"Managerial Turnover and Leverage under a Takeover Threat"

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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. This paper demonstrates that negative (positive) updating prevails when takeover costs are small (large). Managers who lever up to end a takeover threat thus may commit to an increase in the firm's value and yet increase their chances of being replaced by their shareholders. The model predicts that intraindustry leverage is less dispersed when takeover costs are low.
Since Modigliani and Miller (1958), most of the literature on capital structure has assumed that debt is chosen to maximize shareholders' value. Recent papers, however, have explored the implications of giving control over the capital-structure decision to self-interested managers. Zwiebel (1996), for instance, argues that, in the absence of a takeover threat, managers underlever to avoid being ousted in default. In contrast, managers of target firms lever up to commit to an increase in value that makes a disciplinary takeover unnecessary. In support of the managerial approach to the capital-structure problem, Garvey and Hanka (1999) document that firms respond to an increase (decrease) in takeover costs by decreasing (increasing) leverage, while Safieddine and Titman (1999) report an increase in operating performance for firms that lever up the most in response to an unsuccessful takeover attempt.

Yet, committing to increase the firm's value may not save a target manager's job. Despite finding an increase in performance, Safieddine and Titman document that 32% of the 573 firms in their sample replaced their managers within a year of the failed takeover attempt. Since previous studies focusing on broader samples report a much lower turnover rate, managers under a takeover threat apparently need to convince their shareholders that not only will they enhance value but also that they are the best persons for the job. The increase in leverage that commits the managers to increase value also signals their skills.

The existence of opposing effects makes the updating about the manager's skills non trivial. As in the signaling models of Ross (1977) and Leland and Pyle (1977), high leverage conveys good news if it reflects the management's ability to generate cash flows. It conveys bad news, however, if inefficient managers, who are likely to fear takeovers the most, are more pressured to lever up.

This paper demonstrates that if takeover costs are large, high leverage conveys good news about a target manager, as in the classic signaling papers on capital structure choice. With small takeover costs, negative updating prevails. Thus, managers who lever up to end a takeover threat may commit to increase the firm's value and yet increase their chances of being fired by their shareholders.

In the model, a firm is run by a self-interested manager who, in the absence of a takeover threat, would not undertake a reorganization of assets that increases the firm's value but

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1Denis and Denis (1995), for instance, report a 17% managerial turnover rate for a sample of 1,689 firms in the Value Line Survey.
decreases her own utility. Examples of asset reorganizations are divestitures of assets (as in Stulz, 1990) or the end of an inefficient investment program (as in Grossman and Hart, 1982, Jensen, 1986, and Hart and Moore, 1995).

Under a takeover threat, if the manager does not reorganize assets, the raider will take over the firm to maximize its value. Nonetheless, committing to reorganize the firm is not that simple, 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 more recently Zwiebel (1996), the manager will have to use the firm’s capital structure as a commitment device. More precisely, I follow Zwiebel (1996) and assume that, in financial distress, managers lose bargaining power vis-à-vis the shareholders, who – possibly with the help of a bankruptcy court – can then costlessly coordinate their actions to replace the incumbent management whenever they see fit. (A lower cost of removing managers in financial distress is consistent with Gilson (1989), who finds that 52% of his sample of financially distressed firms experience turnover in any given year.) Risky debt, therefore, 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 in 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 she is the best person for the job. Accordingly, consider that the incumbent manager is one of two types: high or low. If the manager does not redeploy assets, high- and low-type managers are equally efficient. But for a reorganized firm, low-type managers are less efficient.\(^2\)

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 the assets. Gathering information is costly, though. As such, in equilibrium, the raider is likely to obtain only 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

\(^2\)For instance, both types of manager may be equally efficient in running a company that has not been operating at full capacity. If some of the firm’s assets are sold, the manager’s ability to optimize the production line may then become crucial to the firm’s profitability.
threat to the high-type manager, who, therefore, has two reasons to lever up: committing to the reorganization plan and signaling to the raider her superior skills.

High leverage will end the takeover threat while sending a positive signal about the manager's quality if the raider believes the incumbent would not have levered up that much had she not felt confident about her ability to reorganize the firm. If high leverage ends the takeover threat, though, a low-type manager may be willing to lever up to a point at which repayment becomes far from certain. As a result, high leverage does not necessarily convey a positive signal about the skills of a target manager. The increase in leverage may reflect a greater willingness by low-type managers to substitute financial distress for a takeover threat.

This paper demonstrates that high leverage implies a negative (positive) signal about the manager's skills if takeover costs are small (large). The intuition is as follows. Suppose that some debt $D^H$ commits the firm to the reorganization plan while revealing the incumbent manager as a high type. The low-type manager will feel compelled to choose this debt as well. After all, neither the shareholders nor the raider will want to replace the incumbent if they are convinced that she is a high type. Yet, $D^H$ will not insulate the low type from the risk of managerial turnover in financial distress if the debt is safe for the high-type manager. In this case, financial distress lets shareholders know that the incumbent is a low-type manager who has mimicked the high type, making it optimal to trigger managerial turnover. Hence it is costly for a low type to mimic a high-type manager who tries to signal her skills with a debt level $D^H$ that is risky for the low-type manager only. The question, then, is whether the low-type manager has a better way to avoid the takeover.

As it turns out, the low-type manager can deter the raider without mimicking the high type. Since takeovers and financial distress are alternative mechanisms to remove bad managers, a distress threat reduces the value added by a takeover. A low-type can thus make the takeover unprofitable to the raider by choosing a debt level that commits the firm to the reorganization plan while implying a probability of financial distress that preempts enough of the only remaining gain of a takeover, namely, managerial turnover. Moreover, if takeover costs are large, a relatively low probability of financial distress should block the takeover. Hence the low-type manager should be able to deter the raider with a debt level – call it $D^{NT}$ – that is risky for her but smaller than the high-type manager's debt $D^H$. The low type has
then no reason to mimic the high type; the smaller debt $D^{NT}$ allows her to deter the raider with a lower probability of being ousted in financial distress. As such, the higher debt $D^H$ reveals the incumbent as a high type, making the raider’s noisy signal about the manager’s quality irrelevant to the takeover decision. A separating equilibrium in which high leverage conveys good news about the manager thus exists when takeover costs are large.

In contrast, small takeover costs imply that $D^{NT}$ will be risky for both types of manager. As a result, the high-type manager may lead the firm into financial distress under any $D^H$ larger than $D^{NT}$, making it impossible for the shareholders to selectively punish a low type who mimics the high-type manager. Thus, if takeover costs are small, high leverage cannot signal the superior skills of a high-type manager.

If high leverage cannot convey good news about the incumbent manager, a separating equilibrium in which the larger debt signals an inferior manager arises as a natural solution to the capital structure problem. As it turns out, such a separating equilibrium does not exist. To obtain an equilibrium in which high leverage conveys bad news, I look at a semiseparating equilibrium. In particular, I focus on a semiseparating equilibrium in which only the low-type manager fears takeovers enough to accept the high risk of financial distress that is required to end the takeover threat. More precisely, the low-type manager is indifferent between a high debt level that deters the raider and the high type’s lower debt that keeps alive the possibility that the raider will take over the firm in response to his noisy signal. When choosing the larger debt, the low-type manager reveals her type. Thus, she commits to enhance firm value and yet increases her chances of being replaced by her shareholders.

The comparative statics on the debt choices of the semiseparating equilibrium resemble some of the predictions of the managerial literature on capital structure choice. For example, both the high and low debt levels decrease with the takeover costs. Somewhat surprisingly, though, the incentives for a low-type manager to pool with the high type at the lower debt level increase when the takeover costs decrease. Accordingly, the model predicts a relatively low dispersion of intraindustry leverage in periods of low takeover costs.

Perhaps more interestingly, the model provides testable implications for the interaction between the takeover costs and the signal debt conveys about the manager’s skills. In periods of large takeover costs, high leverage commits the firm to enhance value in addition to conveying
a positive signal about the incumbent manager’s skills. In contrast, small takeover costs imply that the commitment to enhance value is at least partially offset by the negative signal about the incumbent’s skills that high leverage conveys. Hence the model predicts that stock price reactions to debt-for-equity exchanges should be stronger when the market for corporate control is less threatening to managers.

The remainder of the paper is organized as follows. Section 1 presents the framework. Section 2 shows that high leverage conveys good news about the manager’s ability only if takeover costs are not too small. Section 3 characterizes a semiseparating equilibrium in which high leverage commits the incumbent manager to reorganize the firm’s assets but sends a negative signal about her skills. Section 4 discusses the empirical implications and relates them to the existing evidence on capital structure choice. Conclusions follow. Proofs of the propositions that are not present in the text can be found in the appendix.

1 General Framework

1.1 Preferences and cash flows

Consider an all-equity firm run by a self-interested manager. The conflicts of interest between the manager and the 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 she isn’t, shareholders cannot rely on her to step down voluntarily.3

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 she stays in control until the final cash flows are realized and zero otherwise.4 Moreover, although reorganizing the firm is costly for the

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3The tension between a CEO who wants to keep her 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) and (1989), Israel (1992), and Stulz (1988).

4In his seminal paper, Ross (1977) allows for an exogenous compensation scheme for the manager. Nonetheless, he does not jointly solve for the signaling equilibrium and the optimal incentive contract. More generally,
manager, this cost is secondary to her cost of losing control. Accordingly, I omit the manager’s reorganization cost in the analysis, assuming instead that the manager will be willing to commit to the reorganization plan if its implementation reduces the probability of losing control by even a very small amount.

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, \( \theta \), 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 \( \theta \). In turn, the value of reorganizing the firm depends on the manager’s skills. It is assumed that, regardless of \( \theta \), 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 \( s_H > 0 \) under a high-type manager and by \( s_L < s_H \) under a low-type manager. I do not allow, however, the difference in efficiency to be too large. Formally,

**Assumption 1** If the firm is reorganized, the minimum first-period cash flow under a high-type manager cannot be as large as the maximum first-period cash flow under a low-type manager. Hence, \( s_H - s_L < 1 \).

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. Nonetheless,

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Incentive contracts may be used to avoid costly signaling devices. The signaling literature ignores this possibility, though. Also, Persons (1994) demonstrates that renegotiation weakens the effectiveness of managerial contracts and Garvey (1997) shows that managers’ ability to trade on secondary capital markets undermines managerial incentive schemes.

