

Managerial performance, boards of directors and takeover bidding

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Abstract

This paper models the maintenance of management quality through the simultaneous functioning of internal and external corporate control mechanisms—board dismissals and takeovers. We examine how the information sets of the board and the acquiror are noisily aggregated, and how this affects the behavior of the board and the acquiror. The board of directors, acting in shareholders' interests, will sometimes oppose a takeover, and this opposition can be good news for the firm. An unsuccessful takeover attempt may be followed by a high rate of management turnover, because a takeover attempt conveys adverse information possessed by the bidder about the manager. If there is a probability that the board is ineffective, then a forced resignation of the manager can be either good or bad news for the firm. A positive effect is predicted to dominate when there is more adverse public information available about the manager's performance and when there is a higher *ex ante* probability that the board is ineffective, for example, if the board is management-dominated rather than outsider-dominated.

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Robert A. Schoelhorn appeared to be the model chief executive. As CEO of Abbott Laboratories, the former sales rep had overseen a major comeback, nearly tripling sales and quadrupling profits during the 1980s. He was toasted as an Executive of the Year by a business magazine in 1986 and invited on the boards of more than half a dozen corporations and trade groups.

But few people knew much about the less public Schoelhorn—the grandiose man who ruled over his company as if it were a private fiefdom. Few people, that is, until Abbott's board kicked him out last March.

Cover Story: 'CEO Disease,' *Business Week*, April 1, 1991.

1. Introduction

Despite an apparent decline in the last two decades of the role of the board of directors as the shareholders' watchdog to monitor management performance, boards have traditionally played an important part in the functioning of public corporations (e.g. see DeLong, 1990). With the recent proliferation of regulatory and legal impediments to (hostile) takeovers, boards are expected to become even more significant in corporate monitoring.¹ Of course, to the extent that boards pick up the slack by being tougher on inefficient managers, the cost of these impediments to shareholders is reduced.

¹ In a recent article entitled, 'More Chief Executives Are Being Forced Out By Tougher Boards', the *Wall Street Journal* (6/6/91) reports,

'Chief executives have long been pampered, powerful and paid plenty. And while there's certainly no wholesale corporate revolution going on against CEOs, it's also clear that their perches are getting somewhat more precarious. Just ask the recently departed chiefs of First City Bancorp. of Texas Inc., Data General Corp., Grumman Corp., Circle K Corp., Southeast Banking Corp. and Abbott Laboratories.

The growing list partly reflects the economic hard times. It also shows the increased power of institutional investors and the rising vigilance of outside directors. These directors now run important board committees and outnumber insiders at 96 of 100 large U.S. companies surveyed by executive recruiters SpencerStuart. That's up from 81 a decade ago. The firm says the number of those boards with a 4-to-1 or greater ratio of outsiders to insiders has doubled to 40 in the past decade. The average ratio at big corporations now is 3-to-1, up from 2-to-1 in 1980.'

As this discussion suggests, there is an interplay between the internal mechanism for corporate control (as represented by actions of the board of directors) and the external mechanism for corporate control (as represented by actions of an acquiror). The takeover market is less important when the board is up to the task of removing inefficient managers. Conversely, the board's behavior is likely to be affected by its knowledge that the takeover market is active. This interplay between the board and acquirors has not received attention in the theoretical literature on corporate control which has, for the most part, considered takeovers in isolation (e.g. Grossman and Hart, 1980; Fishman, 1988). The importance of the interplay between board and acquirors is highlighted by the evidence of Kini et al. (1993) that CEO turnover after takeovers is inversely related to prior target performance among targets with insider-dominated boards, but not for those with outsider-dominated boards. See also Brickley and James (1987) whose empirical evidence in banking suggests that the market for takeovers and boards of directors are substitute devices in controlling managerial behavior.

We develop a model in which the disciplinary roles of the board of directors and takeovers are considered simultaneously. Our purpose is to provide a theoretical framework within which to interpret the existing evidence on the relation between these internal and external control mechanisms, and to generate additional predictions.²

We assume in our analysis that the target firm's board can be either lax (aligned with management) or vigilant (aligned with shareholders), and that only the board knows its own type. A lax board ignores internal signals of managerial performance and seeks to protect the manager's job to the extent possible. Thus, it never dismisses the manager. A sufficiently high offer price may exert enough 'price pressure' on it, however, to succumb to the takeover bid. A vigilant board's incentive, on the other hand, is more closely aligned with that of the shareholders, although it too may display some aversion to a takeover.³ Such a board may dismiss the manager, and even if it retains him, it may accept a takeover bid, based on a rational processing of its own information about the manager in conjunction with information conveyed by the bid. We also assume that it is uncertain *ex ante* whether an acquiror will arrive with a more efficient manager to replace the incumbent in the target firm.

We model the interaction between the internal and external corporate control mechanisms as a sequential interaction between the board and the

² For related empirical evidence on takeover-related management turnover, see Martin and McConnell (1991), Klein and Rosenfeld (1988), and the survey by Jensen and Warner (1988).

³ Such aversion may arise from the fact the (hostile) takeovers often result in changes in the composition of the target firm's board of directors.

acquiror. The board moves first in making a decision to either retain or fire the manager. This decision is based on a (noisy) signal of the manager's ability that is privately observed by the board, and also on whether the board is lax or vigilant. If the board fires the manager and replaces him with another manager, the game ends. Otherwise, the acquiror (if one is present) privately observes another signal of the manager's ability and then decides whether or not to make a bid for the firm. The bid price depends in part on the acquiror's beliefs about the board's vigilance. Although the board does not directly observe the acquiror's signal, the bid price conveys information. The board can either accept or reject the bid, based on the noisy aggregation of its own signal with its inference of the acquiror's information. If the bid is accepted, the incumbent target manager is removed by the acquiror. If the bid is rejected, the board can decide once again whether to retain the manager or fire him based on the information communicated by the bid.

The model has several implications. We show that unsuccessful takeover attempts may be followed by a high frequency of management turnover. The reason is that even though a takeover attempt is rejected because the offer price is inadequate, the board infers from the takeover bid that the bidder possesses adverse information about the manager. This, when (noisily) aggregated with its own information about the manager, leads the board to have less favorable posterior beliefs about managerial ability than it did prior to the offer. This explains the otherwise puzzling finding that targeted repurchases of shares held by potential takeover bidders (i.e., greenmail) are frequently associated with top management changes (Klein and Rosenfeld, 1988). Similarly, Franks and Mayer (1993) find that unsuccessful hostile takeover bids—even those not involving greenmail—are followed by high rates of executive dismissals.

Another result is that when the board acts to maximize shareholder wealth, an active takeover market tends to substitute for internal dismissal by the board. When the takeover market is active, board members become more lenient in marginal cases because it becomes more desirable to exploit the information/expertise of the outside acquiror to determine whether a change in management is desirable. Conversely, firms with active boards should be less subject to takeovers. This agrees with the view of some practitioners. For example, in its cover story, *Business Week* (7/3/89) states that

'...management at many companies does need to be made more accountable. If more boards took charge, management would be under less threat of attack—from raiders, from foreign rivals, from shareholders, and from the public at large.'

Furthermore, Shivdasani (1991) reports that directors in hostile takeover targets have lower ownership stakes on average in their firms than do

directors in a control sample. This is consistent with the view that firms with inactive boards are more prone to becoming hostile targets.

Nevertheless, the information aggregation that occurs between the bidder and the board is far from perfect. An obvious problem is that managerial retention may be due to the laxity of the board. Furthermore, even if a board has a good reputation for vigilance, the bidder does not always know if the board regards a retained manager as a marginal or superior performer. To the extent that the bidder is uncertain, this pooling reduces his incentive to replace a marginal manager. Conversely, even if the board has favorable information about the manager, the ignorance of the potential acquiror about the board's information will sometimes lead to a takeover attempt. Now, even a vigilant board will oppose the takeover attempt if its own information about the manager is sufficiently favorable to warrant retention despite the adverse information conveyed by the bid. Or, it may demand a price so high that the bidder is not willing to acquire. Hence, we have the result that board resistance to a takeover attempt can be good news for shareholders.

We show that if there is a probability that the board is lax, a dismissal can be either good or bad news for the firm. The reason is that on the one hand it may signal that the firm has been doing poorly, but on the other may reveal that the board is effective in removing a bad manager. Hence, the positive effect is more likely to dominate when *public* information about the manager's performance is more adverse and when there is a higher *ex ante* probability that the board is lax (for example, if the board is management versus outsider dominated or if directors have lower percentage equity ownership).

