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Managerial Turnover and Leverage under a Takeover Threat

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ABSTRACT

How do shareholders perceive managers who lever up under a takeover threat? Increasing leverage conveys good news if it reflects management's ability to enhance value. It conveys bad news, though, if inefficient managers are more pressured to lever up than the efficient ones. This paper demonstrates that negative updating may prevail. Managers who lever up to end a takeover threat may thus commit to enhance value and yet increase their chances of being replaced by their shareholders. The model provides implications for the dispersion of intraindustry leverage and for the stock price reaction to debt-for-equity exchanges.

RECENT EMPIRICAL RESEARCH ON CAPITAL STRUCTURE choice has documented a strong link between corporate leverage and activity in the market for corporate control. Garvey and Hanka (1999), for example, show that smaller takeover costs lead to higher leverage, while Berger, Ofek, and Yermack (1997) show that the leverage of target firms increases in the aftermath of unsuccessful tender offers. One interpretation of these findings is that, in response to a takeover threat, managers lever up to commit to an increase in firm value that preempts takeover gains (see Grossman and Hart (1982), Jensen (1986), and Zwiebel (1996)). Consistent with this interpretation, Safieddine and Titman (1999) report an increase in operating performance for target firms that lever up the most in response to an unsuccessful takeover attempt.

Committing to increase value does not seem to secure the jobs of target managers, though. In Safieddine and Titman's (1999) sample of target firms that levered up the most, 37 percent of the managers lost their jobs within a year of the failed takeover attempt. Previous studies focusing on broader samples find a much lower turnover rate. Denis and Denis (1995), for instance, report a 17 percent managerial turnover rate for a sample of 1,689 firms in the Value Line Survey. Can it then be that an increase in leverage under a takeover threat commits the firm to enhance value and yet sends a bad signal about the skills of the incumbent management?

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This paper demonstrates that increasing leverage may convey bad news about target managers. As I will argue, the negative updating depends mainly on two ingredients: (1) a low probability of shareholders' activism, and (2) moderate takeover costs. With these two conditions, an equilibrium obtains in which the use of debt as a takeover defense commits the firm to increase value and yet sends a negative signal about the target manager. The model provides testable implications for the dispersion of intraindustry leverage and for the stock price reaction to debt-for-equity exchanges.

To get some intuition for the paper's results, consider a firm run by a self-interested manager who would not voluntarily undertake a reorganization of assets that increases the firm's value but decreases his own utility. Examples of asset reorganizations are divestitures of assets (as in Stulz (1990)) or the end of an inefficient investment program (as in Jensen (1986) and Hart and Moore (1995)).

In the absence of a takeover threat, the manager bets that free-riding problems (see Grossman and Hart (1980)) will prevent shareholders from imposing the reorganization plan. Under a takeover threat, nonetheless, a raider will take over the firm if he believes that the incumbent manager will not reorganize the assets. This takeover threat elicits incentive for the manager to commit to the reorganization plan.

Committing to reorganize assets is not that simple, though, because the raider may anticipate that the reorganization plan will be aborted once the takeover threat ends. As in Grossman and Hart (1982), Jensen (1986), and Zwiebel (1996), the manager will use the firm's capital structure as a commitment device. More precisely, I follow Zwiebel and assume that, in financial distress, managers lose bargaining power vis-à-vis shareholders and debtholders, who—possibly with the help of a bankruptcy court—can coordinate their actions to replace the incumbent management whenever they see fit. Risky debt thus implies a distress threat that makes the value-enhancing reorganization plan in the incumbent manager's best interest whether a raider is present or not.

Unlike the existing capital structure literature, the commitment by incumbent management to reorganize assets may not be enough to block a takeover. In this paper, the target manager must also convince the raider that he is the best person for the job. Accordingly, consider that the incumbent manager's ability to reorganize the assets is either high or low.

In a takeover market, raiders specialize in gathering information that can help them assess the profitability of a takeover. One example of this type of information is the incumbent manager's ability to reorganize assets. Gathering information is costly, however. As such, the raider will obtain a noisy signal of the manager's quality. Acting on his noisy signal, the raider may mistakenly take over the firm, replacing a high-type manager who is committed to the reorganization plan. Hence the raider's noisy signal poses a threat to the high-type manager, who, therefore, has two reasons to lever up: (1) committing to the reorganization plan, and (2) signaling to the raider his superior skills.

Of course, leverage signals superior managerial skills only if low-type managers do not have incentive to mimic the high types with probability one. In

the classical signaling model of Ross (1977), high-type managers separate themselves from low-type managers by choosing a high debt level. Because low-type managers are less efficient, mimicking the high-type managers would imply high expected costs of financial distress. Since Ross assumes that managers maximize firm value, distress costs dissuade low-type managers from mimicking the high type, supporting a separating equilibrium in which high leverage conveys good news.

In this paper, though, managers do not necessarily maximize firm value. In particular, they will accept a high probability of financial distress if the alternative implies a very strong takeover threat. As a result, agency costs in the capital structure choice allow for an equilibrium in which high leverage commits the incumbent manager to reorganize the firm and yet conveys a bad signal about his skills. In this equilibrium, a large increase in leverage under a takeover threat implies an updating that is consistent with the following speech by a hypothetical shareholder:

A capable manager should not fear takeovers. After all, except for rare mistakes, no raider would dismiss a manager who is running the firm in the best possible way. Thus, managers who respond to a takeover threat by adopting strong defensive measures (e.g., a major leverage recapitalization) signal that major gains from managerial turnover exist. Even if the leverage recapitalization delivers some increase in value, we shareholders have no reason to be grateful to the incumbent manager. In fact, managerial turnover should further increase firm value.

Formally, I will characterize a semiseparating equilibrium in which target managers choose between a low debt level that keeps the takeover threat alive and a higher debt level that deters the raider but does not necessarily save the incumbent's job. In this equilibrium, the higher debt deters the raider, for two reasons. First, it induces a threat of managerial turnover in financial distress that makes it in the interest of the target manager to increase efficiency. The higher debt, therefore, commits the target management to the value-enhancing reorganization plan. Second, the negative signal associated with the higher debt increases the chances that shareholders trigger managerial turnover outside financial distress. The combination of the commitment role of debt with the higher probability of shareholders' activism lowers enough of the gains of a disciplinary takeover to deter the raider.

It then follows that, when choosing the firm's debt, low- and high-type managers face a trade-off between a takeover threat (under the lower debt) and the risk that shareholders trigger managerial turnover (under the larger debt). While high-type managers, who do not fear takeovers as much, prefer the takeover threat over the threat of being replaced by their shareholders, low types are indifferent between these two threats, randomizing between the two debt levels. Hence, when low types choose the larger debt that ends the takeover threat, they commit themselves to increase firm value and yet increase their chances of being replaced by their shareholders.

The comparative statics of the debt choices of the semiseparating equilibrium resemble some of the predictions of theories of debt that focus on minimizing managerial agency costs. In particular, changes that increase net takeover gains imply higher debt levels. For example, consistent with the findings of Garvey and Hanka (1999), lower takeover costs increase the equilibrium debt levels; a result that, as the analysis of the model will show, implies that the probability that the low type pools with the high type increases as takeover costs become smaller. The model thus predicts a relatively low dispersion of intraindustry leverage in periods of low takeover costs.

Of course, the level of takeover costs is not the only determinant of the net takeover gains. A lower probability of shareholders' activism increases the value of a disciplinary takeover, implying that the minimum debt that deters the raider goes up. Accordingly, I will show that the debt that ends the takeover threat must be risky for the high-type manager, if the probability of shareholders' activism is sufficiently low. In this case, large takeover costs, which make it possible for a relatively low debt level to end a takeover threat, break down the equilibrium in which leverage conveys bad news about target managers.

As it turns out, this seemingly harmless result does not arise in the classical equilibrium in which debt conveys good news about firms and managers. The model therefore predicts that debt is less likely to convey bad news about target managers when takeover costs are large. Such implication can be tested by looking at stock price reactions to debt-for-equity exchanges in a sample of firms with varying takeover costs.

The remainder of the paper is organized as follows. Section I presents the general framework. Section II characterizes the semiseparating equilibrium in which leverage conveys bad news about managers' quality. Section III explores equilibria in which leverage conveys good news about managers' quality. Section IV discusses the empirical implications, and a conclusion follows in Section V. Proofs of the propositions that are not present in the text can be found in the Appendix.

I. General Framework

A. Preferences and Cash Flows

Consider an all-equity firm run by a self-interested manager. The conflicts of interest between the manager and the firm's shareholders are twofold. First, the firm's value could be enhanced by an action that reduces the manager's utility. For concreteness, this action is identified as the implementation of a reorganization plan, which can be interpreted as a divestiture of assets or the end of an inefficient investment program. Second, the incumbent manager may not be the best person to reorganize the firm. If he isn't, shareholders cannot rely on him to step down voluntarily.¹

¹ The tension between a manager who wants to keep his job and shareholders who want the best person to run the business is the same as in Grossman and Hart (1988), Harris and Raviv (1988, 1989), Stulz (1988), and Israel (1992).

As is standard in the signaling and managerial literature on capital structure choice, managerial incentive contracts are ruled out. Hence, as in Hart and Moore (1995) and Zwiebel (1996), the utility of the manager is $B > 0$ if he stays in control until the final cash flows are realized, and zero otherwise.² Although reorganizing the firm is costly for the manager, it is not as costly as losing the job. Thus, $B > f$, where $f > 0$ is the manager's personal cost of reorganizing the firm.

The analysis is restricted to two production periods. The cash-flow generation of the first period, $\theta + s_1$, consists of two components. The first, θ , is uniformly distributed over the interval $[0, 1]$ and captures the firm's uncertainty that is outside the manager's control. The second component, s_1 , depends on the asset reorganization.

If the firm is not reorganized, $s_1 = 0$ and the first-period cash flow collapses to θ . In turn, the value of reorganizing the firm depends on the manager's skills. It is assumed that, regardless of θ , a high-type manager runs a reorganized firm more efficiently than a low type. For instance, if the reorganization requires a leaner firm with a smaller market share, a high-type manager will be more creative in reducing costs than a low type. Accordingly, the reorganization of assets increases the first cash flow by s_H under a high-type manager and by $s_L < s_H$ under a low-type manager. To assure that reorganizing the assets significantly increases firm value, I impose $s_L \geq 1$.