Assumption 1 rules out separating equilibria in which the high-type manager chooses a debt level that, although safe for her, leads the low-type manager to financial distress with probability 1.
the incumbent manager cannot change the firm’s organization once she 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

\[ V = E[\theta + s_1] + kE[s_2], \]

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 \( \theta \) and the original manager’s type and reorganization decision.\(^6\) 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 \( k s_H \) to \( k \bar{s} \). In turn, the replacement of a low-type incumbent increases value from \( k s_L \) to \( k \bar{s} \).

1.2 The takeover threat

The incumbent manager faces a raider who may profit from a disciplinary takeover that maximizes the value of the firm. As in Zwiebel (1996), the manager is partially entrenched, that is, the takeover succeeds only if it increases the firm’s value by more than a cutoff \( C > 0 \), which is interpreted as a takeover cost.\(^7\)

Although partially entrenched, the incumbent manager is not fully insulated from the takeover market. In particular, a takeover will happen with probability 1 if the manager cannot convince the raider that the company will be reorganized. Convincing the raider is not that easy, though. Since it is assumed that outsiders do not observe the firm’s reorganization, the raider may think that once the takeover threat ends, the incumbent will abort the reorganization plan. Still, it will be shown later that the incumbent manager can commit to the

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\(^6\) This assumption can be justified by the existence of a time lag for a new manager to adapt the firm’s operations to her management style.

\(^7\) Entrenchment may happen for several reasons. For one, free-riding problems may make it more difficult for a raider to profit from a takeover that aims to replace a suboptimal manager. (See Grossman and Hart, 1980.) Free-riding problems can be partly solved if shareholders perceive themselves as pivotal to the outcome of the takeover (Holmstrom and Nalebuff, 1992) or if they allow the raider to dilute the firm’s value. In either of these two cases, the takeover succeeds if the efficiency gains are sufficiently large.
reorganization plan by leveraging up.

The raider's incentives to take over the firm do not necessarily end with the manager's commitment to reorganize the assets. By replacing a low-type manager who is committed to the reorganization plan, the raider increases the firm's continuation value from $kS_L$ to $k\hat{s}$, where $\hat{s} \equiv \frac{1}{2}s_L + \frac{1}{2}s_H$ is the average type of the new manager. Note, however, that the raider may mistakenly replace a high-type manager who has reorganized the firm. If so, the firm's value will decrease from $kS_H$ to $k\hat{s}$. Therefore, the raider's takeover decision depends on his beliefs about the quality of the incumbent. 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. Gathering information is costly, however. Thus, in equilibrium, raiders are likely to obtain only noisy signals of managers' qualities. Accordingly, I assume that $r_1$ ($r_0$) will positively (negatively) update the raider's beliefs about the manager's type. More precisely, for equally likely priors about the two types, $r_1$ updates the probability of the incumbent's being a low type to $\text{prob}(s = s_L | r_1) \equiv p_1 \in (0, \frac{1}{2})$. In turn, $r = r_0$ negatively updates equally likely priors about the incumbent's type to $\text{prob}(s = s_L | r_0) \equiv p_0 \in (\frac{1}{2}, 1)$, which, in spite of the manager's commitment to reorganize, I assume to be enough to trigger a takeover if the raider is the only remaining threat to the incumbent. For the takeover threat to end, leverage must commit the manager to reorganize the company and it must also overcome the realization of the negative signal $r_0$. Formally,

**Assumption 2** Suppose that the incumbent manager is committed to reorganize the firm. Still, a takeover will occur if the raider believes that the probability that the incumbent manager is a low type is at least $p_0 > \frac{1}{2}$ and the raider is the only remaining threat to the incumbent manager's job.

Assumption 2 elicits incentives for the high-type manager to signal her superior type. The capital structure choice under a takeover threat thus depends not only on the commitment role of debt but also on its signaling dimension.\(^8\)

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\(^8\)In other terms, the debt choice links a moral hazard problem, the firm's reorganization, with a signaling
1.3 Timing and information structure

Figure 1: Sequence of events

Figure 1 summarizes the sequence of events. At time $t=0$, the incumbent manager chooses the debt level $D$ and whether to reorganize the firm. In making these choices, the manager aims to maximize her chances of staying in control, which are threatened by the possibility of a takeover at time $t=1$. Moreover, the manager takes into account that she is the only one to know her type and, while in control, the only one to observe whether the reorganization has taken place. The raider and the shareholders have equally likely priors 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 raider receives the private signal $\tau \in \{\tau_0, \tau_1\}$ of the quality of the incumbent manager and takes over the firm if the takeover gains outweigh the takeover cost $C$. For simplicity, I assume that, from the perspective of the raider, the two signals, $\tau_0$ and $\tau_1$, are equally likely when the manager chooses the capital structure (time $t=0$). Therefore, consistency with the priors ($\text{prob}(s = s_H) = \text{prob}(s = s_L) = \frac{1}{2}$) requires that $p_0 + p_1 = 1$, where $p_0 = \text{prob}(s = s_L|\tau_0)$ and $p_1 = \text{prob}(s = s_L|\tau_1)$.\(^9\)

If a takeover does not happen at $t = 1$, the incumbent manager stays in place at least

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.

\(^9\)One might argue that the manager should postpone the increase in leverage to time $t=1$, when the raider actually receives the signal of the manager’s quality. As Berger, Ofek, and Yermack (1997) and Garvey and Hanka (1999) show, however, firms do not necessarily wait until a takeover bid is on the table to adopt defensive measures. In particular, managers are likely to increase leverage once the takeover threat increases. One possible reason for an early increase in leverage is that it might be harder to fight a raider once a substantial fraction of the takeover costs has been sunk. A preemptive increase in leverage thus enhances the chances of avoiding a takeover. To focus on the signaling and commitment dimensions of leverage, I have ignored in the analysis the benefits and costs of preempting a takeover bid. Instead, I assume that the manager leverages up at $t=0$, when the strength of the takeover threat is still uncertain.
until $t = 2$, when the first cash flow, $\theta + s_1$, is realized. Also at $t = 2$, any debt is due. If the firm is unable to pay the debt, an event I call financial distress, shareholders will update their beliefs about the quality of the incumbent. As the next subsection shows, a threat of managerial turnover then follows. Finally, at time $t = 3$ the second cash flow occurs and the firm is liquidated.

1.4 The financial distress threat

If the firm is unable to pay its debt, the manager either sells some of the firm’s assets to pay the creditors or renegotiates the debt. In any case, her bargaining position with the shareholders is weakened. As in Zwiebel (1996), I model this loss of bargaining power by assuming that, in financial distress, shareholders can replace the incumbent whenever they see fit (i.e. $C = 0$). Note, however, that financial distress does not necessarily imply that shareholders are better off replacing the incumbent management. Since financial distress shifts control to the shareholders, they can force both the incumbent and the new manager to reorganize. The dismissal of the incumbent, therefore, boils down to whether, in expectation, a superior manager will be hired.

In the tradition of the costly verification models (e.g. Gale and Hellwig, 1985), shareholders cannot costlessly verify the first-period cash flow without firing the incumbent. Thus if a manager who is committed to the reorganization plan announces that the firm is unable to repay a debt level $D$ (i.e. the firm is financially distressed), shareholders update their beliefs about the quality of the incumbent to $\text{prob}(s = s_L|s + \theta < D)$ and replace her if the expected gains from managerial turnover are positive under the updated beliefs, that is, $k\tilde{s} > kE[\tilde{s}|s + \theta < D]$.

Financial distress is not a costless disentrenchment device, though. An extensive literature in corporate finance has identified efficiency costs in financial distress. Assume then that

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10 All the results are qualitatively unchanged if I assume that financial distress reduces the shareholders’ cost of removing the incumbent manager, without necessarily assuring that shareholders can trigger managerial turnover.

11 See Fluck (1998) for a paper that focuses on the shareholders’ decision to replace the incumbent management. In Harris and Raviv (1990), shareholders also use financial distress as a signal of whether to replace the incumbent manager. In their paper, however, debt maximizes the firm’s value.

12 See Myers (1977) and Titman (1984) for two papers that identify inefficiencies in financial distress and Opler and Titman (1994) for some empirical support of the relevance of the financial distress costs.
financial distress costs a fraction $\lambda \in (0, 1)$ of the firm’s cash-flow. In this case, the firm’s inability to pay the debt $D$ in full imposes a loss of $\lambda(s_1 + \theta)$ where $s_1$ depends on whether the firm has been reorganized and on the original manager’s quality (i.e. $s_1 \in \{0, s_L, s_H\}$). In principle, the financial distress costs could also affect the firm’s continuation value. I assume, however, that, after the firm becomes financially distressed, shareholders/management succeed to restructure the firm, avoiding permanent losses to the firm’s ability to generate cash flows.\(^\text{13}\)

In this setting, shareholders benefit from firing a suboptimal manager regardless of the costs of financial distress. Hence, financial distress costs are not important to the turnover decision. More surprisingly, financial distress costs do not affect the takeover gains, which ultimately determine the manager’s capital structure decision. Since a new manager will not affect the first-period cash-flow, a takeover cannot save financial distress costs, which are then irrelevant to the raider’s takeover decision. Accordingly, we can ignore the financial distress costs in the analysis.\(^\text{14}\)

2 Leverage Conveys Good News about Managers’ Quality

In the classic signaling equilibrium of Ross (1977), the risk of financial distress prevents less profitable firms from mimicking the more profitable ones at a higher leverage. This section demonstrates that financial distress plays a similar role if takeover costs are large. High leverage, therefore, may commit the firm to a value-enhancing reorganization plan while conveying good news about the incumbent manager’s quality.

2.1 The entrenchment role of debt

If high leverage conveys good news about the incumbent manager, low leverage conveys bad news. In this paper, ending a takeover threat is the sole reason for a manager to increase leverage. Accordingly, one might wonder why a manager would choose a low leverage level.

\(^{13}\)Yet, the model allows the financial distress cost to be larger than the takeover cost $C$.

\(^{14}\)Financial distress costs will be relevant to the analysis if the raider can increase cash flows in time to avoid financial distress. In this case, saving the financial distress costs increases the takeover gains, making it more difficult for a manager to use debt to deter the raider. This additional takeover gain can be modeled as a reduction of takeover costs, which, as section 3 shows, also makes it more difficult for debt to block a takeover. Hence, takeover costs that decrease with the manager’s debt choice can substitute for the constraints that the financial distress costs may impose on the use of debt as an entrenchment device. As such, the qualitative results of the paper do not rely on whether a raider can avoid financial distress costs.
that conveys a signal about her skills that in principle should enhance the incentives for a takeover. I now show that debt can deter the raider despite revealing the incumbent as a low-type manager.

