3. Assume the conditions of Example 1 hold. Further, assume there are no takeover costs for the manager. While this is an extreme assumption, it is likely that management's costs are lower than the raider's. The manager is then willing to bid up to y_i^* in state θ_i . (Recall that if the takeover is successful the manager is paid nothing.¹³) This puts another floor on the price at which a raider can take over.

In the absence of managerial resistance, the minimum successful bid in state θ_i is $y_i^* + \bar{\varepsilon} - (\phi - c) > y_i^*$. Thus, in state θ_i a raider with a high valuation still wins against the manager and the probability of a takeover is t . In Example 1 it was assumed that if the manager reports θ_1 , but the state is θ_2 , both types of raider would be willing to take over: $y_2^* + \varepsilon > y_1^* + \bar{\varepsilon} - (\phi - c)$. But, in this model, the manager would outbid the ε -type raider because $\varepsilon < 0$. Hence, a raid only occurs with probability t if the manager shirks; $G_{21} = G_{11}$, and takeovers have no disciplinary value.

The basic idea is that resistance has negative incentive effects because it does not allow shareholders to sell the firm for considerably less than it is worth when the manager shirks. This is the same difficulty that arises when θ is observable, because, in essence, the manager releases information about θ at the time of a bid. Although resistance has negative incentive effects, it may make shareholders better off by enabling the manager to extract more surplus from the raider. This will be especially true if the level of dilution is outside the control of shareholders and is relatively large. But note that social welfare is unambiguously reduced by management resistance since the larger takeover premia are merely transfers from the raider to the shareholders.¹⁴

In this model, it has been assumed unrealistically that the manager cannot bid for the firm if there is no outside bid. If the manager can bid, this exacerbates the problems that arise from managerial resistance. The manager now has an added incentive to report θ_1 in state θ_2 so as to lower shareholders' perceived valuation of the firm and enable him to buy the firm at a low price. Indeed, in the absence of a raider who monitors the firm, the takeover mechanism is just a means for the manager to renegotiate his contract with shareholders. Although at date 1 such renegotiation may increase efficiency, it has negative ex ante incentive effects.

This section also suggests that the existence of more than one raider can have negative ex ante incentive effects. If the manager shirks, and two or more raiders bid against each other, they will bid the price up to their private valuations. Thus, shareholders will be unable to sell the firm at a low price when the manager shirks. As shown above, this has negative incentive effects.

5.4. *Uninformed raiders*

The disciplinary effect of takeovers depends very much on the assumption that the raider is informed about the state. If the raider is uninformed, takeovers can actually have a negative impact on managerial incentives. This is because the recontracting that occurs when there is a takeover destroys the incentives for truthful revelation. Baron and Besanko (1987) and Laffont and Tirole (1987) have demonstrated this point in the context of government regulation of firms; the regulator's inability to commit not to use information revealed early in the relationship (say that costs are low) makes firms reluctant to reveal this information.

Similarly, if a raider takes control and is not bound by the old contract, she will use the information already revealed to the detriment of the manager. The manager will therefore be reluctant to reveal his private information. For example, in the model of Section 4, the manager is induced to reveal the true state by giving him some surplus in state θ_2 , so that he is indifferent between reporting θ_2 and θ_1 . But, this cannot be an equilibrium if there is an uninformed raider who can take over. In this putative equilibrium, if the manager reports θ_2 , the raider will take over and negotiate this surplus down to zero. Thus, the manager will not reveal the true state. Indeed, in this model there is no fully separating equilibrium, and the contract is less efficient.

6. CONCLUDING REMARKS

The implications of this analysis for policy are mixed. Under the view that the raider is informed, the results of Section 5.2 argue against policies that improve shareholders' information at the time of a raid; if shareholders are informed about θ , they will not tender their shares at a low price when the manager shirks. Thus, for example, the Williams Act of the United States, which sets a minimum time that a bid must remain outstanding, and presumably gives shareholders more time to evaluate a takeover bid, decreases social welfare under the assumptions of this model. For the same reasons, the results of Section 5.3 argue against allowing management resistance and more than one bidder.