Our analysis also indicates that the price offered in a takeover bid depends on the bidder's beliefs about the board's vigilance, because vigilance affects the probability of offer success. Somewhat surprisingly, for a range of sufficiently high values of the *ex ante* probability that the board is vigilant, the bid price is *decreasing* in the probability that the board is vigilant. Thus, target shareholders may benefit from the bidder believing that there is a likelihood that the board is lax. However, there is a critical value of the *ex ante* probability of the board being vigilant such that a lower probability may lead to no takeover bid being made. Thus, a sufficiently strong suspicion that the target board is lax can hurt the target shareholders in that there are even fewer takeover attempts relative to the social optimum.

The paper most closely related to our work here is Hirshleifer and Thakor (1991), which also theoretically examines the interaction between the actions of boards and acquirors. The three key differences between that and this paper are as follows. First, Hirshleifer and Thakor allow the acquiror to dismiss the *board* as well as the manager. This gives rise to what is referred to as a 'kick-in-the-pants' effect, so that the board may be overly aggressive in firing the manager to enhance its own reputation for vigilance and thereby

protect its members' job security. Second, Hirshleifer and Thakor assume that all the surplus from the takeover accrues to the target firm's shareholders, whereas the bid price is determined endogenously here. Third, Hirshleifer and Thakor do not examine price reactions to board firings and takeovers. Our principal focus is on the determination of the bid price and on the price reactions to board firings as well as the management turnover implications of takeovers. This focus is motivated by a growing body of empirical work in this area.

The rest of the paper is organized as follows. Section 2 describes the model. Section 3 has the analysis and the results. Section 4 interprets the equilibrium and relates it to the empirical evidence. Section 5 concludes. All proofs are in the Appendix.

2. The model

The basic setup is as follows. There are two types of managers: good (G) and terrible (T). Firm value is higher with a good manager than with a terrible manager, but the manager's type is a priori unknown. The commonly known and shared prior belief is that there is a probability $\gamma \in (0,1)$ that the incumbent manager is good and a probability $1 - \gamma$ that he is terrible. We assume that the board and the acquiror privately receive signals of managerial ability (type). Let x and y be noisy indicators of managerial ability that are privately observed by the board and by the potential outside acquiror, respectively. Let R versus D denote retention versus a board dismissal of the manager, and let A denote an acquisition attempt. We assume that x and y are positive indicators, i.e.,

$$\Pr(x \geq \hat{x} | G) \geq \Pr(x \geq \hat{x} | T) \text{ and } \Pr(y \geq \hat{y} | G) \geq \Pr(y \geq \hat{y} | T). \quad (1)$$

for every \hat{x} in the range of x , with strict inequalities for every \hat{x} except at the end-points of the range of values of x . Further, neither x nor y is a sufficient statistic for the other.

The average stock price reaction to a dismissal as well as the likelihood and size of a takeover bid may depend on the perceived vigilance of the board of directors. We allow for two categories of boards: *vigilant* and *lax*. The objective of a vigilant board is to maximize the expected value of cash flows accruing to shareholders, net of a random, non-pecuniary cost suffered by the board if there is a takeover. It therefore makes its initial dismissal/retention decision as well as its subsequent decision of whether or not to accept a takeover bid based on a rational processing of its own information about the manager as well as that potentially conveyed by the bid.

A lax board ignores information about the incumbent manager's performance and never dismisses him. To the extent possible, it even resists any

takeover attempts, but there may be a critical price level above which an offer will sometimes succeed. We assume that this success probability against a lax board is increasing in the bid. The idea is that even a board that seems to be allied with management may side with an opposing bidder (owing, perhaps, to the threat of lawsuit). For example, in the RJR-Nabisco LBO, the board was viewed as subservient to CEO Ross Johnson, but eventually the board accepted an arguably lower offer from Kohlberg, Kravis and Roberts' instead of Johnson's buyout offer. The success of an offer is assumed to be stochastic to reflect the fact that bidders and investors often do not know with certainty whether a board is willing to remove the top executive.

A high versus low probability that a board is lax is intended to correspond at least partially with Weisbach's (1988) categorization of boards as inside-(management-) versus outside-dominated.^{4,5} Let ω be the prior probability that the board is vigilant, and $1 - \omega$ the prior probability that it is lax. Neither potential acquirors nor investors know the board's type, but the value of ω is common knowledge.

We assume that even a vigilant board has a random cost $\delta > 0$ (with density function $f(\delta)$ uniform over $[\delta, \bar{\delta}]$ and cumulative density function $F(\delta)$) of being acquired. This may be viewed as a control premium, which reflects the fact that a takeover may also displace the board of an acquired target. We assume that this cost is bidder-specific, so that the target board and the bidder assign the same probability distribution at $t = 0$ over δ . The board does not incur this cost if it fires the manager itself.

Let $\tau(P)$ be the probability that a lax board will accept a takeover bid in which a price P is offered for the firm. We envision that there is a critical price P_c such that $\tau(P) = 0$ for all $P \leq P_c$ and $\tau(P) > 0$, $\tau'(P) > 0$ for all $P > P_c$. That is, for a possibly large range of prices, a lax board will staunchly resist any takeover attempt, but will tend to capitulate when faced with higher bid prices.

Firm value has two components. The first, A , arises from past decisions. The second, B , arises from new decisions. If the manager is good (G), then $B = \beta$ and then $A = \alpha$. If the manager is terrible (T), then $A = B = 0$. The expected values of these two components are: $\bar{A} = \alpha \Pr(\text{target manager is good}) \equiv \alpha \Pr(G)$ and $\bar{B} = \beta \Pr(\text{target manager is good}) \equiv \beta \Pr(G)$.

⁴ Rosenstein and Wyatt (1990) find a positive stock price reaction to the appointment of outside board members, consistent with a role for outside board members distinct from that of insiders. The evidence of Kini et al. (1993) referred to in the Introduction also supports the notion that board vigilance increases with outside domination.

⁵ There are other reasons why a board might be reluctant to fire. For example, members of a board could lose reputation by firing a manager, since this could be tantamount to conceding that the board made an error in the original hiring decision. This is similar to Boot's (1992) prediction that managers will be reluctant to terminate unprofitable projects.

The board first observes x , after which a potential acquiror observes y but not x . If the board dismisses the incumbent manager, it replaces him with a random draw from the available pool of managers, i.e., there is a probability γ that the replacement is a good manager. The board does not know y when it makes its retain/dismiss decision after observing x . We simplify by assuming that x and y can take on only the values of 0, 1 or 2. Let \bar{A}^x and \bar{B}^x denote the expected values of the two components of firm value, given x . Similarly, let these expected values be \bar{A}^{xy} and \bar{B}^{xy} , conditional on the pair (x, y) . That is, $\bar{A}^x = E(A | x)$, $\bar{B}^x = E(B | x)$, $\bar{A}^{xy} = E(A | x, y) = \alpha \Pr(G | x, y)$, and $\bar{B}^{xy} = E(B | x, y) = \beta \Pr(G | x, y)$. In addition, we let \bar{B}^{NM} denote the expected value of the second component of firm value under a new manager. That is, $\bar{B}^{NM} = \beta \gamma$.

Conditional on the manager being good or terrible, x and y are i.i.d. random variables. Thus, the following distribution of x also applies to y : $\Pr(x = 0 | G) = p_0$, $\Pr(x = 1 | G) = p_1$, $\Pr(x = 2 | G) = 1 - p_0 - p_1$, $\Pr(x = 0 | T) = q_0$, $\Pr(x = 1 | T) = q_1$, and $\Pr(x = 2 | T) = 1 - q_0 - q_1$. Note that this implies that x and y are *affiliated* random variables (see Milgrom and Weber, 1982). We impose the following restrictions on these exogenous parameters:

$$\begin{aligned} & \text{(i) } p_0 < q_0, \text{ (ii) } p_1 < q_1, \text{ (iii) } p_0[1 - p_0 - p_1] < q_0[1 - q_0 - q_1] \text{ and} \\ & \text{(iv) } p_1[1 - p_0 - p_1] > q_1[1 - q_0 - q_1]. \end{aligned} \quad (\text{R-1})$$

Throughout, 'R' will refer to a set of parametric restrictions. We will explain the need for (R-1) later.

There is a probability $0 < \xi < 1$ that the acquiror will have a good manager, and a probability $1 - \xi$ that it will have an average (*de novo*) manager, whose ability equals the expected value of the ability of a randomly drawn manager. The bidder knows whether its manager is good or average, and makes its bid to maximize his expected profit from acquisition. We will assume shortly that it never pays to make a bid if the bidder's manager is average, so this assumption is equivalent to assuming that there is a probability ξ that a potential bidder will arrive.

The bidder faces two costs associated with takeovers: a bidding cost $b > 0$, and a control transfer cost $K > 0$. The bidding cost prevents the bidder from making a frivolous bid even though its own signal reveals that the target manager is very good and hence that its bid will be rejected with high probability. The control transfer cost, if sufficiently large, ensures that it does not pay to acquire a firm which has just fired its manager.