Suppose that a low-type manager reveals her type through the choice of some debt level $D^L > 0$. Two implications follow. First, shareholders will replace the incumbent as soon as financial distress shifts control to them. Minimizing the risk of managerial turnover in financial distress then leads to the second implication: $D^L$ commits the low-type manager to reorganize the firm. The value added by a takeover is thus determined by the gains of replacing a low-type manager, which do not depend on the raider’s noisy signal $r$. (If debt reveals the incumbent’s type, the raider’s signal about the manager’s quality is irrelevant to the takeover decision.\textsuperscript{15})

The increase in value that follows the raider’s decision to replace the incumbent manager should not be entirely credited to the takeover. Since $D^L$ implies that the shareholders will replace the incumbent in financial distress, the raider’s value added is equal to the managerial turnover gains in the nondistress states only.

More formally, let $D^L = s_L + \alpha$ be the low-type manager’s debt choice. Since $D^L$ commits the incumbent to reorganize the firm, financial distress will happen if and only if $D^L > s_L + \theta \Rightarrow \theta < \alpha$. For $\theta$ uniform in the interval $[0,1]$, financial distress will happen with probability $\alpha$. Therefore, the value added by a takeover is $(1 - \alpha)k(\bar{s} - s_L)$, where $1 - \alpha$ is the probability that $D^L$ does not lead the low-type manager into financial distress and $k(\bar{s} - s_L)$ is the expected gain of hiring a new manager with average type $\bar{s} = \frac{s_L + s_H}{2}$ to replace the low-type incumbent.

Clearly, a sufficiently large probability of financial distress, $\alpha$, will reduce the value added by a takeover enough to make it unprofitable. In particular, for a given takeover cost $C$, the minimum debt level, $D^{NT} = s_L + \alpha^{NT}$, that ends the takeover threat despite revealing the incumbent as a low-type manager solves

$$(1 - \alpha^{NT})k(\bar{s} - s_L) = C.\tag{1}$$

Intuitively, although the debt level $D^{NT}$ reveals to the raider that there are gains in replacing the incumbent manager, it does not pay to take over the company because the firm’s

\textsuperscript{15}The raider’s signal will be important in the analysis of mixed strategy and semiseparating equilibria, though. See Proposition 2 in section 2.2.
leverage is likely to shift control to the shareholders, who will then fire the incumbent. High leverage, thus, may end a takeover threat despite sending a bad signal about the manager's quality.\textsuperscript{16}

It then follows that the low-type manager does not need to mimic the high type to survive the takeover threat. She can choose instead the minimum debt level $D^{NT}$ that ends the takeover threat regardless of the raider's beliefs. Still, while the debt $D^{NT}$ implies managerial turnover in financial distress, the low-type manager may think that, by mimicking the high-type manager's debt strategy, she can insulate herself from both the takeover and the distress threat. After all, shareholders have no reason to trigger managerial turnover in financial distress if they are convinced that the incumbent is a high-type manager. Yet I argue below that mimicking the high-type manager will not insulate a low type from the risk of managerial turnover in financial distress if takeover costs are large.

2.2 Takeover costs and the signaling role of financial distress

In the signaling literature on capital structure choice, high leverage reveals the firm's superior value because the manager of an inferior firm would not be willing to chance financial distress to temporarily mislead the market. In the context of this paper, retaining control is the manager's first and only priority. Accordingly, financial distress imposes a cost on a low-type manager who mimics the high-type manager's strategy only if it triggers managerial turnover. As I now show, this condition implies that high leverage conveys good news about the manager's quality only if takeover costs are large.

From equation (1), the smallest debt that can deter a raider who knows that the incumbent manager is a low type is $D^{NT} = s_L + \alpha^{NT} = s_L + [1 - \frac{C}{k(s^L - s_L)}]$, which decreases with takeover costs. For a sufficiently large takeover cost, $D^{NT}$ is risky for the low-type manager but safe for a high type who is committed to the reorganization plan.\textsuperscript{17} Thus, the high type manager can choose a debt level, call it $D^H$, that is still safe for her but larger than $D^{NT}$.

Given the manager's choice of $D^H$, shareholders can be certain that the firm will repay

\textsuperscript{16}Israel (1991) argues that the presence of risky debt in the target's capital structure shifts some of the takeover gains to the debt holders. For a high enough debt level, this transfer of gains will make the takeover unprofitable to the raider. The results of the paper thus do not rely on the mechanism that I use (i.e., the replacement of the incumbent manager in financial distress) to obtain an entrenchment role for debt.

\textsuperscript{17}Formally, $D^{NT} = s_L + [1 - \frac{C}{k(s^L - s_L)}] < s_H$ if $C > (1 - (s_H - s_L))k(s^L - s_L)$. 

13
the debt if the incumbent manager is a high type. A distress event, therefore, would let the shareholders know the incumbent is a low-type manager who has mimicked the high type. Acting on their updated beliefs, the shareholders will fire the incumbent manager in financial distress. Anticipating managerial turnover in financial distress, the low-type manager will be strictly better off with the debt $D^{NT}$ that deters the raider with a lower probability of financial distress. But then $D^H$ will credibly signal that the incumbent is a superior manager and a separating equilibrium in which high leverage conveys good news obtains. Formally, 19

Proposition 1 If takeover costs are sufficiently large to make the debt $D^{NT}$ safe for a high-type manager who is committed to reorganizing the firm, the following strategies and beliefs form a separating equilibrium in which high leverage commits the firm to the reorganization plan while conveying a positive signal about the incumbent manager's skills.

1. Managers' strategies: The high-type manager chooses $D^H \leq s_H$ whereas the low-type chooses $D^{NT} < D^H$, where, as characterized in equation (1), $D^{NT}$ is the smallest debt that deters a raider who knows that the incumbent is a low-type manager. Moreover, both types of manager reorganize the company at $t = 0$.

2. Shareholders' strategy: Fire the incumbent in financial distress if the firm is not taken over.

3. Beliefs: $\text{prob}(s = s_L|D^H) = 0$, $\text{prob}(s = s_L|D \neq D^H) = 1$, $\text{prob}(s = s_L|\text{Distress}) = 1$.

Assume now that takeover costs are small. Thus the minimum debt $D^{NT}$ that ends the takeover threat is likely to be risky for both types of manager. 20 Still, suppose that the high-type manager could signal her type with some debt level $D^H > D^{NT}$. In that case, the higher debt would be risky for the high-type manager and financial distress would not

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18 Technically, financial distress is out of the equilibrium path. Hence, beliefs that give a probability 1 for the incumbent’s being a low-type manager are consistent with a Perfect Bayesian Equilibrium. Note also that, as in most games of incomplete information, the out-of-equilibrium beliefs must be assigned because, in principle, shareholders could think that the incumbent is a high-type manager who, contrary to the equilibrium strategies, did not reorganize the firm.

19 In the separating equilibrium, the high-type manager is indifferent between the debt levels $D^H$ and $D^{NT}$. The indifference breaks down, though, if the high type’s salary increases with the firm’s market value. (For instance, if the manager’s compensation scheme includes stock options.) In this case, the high type is strictly better off with the higher debt that positively updates the market’s perception about the firm’s value.

20 One can easily check from equation (1) that $D^{NT}$ will be risky for the high type if $C < (1 - (s_H - s_L)k)k(s - s_L)$. 

14
detect a low-type manager who mimicked the high type. Given the updating when the debt is chosen, neither the raider nor the shareholders would have a reason to replace the incumbent. As a result, the low-type manager can insulate herself from the threats of both takeover and financial distress by deviating to the higher debt, breaking down the separating equilibrium.

A separating equilibrium in which high leverage conveys good news about the incumbent manager thus does not exist if takeover costs are small enough to make the debt \( D^{NT} \) that deters the raider risky for the high-type manager. In fact, Proposition 2, below, shows that semiseparating and mixed-strategy equilibria in which high leverage conveys good news about the incumbent manager can be ruled out as well.

**Proposition 2** If takeover costs are small enough to make the debt \( D^{NT} \) risky for a high-type manager who is committed to reorganize the firm, then neither a separating nor a semiseparating equilibrium where high leverage conveys good news exists. If, in addition, the negative updating about the manager’s skills with the signal \( r_0 \) is strong enough, a mixed-strategy equilibrium in which high leverage conveys good news about the incumbent manager can also be ruled out.

From Proposition 2, managers should not expect a positive updating about their skills if takeover costs are small and leverage is increased sharply to end a takeover threat. As the next section shows, a negative updating may actually result, increasing the chances of managerial turnover in spite of the commitment to enhance value.

## 3 Leverage Conveys Bad News about Managers’ Quality

If high leverage cannot convey good news about the manager’s quality, then a separating equilibrium in which the low-type manager chooses the larger debt arises as a natural candidate for solving the capital structure problem. Yet if such an equilibrium existed, the low-type manager would be better off mimicking the high type, whose smaller debt would end the takeover threat with a lower probability of managerial turnover in financial distress. Hence separating equilibria in which high leverage conveys bad news about the incumbent manager do not exist. Nonetheless, this section shows that high leverage may convey bad news in a semiseparating equilibrium.
3.1 The semiseparating equilibrium

In this paper, both types of manager must increase leverage to avoid a takeover. How much leverage should be increased, however, may depend on the manager's type. A modest increase that commits the firm to the reorganization plan should be enough to deter a raider who, after due diligence, learns that the incumbent manager is likely to be a high type. Accordingly, the high-type manager may respond to the takeover threat with a small increase in leverage. In contrast, the low-type manager knows that due diligence will inform the raider about her suboptimal skills, enhancing the incentives for a takeover. Rather than mimicking the high-type manager, the low type may then prefer to choose a higher debt level that leaves no room for a takeover. If so, high leverage will convey bad news about the incumbent because it reflects stronger pressure on the low-type manager to increase leverage.

A semiseparating equilibrium can capture the link between the signaling role of debt and the pressure to lever up. In this equilibrium, the low-type manager is indifferent between a debt level that ends the takeover threat and the high type's lower debt choice. Hence she is willing to randomize between these two debt levels. Since the lower debt may be chosen by both types of manager, the takeover threat remains alive. In particular, the raider will take over if he receives the signal $r_0$ that negatively updates his beliefs about the incumbent manager. Still, only the low-type manager fears takeovers enough to accept the distress threat required to deter the raider. The goal of this section is to characterize this equilibrium, unveiling the restrictions it imposes on the debt strategies.