These implications follow under the assumption that the raider is informed. If, as in Section 5.4, the raider is uninformed, the opposite conclusions may follow. Takeovers are then simply means of renegotiating ex-post inefficient contracts, which has negative ex ante incentive effects. If the raider has synergistic improvements in the firm, these

benefits must be weighed against the negative incentive effects. In this case, the welfare effects of takeovers and the implications of this model for policy are ambiguous.

APPENDIX

Claim 1. (IR1) and (IC2) are binding at an optimum, and (IR2) and (IC1) are slack at an optimum.

Proof. The proof begins by analysing the relaxed program in which (IC1) and (IR2) are slack, and later showing that the optimal solution to this relaxed program satisfies (IC1) and (IR2).

(i) Suppose (IC1) and (IR2) are slack. If (IC2) is slack, it is then optimal to set I_2 as low as possible, and v_2 as high as possible. This violates (IR2), so (IC2) must be binding. If (IR1) is slack, it is possible to reduce I_1 slightly, which still satisfies (IR1), relaxes (IC2), and increases the objective function.

(ii) It is now shown that given (IC2) and (IR1) are binding, and the solution to the problem is as given in the text, (IC1) and (IR2) must be slack. Because (IC2) is binding,

$$G_{22}[I_2 - h(v_2 - \theta_2)] = G_{21}[I_1 - h(v_1 - \theta_2)].$$

Note $G_{22} > G_{21}$, since by Proposition 1, $p_1 < p_2$. By the convexity of $h(\cdot)$ and $G_{22} > G_{21}$,

$$G_{22}[I_2 - h(v_2 - \theta_1)] < G_{21}[I_1 - h(v_1 - \theta_1)] = 0.$$

The equality sign follows from (IR1). Thus, $I_2 - h(v_2 - \theta_1) < 0$ and $U(I_2 - h(v_2 - \theta_1)) = -\infty$, so the manager never reports θ_2 in state θ_1 . This establishes that (IC1) is slack.

Finally, from (IC2) and (IR1) it follows that (IR2) is slack. ||

Claim 2. Let I_i^T be takeover compensation in state θ_i . $I_i^T = 0$ is an optimal solution.

Proof. (IC2) is now written:

$$(IC2) \quad G_{22}[I_2 - h(v_2 - \theta_2)] + (1 - G_{22})I_2^T \cong G_{21}[I_2 - h(v_1 - \theta_2)] + (1 - G_{21})I_1^T.$$

There is an additional individual rationality constraint that $I_i^T \cong 0, i = 1, 2$.

If $I_1^T > 0$, then I_1^T could be reduced slightly, still satisfying the individual rationality, relaxing (IC2), and reducing the expected payment to the manager. Thus, $I_1^T = 0$.

In state θ_2 , shareholders care only about the expected payment to the manager, $G_{22}I_2 + (1 - G_{22})I_2^T$, not the particular values of I_2 and I_2^T . The optimal value satisfies (IC2) with equality, given v_1, v_2 , and I_1 . Thus, $I_2^T = 0$ is an optimal solution, although it is not unique. ||

Claim 3. In the model where ϕ is exogenous, the probability of a takeover is the same in both states; $G_{22} = G_{11}$.

Proof. As in the text, assume there exists at least one solution to

$$(*) \quad b_i = y_i^* + E[\varepsilon | \varepsilon \cong b_i - y_i^*] - (\phi - c).$$

The proof establishes by contradiction that $b_2 - y_2^* = b_1 - y_1^*$, so that the minimum ε above which a takeover is profitable is the same in both states.

(i) Suppose $b_2 - y_2^* > b_1 - y_1^*$. Then set $b' = b_1 - y_1^* + y_2^* < b_2$. As b_1 solves (*), substituting b' into (*) establishes that it too solves (*). This contradicts the assumption that b_2 is the minimum bid in state θ_2 .

(ii) Suppose $b_2 - y_2^* < b_1 - y_1^*$. Choose $b'' = b_2 - y_2^* + y_1^* < b_1$. Substituting b'' into (*), establishes that it too solves (*) if b_2 solves (*). This contradicts the assumption that b_1 is the minimum bid in state θ_1 .