The second-period cash flow, ks_2 , is interpreted as the value of the firm's future operational cash flows (other than the first one), where $k > 1$. This second cash flow also depends on whether and how the firm is reorganized. If the firm is not reorganized, $s_2 = 0$ and the firm's value is equal to the value of the current assets, which is ignored in the analysis to reduce notation. Alternatively, reorganizing the firm increases its continuation value to $ks_2 > 0$, where $s_2 \in \{s_H, s_L\}$. In principle, the incumbent manager is allowed to postpone the firm's reorganization to a point that only the second cash flow would be increased. However, the incumbent manager cannot change the firm's organization once he has reorganized the assets. Assuming a risk-neutral economy with a zero risk-free rate, the firm's value under the incumbent manager is equal to

$$V = E[\theta + s_1] + kE[s_2], \quad (1)$$

where $s_i \in \{0, s_H, s_L\}$ for $i \in \{1, 2\}$ and $s_2 = s_1$ if $s_1 \neq 0$.

If the incumbent manager is fired, a new one—with average type $\bar{s} \equiv \frac{1}{2}s_L + \frac{1}{2}s_H$ —is hired. The hiring of the new manager will not affect the first cash flow, which is determined by the realization of θ and the original man-

² Ross (1977) imposes an exogenous compensation scheme on the manager but does not jointly solve for the signaling equilibrium and the optimal incentive contract. Ignoring managerial incentive contracts in agency models is partly justified by Persons (1994), who demonstrates that renegotiation weakens the effectiveness of managerial contracts, and Garvey (1997), who shows that managers' ability to trade on secondary capital markets undermines managerial incentive schemes.

ager's type and reorganization decision.³ Managerial turnover may affect the second-period cash flow, though. For instance, if a high-type manager who reorganized the firm at $t = 0$ is mistakenly replaced, the firm's continuation value drops from ks_H to $k\bar{s}$. In turn, the replacement of a low-type incumbent increases value from ks_L to $k\bar{s}$.

B. Managerial Entrenchment and Financial Distress

As in Grossman and Hart (1980), free-riding problems imply that dispersed shareholders may fail to discipline a manager who deviates from value maximization. I model these free-riding problems by a probability $A \in [0,1]$ (for activism) that shareholders coordinate their efforts to force the incumbent manager to reorganize the assets (if necessary), or even trigger managerial turnover (if hiring a new manager is in the shareholders' best interest). The probability A is inversely related to the free-riding problems.

In the model, the probability A reflects the chances that shareholders overcome free-riding problems in the absence of extraordinary circumstances. The threat to the manager's job is likely to be substantially increased if the firm lacks operational funds to pay its debt, an event I call financial distress. In financial distress, three alternatives exist: (1) the firm may sell some of its assets to pay the creditors, (2) the debt may be renegotiated, or (3) the firm may borrow against future cash flows. In any event, the manager's bargaining power vis-à-vis shareholders and outside investors is weakened. As in Zwiebel (1996), I model this loss of bargaining power by assuming that whoever takes control in financial distress (shareholders or debtholders) replaces the incumbent whenever he sees fit. In other words, financial distress overcomes any free-riding problems (possibly with the help of the bankruptcy court).⁴

In Dewatripont and Tirole (1994) and Berkovitch and Israel (1996), shareholders and debtholders have conflicting incentives with respect to the dismissal of the incumbent manager. These conflicts do not arise in this paper. Because the model considers only two types (high or low), replacing an incumbent manager by a new one who is more likely to be a high type is optimal for debtholders and shareholders.⁵ Without loss of generality, I can

³ This assumption can be justified by the existence of a time lag for a new manager to adapt the firm's operations to his management style.

⁴ Of course, not all managers lose bargaining power when there are no operational funds to pay interest or principal on the outstanding debt. In particular, borrowing to pay existing debt is expected in firms that finance long-term projects with short-term debt. Yet, in the model, borrowing to pay existing debt signals low managerial skills. Hence, as assumed, the manager should lose some control over business decisions, increasing the chances of managerial turnover. Indeed, Gilson (1989) finds a high turnover rate (52 percent) in his sample of financially distressed firms.

⁵ Suppose that equity value increases if a more efficient manager is hired. Clearly, debtholders have no reason to oppose the shareholders' desire to fire an inefficient manager if debt will be paid in full regardless of the manager's type. In turn, debtholders have incentive to support managerial turnover if the firm needs a high-type manager to pay its debt in full. Likewise, no conflicts exist if hiring a more efficient manager does not increase equity value. In this case, equity value is zero and debtholders are the residual claimants. Shareholders will have no reason to oppose a search for a more efficient manager.

thus assume that, in financial distress, shareholders replace the incumbent manager if and only if managerial turnover is likely to increase efficiency.

In the tradition of the costly verification models (e.g., Gale and Hellwig (1985)), shareholders cannot costlessly verify the firm's cash flow without firing the incumbent manager. Thus, if a manager announces that the firm is unable to pay its debt (i.e., the firm is financially distressed), shareholders update their beliefs about the quality of the incumbent, and trigger managerial turnover if and only if the expected gains are positive.⁶

To simplify the analysis, I follow Zwiebel (1996) and ignore financial distress costs. The analysis of the model will be unchanged, however, if financial distress costs a fraction $\lambda \in (0,1)$ of the cash flow in the distress period, leaving the firm's continuation value intact. In this setting, replacing the incumbent manager cannot save costs of financial distress because, as previously assumed, there is a time lag for a new manager to deliver the increase in efficiency that might have prevented the firm from being financially distressed. As such, financial distress costs have no impact on either shareholders' turnover decision or a raider's takeover decision. The results of the paper, therefore, do not depend on the size of the financial distress costs.

C. The Takeover Threat

In addition to the threat of shareholders' activism, the incumbent manager may be challenged by an outsider investor (the raider) in a takeover attempt. To model this takeover threat, I assume that a takeover succeeds if and only if a raider can increase firm value by more than a cutoff $C > 0$, which I interpret as a takeover cost.⁷ In particular, a takeover will happen with probability one if the manager cannot convince the raider that the company will be reorganized.

Committing to the reorganization plan is not that easy, though. Since I assume that outsiders do not observe the firm's reorganization, the raider may think that the incumbent will abort the reorganization plan once the takeover threat ends. As in Grossman and Hart (1982), Jensen (1986), and Zwiebel (1996), the firm's capital structure lets the manager commit to the reorganization plan.

A raider's incentive to take over the firm does not necessarily end with the manager's commitment to reorganize the assets. By replacing a low-type manager, the raider increases the firm's value. Therefore, the takeover decision depends on the raider's beliefs about the quality of the incumbent.

⁶ This decision rule assumes that, in financial distress, shareholders can force both the incumbent and a new manager to reorganize. See Fluck (1998) for a paper that analyzes shareholders' incentive to replace an incumbent management team.

⁷ In Israel (1991), takeovers happen only if the posttakeover equity value increases by more than the takeover costs. In this setting, Israel shows that risky debt transfers some of the takeover gains to debtholders, decreasing the likelihood of a takeover. In contrast, the focus of this paper is on the defensive role of debt associated with its effects on firm value. Thus, I rule out the Israel effect by modeling entrenchment as a minimum increase in the firm's value (as opposed to the firm's equity value) for a takeover to succeed.

Such beliefs depend on his initial priors, the updating after the capital structure choice, and the realization of a private signal, $r \in \{r_0, r_1\}$.

I interpret the signal r as follows. In a takeover market, raiders specialize in gathering information that can help them assess the profitability of a takeover, for instance, a target manager's quality. Accordingly, r_1 summarizes information that positively updates the probability of the incumbent's being a low type, while r_0 implies a negative updating. The extent of the updating is determined by the conditional probabilities $p(r = r_0 | s = s_L) = p_0 \in (\frac{1}{2}, 1)$ and $p(r = r_0 | s = s_H) = p_1 \in (0, \frac{1}{2})$, which I assume to add to one to simplify some computations.⁸

Note that the raider's signal is a noisy one. Hence, it is possible that the raider will be tempted to take over the firm even if the incumbent is a high-type manager who has reorganized the assets. As a result, the high-type manager has incentive to signal his superior type, implying that the capital structure choice under a takeover threat depends not only on the commitment role of debt but also on its signaling dimension.⁹

D. Timing and Information Structure

Figure 1 summarizes the sequence of events. At time $t = 0$, the incumbent manager chooses the firm's debt to maximize his expected utility. At this time, the manager is the only one who knows his type; shareholders, debtholders, and the raider have equally likely beliefs about the manager's type (s_H and s_L), which may be updated once the capital structure decision is observed.

At time $t = 1$, the manager decides whether to irreversibly reorganize the firm, an act that, while he is in control, the incumbent is the only one to observe. Also at time $t = 1$, the raider receives the private signal $r \in \{r_0, r_1\}$.¹⁰ A takeover will occur if the raider believes that he can increase firm value by more than the takeover cost C . In this case, the raider hires a new manager with an average type $\bar{s} = \frac{1}{2}s_L + \frac{1}{2}s_H$ and, if necessary, the company is reorganized under the raider's monitoring. The net takeover gains will then be split among the raider, the old shareholders, and the debtholders in a way that is unimportant to the analysis.

⁸ Assuming that $p_0 + p_1 = 1$ implies no loss of generality if the priors on the manager's type and the raider's signal are all equally likely, that is, $p(r = r_0) = p(r = r_1) = p(s = s_L) = p(s = s_H) = \frac{1}{2}$.

⁹ In other words, the debt choice links a moral hazard problem—the firm's reorganization—with a signaling problem—the inference of the manager's type. In their study of greenmail payments, Giammarino, Heinkel, and Hollifield (1997) also combine a signaling problem with a moral hazard problem.

¹⁰ One might argue that the manager should postpone the increase in leverage to time $t = 1$ when the raider receives the signal of the manager's quality. However, fighting a raider is likely to be harder once a substantial fraction of the takeover costs has been sunk. A preemptive increase in leverage thus enhances the chances of avoiding a takeover. Indeed, Berger, Ofek, and Yermack (1997) and Garvey and Hanka (1999) show that firms do not necessarily wait until a takeover bid is on the table to adopt defensive measures. In particular, they show that managers increase leverage in response to a takeover threat.

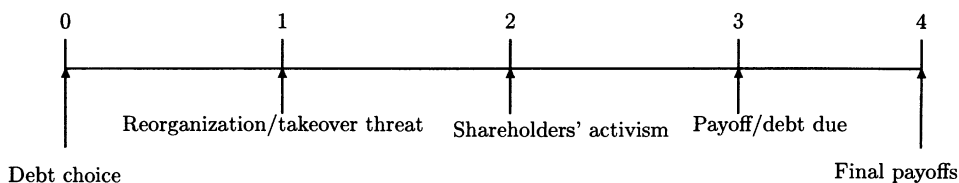


Figure 1. Sequence of events.