Consider first the larger debt $D^L$. Since the high-type manager chooses the lower debt $D^H$ with probability 1, $D^L$ reveals the incumbent as a low-type manager. Hence either $D^L$ ends the takeover threat or the raider takes over the firm with probability 1. Accordingly, a low-type manager will choose $D^L$ only if it deters the raider. In particular, it must end the takeover threat with the smallest possible probability of financial distress. As shown in section 2, this last condition implies that the larger debt is equal to $D^{NT} = s_L + \alpha^{NT} = s_L + \left[1 - \frac{C}{k(s-s_L)}\right]$, which takes into account that the financial-distress threat provides the incentives for the low-type manager to reorganize the firm.

By choosing the larger debt, the low-type manager enters financial distress if and only if $D^{NT} = s_L + \alpha^{NT} > s_L + \theta \Rightarrow \theta < \alpha^{NT}$, which implies that the probability that the manager
will be ousted in financial distress is \( \alpha^{NT} \). In turn, \( D^{NT} \) ends the takeover threat. The expected utility of the low-type manager under \( D^{NT} \) is then

\[
U(D^{NT}|s_L) = (1 - \alpha^{NT}) B,
\]

where \( B \) is the benefit of remaining in control.

Consider now the lower debt \( D^H \). By choosing \( D^H \) over \( D^{NT} \), the low-type manager reduces the probability of financial distress. In fact, the positive signal that \( D^H \) conveys (remember that \( D^H \) is more likely to be chosen by the high-type manager) may actually convince shareholders to keep the incumbent despite financial distress. Nonetheless, if the manager bears no cost in financial distress, \( D^H \) cannot commit the firm to the value-enhancing reorganization. Since the motivation for an increase in leverage in this paper is the commitment to reorganize, the focus is on equilibria in which financial distress triggers managerial turnover. In other words, I look for parameter values that support an equilibrium in which financial distress under \( D^H \) triggers managerial turnover.

If managerial turnover in financial distress were the only concern of the low-type manager, she would be strictly better off with the lower debt \( D^H \). In the proposed equilibrium, however, \( D^H \) allows for the takeover to happen given the signal \( r_0 \). Hence, choosing \( D^H \) entails benefits and costs. On the one hand, it reduces the risk of managerial turnover in financial distress. On the other hand, it increases the risk of a disciplinary takeover.

The strength of the takeover threat is an important determinant of this tradeoff. In particular, the incentives for the low-type manager to mimic the high type should be large if she thinks \( D^H \) will impose a weak takeover threat. Nonetheless, that is not likely to be the case. If the signal \( r \) is informative about the manager’s quality, the low-type manager knows that the raider is likely to learn that she is not the best person to run the firm. Indeed, Bayes’ rule implies that, from the point of view of a low-type manager, the probability that the raider will receive the negative signal about her skills, \( r = r_0 \), is \( p_0 > \frac{1}{2} \). \(^{21}\) Hence from the viewpoint of the low-type manager, the probability that a takeover will not happen under \( D^H \) is \( 1 - p_0 < \frac{1}{2} \), implying that the probability that she will survive both the takeover and the distress threats

\[ \begin{align*}
\text{By Bayes’ rule, } & \prob(r = r_0|s = s_L) = \frac{\prob(s=s_L|r_0) \prob(r_0)}{\prob(s=s_L|r_0) \prob(r_0) + \prob(s=s_L|r_1) \prob(r_1)} = \frac{p_0 + \frac{1}{2}}{p_0 + \frac{1}{2} + 1} = \frac{p_0}{p_0 + 1} = p_0. 
\end{align*} \]
after choosing $D^H = s_L + \beta$ is $(1 - p_0)(1 - \beta)$. The expected utility of the low-type manager is then

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

The low-type manager will be willing to randomize between $D^{NT}$ and $D^H$ only if she is indifferent between these two debt levels. This will happen if and only if $U(D^{NT}|s_L) = U(D^H|s_L)$, which implies that $D^H = s_L + \beta^{NT}$ where $\beta^{NT} = \frac{\alpha^{NT} - p_0}{1 - p_0}$, and $\alpha^{NT} \geq p_0$.  

In computing $D^H$ and $D^L$, the above analysis assumed that the high-type manager chooses $D^H$ with probability 1. A necessary condition for the semiseparating equilibrium to exist, therefore, is that $D^{NT}$ is risky for a high-type manager who is committed to reorganize the company. If $D^{NT}$ were safe, the larger debt would insulate her from both the takeover and the distress threat, which would make her deviate from the debt $D^H$ that keeps the takeover threat alive. The semiseparating equilibrium will then exist only if $D^{NT} = s_L + \alpha^{NT} > \alpha^{H} \Rightarrow C \leq k(\bar{s} - s_L)(1 - \alpha^{NT})$. In other words, the semiseparating equilibrium requires the takeover costs not to be too large.

Of course, $D^{NT}$ being risky is not a sufficient condition for the high-type manager to choose the lower debt with probability 1. The high type should weigh the costs and benefits of the larger debt, that is, $D^{NT}$ raises the probability of managerial turnover in financial distress but ends the takeover threat. For the low-type manager, these costs and benefits cancel each other. For a more efficient manager, levering up to $D^{NT}$ implies a lower probability of financial distress. How then can it be that the high-type manager is unwilling to substitute the distress threat for the takeover threat when the less efficient low-type manager is willing to do so?  

If the signal $r$ is informative about the manager's quality, the high-type manager knows that the raider is likely to learn that she is the best person to run the firm. In other words, contrary to the low type, the high-type manager thinks that the signal $r_0$ that increases the

22 Assuming $\alpha^{NT} \geq p_0$ implies $C \leq k(\bar{s} - s_L)(1 - p_0)$. The intuition for this upper bound on the takeover cost is as follows. The risk of financial distress that $D^{NT}$ imposes on the low-type manager must be large enough to elicit incentives for her to mimic the high type. This lower bound on $D^{NT}$ is translated into an upper bound on the takeover cost $C$ because $D^{NT} = s_L + [1 - \frac{C}{k(\bar{s} - s_L)}]$ decreases with $C$.

23 The greater efficiency of the high-type manager will also reduce the risk of financial distress under $D^H$, which decreases the incentives to deviate. The high-type manager will lose this gain if the firm is taken over, however. In contrast, the gains from a decrease in the distress threat under $D^{NT}$ cannot be destroyed, because the larger debt level deters the raider. Hence the greater efficiency of the high-type manager imposes an unambiguous bias toward the higher debt level.
incentives for a takeover is unlikely to realize. Indeed, a straight application of Bayes' rule implies that \( \text{prob}(r = r_0 | s = s_H) = p_1 < \frac{1}{2} \). Therefore, takeovers do not put as much pressure on high-type managers to lever up as on low ones. The lower debt \( D^H \) can thus be optimal for the high type despite keeping the takeover threat alive.

Yet the greater optimism of the high-type manager may not prevent her from deviating to the higher debt level. If \( D^H \) imposes a high risk of financial distress, the low-type manager may prefer to increase it a little more to end the takeover threat. The lower debt level thus cannot be too large. As Proposition 3 shows, this restriction in the endogenous debt \( D^H \) can be mapped into a restriction in the exogenous takeover cost.

**Proposition 3** *In a semiseparating equilibrium in which high leverage conveys bad news about the incumbent manager, both the larger debt \( D^{NT} \) that deters the raider and the lower debt \( D^H \) that keeps the takeover threat alive decrease with the takeover cost.*

The intuition of Proposition 3 is straightforward. A decrease in the takeover cost makes it harder for a low-type manager to deter the raider, forcing her to increase the probability of managerial turnover in financial distress. Since the larger debt becomes less attractive to the low-type manager, the lower debt must also impose a higher probability of managerial turnover in financial distress or else the low-type manager will no longer be indifferent between the two debt levels, as required by the semiseparating equilibrium. Smaller takeover costs thus increase both \( D^H \) and \( D^{NT} \).

It then follows that takeover costs cannot be too small or else the high-type manager will want to deviate to the debt \( D^{NT} \) that deters the raider. Since it has already been argued that the semiseparating equilibrium requires that the takeover costs not be too large, high leverage conveys bad news about the manager only if takeover costs are neither too large nor too small.

As Proposition 4 shows, if the inefficiency of the low-type manager, \( s_H - s_L \), lies in the interval \([p_0 - p_1, p_0 - \frac{p_0^2}{p_0 - P_1}]\) and \( p_0 > \frac{2}{3} \), then there exist \( C \) and \( \tilde{C} \) such that any takeover cost \( C \in [C, \tilde{C}] \) assures that \( D^H = s_L + \alpha^{NT} \frac{p_0}{1 - p_0} \) is optimal for the high-type manager while

24 By Bayes' rule, \( \text{prob}(r_0 | s_H) = \frac{\text{prob}(s = s_H | r_0) \text{prob}(r_0)}{\text{prob}(s = s_H | r_0) \text{prob}(r_0) + \text{prob}(s = s_L | r_1) \text{prob}(r_1)} = \frac{(1 - p_0)^2}{(1 - p_0)^2 + (1 - p_1)^2} = p_1. \)

25 Formally, both \( D^{NT} = s_L + \alpha^{NT} \) and \( D^H = s_L + \alpha^{NT} \frac{p_0}{1 - p_0} \) increase with \( \alpha^{NT} = 1 - \frac{C}{\delta(\tau - s_L)} \), which decreases with \( C \).
the low-type manager is willing to randomize between $D^H$ and $D^{NT}$. Moreover, the proof of the proposition also shows that any such takeover cost allows $D^H$ to keep the takeover threat alive. A semiseparating equilibrium in which high leverage conveys bad news about the manager thus exists. Formally,

**Proposition 4** Assume that $p_0 - p_1 < s_H - s_L \leq p_0 - \frac{p_0^2}{p_0 - p_1}$ and $p_0 > \frac{2}{3}$. Thus, there exist takeover costs $\tilde{C}$ and $C$ with $\tilde{C} > C$ such that any $C \in [C, \tilde{C}]$ allows for a semiseparating equilibrium that satisfies the intuitive criterion of Cho and Kreps (1987). In the semiseparating equilibrium, the strategies and beliefs are:

- **Debt levels**
  
  
  $$D^{NT} = s_L + \alpha^{NT} > s_H \quad \text{where } D^{NT} \text{ ends the takeover threat and } \alpha^{NT} = 1 - \frac{C}{k(s_H - s_L)};$$
  
  $$D^H = s_L + \alpha^H \frac{p_0}{1 - p_0} < s_H \quad \text{with } D^H \text{ keeping the takeover threat alive.}$$

- **Managers' strategies:** Both types of manager reorganize the firm at $t = 0$. The high-type manager chooses $D^H$ with probability 1 and the low type randomizes between $D^H$ and $D^{NT}$.