We assume that there is a cost of delay to the firm in removing a terrible manager. The cost of waiting is that the expected value arising from new decisions is lower when a terrible manager is retained longer. Specifically, if the board fires the manager before a takeover bid arrives and replaces him

with a *de novo* manager, the expected value of B is \bar{B}^{NM} ; but if the manager is only replaced after an unsuccessful takeover attempt, the expected value is

$$wE(B|x, \text{bid price } P) + [1 - w]\bar{B}^{NM}, \quad (2)$$

where $w \in (0,1)$. The structure of the game is as follows. There are four dates. At date 0 the manager selects a project. If the manager is good, the project will succeed and yield a payoff of $A = \alpha$. If the manager is terrible, the project will fail and yield a payoff of $A = 0$. At date 1, a signal about the manager (or equivalently about project success) is observed by the board of directors. Based on x , the board, if vigilant, decides either to force a resignation (dismissal, D) or to retain (R) the manager. A lax board always retains the manager. At date 2 the acquiror observes whether his own manager is good or terrible, observes y , and decides whether to submit a takeover bid of price P to the target's board. The bidder incurs a cost b if he makes a bid. At date 3, the vigilant target board observes its private cost $\delta > 0$ of being acquired. The vigilant board aggregates its own x with its inference about y drawn from the acquiror's bid price P and makes its decision to accept or reject the offer, conditional on the realized δ . The lax board's action depends only on the bid price P . If the target board accepts the offer, then the bidder incurs a cost of control transfer K and acquires the firm.

We have assumed that the board does not observe y . It will, however, in equilibrium be able to infer y from the presence or absence of a takeover bid and the size of the bid. If there is no bid (and the board has not dismissed the manager previously), then the (vigilant) board will still retain the manager, since the failure of an acquiror to make an offer conveys favorable information about the manager. The bidder will make an offer only if there is a gain to removing the manager that exceeds the total cost $K + b$.

3. The analysis

3.1. Conjectured equilibrium

The strategies of targets and bidders are interdependent. The target board's strategy at date 1 with regard to D or R depends on its own type and its signal x . We will show that a vigilant board will dismiss the manager if its observed signal x falls below a critical value x^* . The bidder's strategy at date 2 depends on the target board's decision of D or R at date 1, as well as its own signal y . Finally, the target board's strategy at date 3 depends on its signal x , the bidder's offered price P and the target's realized δ . It should be remembered that the acquiror does not observe x .

Let δ_{xy} be the critical value of δ such that, given the pair (x, y) , the bid will be accepted if and only if $\delta \leq \delta_{xy}$. Then in the proposed Perfect Bayesian

Equilibrium, we have the following. In this we assume the acquiror has a good manager.⁶

- (i) Vigilant board observes $x = 0$ at date 1 and chooses D
- (ii) Vigilant board observes $x = 1$ at date 1 and chooses R. If the acquiror observes $y = 0$ for target manager, it bids $P = P(0)$ at date 2. If acquiror observes $y = 1$ for target manager, it bids $P = P(1)$ at date 2. Target board accepts bid of $P(0)$ at date 3 only if $\delta \leq \delta_{10}$, accepts bid of $P(1)$ at date 3 only if $\delta \leq \delta_{11}$; otherwise it rejects bid and dismisses the manager, replacing him with a *de novo* manager. If acquiror observes $y = 2$, it does not make a bid.
- (iii) Vigilant board observes $x = 2$ at date 1 and chooses R. Acquiror observes $y = 0$ for target manager, and bid $P = P(0)$. Board accepts bid if $\delta \leq \delta_{20}$; otherwise it rejects the bid and replaces the manager with a *de novo* manager. If acquiror observes $y = 1$, he bids $P = P(1)$, in which case board rejects bid and retains manager. If acquiror observes $y = 2$, he does not make a bid.
- (iv) The acquiror bids only if it has a good manager. A lax board never dismisses the manager and its probability of accepting a bid of P is $\tau(P)$.

3.2. The bidder's strategies

Since the bidder's decision is trivial unless it has a good manager, we will restrict attention to a bidder with a good manager. Furthermore, the fact that the proposed equilibrium is separating in the bidder's strategies implies that the (vigilant) board will be able to infer accurately the bidder's signal from the observed bid price. We will deal separately with each possible value of y .

Case 1: $y = 0$

Subcase: $x = 1$. Suppose first that $x = 1$ is observed by the (vigilant) board. (We can ignore $x = 0$ here since the bidder does not come into play in that case). The board's utility if it rejects the bid and dismisses the manager is

$$\bar{A}^{10} + w\bar{B}^{10} + [1 - w]\bar{B}^{NM}, \quad (3)$$

where $E(B | x = 1, P = P(0)) = E(B | x = 1, y = 0) = \bar{B}^{10}$, since the board can infer from $P(0)$ that $y = 0$. The expression in (3) captures the notion that there is a cost of waiting to dismiss the manager, which is higher (as manifested in a lower \bar{B}^{10}) if the manager is perceived to have lower ability. If the board rejects the bid and retains the manager, its utility is

$$\bar{A}^{10} + \bar{B}^{10}. \quad (4)$$

⁶ We describe here beliefs and actions arising from equilibrium bid levels. A discussion of off-equilibrium bids is given later.

To ensure that it is better for the board to dismiss the manager if the bid is rejected (consistent with our equilibrium), we will find parameters such that (3) is greater than (4), i.e.,

$$\bar{B}^{NM} > \bar{B}^{10}. \tag{R-2'}$$

Note that $\bar{B}^{10} = \beta \Pr(G | x = 1, y = 0)$ where

$$\Pr(G | x = 1, y = 0) = \frac{p_0 p_1 \gamma}{p_0 p_1 \gamma + q_0 q_1 [1 - \gamma]} < \gamma$$

since $p_0 p_1 < q_0 q_1$ by (R-1).

Now the board will accept the bid if

$$P(0) - \delta \geq \bar{A}^{10} + w\bar{B}^{10} + [1 - w]\bar{B}^{NM}.$$

Let δ_{10} be the value of δ for which the above holds an equality, i.e.,

$$\delta_{10} = P(0) - \bar{A}^{10} - w\bar{B}^{10} - [1 - w]\bar{B}^{NM}. \tag{5}$$

So, if the bidder bids $P(0)$ when $y = 0$, his expected payoff, conditional on $x = 1$ and on the board being vigilant, is

$$\int_{\underline{\delta}}^{\delta_{10}} [\bar{A}^{10} + \beta - K - P(0)] f(\delta) d\delta \\ = [\delta_{10} - \underline{\delta}] [\bar{\delta} - \underline{\delta}]^{-1} \{ \bar{A}^{10} + \beta - K - P(0) \}, \tag{6}$$

where the β in the braces above appears without a probability because the bidder bids only when he is sure that it has a good manager with whom to replace the incumbent target manager.

Substituting (5) in (6) yields the bidder's conditional expected payoff

$$[\bar{\delta} - \underline{\delta}]^{-1} \{ [H_1 + H_2 + \underline{\delta}] P(0) - [P(0)]^2 - H_2 [H_1 + \underline{\delta}] \}, \tag{7}$$

where

$$H_1 \equiv \bar{A}^{10} + w\bar{B}^{10} + [1 - w]\bar{B}^{NM},$$

$$H_2 \equiv \bar{A}^{10} + \beta - K.$$

Subcase: $x = 2$. Now suppose the board observes $x = 2$. If the board rejects the bid and dismisses the manager, its utility is

$$\bar{A}^{20} + w\bar{B}^{20} + [1 - w]\bar{B}^{NM}. \tag{8}$$

If it rejects the bid and retains the manager, its utility is

$$\bar{A}^{20} + \bar{B}^{20}. \tag{9}$$

In order for the board to follow the prescribed equilibrium strategy of dismissing the manager after rejecting the bid, we need

$$\bar{B}^{NM} > \bar{B}^{20}. \tag{R-2}$$

Note that

$$\begin{aligned}\bar{B}^{20} &= \beta \Pr(G | x = 2, y = 0) \\ &= \frac{p_0[1 - p_0 - p_1]\gamma}{p_0[1 - p_0 - p_1]\gamma + q_0[1 - q_0 - q_1][1 - \gamma]} < \gamma,\end{aligned}$$

since $p_0[1 - p_0 - p_1] < q_0[1 - q_0 - q_1]$ by (R-1). Also, given (R-2), it is transparent that (R-2') is redundant.