If a takeover does not happen at $t = 1$, the incumbent manager stays in place at least until $t = 2$, when shareholders take control if they overcome their free-riding problems. In this event, shareholders impose the reorganization plan (if necessary) and decide whether to replace the incumbent. At time $t = 3$, the first cash flow, $\theta + s_1$, is realized and any debt is due. If the firm is unable to pay the debt, financial distress occurs. Shareholders will then update their beliefs, replacing the incumbent if a new manager is likely to increase firm value. Finally, the second cash flow occurs at time $t = 4$, and the firm is liquidated.

II. Leverage Conveys Bad News about Managers' Quality

This section characterizes an equilibrium in which debt ends a takeover threat but conveys bad news about the target manager. At first glance, this equilibrium seems unintuitive. After all, if debt conveys bad news about a target manager, shouldn't it increase the likelihood of a disciplinary takeover? Our first task is thus to explain how an increase in leverage that conveys bad news about target managers may end a takeover threat.

A. The Entrenchment Role of Debt

To understand the entrenchment role of debt, suppose that shareholders and the raider know that a target manager is a low type who chose a debt level $D^L = s_L + \alpha$ that commits him to reorganize the assets. Conditioned on the firm's reorganization, the only source of value of a takeover stems from the expected gains of replacing the low-type incumbent. These expected turnover gains amount to an increase in the firm's continuation value that is equal to $k(\bar{s} - s_L)$, where $\bar{s} = (s_H + s_L)/2$ is the expected type of the new manager.

But, if the raider replaces the incumbent manager, we should not credit the expected turnover gains entirely to the takeover. In the absence of a takeover, shareholders would have overcome their free-riding problems with probability A , wasting no time in firing the low-type incumbent. A fraction A of the expected replacement gains should then be excluded from the raider's value added.

Excluding $Ak(\bar{s} - s_L)$ from the expected replacement gains is not enough to give us the takeover gains, though. The incumbent's fate will be sealed in

financial distress, even if shareholders could not previously overcome their free-riding problems. The turnover gains in the distress states, therefore, should not be considered as value added by a takeover either. To exclude these gains, remember that, given the reorganization of assets, the firm's first cash-flow is $s_L + \theta$. As such, the low-type manager will avoid financial distress if and only if $s_L + \theta \geq D^L = s_L + \alpha$, or equivalently, $\theta \geq \alpha$. Because θ is uniform in the interval $[0, 1]$, the probability that the firm avoids financial distress is $1 - \alpha$. Hence, under a debt level $D^L = s_L + \alpha$, the value added by a takeover is $(1 - A)(1 - \alpha)k(\bar{s} - s_L)$.

Clearly, a sufficiently large probability of financial distress, α , will make the takeover unprofitable. In particular, the minimum debt level, $D^{NT} = s_L + \alpha^{NT}$, that ends the takeover threat solves

$$(1 - A)(1 - \alpha^{NT})k(\bar{s} - s_L) = C \Rightarrow \alpha^{NT} = 1 - \frac{C}{(1 - A)k(\bar{s} - s_L)}. \quad (2)$$

Intuitively, it does not pay for the raider to take over the company because the firm's leverage is likely to shift control to the shareholders, who will then replace the inefficient management.

Still, it may not be in the low type's interest to use debt as an entrenchment device. If D^{NT} implies financial distress with a high probability, substituting a strong distress threat for the takeover threat may not represent a gain after all. Moreover, by mimicking the high type, the low type may mislead his shareholders, avoiding managerial turnover in case the latter overcome their free-riding problems outside financial distress. Obtaining conditions for D^{NT} to arise in equilibrium is our next task.

B. The Equilibrium

A separating equilibrium in which the low type chooses a high leverage to deter the raider is a natural candidate for debt to convey bad news about target managers. Yet, this separating equilibrium does not exist because the low type would not resist mimicking the high type, whose smaller debt would reduce the probability of financial distress while ending not only the takeover threat but also the threat of shareholders' activism. A semiseparating equilibrium in which high leverage conveys bad news about target managers exists, though. In this equilibrium, managers', raiders', and shareholders' strategies are:

- **Managers:** Low-type managers randomize between two debt levels, choosing the debt D^{NT} that blocks takeovers (see equation (2)) with probability $1 - \gamma$, and a lower debt level D^H with probability γ . High-type managers choose D^H with probability one. Both types reorganize the assets after choosing the firm's debt.
- **Raiders:** They take over the firm if the signal r_0 is realized and the target manager chooses the debt D^H ; takeover plans cease if the manager chooses the debt D^{NT} .

- Shareholders: They replace the incumbent if a takeover does not occur and the firm becomes financially distressed. Outside financial distress, shareholders trigger managerial turnover if they overcome their free-riding problems and the incumbent chooses any $D \neq D^H$.

In the proposed equilibrium, the low-type manager is the only one to choose the debt level D^{NT} that ends the takeover threat. Hence, using debt as a takeover defense reveals the incumbent's suboptimal skills and implies that it is optimal for shareholders to trigger managerial turnover. Outside financial distress, the threat of shareholders' activism is summarized by the probability A that they overcome their free-riding problems. In financial distress, shareholders are assumed to overcome their free-riding problems (possibly with the help of a bankruptcy court). As such, using debt as a takeover defense implies managerial turnover if the firm cannot pay $D^{NT} = s_L + \alpha^{NT}$, which is an event with probability α^{NT} (see the discussion preceding equation (2)). With the debt D^{NT} , the low type will thus keep his job with probability $(1 - A)(1 - \alpha^{NT})$, implying the following expected utility:

$$U(D^{NT}|s_L) = (1 - A)(1 - \alpha^{NT})B - f, \quad (3)$$

where B is the private benefit of remaining in control and f is the manager's cost of reorganizing the firm.

Is it optimal for the low type to choose D^{NT} instead of mimicking the high type at the lower debt D^H ? By choosing D^H , the low type not only reduces the distress threat but also avoids a bad signal about his skills. In the absence of further information, shareholders will have no reason to replace the incumbent after observing D^H , ending the threat of shareholders' activism.¹¹ In the proposed equilibrium, nonetheless, D^H keeps the takeover threat alive. So, from the low type's perspective, choosing D^H instead of the larger debt D^{NT} involves a trade-off between a takeover threat and the threat of being replaced by shareholders inside and outside financial distress.

Now, since D^H sends a good signal about the target manager but keeps the takeover threat alive, it must be the case that the raider takes over the firm if and only if the negative signal r_0 is realized. As a result, the low-type manager perceives the takeover threat under the lower debt D^H as an event with probability $p(r = r_0|s = s_L) = p_0 > \frac{1}{2}$. From the perspective of the low type, mimicking the high type's debt choice implies an expected cost of p_0B .

To compare the cost p_0B with the benefit of mimicking the high type (i.e., reducing the probability of financial distress and ending the threat of shareholders' activism outside financial distress), let us compute the low type's expected utility under $D^H = s_L + \beta$. With the lower debt level, the firm avoids financial distress if and only if $s_L + \beta \leq s_L + \theta$, or equivalently, $\theta \geq \beta$, which is an event with probability $1 - \beta$. Hence, the probability that

¹¹ More formally, since the high type chooses D^H with probability one and the low type chooses the same debt level with a probability $\gamma < 1$, Bayes' rule implies that $p(s = s_L|D^H) = \gamma/(1 + \gamma) < \frac{1}{2}$.

the low type will keep his job after choosing D^H and subsequently reorganizing the assets is $(1 - p_0)(1 - \beta)$, which implies that the expected utility of the low-type manager is

$$U(D^H|s_L) = (1 - p_0)(1 - \beta)B - f. \quad (4)$$

The low-type manager will be willing to randomize between D^H and D^{NT} only if he is indifferent between these two debt levels, that is, $U(D^{NT}|s_L) = U(D^H|s_L)$, an equality that is satisfied if $D^H = s_L + \beta^{NT}$, where $\beta^{NT} = 1 - \{C/[k(\bar{s} - s_L)(1 - p_0)]\}$.¹² One can easily check that the debt D^H is lower than D^{NT} (recall that our goal is to find an equilibrium in which the larger debt conveys bad news about the incumbent manager) if and only if $A < p_0$. In other words, the threat of shareholders' activism must be weaker than the takeover threat.

It then follows that the low type's optimization behavior pins down the debt levels of the semiseparating equilibrium. First, the larger debt that reveals the incumbent as a low type must be the minimum debt D^{NT} that blocks the raider. After all, among the debt levels that reveal the incumbent as a low type, it is neither optimal for the incumbent to choose a larger debt level that increases the distress threat nor to choose a lower debt level that implies a takeover with probability one. Indifference between D^{NT} and the lower debt that keeps the takeover threat alive then yields a unique candidate for D^H , which, as D^{NT} , decreases with takeover costs.

Of course, the maximization program of the low-type manager does not fully characterize the equilibrium. Other restrictions are: The lower debt D^H must keep the takeover threat alive while triggering managerial turnover in financial distress; D^H must be optimal for the high-type manager; and D^H and D^{NT} must induce the incumbent manager to reorganize the assets. The proof of Proposition 1 provides all the conditions that assure that the proposed strategies form a semiseparating equilibrium. Roughly, the equilibrium obtains if takeover costs are moderate and the threat of shareholders' activism is weak vis-à-vis the takeover threat.

PROPOSITION 1: *Suppose that the probability of shareholders' activism is $A < p_0$ and takeover costs are neither too large nor too small, that is, they belong to a nondegenerate interval that depends on the parameters of the model. Thus, there is a semiseparating equilibrium that satisfies the intuitive criterion of Cho and Kreps (1987). The strategies and beliefs of this semiseparating equilibrium are:*

¹² Two opposing effects explain why D^H does not depend on the probability A of shareholders' activism. On the one hand, a larger probability of shareholders' activism preempts more of the value added by a takeover, reducing the minimum debt D^{NT} that blocks the raider. The lower debt D^H thus becomes less appealing to the low type. On the other hand, a larger probability that shareholders overcome their free-riding problems increases the gains of eliminating the risk of shareholders' activism, leading to stronger incentives for the low type to mimic the high-type manager at the lower debt D^H .

- *Debt levels:*

$$D^{NT} = s_L + \alpha^{NT}$$

where D^{NT} ends the takeover threat and

$$\alpha^{NT} = 1 - \frac{C}{(1-A)k(\bar{s} - s_L)},$$

$$D^H = s_L + \left[1 - \frac{C}{k(\bar{s} - s_L)(1 - p_0)} \right]$$

with D^H keeping the takeover threat alive.