- **Shareholders' strategy:** Dismiss the incumbent manager in financial distress.

- **Beliefs:** $\text{prob}(s = s_L | \text{Distress}) = 1$, $\text{prob}(s = s_L | D \neq D^H) = 1$, $\text{prob}(s = s_L | D = D^H, p) = \frac{p_0}{p_0 + (1 - \gamma)}$, where $p$ is the prior on the incumbent's being a low-type manager and $\gamma$ is the probability that the low type chooses $D^H$.

Proposition 4 characterizes the semiseparating equilibrium in which high leverage conveys bad news about the manager's quality. In the equilibrium, the high-type manager leverages up to a debt level that keeps the takeover threat alive but, once the firm is reorganized, does not impose a distress threat. In contrast, the low-type manager, who fears takeovers the most, is willing to substitute a distress threat for the takeover threat. When choosing the larger debt, the low type manager commits to enhance the firm's value but increases the chances of being replaced by her own shareholders.
3.2 High leverage conveys bad news: An example

Consider a firm whose manager has type \( s \in \{s_L = 1, s_H = 1.4\} \), the takeover cost is \( C = .06 \), \( k = 1.09 \), and the signals \( r_0 \) and \( r_1 \) update equally likely priors to \( p_0 = \text{prob}(s = s_L | r = r_0) = 0.7 \) and \( p_1 = \text{prob}(s = s_L | r = r_1) = 0.3 \), respectively. For these parameters, the smallest debt that deters a raider who knows that the incumbent is a low-type manager is

\[
D^{NT} = s_L + \alpha^{NT} = 1.7248, \quad \text{where } \alpha^{NT} = 1 - \frac{C}{k(s_L - s_L)}. \]

I show that the following strategies form a semiseparating equilibrium when out-of-equilibrium beliefs are properly chosen: i) the high-type manager reorganizes the firm and chooses the debt level \( D^H = s_L + \alpha^{NT} = 1.0826 \), which keeps the takeover threat alive; ii) the low-type manager also reorganizes the firm and randomizes between the debt levels \( D^H \) and \( D^{NT} \) with probabilities \( \gamma = 0.9 \) and \( 1 - \gamma = 0.1 \), respectively; and iii) shareholders fire the incumbent manager in financial distress.

Consider first the random debt strategies of the low-type manager. Since \( D^{NT} = 1.7248 \) is risky for the low-type manager, the shareholders’ strategy of firing the incumbent in financial distress will induce her to reorganize the assets. Thus, the firm will become financially distressed if and only if \( D^{NT} > s_L + \theta \Rightarrow \theta < .7248 \). Since \( \theta \) is uniformly distributed in the interval \([0, 1]\) and, by construction, \( D^{NT} \) ends the takeover threat, the probability that the low-type manager will lose her job under \( D^{NT} \) is .7248 and her expected utility is

\[
U(D^{NT}|s_L) = (1 - .7248)B = .2752B, \quad \text{where } B \text{ is the benefit of staying in control.} \]

Suppose instead that the low-type manager pools with the high type at the lower debt \( D^H = 1.0826 \). Once more, the low-type manager will have incentives to reorganize to minimize the chances of managerial turnover in financial distress, which will happen if and only if \( D^H > s_L + \theta \Rightarrow \theta < .0826 \). The probability that the low-type manager will escape financial distress under \( D^H \) is \( 1 - .0826 = .9174 \). Financial distress is not the only threat to the manager, though. \( D^H \) is supposed to let the takeover occur if the signal \( r_0 \) is realized. By Bayes’ rule, this probability is \( \text{prob}(r_0|s_L) = p_0 = 0.7 \). By choosing \( D^H \) over \( D^{NT} \), the low-type manager reduces the takeover threat but is highly likely to be ousted by the raider. The expected utility of the low-type manager under \( D^H \) is

\[
U(D^H|s_L) = .9174(1 - .7)B = .2752B = U(D^{NT}|s_L). \]

The low-type manager is willing to randomize between the two debt levels, as required by the semiseparating equilibrium.

Let us now move to the high-type manager. Since \( D^H > 0 \), it commits the high-type
manager to reorganize the firm, after which the debt is riskless for her. Nonetheless, $D^H$ will 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 one. By Bayes' rule, this conditional probability is $p_1 = 0.3$. Therefore, takeovers put less pressure on high-type managers to lever up than on low ones. The expected utility of the high-type manager under $D^H$ is $U(D^H|s_H) = (1 - p_1)B = 0.7B$.

By deviating to $D^{NT} = 1.7428$, the high-type manager substitutes a distress threat for the takeover threat. Since financial distress triggers managerial turnover, it would be optimal for the high-type manager to reorganize the firm after choosing $D^{NT}$. Therefore, financial distress happens if and only if $D^{NT} > s_H + \theta \Rightarrow \theta < 1.7428 - s_H = 0.3428$. The expected utility of the high-type manager under $D^{NT}$ is $U(D^{NT}|s_H) = (1 - 0.3428)B = 0.6752B < 0.7B = U(D^H|s_H)$. The high-type manager is then strictly better off with her equilibrium strategy.

It remains to show that $D^H$ keeps the takeover threat alive and that it optimally implies managerial turnover in financial distress. By Bayes’ rule, $l(p_0, \gamma) \equiv \frac{\gamma p_0}{\gamma p_0 + (1 - p_0)} = 0.677$ is the probability that the incumbent manager is a low-type one given that i) $D^H$ has been chosen, ii) the signal $r_0$ updates diffuse priors on the incumbent’s type to $p_0 = 0.7$, iii) the high-type manager chooses $D^H$ with probability 1, and iv) the low-type manager randomizes between $D^H$ and $D^L$ with probabilities $\gamma = .9$ and $1 - \gamma = .1$, respectively. As a result, the value added by a takeover given $D^H = 1.0826$ and the signal $r_0$ is

$$[l(p_0, \gamma)k(\bar{s} - s_L) + (1 - l(p_0, \gamma))k(\bar{s} - s_H)] - l(p_0, \gamma)(.0826)k(\bar{s} - s_H) = .0651 > .06 = C. \quad (2)$$

The term in brackets in equation (2) is the expected increase in the continuation value of an all-equity firm whose incumbent manager – who is a low-type one with probability $l(p_0, \gamma)$ – is replaced by a new one with expected type $\bar{s}$. The negative term in the equation captures the effects of leverage on the value added by a takeover. Given the equilibrium strategies and beliefs, financial distress under $D^H = 1.0826$ happens when the incumbent is a low-type manager and $\theta < .0826$. The value added by a takeover is then reduced because the low-type incumbent would have been dismissed in the distress states with or without the raider. Equation (2) shows that the value added by a takeover is larger than the takeover cost. 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 the high-type manager into financial distress. Hence financial distress and Bayesian updating will let the shareholders know that the incumbent is a low-type manager and managerial turnover will follow. Moreover, for any other debt level, managerial turnover in financial distress will be optimal if out-of-equilibrium beliefs are chosen so that \( \text{prob}(s = s_L|D) = 1 \) for \( D \notin \{D^H, D^L\} \). It has then been shown that i) it is optimal for the high-type manager to choose \( D^H \), ii) it is optimal for the low-type manager to randomize between \( D^H \) and \( D^{NT} \) with probabilities .9 and .1, respectively, iii) it is optimal for the shareholders to fire the incumbent in financial distress, iv) \( D^H \) does not end the takeover threat, and v) it is optimal for both types of manager to reorganize the firm after the increase in leverage. A semiseparating equilibrium in which high leverage conveys bad news about the manager thus follows.

### 3.3 Takeover costs and equilibrium selection

As demonstrated in Proposition 4, the semiseparating equilibrium in which high leverage conveys bad news about the manager breaks down if the debt \( D^{NT} \) that deters the raider is safe for the high-type manager. Intuitively, if \( D^{NT} \) were safe for the high type, she would be strictly better off deviating to the higher debt level, which would end the takeover threat without imposing a distress threat. But then the larger debt could not possibly send a bad signal about the incumbent manager.

As it turns out, Proposition 1 in section 2 shows that a separating equilibrium in which high leverage conveys good news exists when \( D^{NT} \) is safe for the high-type manager, which is likely to be the case when takeover costs are high. In times when takeover costs are high, therefore, the model predicts that a large increase in leverage will convey good news about the manager. As I discuss in section 4, this prediction leads to implications for the stock price reaction to debt-for-equity exchanges that can be used to test the relevance of the signaling role of debt under a takeover threat.

Large takeover costs are not the only reason for breaking down the equilibrium in which high leverage conveys bad news about the manager, though. The equilibrium does not survive
small takeover costs either. The intuition is the following. As the takeover costs decrease, the probability of managerial turnover in financial distress must be increased for $D^{NT}$ to block the takeover. From Proposition 3, the lower debt $D^H$ must increase as well. The increase in $D^H$ challenges the semiseparating equilibrium in two ways. First, the lower debt $D^H$ may impose a threat of financial distress on the high-type manager, who will then feel too tempted to deviate to the debt $D^{NT}$ that ends the takeover threat. Second, $D^H$ may end up being large enough to deter the raider, which obviously breaks down the semiseparating equilibrium because the low-type manager now has no incentives to lever up to $D^{NT}$. For the semi-separating equilibrium to exist, therefore, the takeover costs cannot be too small.

More interestingly, as the takeover cost decreases, it is more likely that the low-type manager will mimic the high-type. More precisely, the probability $\gamma$ that the low-type manager will choose $D^H$ must be above a cutoff $\hat{\gamma}$ that increases when the takeover costs decrease. A pooling equilibrium in which both types of manager commit to reorganize the firm by choosing the same debt level then arises as a natural outcome of the capital structure problem when takeover costs become sufficiently small. Formally,

**Proposition 5** In the semiseparating equilibrium in which high leverage conveys bad news about the manager, the probability $\gamma$ that the low-type manager pools with the high-type one at the smaller debt $D^H$ must be greater than or equal to a cutoff $\hat{\gamma}$ that decreases with the takeover cost. Moreover, the semiseparating equilibrium breaks down if takeover costs become too small.