As in the previous case, we obtain δ_{20} as a solution to

$$\delta_{20} = P(0) - \bar{A}^{20} - w\bar{B}^{20} - [1 - w]\bar{B}^{NM}. \quad (10)$$

The expected payoff of the bidder with a price of P , given $x = 2, y = 0$ and a vigilant board, is

$$[\bar{\delta} - \underline{\delta}]^{-1} \{ [H_3 + H_4 + \underline{\delta}]P - P^2 - H_4[H_3 + \underline{\delta}] \}, \quad (11)$$

where

$$H_3 \equiv \bar{A}^{20} + w\bar{B}^{20} + [1 - w]\bar{B}^{NM}, \quad H_4 \equiv \bar{A}^{20} + \beta - K.$$

The bidder's optimization

Now, having observed that the board did not dismiss the manager and also having observed the signal $y = 0$, the bidder revises its prior belief about the board's vigilance. The bidder's posterior belief is given by $\Pr(\text{board vigilant} | y = 0, \text{board chose R}) \equiv \omega_p(R, y = 0)$. Explicit expressions for this and most other posteriors are given in the Appendix. Now, if the board is lax, the bidder's expected payoff from bidding P is $\tau(P)[\beta - K + E(A | y = 0)]$, where $E(A | y = y^*) = \Pr(x = 0 | y = y^*)\bar{A}^{0y^*} + \Pr(x = 1 | y = y^*)\bar{A}^{1y^*} + \Pr(x = 2 | y = y^*)\bar{A}^{2y^*}$. Combining this fact with (7) and (11) yields the maximization problem of the bidder who has observed $y = 0$:

$$\begin{aligned}&\text{maximize } \mathcal{L}_0 \\ &\quad P \\ &\equiv \hat{\omega}_p \times \left\{ \begin{aligned} &\Pr(x = 1 | y = 0) [\bar{\delta} - \underline{\delta}]^{-1} \\ &[\{H_1 + H_2 + \underline{\delta}\}P - P^2 - H_2\{H_1 + \underline{\delta}\}] \\ &+ \Pr(x = 2 | y = 0) [\bar{\delta} - \underline{\delta}]^{-1} \\ &[\{H_3 + H_4 + \underline{\delta}\}P - P^2 - H_4\{H_3 + \underline{\delta}\}] \end{aligned} \right\} \\ &\quad + [1 - \hat{\omega}_p] \tau(P) [\beta - K + E(A | y = 0)] - b, \quad (12)\end{aligned}$$

where $\hat{\omega}_p \equiv \omega_p(R, y = 0)$. Observe that $\Pr(x = 2 | y = 0) < \Pr(x = 1 | y = 0)$. The bidder is choosing $P(0)$ to maximize his expected profits, taking as given that his bid will reveal him to have the signal $y = 0$. In computing his

expected profits, the bidder takes into account his posterior belief that the board is lax. This may be viewed as follows. In the proposed equilibrium there are separating bid levels of $P(0)$ and $P(1)$ for bidders with signal values of 0 and 1, respectively. To ensure that this is an equilibrium, we will check the incentive compatibility conditions that a bidder with signal $y = i \in \{0,1\}$ does not bid $P(j)$ with $j \in \{0,1\}$ and $j \neq i$. Moreover, if we stipulate beliefs such that off-equilibrium bids below $P(0)$ are interpreted as having been made by a bidder with $y = 0$, then $P(0)$ must be the solution to the optimization problem of (12).⁷

Now, $P(0)$ must satisfy the first order condition $\partial \mathcal{L}_0 / \partial P(0) = 0$, which yields

$$P(0) = \frac{[H_1 + H_2 + \underline{\delta}]Pr(x = 1 | y = 0) + [H_3 + H_4 + \underline{\delta}]Pr(x = 2 | y = 0) + \hat{\omega}_p^{-1}[1 - \hat{\omega}_p][\bar{\delta} - \underline{\delta}]\tau'(P(0))[\beta - K + E(A | y = 0)]}{2[Pr(x = 1 | y = 0) + P(x = 2 | y = 0)]} \quad (13)$$

Note that $H_3 + H_4 + \underline{\delta} > H_1 + H_2 + \underline{\delta}$, implying that $\delta_{20} < \delta_{10}$, which implies, in turn, that the probability of acceptance is lower when $x = 2$ than when $x = 1$. Intuitively, a target board with a more favorable signal about its manager is more inclined to reject the bid, both because the value arising from old decisions is higher, and because there is a greater gain to retaining the old manager.

We must ensure that the bidder finds it profitable to make an offer. This follows if (12) with P replaced by $P(0)$ is positive, i.e.,

$$\hat{\omega}_p \times \left\{ \begin{aligned} &Pr(x = 1 | y = 0) [\bar{\delta} - \underline{\delta}]^{-1} \\ &\left[\{ \bar{H}_1 + \bar{H}_2 + \underline{\delta} \} P(0) - [P(0)]^2 - H_2 \{ H_1 + \underline{\delta} \} \right] \\ &+ Pr(x = 2 | y = 0) [\bar{\delta} - \underline{\delta}]^{-1} \\ &\left[\{ H_3 + H_4 + \underline{\delta} \} P(0) - [P(0)]^2 - H_4 \{ H_3 + \underline{\delta} \} \right] \end{aligned} \right\} + [1 - \hat{\omega}_p] \tau(P(0)) [\beta - K + E(A | y = 0)] - b > 0. \quad (R-3)$$

Case 2: $y = 1$

The bidder bids $P(1)$ in equilibrium. Define

$$\begin{aligned} I_1 &\equiv \bar{A}^{11} + w\bar{B}^{11} + [1-w]\bar{B}^{NM}, & I_2 &\equiv \bar{A}^{11} + \beta - K, \\ I_3 &\equiv \bar{A}^{12} + w\bar{B}^{12} + [1-w]\bar{B}^{NM}, & I_4 &\equiv \bar{A}^{12} + \beta - K. \end{aligned}$$

⁷ Note that the standard refinements of sequential equilibrium (such as those of Banks and Sobel, 1987, for example) are not applicable here, because we examine a game of two-sided asymmetric information.

To make it optimal for the board to dismiss the manager at date 3 if $x = 1$ and a bid of $P(1)$ is rejected, we need

$$\bar{\beta}^{NM} > \bar{\beta}^{11}. \tag{R-4}$$

Furthermore, in equilibrium the board rejects the bid and retains the manager at date 3 if $x = 2$ and a bid of $P(1)$ is received. For this, the necessary condition is $\bar{B}^{NM} < \bar{B}^{12}$, and using the definition $\beta\gamma$, the following condition is sufficient for the above condition to be satisfied

$$\gamma < \Pr(G | x = 2, y = 1) = \frac{p_1[1 - p_0 - p_1]\gamma}{p_1[1 - p_0 - p_1]\gamma + q_1[1 - q_0 - q_1][1 - \gamma]}.$$

This is true since (R-1) asserts that $p_1[1 - p_0 - p_1] > q_1[1 - q_0 - q_1]$. Moreover, to be consistent with the conjectured equilibrium, we make the following assumptions:

- (i) $\beta - \bar{B}^{20} > K + \underline{\delta}$,
- (ii) $\beta - \bar{B}^{11} > K + \underline{\delta}$,
- (iii) $\beta - \bar{B}^{21} < K + \underline{\delta}$. (R-5)

In (R-5), (i) and (ii) imply that even if all the surplus were to accrue to the target and $\delta = \underline{\delta}$, it would pay to displace the manager for those combinations of signals. Condition (iii) implies that when $x = 2$ and $y = 1$, the manager is not displaced even by a combination of the best offer by the bidder and a realization of the lowest possible δ .

Now, proceeding as before, we have

$$\delta_{11} = P(1) - \bar{A}^{11} - w\bar{B}^{11} - [1 - w]\bar{B}^{NM}. \tag{14}$$

Since the bid is rejected by a vigilant board if $x = 2$, the bidder's objective function becomes

$$\begin{aligned} \text{Max}_P \mathcal{L}d1 \\ \equiv [\bar{\delta} - \underline{\delta}]^{-1} \Pr(x = 1 | y = 1) \bar{\omega}_p [\{I_1 + I_2 + \underline{\delta}\} P - P^2 - I_2 \{I_1 + \underline{\delta}\}] \\ + [1 - \bar{\omega}_p] \tau(P) [\beta - K + E(A | y = 1)] - b, \end{aligned} \tag{15}$$

where $\bar{\omega}_p \equiv \omega_p(R, y = 1) \equiv \Pr(\text{board vigilant} | \text{board retained manager}, y = 1)$. Let $\bar{P}(1)$ be the bid price that satisfies the first order condition $\partial \mathcal{L}_1 / \partial P = 0$. Thus,

$$\bar{P}(1) = \frac{[I_1 + I_2 + \underline{\delta}] + [\Pr(x = 1 | y = 1) \bar{\omega}_p]^{-1}}{[1 - \bar{\omega}_p] [\bar{\delta} - \underline{\delta}] \tau'(\bar{P}(1)) [\beta - K + E(A | y = 1)]}. \tag{16}$$

Now let us assume that (1, 1) is a more favorable signal than (2, 0), as would be the case if it is very unlikely that a signal of 0 would come from a good manager. This means that

$$\Pr(G | x = 1, y = 1) > \Pr(G | x = 2, y = 0),$$

or

$$\frac{p_1^2 \gamma}{p_1^2 \gamma + q_1^2 [1 - \gamma]} > \frac{p_0 [1 - p_0 - p_1]}{p_0 [1 - p_0 - p_1] + q_0 [1 - q_0 - q_1] [1 - \gamma]}. \quad (\text{R-6})$$

Note that $I_1 > H_1$ and $I_2 > H_2$. Then comparing (13) and (16) we see that $\tilde{P}(1) > P(0)$.