This establishes that if there is a solution to (*) the minimum bids must solve $b_2 - y_2^* = b_1 - y_1^*$. ||

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NOTES

1. One interpretation of this process is that a small group of shareholders get together at date 0 and hire a manager. There are thus no free-rider problems among the shareholders. Later on, these shareholders sell their stakes in the firm to a large group of shareholders subject to considerable free-rider problems. This is roughly the scenario described by Grossman and Hart.

2. This point of discontinuity is chosen to coincide with the manager's reservation income level to ensure that the payments to the manager are low enough so that he exhibits some risk aversion.

3. It is assumed the raider observes θ costlessly to simplify the model. In equilibrium, the raider generally earns positive expected profits. Thus, it will pay for her to observe θ provided it is not too costly.

4. If firm value is not v_i , the manager receives the maximum feasible penalty. He would then always choose effort so that the firm value is v_i .

5. In many contracting models, analysis of the direct revelation game is equivalent to an incentive scheme based on observable variables; however, here the revelation game may actually perform better. This is because there is no observable outcome in the event the manager reports θ and there is a takeover; and hence the takeover price cannot be made contingent on firm value.

If, however, the model is extended to two periods, the two schemes will be equivalent. In the two-period model without takeovers, Baron and Besanko show (in a related model) that the optimal scheme is simply the one-period scheme repeated in the second period. The principal essentially commits not to use the information revealed in the first period. Now suppose a takeover can occur after the first period. Then shareholders can specify a function $p(v)$ giving the takeover price as a function of firm performance in the first period. This scheme will be equivalent to a direct revelation mechanism based on the manager's report. A takeover price based on a report of θ is like a takeover price based on firm performance. The models should be reinterpreted along these more realistic lines.

6. Although this contract is referred to as the first best, it should be kept in mind that it is first best in that it maximizes shareholder welfare, not social welfare.

7. Maskin (1981) and others have shown that introducing randomness in the incentive scheme can improve incentives if the agent is risk-averse. The takeover mechanism implicitly introduces randomness in the incentive scheme; however, his results do not apply here since the manager is risk-neutral in the relevant range of incomes.

8. This is the condition identified by Grossman and Hart. To prove this, suppose that shareholders conjecture that only a raider with a valuation exceeding ε' would take over. Then the minimum successful bid in state θ_i solves

$$b_i = y_i^* + c - \phi + E[\varepsilon | \varepsilon \geq \varepsilon'].$$

The profit of a raider with a valuation of ε' must be zero:

$$y_i^* + \varepsilon' - b_i = \varepsilon' - E[\varepsilon | \varepsilon \geq \varepsilon'] + \phi - c = 0.$$

But, since the first two terms sum to a negative number, $\phi - c$ must be positive. (Note if $\phi = c$, a raider with a valuation of $\bar{\varepsilon}$ could take over, but this event occurs with probability zero.)

9. Without this assumption, the winning bid would be the greater of b_i and $v_i - I_i$, since a successful bid must exceed the value of the firm as an independent entity. This opens up the possibility that the shareholders would choose a higher level of $v_i - I_i$ so as to get a higher takeover price. However, bids exactly equal to the firm's independent value are rarely observed, and hence this possibility is ignored.

10. Another possible equilibrium is where both types of raider bid. It is straightforward to verify that the assumption that $\phi - c < t(\bar{\varepsilon} - \underline{\varepsilon})$ rules out the possibility of such an equilibrium.

11. See Grossman and Hart (1986) and Hart and Moore (1985) for a discussion of contracting problems under these circumstances.

12. This assumes that contracts cannot be written in which both shareholders and the manager report θ , and both are penalized severely if their reports differ. If such a contract were feasible, it would achieve the first best. One possible way of ruling out such contracts is to assume that while shareholders can observe θ at date 1, they cannot adequately describe the state.

13. One might argue that increasing takeover compensation would reduce the amount the manager would be willing to bid, and hence would reduce the problems arising from management resistance. However, when takeover compensation is increased it also reduces the amount the raider is willing to bid because the raider must pay this compensation. The two effects exactly balance each other.

14. This assumes that the gains from a change in control do not come at the expense of other agents in the economy, for example through increased monopoly power.

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