Proposition 5 suggests that as takeover costs decrease, debt will be used as an entrenchment device less often. Intuitively, debt can block a strong takeover threat only if it implies a high probability of managerial turnover in financial distress. Substituting turnover in a very likely distress event for a takeover is not a substantial improvement for low-type managers, though. As a result, the latter may prefer to pool with the high-quality managers at lower debt in an attempt to mislead the raider while reducing the probability of losing their jobs in financial distress. The model thus predicts a relatively low dispersion of intraindustry leverage in periods of low takeover costs.
4 Discussion and Implications

4.1 Stock price reaction to debt-for-equity exchanges

In this paper, leverage serves two purposes. On the one hand, it substitutes a distress threat for a takeover threat, committing the firm to an increase in value. On the other hand, it sends a signal of the incumbent manager's ability to enhance value. Although the commitment role of debt implies that high leverage conveys good news to shareholders, high leverage sends a bad signal of the incumbent manager's ability if takeover costs are small. In other words, the model predicts that the signaling role of debt depends on the takeover costs. As I argue below, the stock price reaction to a debt-for-equity exchange provides a test of this prediction.26

In the model, a takeover threat is the only reason for a manager to introduce debt into the capital structure. In reality, a manager who is insulated from the takeover market is unlikely to remain with an all-equity capital structure. Hart and Moore (1995), for instance, argue that empire-building motives induce managers to borrow to finance new projects. Likewise, tax benefits of debt might induce managers with stock options in their compensation plans to accept some risk of financial distress.

Consider then a decrease in takeover costs that leads to the semiseparating equilibrium in which high leverage conveys bad news about the incumbent manager. This decrease in takeover costs will not induce an increase in leverage in firms run by high-type managers who, for tax reasons or empire-building motives, may have previously levered up their firms to debt levels higher than or equal to the lower debt $D_H^L$ of Proposition 4. The decrease in the takeover costs is more likely to increase leverage in firms run by low-type managers who choose to lever up to the higher debt $D_{NT}^H$ that deters the raider. Accordingly, the stock price reaction to a debt-for-equity exchange should mostly reflect a low-type manager's leverage decision when small takeover costs imply the semiseparating equilibrium in which high leverage conveys bad news about the incumbent manager.

In contrast, there is no reason to believe that a debt-for-equity exchange will mostly reflect a low-type manager's leverage decision in periods of large takeover costs. As section 2 demonstrated, low-type managers choose lower debt levels in such times. An increase in the takeover costs...
threat that induces a low-type manager to lever up will also increase the minimum debt level that allows a high-type manager to signal her superior skills. Hence the average stock price reaction to debt-for-equity exchanges should be stronger in periods of large takeover costs than in periods of small takeover costs.

Garvey and Hanka (1999) find evidence that the adoption of antitakeover laws increases takeover costs, leading to changes in corporate leverage. As such, the model's predictions can be tested by comparing stock price reactions to debt-for-equity exchanges in firms incorporated in different states. Assuming that the proportion of low-type managers is the same across states, the model predicts a stronger stock price reaction in firms incorporated in states that adopt antitakeover laws.

4.2 Leverage and managerial turnover

In the model, shareholders act on their beliefs only if the firm becomes financially distressed. In reality, financial distress is not the only corporate event that makes managers more vulnerable to shareholders' assessment of their skills. The presence of a new large shareholder, for instance, may trigger the same type of control fight that is implicitly assumed to happen in financial distress. By causing a negative updating about the incumbent manager's abilities, an increase in leverage enhances the chances of a future control fight both in and outside financial distress.27

In deciding whether to use debt as an entrenchment device, managers then face a tradeoff between an ongoing takeover threat and the risk of being ousted later on by their shareholders. This tradeoff is the essence of the semiseparating equilibrium of section 3, which yields the following implications for the leverage and managerial turnover decisions: i) managers who lever up the most are more likely to be replaced by their shareholders, ii) corporate leverage decreases with takeover costs, and iii) intraindustry leverage is less dispersed in periods when

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27 Allowing the shareholders to replace the incumbent management outside financial distress reduces the takeover gains. Nonetheless, this reduction will not entirely eliminate the takeover gains if the raider has private information about the incumbent manager's skills. Managers' incentives to use debt as a takeover defense, therefore, are still present. In this setting, the semiseparating equilibrium of section 3 obtains: A high-type manager chooses a debt level that does not block the takeover while a low type randomizes between the high type's choice and a higher level that blocks the takeover. Unlike in section 3, though, the low-type manager is now indifferent between a debt level that allows for a takeover with a positive probability and a higher debt level that implies a positive probability that her shareholders will trigger managerial turnover in and outside financial distress.
takeover costs are small.

The first implication, which follows naturally from high leverage conveying a negative signal of the manager's quality, is consistent with the findings in Safieddine and Titman (1999). In a sample of 573 firms that defeat a takeover bid, Safieddine and Titman document an average turnover rate of 36.8% for the firms that increase leverage the most and a 30% turnover rate for those that increase leverage the least.28

Turning to the second implication, Proposition 3 shows that both equilibrium debt levels decrease with the takeover cost. Accordingly, Garvey and Hanka (1999) find that, on average, leverage decreases for a sample of firms incorporated in states that adopt antitakeover laws, which - the authors argue - increase takeover costs.

Finally, Proposition 5 shows that, in response to smaller takeover costs, low-type managers are more likely to pool with high-type managers. Instead of levering up and facing a large risk of financial distress (remember that the debt $D_{NT}$ that deters the raider decreases with takeover costs), inefficient managers may pool with the efficient ones at lower debt in an attempt to mislead not only the raider but also the shareholders. Intraindustry leverage, thus, should be less dispersed in periods when takeover costs are small.

I am not aware of any empirical study that has looked at the relation between intraindustry leverage and takeover costs. The experiment design of Garvey and Hanka can be used to test this implication, though. The model predicts that, in a sample of firms incorporated in states that adopt antitakeover laws, there should be more dispersion of intraindustry leverage after antitakeover laws are adopted.

5 Conclusions

Recent empirical research provides evidence that, under a takeover threat, managers lever up to commit to an increase in firm value that makes a disciplinary takeover unnecessary.

28More precisely, Safieddine and Titman split the firms that remain independent for at least a year after the failed takeover bid into two subsamples: The ones that increase leverage above the median leverage increase in the sample and those that increase leverage less than the median. Although a larger fraction of managers who lever up the most are dismissed, the difference in the turnover rates is not statistically significant. The lack of statistical significance is actually not surprising. Since a takeover bid is probably the ultimate consequence of small takeover costs, Proposition 5 suggests that a large fraction of the low-type managers would pool with the high-type ones, increasing the incentives for managerial turnover at the lower debt levels as well.
In particular, Safieddine and Titman (1999) document an increase in operating performance for the firms in their sample that increase leverage the most 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 for managers under a takeover threat to 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 the incumbent manager to enhance value and yet convey a bad signal of her ability to turn the firm around. The negative updating cannot be taken as given, though. If takeover costs are large, high leverage conveys a positive signal about the incumbent manager's skills, as in the standard signaling literature on capital structure choice. Shareholders and boards of directors must infer the incumbent manager's quality from the size of the leverage increase and the size of the takeover costs; a task that is by no means simple.

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 for the frequency of managerial turnover, the strength of the stock price reaction to debt-for-equity exchanges, and the dispersion and level of intraindustry leverage provide a starting point for future empirical work.
References


Appendix

Proof of Proposition 1

Since the shareholders' strategy implies that financial distress triggers managerial turnover, it is optimal for both types of manager to implement the value-enhancing reorganization plan for any debt choice $D > 0$. In fact, $D^H \leq s_H$ implies that the high-type manager can end the distress threat by reorganizing the firm. Moreover, because $D^H$ reveals the incumbent as a high-type manager, the commitment to reorganize also ends the takeover threat. Therefore, the equilibrium strategies assure that the high-type manager stays in control, giving her no reason to deviate.

Likewise, it is not in the interest of the low-type manager to deviate from her equilibrium strategy. Any debt level $D > D^{NT}$ increases the risk of managerial turnover in financial distress. In turn, the out-of-equilibrium beliefs assign a probability 1 for the incumbent's being a low-type manager for any $D < D^{NT}$. Since $D^{NT}$ is the minimum debt that deters a raider who knows the incumbent is a low-type manager, $D < D^{NT}$ and the out-of-equilibrium beliefs imply that a takeover will surely happen. Finally, the shareholders' strategy of firing the incumbent manager in financial distress is optimal because $D^{NT}$ reveals the incumbent as a low type and the out-of-equilibrium beliefs assign probability 1 to the incumbent's being a low-type manager if $D^H$ leads the firm into financial distress or any $D \notin \{D^H, D^{NT}\}$ is chosen. The strategies and beliefs, therefore, form a separating equilibrium.

\[\square\]

Proof of Proposition 2

Separating equilibria

Consider first a separating equilibrium in which both types of manager reorganize the firm at $t = 0$, the high type chooses $D^H$, and the low type chooses $D^L < D^H$. In the proposed equilibrium, $D^H$ ends the takeover threat. Therefore, $D^L$ can be optimal for the low-type manager only if it also ends the takeover threat. In particular, it must be equal to the debt $D^{NT}$ that deters a raider who knows the incumbent is a low-type manager with the minimum probability of managerial turnover in financial distress.

Since $D^H > D^L = D^{NT}$ and $D^{NT}$ is assumed to be risky for the high-type manager, so is $D^H$. In equilibrium, therefore, the high-type manager will go into financial distress.
with positive probability. Bayesian updating then implies that shareholders see a manager who chooses $D^H$ as a high type despite financial distress. The larger debt thus insulates the manager from the takeover and financial distress threats in the proposed equilibrium. But then the low-type manager is strictly better off deviating to $D^H$ because $D^{NT}$ implies managerial turnover in financial distress with positive probability.

Consider now an equilibrium in which the high-type manager does not reorganize the firm at time $t = 0$. If the lack of commitment induces the raider to replace the high-type manager after the choice of $D^H$, then the equilibrium breaks down because the high type would be better off with $D^{NT}$. Otherwise, the manager is insulated from both the takeover and the distress threats. Moreover, $D^H > 0$ implies that financial distress will happen with positive probability. But then the previous argument applies. The low-type manager has incentives to deviate to $D^H$, which, contrary to $D^{NT}$, deters the raider while insulating the manager from the risk of managerial turnover in financial distress.