3.3. Incentive compatibility of the bidder's strategy

We will first discuss how $P(1)$, the equilibrium bid price when $y = 1$, should be determined. One incentive compatibility (IC) condition that must be satisfied is that a bidder who observes $y = 0$ will bid $P(0)$ and not $P(1)$.

$$\begin{aligned} & -b + \hat{\omega}_p \times \left\{ \Pr(x = 1 | y = 0) \Pr(\delta \leq \delta_{10}) [\bar{A}^{10} + \beta - K - P(0)] \right. \\ & \quad \left. + \Pr(x = 2 | y = 0) \Pr(\delta \leq \delta_{20}) [\bar{A}^{20} + \beta - K - P(0)] \right\} \\ & \quad + [1 - \hat{\omega}_p] \tau(P(0)) [\beta - K + E(A | y = 0)] \\ & \geq -b + \hat{\omega}_p (R, y = 0) \left\{ \Pr(x = 1 | y = 0) \Pr(\delta \leq \delta_{11}) \right. \\ & \quad \left. \times [\bar{A}^{10} + \beta - K - P(1)] \right\} \\ & \quad + [1 - \hat{\omega}_p] \tau(P(1)) [\beta - K + E(A | y = 0)]. \end{aligned} \quad (\text{R-7})$$

Now let $P_l(1)$ denote the value of $P(1)$ for which (R-7) holds as an equality. Thus, $P_l(1)$ provides a *lower bound* on the equilibrium value of $P(1)$. The other IC condition is that a bidder who observes $y = 1$ must choose $P(1)$ over $P(0)$, i.e.,

$$\begin{aligned} & -b + \tilde{\omega}_p \left\{ \Pr(x = 1 | y = 1) \Pr(\delta \leq \delta_{10}) [\bar{A}^{11} + \beta - K - P(0)] \right. \\ & \quad \left. + \Pr(x = 2 | y = 1) \Pr(\delta \leq \delta_{20}) [\bar{A}^{21} + \beta - K - P(0)] \right\} \\ & \quad + [1 - \tilde{\omega}_p] \tau(P(0)) [\beta - K + E(A | y = 1)] \\ & \leq -b + \tilde{\omega}_p \left\{ \Pr(x = 1 | y = 1) \Pr(\delta \leq \delta_{10}) [\bar{A}^{11} + \beta - K - P(1)] \right\} \\ & \quad + [1 - \tilde{\omega}_p] \tau(P(1)) [\beta - K + E(A | y = 1)]. \end{aligned} \quad (\text{R-8})$$

Let $P_u(1)$ denote the value of $P(1)$ for which (R-8) holds as an equality. In other words, the $y = 1$ bidder maximizes profits by making the lowest

possible offer consistent with his being viewed as having $y = 1$. Thus, $P_u(1)$ provides an *upper bound* on the equilibrium value of $P(1)$. It can be verified that $P_l(1) < P_u(1)$.

Now, if $\tilde{P}(1) \leq P_l(1)$, then we set the equilibrium bid $P(1) = P_l(1)$. Thus, (R-7) holds as an equality and (R-8) is slack. On the other hand, if $\tilde{P}(1) \in (P_l(1), P_u(1))$, then we set $P(1) = \tilde{P}(1)$, and both (R-7) and (R-8) are slack. Another IC condition is that the bidder will abstain from bidding if $y = 2$. That is,

$$\omega_p(\mathbf{R}, y = 2) \left\{ \Pr(x = 1 | y = 2) \Pr(\delta \leq \delta_{11}) \left[\bar{A}^{12} + \beta - K - P(1) \right] \right. \\ \left. + \left[1 - \omega_p(\bar{\mathbf{R}}, y = 2) \right] \tau(P(1)) \left[\beta - K + E(A | y = 2) \right] \right\} < b, \quad (\text{R-9})$$

where $\omega_p(\mathbf{R}, y = 2) \equiv \Pr(\text{board vigilant} | y = 2, \text{board chose } \mathbf{R})$. The exogenous parameter restrictions implied by (R-9) ensure that the bidder will find it unprofitable to bid $P(1)$ when $y = 2$. It can be verified, by monotonicity, that the bidder will also find it unprofitable to bid $P(0)$ when $y = 2$. Finally, we need to check that if $y = 1$, the bidder makes a positive profit by bidding (conditional on having a good manager to replace the incumbent in the target). This participation constraint is

$$\hat{\omega}_p \Pr(x = 1 | y = 1) \Pr(\delta \leq \delta_{11}) \left[\bar{A}^{11} + \beta - K - P(1) \right] \\ + \left[1 - \hat{\omega}_p \right] \tau(P(1)) \left[\beta - K + E(A | y = 1) \right] > b. \quad (\text{R-10})$$

3.4. Strategy of a vigilant target board

Case 1: $x = 0$

First, we must ensure that there will be no bid if the manager is dismissed. The parametric restriction that is sufficient for this is

$$\left[\bar{A}^{02} + \beta - K - \underline{\delta} - b \right] - \left[\bar{A}^{00} + \bar{B}^{\text{NM}} \right] \leq 0. \quad (\text{R-11})$$

Now, given $x = 0$, if the board dismisses the manager its utility is

$$\bar{A}^0 + \bar{B}^{\text{NM}}, \quad (17)$$

where $\bar{A}^0 \equiv \alpha \Pr(G | x = 0)$. If the board retains the manager, a bid is received if the bidder observes $y = 0$ or 1 and has a good manager. The expected utility of the board from retaining the manager, given $x = 0$, $\text{EU}(\mathbf{R} | x = 0)$, is

$$\text{EU}(\mathbf{R} | x = 0)$$

$$= \xi \Pr(y = 0 | x = 0) \left[F \left(\delta_{10}, P(0) - \int_{\underline{\delta}}^{\delta_{10}} \delta f(\delta) d\delta \right) \right] \\ + \xi \Pr(y = 1 | x = 0) \left[F(\delta_{10}) P(1) \int_{\underline{\delta}}^{\delta_{10}} \delta f(\delta) d\delta \right]$$

$$\begin{aligned}
 &+ [\xi \Pr(y = 2 | x = 0) + 1 - \xi] [\bar{A}^{on} + w\bar{B}^{on} + [1 - w]\bar{B}^{NM}] \\
 &+ \xi \Pr(y = 1 | x = 0) [1 - F(\delta_{10})] [\bar{A}^{01} + w\bar{B}^{01} + [1 - w]\bar{B}^{NM}] \\
 &+ \xi \Pr(y = 0 | x = 0) [1 - F(\delta_{00})] [\bar{A}^{00} + w\bar{B}^{00} + [1 - w]\bar{B}^{NM}], \quad (18)
 \end{aligned}$$

where \bar{A}^{on} and \bar{B}^{on} are the components of expected firm value arising from old and new decisions of the incumbent, respectively, given that $x = 0$ and that no bid was received. That is,

$$\bar{A}^{on} \equiv \alpha \Pr(G | x, y = 2 \text{ or bidder did not have good manager}),$$

$$\bar{B}^{on} \equiv \beta \Pr(G | x, y = 2 \text{ or bidder did not have good manager}).$$

What should the (vigilant) board do if it retains the manager despite $x = 0$, and then fails to receive a bid? If it retains the manager, its utility is $\bar{A}^{on} + \bar{B}^{on}$. If it dismisses him after observing that there is no bid, its utility is $\bar{A}^{on} + w\bar{B}^{on} + [1 - w]\bar{B}^{NM}$. Thus, if $\bar{B}^{NM} > \bar{B}^{on}$, it will pay for the board to dismiss the manager even if no bid is received. Given (R-2), it is easy to verify that $\bar{B}^{NM} > \bar{B}^{on}$.