- *Managers' strategies:* Both types of managers reorganize the firm. The high type chooses D^H with probability one and the low type randomizes between D^H and D^{NT} .
- *Shareholders' strategy:* Dismiss the incumbent manager in financial distress. Dismiss the incumbent outside financial distress if, with probability A , shareholders overcome their free-riding problems and the manager chooses any $D \neq D^H$.
- *Beliefs:* $p(s = s_L | D \neq D^H) = 1$, $p(s = s_L | D = D^H, r_i) = \gamma p_i / (\gamma p_i + p_j)$, where γ is the probability that the low type chooses D^H and $i \neq j$ with $i, j \in \{0, 1\}$.

As in most managerial models of capital structure choice (e.g., Zwiebel (1996)), the equilibrium debt levels decrease with takeover costs. The intuition is straightforward. An increase in takeover costs lets managers reduce firm value without eliciting incentive for a takeover. The financial distress threat that preempts the takeover gains can thus be weakened, implying that the minimum debt D^{NT} that deters the raider decreases. Given that D^{NT} imposes a weaker distress threat, the low type will have less incentive to mimic the high type at the lower debt D^H . To preserve indifference, D^H must be lowered as well.

More interestingly, takeover costs impose restrictions on the probability of shareholders' activism. To see this, let us investigate the high-type manager's capital structure decision. From the perspective of the high type, the takeover threat under the lower debt D^H is summarized by the probability that the raider mistakenly receives the negative signal r_0 , that is, $p(r = r_0 | s = s_H) = p_1 < \frac{1}{2}$. Hence, the high type knows that the raider is unlikely to mistake him for a low-type manager.

In addition to not fearing takeovers as much as the low-type manager, the high-type manager is under a weaker distress threat because his greater efficiency reduces the risk of financial distress. In particular, given $D^H = s_L + \beta^{NT}$, a high-type manager will be unable to pay the debt only if $s_L + \beta^{NT} > s_H + \theta$, or equivalently, $\theta < \beta^{NT} - (s_H - s_L)$. The probability of

managerial turnover in financial distress is then $\max\{\beta^{NT} - (s_H - s_L), 0\}$, which implies the following expected utility under the lower debt D^H :

$$U(D^H|s_H) = (1 - p_1)(1 - \max\{\beta^{NT} - (s_H - s_L), 0\})B - f. \quad (5)$$

Curiously, while the weaker takeover threat helps the high type favor D^H over the debt D^{NT} that deters the raider, his greater efficiency elicits incentive toward the debt D^{NT} . Since financial distress is a less likely event for the high type, leveraging up to D^{NT} is less costly for him, possibly making it optimal to deviate to the larger debt D^{NT} . The high type's perception of a weak takeover threat is thus crucial for the existence of the semiseparating equilibrium.

To make it optimal for the high-type manager to choose D^H , we must have $U(D^H|s_H) \geq U(D^{NT}|s_H)$, with $U(D^H|s_H)$ as in equation (5) and $U(D^{NT}|s_H)$ given by

$$U(D^{NT}|s_H) = (1 - A)(1 - \max\{\alpha^{NT} - (s_H - s_L), 0\})B - f. \quad (6)$$

Plugging equations (5) and (6) into $U(D^H|s_H) \geq U(D^{NT}|s_H)$ yields

$$\begin{aligned} & (1 - p_1)(1 - \max\{\beta^{NT} - (s_H - s_L), 0\}) \\ & \geq (1 - A)(1 - \max\{\alpha^{NT} - (s_H - s_L), 0\}). \end{aligned} \quad (7)$$

As it turns out, equation (7) implies that the semiseparating equilibrium in which high debt conveys bad news about target managers does not survive a combination of large takeover costs and low probability of shareholders' activism. To see this, remember that a sufficiently large takeover cost will reduce the larger debt D^{NT} enough to make it safe for a high-type manager who has reorganized the firm.¹³ In this case, the probabilities of default under D^{NT} and D^H are zero and equation (7) collapses to

$$(1 - p_1) \geq (1 - A) \Leftrightarrow A \geq p_1. \quad (8)$$

It then follows that takeover costs cannot be too large in firms with low probability of shareholders' activism ($A < p_1$), a result that actually extends to any equilibrium (mixed-strategy equilibria included) in which debt conveys bad news about target managers.

PROPOSITION 2: *Suppose that the threat of shareholders' activism is weaker than the takeover threat from the perspective of a high-type manager (i.e., $A < p_1$); then debt conveys bad news about target managers only if small takeover costs imply that a high-type manager cannot end a takeover threat without bearing a financial distress threat.*

¹³ Formally, the larger debt is safe for the high type if $D^{NT} = s_L + \alpha^{NT} \leq s_H \Leftrightarrow \alpha^{NT} \leq s_H - s_L \Leftrightarrow C \geq [1 - (s_H - s_L)](1 - A)k(\bar{s} - s_L)$.

Section IV shows that Proposition 2 yields a testable implication for whether debt conveys bad news about target managers.

The semiseparating equilibrium also imposes restrictions on the randomization strategy of the low-type manager. The intuition is the following. If the low type rarely mimics the high type, the lower debt provides a strong signal that the incumbent is a high-type manager, making a takeover unprofitable. To keep the takeover threat alive, the probability that the low type pools with the high type must be above a certain cutoff. Since lower takeover costs increase D^H , the stronger distress threat will reduce the value added by a raider. Keeping the takeover threat alive, therefore, requires larger takeover gains under the lower debt, which will be obtained if the low type is more likely to pool with the high type at the lower debt. The minimum probability that the low type pools with the high type thus decreases with takeover costs. This is stated formally in Proposition 3.

PROPOSITION 3: *The probability γ that the low-type manager pools with the high type at the lower debt D^H is bigger than a cutoff $\hat{\gamma}$ that decreases with takeover costs. As such, the probability that the low type mimics the high type is large in periods of small takeover costs.*

Proposition 3 leads to a second testable implication of the semiseparating equilibrium in which debt conveys bad news about target managers: a relatively low dispersion of intraindustry leverage in periods of low takeover costs.

C. An Example

Consider a firm whose manager has type $s \in \{s_L = 1, s_H = 1.4\}$, the takeover cost is $C = 0.06$, $k = 1.09$, the ratio of the reorganization cost to the manager's private benefit is $f/B = 0.2$, $p(r = r_0 | s = s_L) = p_0 = 0.7$, $p(r = r_0 | s = s_H) = p_1 = 0.3$, and the probability of shareholders' activism outside financial distress is $A = 0.1$. For these parameter values, the smallest debt that deters a raider who knows that the incumbent is a low-type manager is $D^{NT} = s_L + \alpha^{NT} = 1.6942$, where $\alpha^{NT} = 0.6942 = 1 - C/[(1 - A)k(\bar{s} - s_L)]$.

I show that the following strategies form a semiseparating equilibrium: (1) the high type chooses $D^H = s_L + \{1 - C/[k(\bar{s} - s_L)(1 - p_0)]\} = 1.0826$ and reorganizes the firm; (2) the low type randomizes between the debt levels D^H and D^{NT} with probabilities $\gamma = 0.9$ and $1 - \gamma = 0.1$, respectively, and reorganizes the firm; (3) shareholders trigger managerial turnover if financial distress occurs or if they overcome the free-riding problems after the manager chooses D^{NT} ; and (4) the raider takes over the firm if the incumbent chooses D^H and r_0 is realized.

I start checking the low type's strategy. If the low-type manager chooses D^{NT} but does not reorganize the assets, the first cash flow is $\theta \in [0, 1]$, which is less than D^{NT} with probability one. Financial distress occurs and, given the shareholders' strategy, managerial turnover will follow. In contrast, reorganizing the assets allows for financial distress if $D^{NT} > s_L + \theta$, which implies $\theta < 0.6942$. Since θ is uniformly distributed in the interval

$[0,1]$, the probability of financial distress is 0.6942. The probability that the low type keeps his job is then $(1 - 0.1)(1 - 0.6942) = 0.2752$, which takes into account that shareholders will trigger managerial turnover outside financial distress with probability $A = 0.1$. Reorganizing the assets under D^{NT} is optimal for the low type if $U(D^{NT}|s_L) = 0.2752B - f \geq 0$, or $f/B \leq 0.2752$, which is satisfied in the example ($f/B = 0.2$).

Instead of using debt as a takeover defense, the low-type manager may mimic the high type by choosing $D^H = 1.0826$, and reorganizing the firm. In this case, the threat of shareholders' activism outside financial distress ends (thanks to the the good signal that D^H conveys). Moreover, the lower debt weakens the threat of financial distress, which will occur if $D^H > s_L + \theta$, or $\theta < 0.0826$. Yet, D^H lets the takeover occur if the signal r_0 updates the raider's beliefs to $p(s = s_L|D^H, r_0)$. Since the probability that r_0 is realized under the low type is $p(r_0|s_L) = p_0 = 0.7$, the low type's expected utility under D^H is $U(D^H|s_L) = (1 - 0.0826)(1 - 0.7)B - f = 0.2752B - f$, which is equal to the low type's expected utility under the larger debt D^{NT} . The low-type manager is thus willing to randomize between the two debt levels, as required by the semiseparating equilibrium.

Let us now move to the high-type manager. In the proposed equilibrium, D^H ends the threat of shareholders' activism outside financial distress but does not block the takeover if the raider receives the signal r_0 . From the perspective of a high-type manager, the probability of losing the job after choosing D^H is then equal to the probability that $r = r_0$ conditioned on the incumbent's being a high type, that is, $p(r_0|s_H) = p_1 = 0.3$. Therefore, takeovers put less pressure on high-type managers than on low ones.

By choosing D^H and reorganizing the assets, the high type insulates himself from the distress threat. The high type's expected utility under the equilibrium strategies will be $U(D^H|s_H) = (1 - p_1)B - f = 0.7B - f$, which is greater than zero because $f/B = 0.2$. If, instead, the high type does not reorganize, $D^H > 1$ will imply financial distress with probability one. Since the shareholders' strategy calls for managerial turnover in financial distress, it is indeed optimal for the high type to reorganize the assets conditioned on his choosing D^H . But is it optimal for the high-type manager to choose D^H ? By deviating to $D^{NT} = 1.6942$, the high type substitutes the threat of being replaced by his shareholders (inside and outside financial distress) for the takeover threat. Since $D^{NT} > 1$, not reorganizing implies financial distress (and managerial turnover) with probability one. In contrast, reorganizing the firm allows for financial distress if $D^{NT} > s_H + \theta$, or equivalently $\theta < 1.6942 - s_H = 0.2942$. The expected utility of the high-type manager under D^{NT} is $U(D^{NT}|s_H) = (1 - 0.1)(1 - 0.2942)B - f = 0.6352B - f < 0.7B - f = U(D^H|s_H)$. The high type is thus strictly better off with the equilibrium strategy.