**Semiseparating equilibria**

Two types of semiseparating equilibrium allow for the largest debt – call it $D^H$ – to convey good news about the incumbent manager. In the first one, the high-type manager chooses $D^H$ with probability 1 while the low type randomizes between $D^H$ and a lower debt level – call it $D^L$. In the second type of equilibrium, the low-type manager chooses the lower debt $D^L$ with probability 1 while the high type randomizes between $D^L$ and $D^H$.

Consider first the equilibrium in which the low-type manager randomizes. The lower debt $D^L$ then reveals the incumbent as a low type, implying that it must be equal to the debt level $D^{NT}$ that deters the raider with the smallest probability of financial distress. Since $D^L = D^{NT}$ ends the takeover threat, the larger debt $D^H$ can allow for a takeover only if it does not commit the firm to the reorganization plan. But if this were the case, $D^H$ would imply a takeover with probability 1 and the low-type manager would be strictly better off with $D^{NT}$. Hence, we can assume that $D^H$ ends the takeover threat. Free from the takeover threat, the high-type manager will reorganize the firm at $t = 0$ only if $D^H$ triggers managerial turnover in financial distress. Suppose instead that distress under $D^H$ does not trigger turnover. Then the high-type manager does not reorganize and yet she is insulated from both the takeover and the distress threats. But then the low-type manager would be strictly better off choosing $D^H$. 

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making it impossible for the randomization to be optimal. The semiseparating equilibrium thus requires that $D^H$ triggers turnover in financial distress, which implies that the high-type manager will reorganize. Now, if in spite of the firm’s reorganization $D^H$ is risky for the high-type manager, she is strictly better off deviating to $D^L$, which ends the takeover threat with a lower probability of distress. It then follows that the semiseparating equilibrium can exist only if $D^H \leq s_H$ to allow for managerial turnover in financial distress for the low-type manager only. But this implies $D^{NT} = D^L < s_H$, which contradicts an assumption of the proposition.

Consider now the semiseparating equilibrium in which the high-type manager randomizes. In this case, $D^H$ reveals the incumbent as a high-type manager. Hence a takeover can only happen if the debt $D^H$ does not commit the incumbent to reorganize. If this were the case, however, the high type would be strictly better off with $D^{NT}$, breaking down the equilibrium. If $D^H$ does not trigger managerial turnover in financial distress, the debt insulates the incumbent from both the takeover and the distress threats. But then the low-type manager would be strictly better off deviating to $D^H$. For the semiseparating equilibrium to exist, $D^H$ must imply a risk of managerial turnover in financial distress. Given the equilibrium strategies and Bayesian updating, this can happen only if shareholders perceive financial distress as an out-of-equilibrium event that results from the low-type manager’s deviation to the debt level $D^H$. The semiseparating equilibrium thus requires that $D^H$ and the lower debt $D^L$ are safe for a high-type manager who is committed to the firm’s reorganization.

If $D^H$ is safe for a high-type manager, $D^L$ must end the takeover threat or else the high-type manager would be strictly better off under $D^H$, which assures her job with probability 1. To see what type of restriction this condition imposes, let $p = \text{prob}(s = s_L|D^L, r_0) > \frac{1}{2}$ be the probability that $s = s_L$ when $D^L$ is observed and the raider receives the signal $r_0$ that negatively updates his beliefs about the incumbent’s skills. Then $D^L$ deters the raider only if

$$p(1 - \alpha)k(s - s_L) + (1 - p)k(\bar{s} - s_H) < C. \quad (3)$$

The first term in equation (3) is the expected gain of a takeover conditioned on the incumbent’s being a low-type one, the realization of the signal $r_0$, and the choice of $D^L = s_L + \alpha$. The second term shows that the takeover may be a mistake. With probability
1 - p, the raider will mistakenly replace a high-type manager. Since $D^L$ must be safe for the high-type manager, $D^L \leq s_H \Rightarrow \alpha \leq s_H - s_L$. The equilibrium then breaks down if $C \leq p(1 - (s_H - s_L))k(\bar{s} - s_L) + (1 - p)k(\bar{s} - s_H)$.

Mixed-strategy equilibria

In this type of equilibrium, the high-type manager randomizes between a high debt level, $D^H$, and a low debt level, $D^L$, with probabilities $h$ and $1 - h$, respectively. The low-type manager randomizes between the same debt levels with probabilities $l$ and $1 - l$. The larger debt will convey good news about the manager if and only if $h > l$.

There are four cases to analyze: i) $D^L$ ends the takeover threat but not $D^H$, ii) Both $D^H$ and $D^L$ end the takeover threat, iii) Neither $D^H$ nor $D^L$ ends the takeover threat, and iv) $D^H$ ends the takeover threat but not $D^L$. In all cases, I can assume that the debt levels do not allow a takeover with probability 1. Otherwise $D^{NT}$ dominates both $D^H$ and $D^L$.

The first case is impossible because $D^L$ blocking the takeover implies that so does the larger $D^H$ that is supposed to convey better news about the incumbent. The second case is also impossible. To see this, note first that $D^L$ must imply managerial turnover in financial distress or else the takeover will surely happen if the signal $\tau_0$ is realized. Hence, $D^H$ must also trigger managerial turnover in distress or else no manager would choose $D^L$. But if $D^H$ triggers managerial turnover in financial distress, the low-type manager is strictly better off with the lower debt that ends the takeover threat with a lower probability of financial distress.

Consider now the third case, that is, neither $D^H$ nor $D^L$ ends the takeover threat. There are four subcases to consider. If both debt levels imply managerial turnover in financial distress, the two types of manager would be strictly better off with the lower debt, contradicting the mixed-strategy equilibrium. In turn, if neither debt level triggers managerial turnover in financial distress, no manager has an incentive to reorganize, which is the motivation for an increase in leverage in the model. Therefore, I will not analyze this case. Finally, if either $D^H$ or $D^L$ is the only debt that does not trigger managerial turnover in financial distress, both types of manager would be strictly better off with this debt choice. But then the managers cannot be indifferent between $D^H$ and $D^L$ and the mixed-strategy equilibrium breaks down.

In the fourth and last case, the larger debt $D^H = s_L + \beta$ is the only one to end the takeover threat. If $D^H$ does not trigger managerial turnover in financial distress, the low-type manager
is strictly better off deviating to $D^H$ which, contrary to $D^L$, assures the continuation of the incumbency with probability 1. $D^H$ can then be assumed to trigger managerial turnover in financial distress. I show that if the negative updating from $r_0$ can be made as large as needed (i.e. $p_0 \equiv \text{prob}(s = s_L| r_0) \rightarrow 1$), any debt $D^H$ that does not eliminate all the uncertainty about the manager’s quality can end the takeover threat only if it sufficiently reduces the value added by the raider. This condition cannot be satisfied, however, if the takeover costs are sufficiently small.

To see this, let $v$ be the probability that the incumbent is a low type conditioned on $D^H$ and the realization of $r_0$. By Bayes’ rule, $v = \frac{p_0}{p_0 + p_H}$, which is assumed to be bigger than $\frac{1}{2}$ because $p_0$ can be as close to 1 as needed. To obtain the value added by a takeover under $D^H = s_L + \beta$, note first that the probabilities that the low type and the high type go into financial distress are $\beta$ and $\beta - (s_H - s_L)$, respectively. Inserting these probabilities along with the probability $v$ that the incumbent is a low-type manager into equation (3) after taking into account that $D^H$ may be risky for the high-type manager yields,

$$v(1 - \beta)k(\bar{s} - s_L) + (1 - v)(1 - \max\{\beta - (s_H - s_L), 0\})k(\bar{s} - s_H).$$  \hfill (4)

Now, $\beta$ is determined by the incentive compatibility conditions of the debt strategies of the two types of manager, which are independent of the takeover cost $C$. For given $v > \frac{1}{2}$, $s_H$, $s_L$, and $\bar{s}$, the takeover gain will outweigh the takeover cost $C$ if the latter is small enough. In this case, $D^H$ will not end the takeover threat, breaking down the mixed-strategy equilibrium.

\[\Box\]

**Proof of Proposition 4**

The proof consists of four steps. The first step assures that the strategies of the two types of manager are optimal while assuming that the lower debt $D^H$ does not end the takeover threat. The second step obtains the restrictions that allow $D^H$ to keep the takeover threat alive and show that they are consistent with the restrictions from the incentive compatibility conditions. The third step shows that the shareholders’ strategy of firing the incumbent in financial distress is optimal given Bayesian updating and the out-of-equilibrium beliefs. Finally, the fourth step shows that the semiseparating equilibrium satisfies the intuitive criterion.
Step 1: Optimality of the debt strategies.

Section 3 shows that the low-type manager is willing to randomize between $D^H$ and $D^{NT}$ if $\alpha^{NT} \geq p_0$. Any debt $D > D^{NT}$ is strictly dominated because it ends the takeover threat at a higher probability of managerial turnover in financial distress. In turn, the out-of-equilibrium beliefs imply a probability 1 for the incumbent’s being a low type for any $D < D^{NT}$ different from $D^H$. Since $D^{NT}$ is the smallest debt that ends the takeover threat with these beliefs, those debt choices are strictly dominated because a takeover would happen with probability 1.

Consider now the high-type manager. For the reasons given above, the high-type manager is strictly worse off with any $D \notin \{D^H, D^{NT}\}$. It thus suffices to show that the high-type manager prefers $D^H$ to $D^{NT}$. Given the shareholders’ strategy, the high-type manager will be fired if she leads the firm into financial distress with either $D^H$ or $D^{NT}$. Hence, we can assume below that the high-type manager will reorganize the firm.

In the proposed equilibrium, $D^H = s_L + \beta^{NT}$ does not block the takeover if the signal $r_0$ occurs. By Bayes’ rule, this is an event with probability $\text{prob}(r = r_0|s = s_H) = p_1$. In addition, $D^H$ will be risky for the high-type manager if takeover costs are below a cutoff that solves $D^H \equiv s_L + \frac{\beta^{NT} - p_0}{1 - p_0} = s_H \Rightarrow \hat{C} = (1 - p_0)k(s - s_L)[1 - (s_H - s_L)]$, where $\alpha^{NT} = 1 - \frac{C}{k(s - s_L)}$ was used to solve for $\hat{C}$. $D^H = s_L + \beta^{NT}$ is thus risky for the high-type manager if and only if $C < \hat{C}$, implying financial distress whenever $\theta < \beta^{NT} - (s_H - s_L)$. The expected utility of the high-type manager under $D^H$ is then $U(D^H|s_H) = (1 - p_1)(1 - \max[\beta^{NT} - (s_H - s_L), 0])B$.