If the board retains the manager with $x = 0$ and then receives a bid of $P(0)$, it will accept the bid if $\delta \leq \delta_{00}$. Given our preceding arguments, it will reject the bid and dismiss the manager if $\delta > \delta_{00}$. Here δ_{00} satisfies

$$\delta_{00} = P(0) - \bar{A}^{00} - w\bar{B}^{00} - [1 - w]\bar{B}^{NM}, \quad (19)$$

where

$$\bar{A}^{00} \equiv \alpha \Pr(G | x = 0, y = 0),$$

$$\bar{B}^{00} \equiv \beta \Pr(G | x = 0, y = 0).$$

For incentive compatibility of the board's dismissal of the manager when $x = 0$, we need

$$\bar{A}^0 + \bar{B}^{NM} \geq \text{EU}(R | x = 0). \quad (\text{R-12})$$

Case 2: $x = 1$

If the board dismisses the manager, its utility is

$$\bar{A}^1 + \bar{B}^{NM} \quad (20)$$

where $\bar{A}^1 \equiv \alpha \Pr(G | x = 1)$. If the board initially retains the manager, should it later dismiss him if no bid appears? We shall assume that the board will retain the manager in this case. A sufficient condition for this is

$$\bar{A}^{1n} + w\bar{B}^{1n} + [1 - w]\bar{B}^{NM} < \bar{A}^{1n} + \bar{B}^{1n},$$

which reduces to

$$\bar{B}^{NM} < \bar{B}^{1n}. \quad (\text{R-13})$$

The board's expected utility from retaining the manager, $EU(R | x = 1)$, is

$$\begin{aligned}
 & EU(R | x = 1) \\
 &= \xi \Pr(y = 0 | x = 1) \left[F(\delta_{01})P(0) - \int_{\underline{\delta}}^{\delta_{10}} \delta f(\delta) d\delta \right] \\
 &\quad + \xi \Pr(y = 1 | x = 1) \left[F(\delta_{11})P(1) - \int_{\underline{\delta}}^{\delta_{11}} \delta f(\delta) d\delta \right] \\
 &\quad + \xi \Pr(y = 0 | x = 1) [1 - F(\delta_{10})] [\bar{A}^{11} + w\bar{B}^{11} + [1 - w]\bar{B}^{NM}] \\
 &\quad + \xi \Pr(y = 1 | x = 1) [1 - F(\delta_{11})] [\bar{A}^{11} + w\bar{B}^{11} + [1 - w]\bar{B}^{NM}] \\
 &\quad + [\xi \Pr(y = 2 | x = 1) + 1 - \xi] [\bar{A}^{1n} + \bar{B}^{1n}]. \tag{21}
 \end{aligned}$$

The IC condition which guarantees that the board will choose to retain the manager conditional on $x = 1$ is

$$EU(R | x = 1) < \bar{A}^1 + \bar{B}^{NM}. \tag{R-14}$$

Case 3: $x = 2$

Given our earlier parametric restrictions, it will obviously not pay for the board to dismiss the manager if the manager is initially retained and then no bid is received. If the board dismisses the manager, its utility is

$$\bar{A}^2 + \bar{B}^{NM}. \tag{22}$$

If it retains the manager, its expected utility, $EU(R | x = 2)$, is given by

$$\begin{aligned}
 & EU(R | x = 2) \\
 &= \Pr(y = 0 | x = 2) \xi \left[F(\delta_{20})P(0) - \int_{\underline{\delta}}^{\delta_{20}} \delta f(\delta) d\delta \right] \\
 &\quad + \Pr(y = 1 | x = 2) \xi [\bar{A}^{21} + w\bar{B}^{21} + [1 - w]\bar{B}^{NM}] \\
 &\quad + \Pr(y = 0 | x = 2) \xi [1 - F(\delta_{20})] [\bar{A}^{20} + w\bar{B}^{20} + [1 - w]\bar{B}^{NM}] \\
 &\quad + [\Pr(y = 2 | x = 2) \xi + 1 - \xi] [\bar{A}^{2n} + w\bar{B}^{2n} + [1 - w]\bar{B}^{NM}]. \tag{23}
 \end{aligned}$$

To ensure that the board will not dismiss the manager when it observes $x = 2$, we need the following IC condition,

$$EU(R | x = 2) > \bar{A}^2 + \bar{B}^{NM}. \tag{R-15}$$

We can now state the main result of this section.

Proposition 1. *There exists an open set of exogenous parameter values such that restrictions (R-1)–(R-15) are satisfied. For these parameter values, the conjectured equilibrium is a Perfect Bayesian equilibrium.*

An important aspect of this proposition is that the price offered in the takeover attempt reveals the bidder's private information about managerial

performance. The intuition underlying the incentive compatibility of such a scheme is as follows. When a potential acquiror observes that the manager was not fired, he revises upward his probabilistic assessment that the target board observed $x = 1$ or 2. Moreover, when he observes $y = 1$, he assesses the probability of $x = 1$ to be higher than the probability of $x = 0$ or the probability of $x = 2$. This is because x and y are affiliated random variables. Now, *conditional* on the pair of signals (1, 1), the potential acquiror knows that he can increase the probability of acceptance of the bid by a *vigilant board* by bidding higher. Moreover, the probability of acceptance by a lax board is weakly increasing in the bid price. Thus, having observed $y = 1$, a potential acquiror knows that the probability of acceptance of the bid is strictly greater with a higher bid. The key is that the bidder has a stronger incentive to bid more when he has $y = 1$ than when he has $y = 0$ because the expected value of the target firm due to old decisions is larger in the former case. Thus, separation through the bid price ($P(1) > P(0)$) can occur as part of a Perfect Bayesian Equilibrium.

We will now examine some of the properties of this equilibrium in our next result.

Proposition 2. *There exists an open set of exogenous parameter values such that, for some critical probability of board vigilance, $\omega_c(0,1)$, the equilibrium bid price $P(y)$ is decreasing in ω for all $\omega \in (\omega_c, 1)$ and $y \in \{0,1\}$. There also exist exogenous parameter values such that no takeover attempt is made for ω sufficiently low.*

An interesting aspect of the model is that suspicion on the part of a potential acquiror that the target board may be lax may actually make the target board's shareholders better off by inducing a higher bid. The intuition is that the bidder is setting his price to overcome the takeover resistance of a lax board, so that a stronger suspicion of laxity causes the bidder to offer a higher price. This is consistent with the stylized fact that anti-takeover charter amendments, which reduce the probability of takeover (Pound, 1987) and thereby protect the board from hostile removal, are almost always voluntarily approved by shareholders (Brickley et al., 1988). Of course, in our model if the suspicion of laxity becomes strong enough, the *expected* payoff to the bidder from submitting a bid may be negative, given bidding and control transfer costs. In this case, there are on average too few takeover attempts relative to the social optimum. This is consistent with the evidence that proposals of some anti-takeover amendments are associated with negative stock price reactions, whereas others are not. For instance, McWilliams (1990) finds a significant positive stock price reaction to the proposal of anti-takeover amendments when managers own less than 10% of the target's shares, but a negative reaction when managers have larger holdings, see also Jarrell and Poulsen (1987).

4. Interpretation of equilibrium and relation to empirical evidence

Our equilibrium has numerous implications which we now discuss and relate to empirical evidence. Although to conserve on algebra we have not computed stock price reactions to the equilibrium strategies of the board and the acquiror, it is straightforward to add this feature by assuming that investors know neither x nor y . The model then yields price reactions consistent with the ensuing discussion.

4.1. *Turnover implications*

There are three principal implications of our analysis for management turnover in targets. First, a successful takeover always triggers a management change. This implication is consistent with the evidence in Martin and McConnell (1991) that the turnover rate for top managements of targets of tender offers increases significantly after the takeovers. Second, and even more interestingly, even an unsuccessful takeover attempt leads to higher management turnover on average in the target. This is consistent with the evidence of Klein and Rosenfeld (1988) that top management changes often follow targeted repurchases of shares held by potential bidders (i.e., greenmail). Third, since a lax board always resists a takeover and never dismisses the manager, we should not expect all failed takeover attempts to trigger internally precipitated management changes. Rather, there will sometimes be firings and sometimes the incumbent will be retained.

4.2. *Management performance implications*

In the equilibrium we have described, a firm becomes a takeover target when a potential bidder observes a signal of the target manager's performance that is so adverse that it more than offsets the favorable information conveyed by the fact that the board chose not to dismiss. The manager of a takeover target has $x = 1$ and $y = 0$, a combination that leads the potential acquiror to a lower posterior assessment of his ability than the average ability of the pool of retained managers. That is, his firm in retrospect will be viewed as doing poorly relative to its cohort group. The same is true for firms in which managers are dismissed by their boards, since in those cases $x = 0$. In our model we have assumed that the commonly held priors on the incumbent are the same as those on a manager. In practice, however, investors' priors about the incumbent manager are likely to be influenced by prior managerial performance that was publicly observable. Hence, if the firm has been doing poorly, investors will have a relatively low γ about the incumbent, whereas their γ on his replacement will be higher. Our model implies a greater likelihood of takeover in this case, an observation that is

consistent with the findings of Hasbrouck (1985) and Palepu (1986) who report that takeover targets tend to have poor prior performance as measured by Tobin's q . Similarly, Coughlan and Schmidt (1985) find that low stock returns lead to relatively high management turnover.