Our next task is to show that D^H implies a takeover if the negative signal r_0 is realized. To see this, note that since the positive updating from D^H ends the threat of shareholders' activism outside financial distress, the takeover gains amount to the expected replacement gains in the nondistress states.

After taking into account that $p(s_L|D^H, r_0) = \gamma p_0 / (\gamma p_0 + p_1) = 0.677$, the takeover gains are

$$[p(s_L|D^H, r_0)k(\bar{s} - s_L) + (1 - p(s_L|D^H, r_0))k(\bar{s} - s_H)] - p(s_L|D^H, r_0)\beta^{NT}k(\bar{s} - s_L) = 0.065. \quad (9)$$

The term in brackets in equation (9) is the expected increase in the continuation value of an all-equity firm whose manager—who is a low type with probability $p(s_L|D^H, r_0)$ —is replaced by a new one with expected type $\bar{s}$. The last term in the left-hand side of the equation captures the effects of leverage on the value added by a takeover. Given the equilibrium strategies and beliefs, financial distress under $D^H = 1.0826$ occurs when $\theta < \beta^{NT} = 0.0826$ and the incumbent is a low type. The value added by a takeover is then reduced because the low-type incumbent would have been dismissed in the distress states regardless of the raider. Equation (9) shows that the value added by a takeover is 0.065, which is larger than the takeover cost, $C = 0.06$. As required by the semiseparating equilibrium, D^H keeps alive the takeover threat.

Finally, given the equilibrium strategies, D^{NT} reveals the incumbent as a low-type manager and D^H cannot lead a high-type manager into financial distress. Hence financial distress and Bayesian updating will let shareholders know that the incumbent is a low type. As such, managerial turnover can only increase shareholders' value. Moreover, for any other debt level, managerial turnover in financial distress will be optimal if out-of-equilibrium beliefs are chosen so that $p(s = s_L|D) = 1$ for $D \notin \{D^H, D^L\}$, proving that the strategies and beliefs form a semiseparating equilibrium in which high leverage conveys bad news about the manager.

III. The Signaling Role of Debt under a Takeover Threat

From Proposition 2, equilibria in which high debt conveys bad news about target managers do not survive a combination of large takeover costs and low probability of shareholders' activism. In contrast, this section shows that, regardless of the probability of shareholders' activism, large takeover costs do not prevent equilibria in which high debt conveys good news about target managers. Large takeover costs, therefore, bias the signaling role of debt toward the classical positive updating.

A. Leverage Conveys Good News about the Incumbent Manager

A separating equilibrium in which the high-type manager levers up the most is a natural candidate for debt to convey good news about a target manager. In this equilibrium, the raider's signal is irrelevant to the takeover decision because the debt choice reveals the incumbent's type. Thus, either the low type's debt choice deters the raider or it implies a takeover

with probability one. In the latter case, reorganizing the assets is clearly a dominated strategy for the low-type manager. Accordingly, I focus on the more interesting separating equilibrium in which the low type's debt ends the takeover threat.

Consider first the low type's strategy. For debt to block the raider despite revealing the incumbent as a suboptimal manager, financial distress must impose a probability of managerial turnover that preempts enough of the takeover gains. Of course, the low-type manager would like to end the takeover threat while bearing the minimum financial distress threat. As Section II shows, the low type's debt choice is then $D^{NT} = s_L + \alpha^{NT}$ (see equation (2)).

Moving to the high-type manager, let his debt choice be $D^H > D^{NT}$. (Remember that we look for a separating equilibrium in which the high type chooses the largest debt.) Neither the raider nor shareholders gain by replacing a manager whose debt choice reveals superior skills. One might wonder, therefore, whether the high type's job security elicits incentive for him to reorganize the firm.

As it turns out, such incentive exists if D^H is safe for the high type after the firm is reorganized. In this case, financial distress lets shareholders know the incumbent is a low-type manager who has mimicked the high type.¹⁴ Acting on their updated beliefs, shareholders will fire the incumbent manager, making it in the high type's best interest to end the distress threat by reorganizing the assets.

If the larger debt D^H is safe for the high-type manager, so too is the lower debt D^{NT} . Making the debt D^{NT} safe for the high type is important not only to induce the latter to reorganize the firm but also to prevent the low-type manager from mimicking the high type. Intuitively, if D^{NT} were risky for the high type, so would be the higher debt level D^H . But then financial distress would not detect a low type who mimicked the high type at the higher debt D^H .¹⁵ The separating equilibrium breaks down because neither the raider nor shareholders would penalize a low-type manager who deviates to D^H .

Yet, D^{NT} safe for the high type is not a sufficient condition for the separating equilibrium. First, D^{NT} must induce the low type to reorganize the assets, a condition that, from the proof of Proposition 1, requires that the manager's reorganization cost satisfy $f/B \leq C/[k(\bar{s} - s_L)]$. Second, while D^H is clearly optimal for the high type (it assures his job with probability one), from the low type's perspective, choosing D^{NT} instead of D^H involves a trade-off between a financial distress threat, which is weakened by the lower debt

¹⁴ Technically, financial distress is out of the equilibrium path. Hence, beliefs that assign probability one for the incumbent's being a low-type manager are consistent with Bayesian equilibrium.

¹⁵ In this candidate for a separating equilibrium, financial distress under D^H is on the equilibrium path. Hence, there is no scope for refinements, regardless of how unlikely it is that a high type leads the firm into financial distress under D^H .

D^{NT} , and the threat of shareholders' activism outside financial distress, which is eliminated by the debt D^H that sends a good signal about the incumbent.

As it turns out, Proposition 4 shows that large takeover costs make it easier for the low type to choose D^{NT} over D^H . The intuition is as follows. If takeover costs increase, the minimum debt D^{NT} that deters the raider is reduced, making it less costly for the low type to end the takeover threat without mimicking the high type.

PROPOSITION 4: *Assume that the manager's cost of reorganizing the assets satisfies $f/B \leq C/k[(\bar{s} - s_L)]$. Then, the strategies and beliefs below form a separating equilibrium if and only if $C > (1 - (s_H - s_L))k(\bar{s} - s_L)$, which implies that the debt D^{NT} that deters the raider is safe for the high type for any probability A that shareholders overcome their free-riding problems.*

1. *Managers' strategies:* The high type chooses $D^H \leq s_H$ whereas the low type chooses $D^{NT} < D^H$. Both debt levels end the takeover threat and both types reorganize the company.
2. *Shareholders' strategy:* Dismiss the incumbent manager in financial distress. Dismiss the incumbent outside financial distress if, with probability A , shareholders overcome their free-riding problems and the manager chooses $D \neq D^H$.
3. *Beliefs:* $p(s = s_L | D^H) = 0$, $p(s = s_L | D \neq D^H) = 1$, $p(s = s_L | \text{Distress}) = 1$.

Exhibiting a signaling equilibrium in which high leverage conveys good news is not surprising. (Signaling games rarely have a unique equilibrium.) The interest of Proposition 4 lies on the conditions that allow for this equilibrium to obtain, namely, D^{NT} must be safe for the high-type manager. In contrast, Proposition 2 tells us that, in firms with a low probability of shareholders' activism, debt conveys bad news about target managers only if D^{NT} is risky for the high type. Since D^{NT} decreases with takeover costs, Propositions 2 and 4 combined tell us that large takeover costs favor equilibria in which high leverage conveys good news about target managers. We have thus proved the following proposition.

PROPOSITION 5: *Suppose that the probability of shareholders' activism is $A < p_1$. Then, if takeover costs are sufficiently large, debt can only convey good news about the skills of target managers.*

As Section IV will show, Proposition 5 provides a test of the relevance of the signaling role of debt under a takeover threat.

B. Shareholders' Activism and Equilibrium Selection

In the standard signaling literature on capital structure choice (e.g., Ross (1977)), debt conveys good news while assuming that managers maximize firm value. Nonetheless, large takeover costs are usually associated with managerial entrenchment and deviation from value maximization. How can

we then reconcile the value-maximizing signaling models with Proposition 5, which implies that large takeover costs bias the signaling role of debt toward a positive updating?

In an equilibrium in which high debt conveys bad news, the use of debt as a takeover defense by low-type managers implies a financial distress threat that dissuades high types from further leveraging up to signal their superior skills. As takeover costs go up, however, the minimum debt that deters the raider decreases. When takeover costs reach the point that the low type can deter the raider with a debt level that is safe for the high type, then the latter has scope to choose a higher debt level to signal his skills. Large takeover costs favor a positive updating, therefore, because they reduce the minimum leverage that high-type managers must exceed to use debt as a signaling device.

Now, the larger the probability A that shareholders overcome their free-riding problems, the less likely that a raider is needed to restore value maximization. The lower takeover gains will reduce the minimum debt D^{NT} that ends the takeover threat, making it easier for high-type managers to use debt as a signaling device. Hence the model implies that debt is more likely to convey good news about target managers in firms in which shareholders' activism curbs a substantial fraction of the managerial agency costs.

IV. Empirical Implications

A. Corporate Leverage and Takeover Costs

As Section III shows, the capital structure problem under a takeover threat may have multiple equilibria. Depending on the type of equilibrium, a large increase in leverage may convey bad or good news about the target manager. Proposition 3, however, establishes an implication that is unique of the semiseparating equilibrium in which debt conveys bad news about the target manager: Intraindustry leverage is less (more) dispersed in periods of small (large) takeover costs.¹⁶ As I now argue, the experiment design of Garvey and Hanka (1999) can be used to test this implication.

Garvey and Hanka (1999) document that, on average, leverage decreased in a sample of firms incorporated in states that had adopted antitakeover laws. After arguing that antitakeover laws increase takeover costs, Garvey and Hanka interpret their finding as evidence that leverage decreases with takeover costs.

Likewise, the adoption of antitakeover laws provides a test of the prediction that an increase in takeover costs increases the dispersion of the leverage of firms in a same industry. More specifically, if the semiseparating equilibrium in which leverage conveys bad news about a target manager is

¹⁶ In a pooling equilibrium, there is no dispersion of intraindustry leverage regardless of the level of takeover costs. Hence, a positive correlation between takeover costs and the dispersion of intraindustry leverage also indicates that a pooling equilibrium is an unlikely outcome of the capital structure problem under a takeover threat.

a relevant one, then the adoption of antitakeover laws should increase the dispersion of intraindustry leverage in a sample of firms incorporated in the states that passed the laws.