By deviating to $D^{NT} = s_L + \alpha^{NT}$, the high-type manager ends the takeover threat. If the higher debt is safe for the high-type manager, the equilibrium breaks down because the manager is insulated from both the takeover and the distress threats. For the semiseparating equilibrium to exist, it must be true that $D^{NT} > s_H \Rightarrow \alpha^{NT} > s_H - s_L$, which is satisfied by $\alpha^{NT} \geq p_0$ if $s_H - s_L < p_0$. Assuming that this is the case, the expected utility of the high-type manager under $D^{NT}$ is $U(D^{NT}|s_H) = (1 - [\alpha^{NT} - (s_H - s_L)])B$, where $1 - [\alpha^{NT} - (s_H - s_L)]$ is the probability that $D^{NT}$ does not lead the high-type manager into financial distress. It follows that the high-type manager prefers $D^H$ over $D^{NT}$ if and only if

$$U(D^H|s_H) \geq U(D^{NT}|s_H) \Rightarrow \begin{cases} C \leq [p_0 - (s_H - s_L)]k(s - s_L) & \text{if } C \geq \hat{C} \Rightarrow D^H \leq s_H \\ C \geq k(s - s_L)(s_H - s_L)\frac{p_2}{p_0 - p_1} & \text{if } C < \hat{C} \Rightarrow D^H > s_H. \end{cases}$$

(5)
Using \( \hat{C} = (1 - p_0)k(\bar{s} - s_L)[1 - (s_H - s_L)] \), simple algebra shows that \( \hat{C} < [p_0 - (s_H - s_L)]k(\bar{s} - s_L) \) and \( \hat{C} > k(\bar{s} - s_L)(s_H - s_L)\frac{p_1^2}{p_0 - p_1} \) if and only if \( s_H - s_L \leq \frac{p_0 - p_1}{p_0} \Rightarrow s_H - s_L < p_0 \).

This last inequality assures that \( D^NT \) is risky for the high-type manager if \( a^NT \geq p_0 \Rightarrow C \leq k(\bar{s} - s_L)(1 - p_0) \). Showing that this last condition is consistent with equation (5) will prove that there exist takeover costs that allow for the strategies to be optimal for the managers.

Consider first the restrictions on the takeover cost when \( D^H > s_H \). Then \( C \leq k(\bar{s} - s_L)(1 - p_0) \) will not bind if \( k(\bar{s} - s_L)(1 - p_0) \geq \hat{C} = k(\bar{s} - s_L)(1 - p_0)[1 - (s_H - s_L)] \), which holds with strict inequality. When \( D^H \leq s_H \), \( C \leq k(\bar{s} - s_L)(1 - p_0) \) will not bind if \( k(\bar{s} - s_L)(1 - p_0) \geq k(\bar{s} - s_L)p_0 - (s_H - s_L) \), which is satisfied if \( s_H - s_L \geq p_0 - p_1 \). It has then been shown that there exist \( \hat{C} \) and \( C \) with \( \hat{C} > C \) such that the incentive compatibility conditions of the two types of manager hold if \( p_0 - p_1 \leq s_H - s_L < \frac{p_0 - p_1}{p_0} \).

**Step 2:** \( D^H \) does not end the takeover threat

Let \( l(\gamma, p_0) \) be the updating of the probability that the incumbent is a low-type manager conditioned on \( D^H \), a prior \( p_0 \), and the probabilities 1 and \( \gamma \) that the high type and the low-type manager, respectively, choose \( D^H \). By Bayes’ rule, \( l(\gamma, p_0) \equiv \frac{\gamma p_0}{\gamma p_0 + (1 - p_0)} \). Assuming that financial distress triggers managerial turnover, the increase in the firm’s value with a takeover can be shown to be equal to

\[
l(\gamma, p_0)(1 - \beta^NT)k(\bar{s} - s_L) + (1 - l(\gamma, p_0))(1 - \max(\beta^NT - (s_H - s_L), 0))k(\bar{s} - s_H). \tag{6}
\]

The first term in equation (6) is the expected gain of a takeover conditioned on the incumbent’s being a low-type one, which is an event with probability \( l(\gamma, p_0) \). The raider’s decision to replace the incumbent increases the firm’s value only if the managerial change would not have happened in the absence of the takeover. For debt \( D^H = s_L + \beta^NT \), managerial turnover in distress happens with probability \( \beta^NT \). Therefore, given \( D^H \), the expected gain of a takeover conditioned on the incumbent’s being a low-type manager is \( (1 - \beta^NT)k(\bar{s} - s_L) \). The second term shows that managerial turnover may be a mistake. With probability \( 1 - l(\gamma, p_0) \), the incumbent is a high type and managerial turnover leads to an expected loss. Only the replacement loss in the nondistress states, which is an event with probability \( 1 - \max(\beta^NT - (s_H - s_L), 0) \), can be attributed to the takeover, though.

From equation (6), one can check that the value added by a takeover is positive only if
In this case, the incentives to take over are maximized if, all else being equal, the low-type manager chooses $D_H$ with a probability $\gamma \to 1$ and the inefficiency of the low-type manager is as large as possible. For $\gamma \to 1$, one can easily check that $l(\gamma, p_0) \to p_0$. From step 1, an upper bound on the inefficiency of the low-type manager is $s_H - s_L = \frac{p_0 - p_1}{p_0}$. Plugging this upper bound along with $D_H = s_H$ into equation (6), one can check that the value added by a takeover is zero. Since debt levels higher than $D_H$ will only make the takeover gain negative, it has been shown that the lower debt $D_H$ must be safe for a high-type manager who is committed to reorganize the firm. Using $D_H < s_H$ and plugging $l(p_0, \gamma) = p_0$ into equation (6), the debt $D_H$ will allow the takeover to happen if

$$p_0(1 - \beta^{NT})k(\bar{s} - s_L) + (1 - p_0)k(\bar{s} - s_H) \geq C. \quad (7)$$

Plugging $\beta^{NT}$ into equation (7) yields,

$$C \geq k \frac{s_H - s_L}{2} \frac{(1 - p_0)^2}{p_0 - p_1} \equiv \tilde{C}.$$

The above condition and the incentive compatibility conditions summarized in equation (5) can be simultaneously satisfied if there exists a level of takeover cost such that $C \geq \tilde{C}$, $C \leq [p_0 - (s_H - s_L)]k(\bar{s} - s_L)$, and $C \geq \tilde{C} \equiv (1 - p_0)k(\bar{s} - s_L)[1 - (s_H - s_L)]$. Clearly, it suffices to show that $[p_0 - (s_H - s_L)]k(\bar{s} - s_L) > \tilde{C}$, which is satisfied if $s_H - s_L < p_0 - \frac{p_1}{p_0 - p_1}$. Now, some simple algebra shows that $p_0 - \frac{p_1}{p_0 - p_1} < \frac{p_0 - p_1}{p_0}$, and $p_0 - \frac{p_1}{p_0 - p_1} > p_0 - p_1$ for any $p_0 > \frac{2}{3}$. Therefore, $D_H$ can keep the takeover threat alive while simultaneously allowing for the incentive compatibility conditions to obtain if $p_0 - p_1 < s_H - s_L \leq p_0 - \frac{p_1}{p_0 - p_1}$ and $p_0 > \frac{2}{3}$.

**Step 3: Dismissing the manager in financial distress**

Since $D^{NT}$ reveals the manager as a low type, the optimality of firing the incumbent follows trivially. For $D_H$, only the low-type manager can lead the firm into financial distress given the low- and the high-type manager’s strategy of reorganizing the firm. Therefore, Bayesian updating and the equilibrium strategies imply that a manager who leads the firm into distress under $D_H$ is a low type with probability 1, making it optimal for the shareholders to fire her. Any debt $D$ different from $D_H$ or $D^{NT}$ is out of the equilibrium path. Hence, $\text{prob}(s = s_L | D) = 1$ can be assigned, making it optimal for the shareholders to fire the
incumbent in financial distress.

**Step 4:** Semiseparating equilibrium satisfies the intuitive criterion

Testing whether the equilibrium satisfies the intuitive criterion requires assuming that there is no takeover under a proposed deviation $D^v$. For $D^v \leq s_H < D^{NT}$, the low-type manager is strictly better off under $D^v$ because the new debt will end the takeover threat while implying a lower probability of financial distress than $D^{NT}$. For $D^v > s_H$, the high-type manager will be in financial distress with positive probability. Hence, the intuitive criterion requires that there is no takeover and that financial distress does not trigger managerial turnover. The low-type manager reaches her first best with $D^v$, implying that the deviation does not prune the equilibrium. The semiseparating equilibrium thus satisfies the intuitive criterion.

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**Proof of Proposition 5**

Plugging $D^H = s_L + \beta^{NT} < s_H$ into equation (6) in the proof of Proposition 4 and equating it to the takeover cost $C$ yields the minimum probability $\gamma$—call it $\hat{\gamma}$—that allows a takeover to happen. The cutoff $\hat{\gamma}$ is implicitly defined by the equation $l(\hat{\gamma}, p_0) = 1 - \frac{C p_0}{C + \frac{(1-p_0)k(s-s_L)}{\hat{\gamma}}}$.

The proof that $\hat{\gamma}$ decreases with $C$ follows by showing that $l(\hat{\gamma}, p_0)$ increases with $\hat{\gamma}$, while the right-hand side of the equation decreases with $C$.

To prove that the semiseparating equilibrium in which high leverage conveys bad news breaks down when $C$ is sufficiently small, note that $D^H = s_L + \frac{\alpha^{NT} - p_0}{1-p_0}$ decreases with $C$ through $\alpha^{NT} = 1 - \frac{C}{k(s-s_L)}$, reaching $D^H = s_H$ at $\hat{C} = (1-p_0)k(s-s_L)[1-(s_H-s_L)]$. Since the proof of Proposition 4 showed that $D^H$ must be safe for the high-type manager, the semiseparating equilibrium breaks down for any $C < \hat{C}$.

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29 Differently from in the case in which $D^v$ is safe for the high-type manager, the set of types that may have led the firm to distress is now $T = \{s_L, s_H\}$. The intuitive criterion requires the low-type manager to be strictly better off in the equilibrium strategy than in $D^v$ for any best response of the shareholders given beliefs in $T$. 

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