4.3. Market reaction to dismissals

Our analysis implies that the market reaction to a dismissal of the CEO can be either positive or negative. To see this, suppose that γ , the prior probability that the incumbent manager is good is very low, relative to the γ for his replacement. Moreover, suppose that ω , the prior probability that the board is vigilant, is also very low. This combination implies that *public* information about the manager as well as the board is quite adverse. The firm's stock price will reflect this pessimism. So when the manager is fired, investors view as quite significant the expected improvement in productivity achieved by replacing the incumbent with a new manager. Thus, the more adverse the public information about the manager, the greater is the positive stock price reaction to his dismissal.⁸ On the other hand, if the market's prior belief reflected high values for γ and ω , then a dismissal constitutes a 'negative surprise' since it indicates poor managerial performance and the incidence of dismissal costs. It is also intuitive that the higher the *ex ante* probability that the board is lax, the greater will be the positive stock price reaction to the dismissal.⁹ The greater the investors' initial pessimism about the board's vigilance, the more pleasantly surprised they are at the dismissal of the incumbent.

⁸ Accentuating this effect is the favorable information conveyed by the dismissal that the board is vigilant. Although not explicitly modeled, it would be easy to include a value component that is higher for a vigilant board than for a lax one. This would implicitly reflect the fact that in a multiperiod setting, learning that the board is vigilant provides favorable information about how well the firm will be managed in the future.

⁹ For example, Weisbach (1988) classifies boards based on the fractions of boards that are managers versus outside directors as inside-dominated, mixed, or outside-dominated boards. The implication of a positive link between the probability that a board is lax and the price reaction to a dismissal seems inconsistent with the evidence provided by Weisbach (1988) that the abnormal returns on announcement of resignation are positive (with significance sensitive to the event window) for outside and mixed boards and close to zero for inside boards. A possible explanation for this is that, contrary to our model, resignations do occur even when the board is management dominated. These may be voluntary resignations that are uncorrelated with poor performance and which may not convey as much news relevant for the stock price. This interpretation is consistent with Weisbach's evidence that the relationship between prior poor performance and the probability of CEO turnover is stronger for outside boards than for inside boards. It would be of interest to examine the price reaction to resignations for outside versus inside boards after normalizing for the prior performance of management.

This implication is consistent with the findings of Warner et al. (1988) that a forced resignation can be either good news or bad news. It is also consistent with the findings of Weisbach (1988) and Bonnier and Bruner (1989) that the more adverse the publicly available information about the performance of the manager, the more positive is the stock price reaction to forced resignation.

The increase in outsider representation on boards in the last decade (see Lublin, 1991) suggests an increase in board vigilance over this period. Our analysis would then imply an intertemporal weakening of the stock price reaction to a dismissal. This time series prediction has not yet been tested, to the best of our knowledge.

4.4. Market reaction to takeover resistance

Our analysis implies that takeover resistance can be either good or bad news for the target firm's shareholders. Since a vigilant board always acts in its shareholders' best interests, any takeover resistance on its part conveys the good news that the manager is probably good, so that the value from old decisions is high, and there may be further benefit from retaining the old manager. Thus, if the target firm's board is generally perceived to be vigilant and its δ is sufficiently low, the stock price of the target will increase when its board resists a takeover.¹⁰ On the other hand, if the board is perceived as being lax or controlled by the incumbent manager, takeover resistance by it will lead to a price decline because the resistance strengthens investors' beliefs about the board's type and the low ability of management. Consistent with this prediction, Brickley et al. (1992) provide evidence that the enactment of poison pills leads to a positive stock price reaction when the majority of the board consists of outsiders, and a negative stock price reaction when the majority of the board consists of insiders. (Our prediction predates Brickley et al.'s evidence and independent modeling of this phenomenon).

While some takeover defensive measures are bad news for target shareholders (e.g. poison pills; see Ryngaert, 1988; Malatesta and Walkling, 1988), others are not. For example, Jarrell (1985) argues that his evidence on defensive litigation is consistent with shareholder interest. Partch (1987) finds that the stock price reactions to dual voting class recapitalization is not on average negative. However, Jarrell and Poulsen (1988) do find a negative reaction in a more recent sample of dual-class recapitalizations. Moreover, Handa and Radhakrishnan (1989) find that defensive leveraged recapitalizations are associated with positive target abnormal returns.

¹⁰ Huang and Walkling (1987) find that announcement day abnormal returns are slightly higher for takeover bids that are opposed by management than for unopposed ones.

4.5. Bid premiums in takeovers

Our model predicts that the bid premium in takeovers is not monotonically related to the probability that the board is vigilant. Bidders must believe that this probability is sufficiently high in order to be induced to bid. However, for all values of the vigilance probability above a critical value, the bid premium declines as the vigilance probability increases. Thus, the target shareholders may be made better off by suspicion in the acquiror's mind that the board is lax, which may perhaps explain why shareholders almost always approve anti-takeover charter amendments which protect the board from hostile removal (Brickley et al., 1988).

5. Conclusion

We have examined the interaction between the internal mechanism for corporate control, as represented by actions of the board of directors, and the external mechanism for corporate control, as represented by takeovers. Our objective has been to study the determination of the bid price as well as the behavior of the board and that of the acquiror in this setting. The principal results and implications of our analysis are summarized below.

1. The board of directors, acting in shareholders' interests, will sometimes oppose a takeover, and this opposition can be good news for the firm, because the board has favorable private information about firm value. Such takeover resistance can sometimes cause the bid to fail.
2. Unsuccessful takeover attempts may be followed by a high frequency of management turnover. This occurs in our model because a takeover attempt conveys adverse information possessed by the bidder about the target's manager.
3. Investors' perception of the board's vigilance will influence the market's reaction to takeover resistance. If the board is viewed as being insider-dominated—and hence more likely to be lax—then defensive measures against a takeover are bad news. On the other hand, for boards perceived to be outsider-dominated, they are good news.
4. If the stock market believes that the board may be lax, then a forced resignation can be either good or bad news for the firm. A positive effect is predicted to dominate when there is more adverse public information available about the manager's performance and when there is a higher *ex ante* probability that the board is lax; for example, if the board is management rather than outsider dominated.
5. For sufficiently high prior beliefs that the board is vigilant, a decrease in the prior probability that the board is vigilant can increase the price offered in a takeover bid.

Our analysis highlights the importance of the board of directors in corporate control. Even with a well-functioning takeover market, the wealth of the firm's shareholders depends on the reputation and actions of the board since these determine whether a bid is made for the firm and the price at which the bid is made. The link this suggests between the 'qualities' of boards of directors and the health of financial capitalism is an indication of the need for further study of board composition and motives.

6. Appendix

Proof of Proposition 1

Consider the following exogenous parameter values: $p_0 = 0.01$, $q_0 = 0.02$, $p_1 = 0.16$, $q_1 = 0.17$, $\delta = 0$, $\bar{\delta} = 1$, $\omega = 0.8$, $b = 10^{-5}$, $w = 0.8$, $K = 0.109$, $\gamma = 0.65$, $\beta = 0.3$, $\xi = 0.35$, $\tau(P) = [10.72]^{-1} P^2 I_{(0.28, 1)}(P)$, where $I(\cdot)$ is the indicator function on the interval $(0.28, 1]$. It can be verified that all of the restrictions on exogenous parameters, (R-1) through (R-15), are satisfied. Thus, the set of exogenous parameters for which the conjectured strategies and beliefs constitute a Nash equilibrium is nonempty. We will now show that this is also a Perfect Bayesian Equilibrium. Since x can never be observed by any party other than the board itself, the only out-of-equilibrium move is for the bidder to bid $P \neq \{P(0), P(1)\}$. Given an out-of-equilibrium bid P , suppose the board believes that $y = 2$. Then, if $x = 1$ and $P \in \{[0, P(0)) \cup (P(0), P(1))\}$, it is obvious that the board will reject the bid since the combination $\{x = 2, y = 1\}$ leads it to reject a bid of $P(1)$, and this combination implies the same firm value as $\{x = 1, y = 2\}$. Clearly if $x = 2$, the board has an even stronger incentive to reject the bid.