B. Stock Price Reaction to Debt-for-Equity Exchanges

The stock price reaction to debt-for-equity exchanges provides a second—and more direct—test of the signaling role of leverage under a takeover threat.¹⁷ In this experiment design, we start dividing a sample of firms according to the strength of their takeover defenses, for instance, strong or weak. Comment and Schwert (1995) report that, as of 1991, 13 percent of the exchange firms had no poison pills, no antitakeover-charter amendments, and were not protected by either control share laws or business combination laws. These firms could be grouped in the subsample of firms with weak takeover defenses, while the remaining 87 percent of firms could be grouped in the subsample of strong takeover defenses. As in Garvey and Hanka (1999), I associate strong (weak) takeover defenses with large (small) takeover costs.

From each subsample, select the firms that exchanged debt for equity and run a regression of the stock price reaction to the debt-for-equity exchange on the size of the leverage increase. The coefficient of the size of the leverage increase captures two effects: (1) the role of debt in committing the firm to increase value, and (2) the updating on the target management's skills.¹⁸

Proposition 5 implies that, in a sample of firms with low probability of shareholders' activism, large takeover costs bias the signaling role of debt toward a positive updating about the skills of the target manager. The model thus predicts that the coefficient of the size of the leverage increase should be larger in the subsample of firms with strong takeover defenses (i.e., large takeover costs).¹⁹ For these firms, high debt conveys good news about the incumbent, reinforcing the commitment role of debt. In contrast, the semiseparating equilibrium in which high debt conveys bad news might prevail in at least some of the firms with weak takeover defenses (small takeover costs), offsetting the commitment role of debt.

¹⁷ See Cornett and Travlos (1989) and Masulis (1980, 1983) for some empirical papers that document the stock price reaction to debt-for-equity exchanges in the United States.

¹⁸ Of course, two-type models are not amenable to regression-based tests, which implicitly assume a continuum of types. Yet, the insights of the two-type model extend to a continuous-type model if we allow for the raider's signal to take values in the interval $[0,1]$, with higher values requiring decreasing debt levels to end the takeover threat. In this setting, the analogous semiseparating equilibrium has types above a certain level of efficiency pooling with the most efficient manager at the lowest debt (with probability one), while managers with an efficiency level below the cutoff randomize between the lowest debt and a revealing larger debt, which increases with the manager's inefficiency.

¹⁹ To implement this regression-based test, the empiricist must assure that the two subsamples (high and low takeover costs) include firms with low probability of shareholders' activism, which is a necessary condition for Proposition 5. Another concern in implementing the test is to exclude firms whose largest shareholder has the majority of votes. In these firms, a debt-for-equity exchange is an unlikely response to a takeover threat.

V. Conclusions

Recent empirical research provides evidence that, in response to a takeover threat, managers lever up to commit to an increase in firm value that makes a disciplinary takeover unnecessary. In particular, Safieddine and Titman (1999) document an increase in operating performance for target firms that increase the most leverage in response to a takeover bid. Despite the increase in performance, these firms experience a high rate of managerial turnover. Apparently, it is not enough that managers under a takeover threat commit to reorganize the firm. They must also prove to their shareholders that they are the best people to turn the firm around.

This paper shows that an increase in leverage that ends a takeover threat may commit target managers to enhance value and yet convey a bad signal of their skills. The negative updating cannot be taken as given, though. If takeover costs are large and the probability of shareholders' activism is low, high leverage cannot convey a negative signal about the target manager. Either high leverage conveys a good signal about the incumbent manager or it conveys no signal.

Empirical research is thus needed to determine whether an increase in leverage under a takeover threat conveys a relevant signal of management's quality. The model's implications regarding the strength of the stock price reaction to debt-for-equity exchanges, and the dispersion of intraindustry leverage provide a starting point for future empirical work.

Appendix: Proofs

A. Proof of Proposition 1:

The proof consists of six steps. Steps 1 to 4 derive conditions for the proposed strategies to be optimal. Step 5 provides sufficient conditions for the semiseparating equilibrium to exist. Finally, step 6 shows that the equilibrium satisfies the intuitive criterion.

A.1. Step 1: The Low Type's Strategy

Section II shows that, given the other players' strategies, a low-type manager who reorganizes the assets is indifferent between $D^{NT} = s_L + \alpha^{NT}$ (as defined in equation (2)) and $D^H = s_L + \beta^{NT} = s_L + \{1 - C/[k(\bar{s} - s_L) \times (1 - p_0)]\}$. In computing these two debt levels, I assumed that $D^H \geq s_L$, which implies that $C \leq (1 - p_0)k(\bar{s} - s_L)$. Moreover, $D^{NT} > D^H$ if and only if $A < p_0$. Hence, aside from the values of D^H and D^{NT} , our first restrictions are $A < p_0$ and $C \leq (1 - p_0)k(\bar{s} - s_L)$.

The next task is to prove that reorganizing the firm is optimal for the low type if $f/B \leq C/[k(\bar{s} - s_L)]$. The expected utility of a low-type manager who reorganizes the firm after choosing D^{NT} (see equation (3)) is greater than or equal to zero if $U(D^{NT}|s_L) = (1 - A)(1 - \alpha^{NT})B - f \geq 0 \Leftrightarrow f/B \leq (1 - A) \times (1 - \alpha^{NT})$. Plugging $\alpha^{NT} = 1 - C/[(1 - A)k(\bar{s} - s_L)]$ in this latter inequality

yields $f/B \leq C/[k(\bar{s} - s_L)]$, which is thus a necessary and sufficient condition for the equilibrium strategy to satisfy the low type's reservation value.

Suppose now that, after choosing D^{NT} or D^H , the low type does not reorganize the assets. The first cash flow will then be $\theta \in [0, 1]$. Since $D^{NT} > D^H \geq s_L \geq 1$, the firm will become distressed with probability one, implying that the low type's expected utility is zero. Hence, reorganizing the assets is optimal for the low type if $f/B \leq C/[k(\bar{s} - s_L)]$.

To finish the analysis of the low type's strategy, I show that he has no incentive to choose $D \notin \{D^H, D^{NT}\}$, whether or not the firm is reorganized. Because D^{NT} is the smallest debt that deters the raider when $p(s = s_L) = 1$, a takeover occurs with probability 1 if $D \notin \{D^H, D^{NT}\}$ and $D < D^{NT}$. (Recall that the out-of-equilibrium beliefs are such that $p(s = s_L | D \notin \{D^H, D^{NT}\}) = 1$.) For $D > D^{NT}$, the takeover threat ends but any such D implies a higher probability of managerial turnover in financial distress than D^{NT} . Since both D and D^{NT} imply managerial turnover outside financial distress with probability A , choosing D^{NT} and reorganizing the assets dominates any $D > D^{NT}$.

A.2. Step 2: The High Type's Strategy

Under the lower debt D^H , the expected utility of the high-type manager is larger than the low type's, for two reasons. First, the high type's greater efficiency implies a weaker threat of financial distress. Second, the high type does not fear takeovers as much as the low type. (Recall that, in the proposed equilibrium, a takeover occurs under D^H if and only if r_0 is realized. Hence high-type managers do not fear takeovers as much because $p(r = r_0 | s = s_L) = p_0 > \frac{1}{2}$, while $p(r = r_0 | s = s_H) = p_1 < \frac{1}{2}$.) As such, $U(D^H | s_L) \geq 0$ implies that $U(D^H | s_H) > 0$. It then follows that, given D^H , $f/B < C/[k(\bar{s} - s_L)]$ is a sufficient condition for reorganizing the firm to satisfy not only the low type's but also the high-type manager's reservation value. In fact, reorganizing the firm under D^H leaves the high type above his reservation value.

In contrast, not reorganizing the firm after choosing D^H leads the high type into financial distress with probability one, which, according to the shareholders' strategy, implies managerial turnover. It is thus optimal for the high type to reorganize the assets after choosing D^H .

Consider now a deviation to $D \notin \{D^H, D^{NT}\}$. Because $p(s = s_L | D \notin \{D^H, D^{NT}\}) = 1$, any debt $D \neq D^H$ that is smaller than D^{NT} implies a takeover with probability one, making it a dominated choice for the high type whether or not he reorganizes the firm. Likewise, any $D > D^{NT}$ is dominated because D^{NT} can deter the raider with a weaker distress threat. As a result, it suffices to show that it is optimal for the high type to choose D^H instead of D^{NT} , a restriction that yields equation (7) in the text.

A.3. Step 3: The Raider's Strategy

By construction, any $D \geq D^{NT}$ blocks the takeover regardless of the raider's belief. For D different than D^H and lower than D^{NT} , the out-of-

equilibrium beliefs imply that $p(s_L) = 1$. With such beliefs, the value added by the raider is above the takeover cost for any $D < D^{NT}$. Hence, it is optimal for the raider to take over the firm.

Consider now the lower equilibrium debt D^H . Given equally likely priors and the equilibrium strategies, Bayes' rule implies that $p(s_L|D^H) = \gamma/(1 + \gamma) < \frac{1}{2}$. The lower debt D^H , therefore, sends a good signal about the incumbent's skills, ending the risk of shareholders' activism outside financial distress. Still, the equilibrium requires that the negative updating from the signal r_0 triggers a takeover. In other words, given D^H and r_0 , the value added by a raider must be greater than the takeover cost C . Formally,

$$\begin{aligned} & p(s_L|D^H, r_0)(1 - \beta^{NT})k(\bar{s} - s_L) + (1 - p(s_L|D^H, r_0)) \\ & \times (1 - \max\{\beta^{NT} - (s_H - s_L), 0\})k(\bar{s} - s_H) > C, \end{aligned} \quad (A1)$$

where $p(s_L|D^H, r_0) = \gamma p_0 / (\gamma p_0 + p_1)$ follows from Bayes' rule. The value added by the raider should be interpreted as follows. With probability $p(s_L|D^H, r_0)$, the incumbent is a low type, who would have led the firm into financial distress when $D^H = s_L + \beta^{NT} > s_L + \theta \Rightarrow \theta < \beta^{NT}$, which is an event with probability β^{NT} . Since financial distress triggers managerial turnover, the expected gains of the takeover are limited to the turnover gains in the nondistress states, that is, $(1 - \beta^{NT})k(\bar{s} - s_L)$. The second term in the takeover gains shows that the raider may mistakenly replace a high-type manager, implying an expected cost of $(1 - \max\{\beta^{NT} - (s_H - s_L), 0\})k(s_H - \bar{s}) > 0$, which takes into account that the cost of replacing a high-type manager should not be credited to the takeover in the states of nature that financial distress would have led the firm's shareholders to replace the high type.

A.4. Step 4: Shareholders' Strategy

Suppose that the target manager chooses $D \neq D^H$. Then either Bayes' rule (if $D = D^{NT}$) or the out-of-equilibrium beliefs imply $p(s = s_L|D) = 1$, which makes it optimal for shareholders to trigger managerial turnover as soon as they overcome their free-riding problems (inside and outside financial distress). If the manager chooses D^H , the takeover occurs if and only if the signal r_0 is realized, in which case the old shareholders can no longer interfere in the firm's business. Hence, it suffices to show that the shareholders' strategy is optimal in the event that r_1 is realized and the raider decides not to take over the firm.

Consider then that shareholders overcome their free-riding problems after observing D^H and learning that a takeover did not occur and thus r_1 must have been realized. In this case, the equilibrium strategy calls for no managerial turnover, which will be optimal if $p(s = s_L|D^H, r_1) = p_1\gamma / (p_1\gamma + p_0) \leq \frac{1}{2}$. This condition is satisfied if and only if $p_1\gamma \leq p_0$, which is true because $p_0 > p_1$ and $\gamma < 1$.

Now, suppose that D^H leads the incumbent to financial distress. Under the equilibrium strategies, financial distress reveals the incumbent as a

low-type manager—justifying managerial turnover—if $D^H \leq s_H$. If $D^H > s_H$, Bayes' rule implies

$$p(s = s_L | D^H, r_1, \text{Distress}) = \frac{\beta^{NT} \frac{p_1 \gamma}{p_1 \gamma + p_0}}{\beta^{NT} \frac{p_1 \gamma}{p_1 \gamma + p_0} + [\beta^{NT} - (s_H - s_L)] \frac{p_0}{p_1 \gamma + p_0}}.$$

Making it optimal for shareholders to trigger managerial turnover in financial distress then requires $p(s = s_L | D^H, r_1, \text{Distress}) \geq \frac{1}{2} \Leftrightarrow C \geq \{1 - [p_0 / (p_0 - p_1 \gamma)](s_H - s_L)\}(1 - p_0)k(\bar{s} - s_L)$.

A.5. Step 5: Existence of Equilibrium

Steps 1 to 5 derive six restrictions. I now prove that the set of parameter values that satisfies these six restrictions is nonempty.

Case 1: $D^{NT} \leq s_H$

The first three restrictions are associated with the low type's maximization program (step 1). The first of these three restrictions makes it optimal for the low type to reorganize the assets by imposing an upper bound on the ratio of the manager's reorganization cost to the private benefits of control, f/B . The second assures that $D^H \geq s_L$ by imposing an upper bound on the takeover costs, $C \leq (1 - p_0)k(\bar{s} - s_L)$, and the third imposes $A < p_0$ to obtain $D^{NT} > D^H$.

The fourth restriction is the incentive-compatibility condition of the high-type manager (equation (7)). One can easily check that it collapses to $A \geq p_1$ in the case that $D^{NT} \leq s_H$. Therefore, the upper bound on the takeover cost; f sufficiently small; and $p_1 \leq A < p_0$ take care of the first four restrictions.

The fifth restriction assures that D^H keeps the takeover threat alive. To take into account this restriction, I consider the best randomization strategy for D^H to keep the takeover threat alive, that is, the probability γ that the low type chooses D^H is very close to one. In this case, the positive updating from the choice of D^H is as weak as possible, maximizing the probability that the incumbent is a low-type manager. More specifically, $\lim_{\gamma \rightarrow 1} p(s = s_L | D^H, r_0) = \lim_{\gamma \rightarrow 1} \gamma p_0 / (\gamma p_0 + p_1) = p_0 / (p_0 + p_1) = p_0$. If, in addition, $D^H < D^{NT} \leq s_H$, the condition that D^H keeps the takeover threat alive (equation (A1)) collapses to

$$p_0(1 - \beta^{NT})k(\bar{s} - s_L) + (1 - p_0)k(\bar{s} - s_H) > C. \quad (\text{A2})$$

Plugging $1 - \beta^{NT} = C/[k(\bar{s} - s_L)(1 - p_0)]$ into equation (A2) and taking into account that $p_0 + p_1 = 1$ and $k(\bar{s} - s_L) = -k(\bar{s} - s_H)$ yields $C > [p_1^2 / (p_0 - p_1)]k(\bar{s} - s_L)$.

Finally, the sixth restriction makes it optimal for shareholders to trigger managerial turnover in financial distress even if D^H conveys good news about the incumbent. As it turns out, managerial turnover in financial distress is not a relevant restriction here because the equilibrium strategies and $D^H \leq s_H$ imply that only a low type can lead the firm into financial distress. It then follows that the existence of the semiseparating equilibrium depends on whether three restrictions on the takeover costs can be simultaneously satisfied:

$$D^H \text{ does not block the takeover: } C > k(\bar{s} - s_L) \frac{p_1^2}{p_0 - p_1}, \quad (\text{A3})$$

$$D^{NT} \text{ is safe for the high type: } C \geq [1 - (s_H - s_L)](1 - A)k(\bar{s} - s_L), \quad (\text{A4})$$

and

$$D^H \geq s_L: C \leq (1 - p_0)k(\bar{s} - s_L). \quad (\text{A5})$$

Define $\bar{C} = (1 - p_0)k(\bar{s} - s_L)$ and $\underline{C} = \max\{k(\bar{s} - s_L)[p_1^2/(p_0 - p_1)], [1 - (s_H - s_L)](1 - A)k(\bar{s} - s_L)\}$. Existence follows if $\bar{C} > \underline{C}$, which is satisfied if $p_0 > \frac{2}{3}$ and $s_H - s_L > (p_0 - A)/(1 - A)$.

Case 2: $D^{NT} > s_H \geq D^H$

Only two restrictions distinguish this case from the previous one. The obvious one is $D^{NT} > s_H \Leftrightarrow C < [1 - (s_H - s_L)](1 - A)k(\bar{s} - s_L)$. The second difference arises from the incentive-compatibility condition of the high-type manager, equation (7), that collapses to $C \leq [p_0 - (1 - A)(s_H - s_L)]k(\bar{s} - s_L)$ if $D^{NT} > s_H \geq D^H$.

Thus, the semiseparating equilibrium exists if the cost of reorganizing the assets, f , is sufficiently small; $A < p_0$; $\gamma \rightarrow 1$; and if the following five restrictions on the takeover costs are simultaneously satisfied:

$$D^H \text{ does not block the takeover: } C > k(\bar{s} - s_L) \frac{p_1^2}{p_0 - p_1}, \quad (\text{A6})$$

$$D^H \text{ optimal for the high type: } C \leq [p_0 - (1 - A)(s_H - s_L)]k(\bar{s} - s_L), \quad (\text{A7})$$

$$D^{NT} \text{ is risky for the high type: } C < [1 - (s_H - s_L)](1 - A)k(\bar{s} - s_L), \quad (\text{A8})$$

$$D^H \text{ is safe for the high type: } C \geq [1 - (s_H - s_L)](1 - p_0)k(\bar{s} - s_L), \quad (\text{A9})$$

and

$$D^H \geq s_L: C \leq (1 - p_0)k(\bar{s} - s_L). \quad (\text{A10})$$

Define $\bar{C} = \min\{[p_0 - (1 - A)(s_H - s_L)]k(\bar{s} - s_L), [1 - (s_H - s_L)] \times (1 - A)k(\bar{s} - s_L), (1 - p_0)k(\bar{s} - s_L)\}$ and $\underline{C} = \max\{[p_1^2/(p_0 - p_1)] \times k(\bar{s} - s_L), [1 - (s_H - s_L)](1 - p_0)k(\bar{s} - s_L)\}$. If $A < p_1$, $\bar{C} = \min\{[p_0 - (1 - A)(s_H - s_L)]k(\bar{s} - s_L), (1 - p_0)k(\bar{s} - s_L)\}$. Simple algebra then shows that $\bar{C} > \underline{C}$ if $p_0 > \frac{2}{3}$ and $s_H - s_L < \max\{[1/(1 - A)][p_0 - [p_1^2/(p_0 - p_1)]]], [(p_0 - p_1)/(p_0 - A)]\}$. For $A \geq p_1$, $\bar{C} = \min\{[1 - (s_H - s_L)] \times (1 - A)k(\bar{s} - s_L), (1 - p_0)k(\bar{s} - s_L)\}$, and $\bar{C} > \underline{C}$ if $s_H - s_L < 1 - [1/(1 - A)][p_1^2/(p_0 - p_1)]$ and $p_0 > \frac{2}{3}$.

Case 3: $D^{NT} > D^H > s_H$

This case differs from the previous ones in four ways. First, the lower debt is risky for both types of manager, that is, $D^H > s_H \Leftrightarrow C < [1 - (s_H - s_L)](1 - p_0)k(\bar{s} - s_L)$. The second difference is that, under D^H , step 4 shows that shareholders will trigger managerial turnover in financial distress only if $C \geq [1 - [p_0/(p_0 - p_1\gamma)](s_H - s_L)](1 - p_0)k(\bar{s} - s_L)$. The third difference is on the incentive-compatibility condition of the high-type manager. Given that both D^H and D^{NT} are risky for the high type, equation (7) collapses to $C \geq (s_H - s_L)[(p_1 - A)/(p_0 - p_1)]p_1k(\bar{s} - s_L)$. Finally, the last difference lies on the takeover incentive (equation (A1) in step 3). In the best case scenario that γ converges to one, equation (A1) collapses to $C(p_0 - 2p_1) > p_1^2(s_H - s_L)k(\bar{s} - s_L)$. This condition is satisfied only if $p_0 > \frac{2}{3}$.