Now consider a bid of $P > P(1)$. Suppose $x = 1$. It is possible that there exists some δ , call it $\delta_1^*(P)$, such that the board would accept such a bid, conditional on a belief that $\Pr(y = 2 | P > P(1)) = 1$ and a realized value $\delta \leq \delta_1^*(P)$. Now consider the maximum P , call it P_{\max} , at which the bidder will make a bid. This is the bid price that renders him indifferent between making a bid and not making a bid. Then, condition (iii) of (R-5) implies that $\delta_1^*(P_{\max}) < \underline{\delta}$. Hence, we can rule out this out-of-equilibrium move too. \square

Proof of Proposition 2

It is apparent from (13) that $\partial P(0)/\partial \omega < 1$. Suppose exogenous parameter values are such that $P(1) = \tilde{P}(1) \forall \omega \in (\omega_c, 1)$. Assume that $\tau'(P) > 0$, $\tau''(P) \geq 0$ for the relevant range of P values. It is clear now from (16) that $\partial \tilde{P}(1)/\partial \omega < 1$. It is straightforward to verify that there do exist exogenous parameter values for which $P(1) = \tilde{P}(1)$. (Take, for instance, the parameter

values in the proof of Proposition 1.) To see that there may not be any bids if ω is too low, consider the case in which $\omega = 0$ and $\tau(P) = 0 \forall P \leq \hat{P}_{\max}$, and \hat{P}_{\max} arbitrarily high. Then, the bidder's expected payoff from a takeover is clearly negative if \hat{P}_{\max} is high enough. By continuity, the bidder's expected payoff will be negative for $\omega > 0$ small enough. \square

Details of posterior probabilities

$$\begin{aligned} \omega_p(R, y = 0) &= \frac{\Pr(y = 0, \text{board chose R} \mid \text{board vigilant}) \times \Pr(\text{board vigilant})}{\left\{ \Pr(y = 0, \text{board chose R} \mid \text{board vigilant}) \times \Pr(\text{board vigilant}) \right.} \\ &\quad \left. + \Pr(y = 0, \text{board chose R} \mid \text{board lax}) \times \Pr(\text{board lax}) \right\}} \\ &= \frac{[\gamma p_0 + [1 - \gamma]q_0][\gamma\{1 - p_0\} + \{1 - \gamma\}\{q - q_0\}]\omega}{\left\{ [\gamma p_0 + [1 - \gamma]q_0][\gamma\{1 - p_0\} + \{1 - \gamma\}\{1 - q_0\}]\omega \right.} \\ &\quad \left. + [\gamma p_0 + \{1 - \gamma\}q_0][1 - \omega] \right\}}. \end{aligned} \quad (\text{A-1})$$

Note that

$$\begin{aligned} \Pr(x = 1 \mid y = 0) &= \Pr(x = 1 \mid G)\Pr(G \mid y = 0) + \Pr(x = 1 \mid T)\Pr(T \mid y = 0), \end{aligned} \quad (\text{A-2})$$

with $\Pr(x = 1 \mid G) = p_1$, $\Pr(x = 1 \mid T) = q_1$, $\Pr(G \mid y = 0) = p_0\gamma\{p_0\gamma + q_0[1 - \gamma]\}$, $\Pr(T \mid y = 0) = q_0[1 - \gamma]\{p_0\gamma + q_0[1 - \gamma]\}$.

Thus,

$$\Pr(x = 1 \mid y = 0) = \frac{p_0 p_1 \gamma + q_0 q_1 [1 - \gamma]}{p_0 \gamma + q_0 [1 - \gamma]}. \quad (\text{A-3})$$

Similarly,

$$\Pr(x = 2 \mid y = 0) = \frac{[1 - p_0 - p_1]p_0\gamma + [1 - q_0 - q_1]q_0[1 - \gamma]}{p_0\gamma + q_0[1 - \gamma]}. \quad (\text{A-4})$$

$$\Pr(G \mid x = 1, y = 1) = \frac{p_1^2 \gamma}{p_1^2 \gamma + q_1^2 [1 - \gamma]} < \gamma, \text{ since } p_1 < q_1. \quad (\text{A-5})$$

$$\begin{aligned} \omega_p(R, y = 1) &= \frac{[\gamma p_1 + \{1 - \gamma\}q_1][\gamma\{1 - p_0\} + \{1 - \gamma\}\{1 - q_0\}]\omega}{\left\{ [\gamma p_1 + \{1 - \gamma\}q_1][\gamma\{1 - p_0\} + \{1 - \gamma\}\{1 - q_0\}]\omega \right.} \\ &\quad \left. + [\gamma p_1 + \{1 - \gamma\}q_1][1 - \omega] \right\}}. \end{aligned} \quad (\text{A-6})$$

$$\Pr(x = 1 \mid y = 0)\Pr(\delta \leq \delta_{10}) = \left\{ \frac{p_0 p_1 \gamma + q_0 q_1 [1 - \gamma]}{p_0 \gamma + q_0 [1 - \gamma]} \right\} \left\{ \frac{\delta_{10} - \underline{\delta}}{\bar{\delta} - \underline{\delta}} \right\}. \quad (\text{A-7})$$

$$\Pr(x = 2 | y = 0) = \frac{[1 - p_0 - p_1]p_0\gamma + [1 - q_0 - q_1]q_0\gamma\gamma}{p_0\gamma + q_0[1 - \gamma]} \quad (\text{A-8})$$

$$\Pr(\delta \leq \delta_{20}) = \frac{\delta_{20} - \underline{\delta}}{\bar{\delta} - \underline{\delta}} \quad (\text{A-9})$$

$$\Pr(\delta \leq \delta_{11}) = \frac{\delta_{11} - \underline{\delta}}{\bar{\delta} - \underline{\delta}} \quad (\text{A-10})$$

$$\begin{aligned} \Pr(x = 1 | y = 1) &= \Pr(x = 1 | G)\Pr(G | y = 1) \\ &\quad + \Pr(x = 1 | T)\Pr(T | y = 1) \\ &= \frac{p_1^2\gamma}{p_1\gamma + q_1[1 - \gamma]} + \frac{q_1^2[1 - \gamma]}{p_1^2\gamma + q_1[1 - \gamma]} \end{aligned} \quad (\text{A-11})$$

$$\Pr(x = 2 | y = 1) = \frac{[1 - p_0 - p_1]p_1\gamma + [1 - q_0 - q_1]q_1[1 - \gamma]}{p_1\gamma + q_1[1 - \gamma]} \quad (\text{A-12})$$

$$\omega_p(R, y = 2) = \frac{J_1}{J_1 + [\gamma(1 - p_0 - p_1) + (1 - \gamma)(1 - q_0 - q_1)][1 - \omega]} \quad (\text{A-13})$$

$$\begin{aligned} J_1 &\equiv [\gamma(1 - p_0 - p_1) + (1 - \gamma)(1 - q_0 - q_1)] \\ &\quad \times [\gamma(1 - p_0) + (1 - \gamma)(1 - q_0)]\omega \end{aligned}$$

$$\begin{aligned} \Pr(G | x = 0, y = 2 \text{ or bidder did not have good manager}) \\ &= \frac{p_0[\xi(1 - p_0 - p_1) + 1 - \xi]\gamma}{p_0[\xi(1 - p_0 - p_1) + 1 - \xi]\gamma + q_0[\xi(1 - q_0 - q_1) + 1 - \xi][1 - \gamma]} \end{aligned} \quad (\text{A-14})$$

$$\Pr(y = 0 | x = 0) = \frac{p_0^2\gamma + q_0^2[1 - \gamma]}{p_0\gamma + q_0[1 - \gamma]} \quad (\text{A-15})$$

$$\Pr(G | x = 0, y = 0) = \frac{p_0^2\gamma}{p_0^2\gamma + q_0^2[1 - \gamma]} \quad (\text{A-16})$$

$$\begin{aligned} \Pr(G | x = 1, y = 2 \text{ or bidder does not have a good manager}) \\ &= \frac{p_1[\xi(1 - p_0 - p_1) + 1 - \xi]\gamma}{p_1[\xi(1 - p_0 - p_1) + 1 - \xi]\gamma + q_1[\xi(1 - q_0 - q_1) + 1 - \xi][1 - \gamma]} \end{aligned} \quad (\text{A-17})$$

$$\int_a^b \phi_j(\delta) d\delta = [b^2 - a^2]/2[\bar{\delta} - \underline{\delta}] \quad (\text{A-18})$$

$$\Pr(y = 0 | x = 1) = \frac{p_0 p_1 \gamma + q_0 q_1 [1 - \gamma]}{p_1 \gamma + q_1 [1 - \gamma]} \quad (\text{A-19})$$

$$\Pr(G | x = 2, y = 2 = \text{or bidder does not have a good manager}) \\ \times \frac{[1 - p_0 - p_1] [\xi(1 - p_0 - p_1) + 1 - \xi] \gamma}{[1 - p_0 - p_1] [\xi(1 - p_0 - p_1) + 1 - \xi] \gamma + [1 - q_0 - q_1] [\xi(1 - q_0 - q_1) + 1 - \xi] [1 - \gamma]} \quad (\text{A-20})$$

7. References

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