Hence, the semiseparating equilibrium exists if the cost of reorganizing the assets, f , is sufficiently small; $A < p_0$; $p_0 > \frac{2}{3}$; $\gamma \rightarrow 1$; and if the following four restrictions on the takeover costs are simultaneously satisfied:

$$D^H \text{ does not block the takeover: } C > k(\bar{s} - s_L)(s_H - s_L) \frac{p_1^2}{p_0 - 2p_1}, \quad (\text{A11})$$

Distress triggers managerial turnover:

$$C \geq \left[1 - \frac{p_0}{p_0 - p_1}(s_H - s_L)\right](1 - p_0)k(\bar{s} - s_L), \quad (\text{A12})$$

$$D^H \text{ optimal for the high type: } C \geq (s_H - s_L) \left(\frac{p_1 - A}{p_0 - p_1}\right)p_1k(\bar{s} - s_L), \quad (\text{A13})$$

and

$$D^H > s_H: C < [1 - (s_H - s_L)](1 - p_0)k(\bar{s} - s_L). \quad (\text{A14})$$

Define $\bar{C} = [1 - (s_H - s_L)](1 - p_0)k(\bar{s} - s_L)$ and $\underline{C} = \max\{[p_1^2/(p_0 - 2p_1)](s_H - s_L)k(\bar{s} - s_L), [1 - [p_0/(p_0 - p_1)](s_H - s_L)](1 - p_0)k(\bar{s} - s_L),$

$(s_H - s_L)[(p_1 - A)/(p_0 - p_1)]p_1 k(\bar{s} - s_L)\}$. Thus, one can check that $\bar{C} > \underline{C}$ if $s_H - s_L < \min\{(p_0 - 2p_1)/(p_0 - p_1), (p_0 - p_1)/(p_0 - A)\}$.

A.6. Step 6: Semiseparating Equilibrium Satisfies the Intuitive Criterion

Consider that the high-type manager deviates to a debt level D^v . The intuitive criterion breaks down the semiseparating equilibrium if D^v reveals the incumbent as a high type and yet the low-type manager prefers his equilibrium strategy over D^v .

Assume first that $D^v < D^{NT}$. Thus, the low-type manager is strictly better off under D^v because the new debt will end both the takeover threat and the threat of shareholders' activism while implying a lower probability of financial distress than D^{NT} .

For $D^v > D^{NT} \geq s_H$, the high-type manager will be in financial distress with positive probability. The set of types that may have led the firm to distress is then $T = \{s_L, s_H\}$, and applying the intuitive criterion requires that shareholders do not trigger managerial turnover in financial distress. Contrary to his equilibrium strategy, D^v lets the low-type manager keep his job with probability one.

Finally, suppose that $D^{NT} < s_H$ and $D^v > D^{NT}$. The best chance to break down the equilibrium is to set $D^v = s_H$ while considering that, unlike in the case in which D^v is risky for the high-type manager, the set of types that may have led the firm to distress is $T = \{s_L\}$. In this case, financial distress triggers managerial turnover and the expected utility of the low-type manager is $U(D^v|s_L) = [1 - (s_H - s_L)]B - f$. To satisfy the intuitive criterion, we must have $U(D^v|s_L) = [1 - (s_H - s_L)]B - f \geq U(D^{NT}|s_L) = (1 - A) \times (1 - \alpha^{NT})B - f$, or equivalently, $C \leq [1 - (s_H - s_L)]k(\bar{s} - s_L)$. One can easily check in case 1 of step 5 that this inequality does not affect the upper bound of the takeover cost, $\bar{C}$, if $s_H - s_L \leq p_0$. Hence, a semiseparating equilibrium that satisfies the intuitive criterion exists. Q.E.D.

B. Proof of Proposition 2

Since the first paragraph of Section II.B has already shown that there is no separating equilibrium in which high debt conveys bad news about the target manager, we can restrict attention to mixed-strategy equilibria. Consider then a mixed strategy equilibrium in which the low-type manager randomizes between a high debt level, D^L , and a low debt level, D^H , with probabilities l and $1 - l$, respectively. The high type randomizes between the same debt levels with probabilities h and $1 - h$. If $l > h$, the higher debt D^L conveys bad news about the incumbent. I will prove that such mixed strategy equilibrium does not exist if (1) the threat of shareholders' activism is weaker than the takeover threat from the high type's perspective (i.e., $A < p_1$), and (2) D^{NT} (see equation (2)) is safe for a high type who reorganizes the firm (i.e., $D^{NT} \leq s_H$).

Let us first show that we can restrict attention to equilibria in which h and l lie in the open interval $(0,1)$. Clearly, we cannot have $l > h$ when $l = 0$ or $h = 1$. If $h = 0$, either we have a separating equilibrium, which does not

exist, or we have a semiseparating equilibrium in which, with positive probability, the low type reveals his suboptimal skills by choosing the debt D^L . In this semiseparating equilibrium, D^L is optimal for the low type only if it is equal to the minimal debt D^{NT} that deters the raider. But then we are back to the semiseparating equilibrium of Section II, which, conditioned on $A < p_1$, exists only if D^{NT} is risky for the high type. The last polar case is when $l = 1$, which implies that D^H reveals the incumbent as a high type, ending the takeover threat and the threat of shareholders' activism. In this case, the low type would be strictly better off with the lower debt D^H because the larger debt D^L sends a bad signal about his skills, leading to managerial turnover in case shareholders overcome their free-riding problems. Hence, without loss of generality, we can assume that h and l belong to the open interval $(0,1)$.

Conditioned on h and l belonging to the open interval $(0,1)$, there are four cases to analyze: (1) D^L and D^H end the takeover threat, (2) neither D^L nor D^H ends the takeover threat, (3) D^H ends the takeover threat but not D^L , and (4) D^L ends the takeover threat but not D^H . In all these cases, I can assume that a takeover is not certain to occur under either D^H or D^L .

In cases (1) to (3), D^H works at least as well as D^L in terms of ending the takeover threat. Moreover, contrary to D^L , the lower debt D^H sends a good signal about the incumbent manager, ending the threat of shareholders' activism outside financial distress. Since D^H implies a lower probability of financial distress than D^L , both types prefer D^H over D^L , breaking down the mixed-strategy equilibrium.

In the fourth case, the larger debt D^L is the only one that ends the takeover threat. Here, $D^L \leq D^{NT}$, or else a lower probability of financial distress under D^{NT} makes it a dominating debt choice over D^L . Hence, if D^{NT} is safe for the high type, so too are the lower debt levels D^L and D^H . Moreover, although D^H sends a good signal about the incumbent ($p(s = s_L | D^H) = (1 - l) / [(1 - l) + (1 - h)] < \frac{1}{2}$), the positive updating is more than offset by the negative signal r_0 , or else D^H would also deter the raider.

It then follows that, from the high-type manager's perspective, the choice between D^H and D^L boils down to a trade-off between a takeover threat (the cost of choosing D^H) and the threat of shareholders' activism outside financial distress (the cost of choosing the debt D^L that sends a bad signal). While the probability A captures the threat of shareholders' activism, the takeover threat to the high type is summarized by the conditional probability $p(r_0 | s_H) = p_1$. Therefore, $A < p_1$ implies that the high type is strictly better off with D^L and the mixed-strategy equilibrium breaks down. Q.E.D.

C. Proof of Proposition 3

Suppose that $D^H \leq s_H$. Thus, from equation (A1) in the proof of Proposition 1, the net takeover gains are

$$p(s_L | D^H, r_0)(1 - \beta^{NT})k(\bar{s} - s_L) + (1 - p(s_L | D^H, r_0))k(\bar{s} - s_H) - C, \quad (\text{A15})$$

where $p(s_L | D^H, r_0) = \gamma p_0 / [\gamma p_0 + (1 - p_0)]$.

One can easily check that the net takeover gains increase with the probability γ that the low type chooses D^H . Hence, the maximum probability γ —call it $\hat{\gamma}$ —that blocks the takeover solves

$$\frac{\hat{\gamma}p_0}{\hat{\gamma}p_0 + (1 - p_0)}(1 - \beta^{NT})k(\bar{s} - s_L) + \left(1 - \frac{\hat{\gamma}p_0}{\hat{\gamma}p_0 + (1 - p_0)}\right)k(\bar{s} - s_H) = C, \quad (\text{A16})$$

which yields $\hat{\gamma} = [(1 - p_0)/p_0]^2(1 + [k(\bar{s} - s_L)]/C)$. It then follows that $\partial\hat{\gamma}/\partial C < 0$.

Now, suppose that $D^H > s_H$. In this case, the net takeover gains are

$$p(s_L|D^H, r_0)(1 - \beta^{NT})k(\bar{s} - s_L) + (1 - p(s_L|D^H, r_0)) \times [1 - \beta^{NT} + (s_H - s_L)]k(\bar{s} - s_H) - C. \quad (\text{A17})$$

Plugging $p(s_L|D^H, r_0) = \gamma p_0 / [\gamma p_0 + (1 - p_0)]$, $1 - \beta^{NT} = C / [k(\bar{s} - s_L) \times (1 - p_0)]$, $k(\bar{s} - s_L) = -k(\bar{s} - s_H)$, and $p_1 = 1 - p_0$ into the net takeover gains yields

$$\frac{\gamma p_0 - (1 - p_0)}{\gamma p_0 + (1 - p_0)} \left(\frac{C}{1 - p_0} \right) - \frac{1 - p_0}{\gamma p_0 + (1 - p_0)} (s_H - s_L)k(\bar{s} - s_L) - C. \quad (\text{A18})$$

One can check that the net takeover gains, equation (A18), increase with γ . Moreover, equation (A18) shows that the net takeover gains are positive, which is a requirement of the semiseparating equilibrium, only if they increase with C . Hence, $\partial\hat{\gamma}/\partial C < 0$ in the semiseparating equilibrium. Q.E.D.

D. Proof of Proposition 4

To characterize the separating equilibrium, it remains to show that the low type prefers D^{NT} over D^H . Given $D^{NT} = s_L + \alpha^{NT}$, the low type's expected utility is $U(D^{NT}|s_L) = (1 - A)(1 - \alpha^{NT})B - f$, where $(1 - A)(1 - \alpha^{NT})$ is the probability that the low type survives the threat of shareholders' activism, $1 - A$, and the distress threat, $1 - \alpha^{NT}$. In turn, the expected utility under $D^H = s_L + \beta$ is $U(D^H|s_L) = (1 - \beta)B - f$, which takes into account that if D^{NT} ends the takeover threat, so does the larger D^H that sends a good signal about the incumbent. The low type prefers D^{NT} over D^H if and only if

$$U(D^{NT}|s_L) \geq U(D^H|s_L) \Leftrightarrow \beta \geq 1 - \frac{C}{k(\bar{s} - s_L)}. \quad (\text{A19})$$

Equation (A19) shows that the larger D^H is, the smaller the low type's incentives to mimic the high type. Thus, the best case scenario for D^{NT} to be optimal for the low type occurs when $D^H = s_H \Rightarrow \beta = s_H - s_L$. Plugging this value of β into equation (A19) yields $C > [1 - (s_H - s_L)]k(\bar{s} - s_L)$, which assures that the debt D^{NT} is safe for the high type for any probability A of shareholders' activism. Q.E.D.

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