Why Tender Offers Should be Financed with Debt

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Abstract

This paper shows that the profitability of tender offers for firms with widely dispersed shareholders depends greatly on the way the tender offer is financed. If the tender offer is financed with equity or cash from the raider's own pocket, any gains from future value improvements must be passed to the target shareholders to induce them to tender their shares. Consequently, the tender offer fails. In contrast, if the tender offer is financed with debt, the additional leverage introduced into the target firm's capital structure reduces the posttakeover share value and thereby allows the raider to extract at least part of the efficiency gain. The paper further considers the optimal choice of capital structure by an incumbent management facing a takeover threat. It is shown that an increase in leverage raises the bid premium but reduces the probability that the tender offer succeeds as it limits the raider's ability to borrow against the target's existing assets.

Keywords: Tender offer, leverage, free-rider problem.

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1 Introduction

One of the prominent characteristics of the 1980s takeover wave is the dramatic increase in the use of debt to finance takeovers. In spite of this fact, a large part of the tender offer literature implicitly assumes that the offer is financed with cash out of the raider's own pocket (e.g. Grossman and Hart 1980; Shleifer and Vishny 1986; Hirshleifer and Titman 1990; Burkart, Gromb, and Panunzi 1998).[1] In this paper, we examine whether the choice of tender offer financing matters. We consider three different sources of financing: debt, equity, and cash from the raider's own pocket. In accordance with the majority of the tender offer literature, we assume that the target firm is widely held.

If the tender offer is financed with equity or cash, the mode of financing has no effect on the target firm's capital structure, except that the identity of part of the shareholders changes: shares that were formerly held by the tendering shareholders are now held by the raider. But this implies that any future value improvement brought about by the raider is fully reflected in the posttakeover share value. Accordingly, the raider must pass the full value improvement to the target shareholders in the form of a bid premium to induce them to tender their shares (Grossman and Hart 1980). In the absence of a sufficiently large toehold, private benefits of control, or methods to dilute the claims of minority shareholders, this implies that the takeover is unprofitable.

If the tender offer is financed with debt, we assume that the debt is backed by the assets of the target firm. Given that the wealth of the acquiring party is typically too small to serve as collateral, this practice is standard. To provide the debtholders with legal access to the target's assets, the raider (more precisely: the shell corporation in whose name the debt was issued) and the target must merge. For an overview of possible types of mergers (e.g. two-party transactions, three-party transactions, triangular mergers, etc.), see Scharf, Shea, and Beck (1991). The effect of the merger on the posttakeover value of the target's shares is obvious. Due to the additional debt introduced into the target firm's capital structure, the posttakeover share value increases by an amount that is much smaller than the raider's value improvement. In fact, if the debt taken on by the raider is sufficiently large, the posttakeover share value may even fall below the target's initial net worth. As is shown, this implies that the raider can typically extract at least part of the potential efficiency gain. Our paper thus provides an explanation for the role of leverage in takeovers that is different from the standard tax argument (Kaplan 1989), or the argument that leverage mitigates the free cash flow problem (Jensen 1986).[2]

[1] An exception is the paper by Chowdhry and Nanda (1993).

[2] If all three arguments are considered simultaneously, the total effect of leverage on the posttakeover share value is ambiguous. On the one hand, for any given posttakeover value of the target's assets, an increase in the raider's leverage (where the proceeds are used to pay for the tendered shares, and to pay

In our model, we follow Burkart, Gromb, and Panunzi (1998) by assuming that the value improvement brought about by the raider is endogenous.[3] More precisely, we assume that after gaining control, the raider can expend costly effort to improve the value of the target firm's assets. This automatically puts an upper bound on the amount that the raider can borrow in equilibrium. The reason is that, if the debt is too high, it may be (ex post) optimal for the raider to exert no effort at all as most of the value improvement goes to the debtholders. This is a classic example of Myers' (1977) underinvestment problem. Accordingly, to provide the raider with sufficient incentives to improve the value of the target firm's assets, the debt level must not be too high. As is shown, the existence of an upper bound on the raider's debt is one of the reasons why the raider typically cannot extract the full efficiency gain.

For the most part of the paper, we assume that the incumbent management remains passive when it faces a takeover threat. If the incumbent management can respond to the takeover threat by changing the target firm's capital structure, the outcome depends on whether the management acts in its own interest or in the interest of its shareholders. If the management acts in its own interest, we assume that it maximizes its tenure. Consequently, it will try to prevent the takeover whenever this is possible. In this case, the management will typically reduce the target's market value (e.g. through a leveraged recapitalization or by selling off assets and distributing the proceeds to the shareholders) in order to limit the raider's ability to borrow against the target's existing assets. If the incumbent management acts in the interest of its shareholders, we assume that it maximizes the bid premium. In this case, a reduction in the target's market value is beneficial only up to a certain level (viz., the level where the raider's profit is just zero). If the market value is reduced beyond this level, the takeover becomes unprofitable for the raider and does not take place. An interesting implication of this is that for firms with a low initial market value, it may be optimal to increase the market value (e.g. by issuing new equity) to ensure that the takeover will be undertaken. This way, the target shareholders can extract the full efficiency gain.

In addition to the takeover literature, our paper is related to the literature on the strategic use of debt in bargaining. In Perotti and Spier (1993) and Dasgupta and Sengupta (1993), a firm increases its leverage to redistribute rents from workers (which are represented by a labor union) to shareholders. Like in our model, the surplus to be

fees to participating banks, lawyers, or the raider himself ("up-front fees")) reduces the posttakeover share value (direct effect). On the other hand, an increase in the raider's leverage increases the post-takeover share value due to the additional tax benefits and the reduction in the agency cost of free cash flow (indirect effect). We thank Andrei Shleifer for pointing this out.

[3] This assumption is not crucial. As is shown in Section 3, the basic effect of leverage on the outcome of the tender offer is the same if the value improvement is exogenous.

distributed is reduced by the face value of the additional debt. Given that the workers always get a constant fraction of the surplus and debt is sold at a fair price, this means that the shareholders must benefit from the increase in leverage.

The rest of the paper is organized as follows. Section 2 presents the basic model and examines the choice of tender offer financing for the case where the raider's value improvement is endogenous. The case of exogenous value improvements is considered in Section 3. Section 4 discusses the choice of capital structure by the incumbent management in the presence of a takeover threat. Section 5 presents the empirical implications of our model. Section 6 concludes. All proofs are provided in the Appendix.

2 Optimal Financing of Tender Offers

2.1 The Model

Consider a firm with atomistic shareholders facing a tender offer by a potential acquirer (the "raider"). We restrict attention to tender offers where the target shareholders receive cash in exchange for selling their shares.[4] The target's initial net worth (i.e. the market value of the target's assets net of any debt) is denoted by $w > 0$. We follow Burkart, Gromb, and Panunzi (1998) by assuming that the raider's value improvement is endogenous. More precisely, if the raider gains control, he can improve the value of the target firm's assets by $e \geq 0$. The sequence of events is as follows.

Stage 1:

In stage 1, the raider makes a bid b for the target's shares. The bid is conditional and unrestricted in the sense that the raider is obliged to purchase all shares tendered conditional upon attaining the relevant control majority $\hat{\beta} \in (0,1]$.[5] Prior to making his bid, the raider must decide how to raise the cash needed for the acquisition. We consider three possible sources of financing: debt, equity, and cash coming from the raider's own pocket. The details of the financing are publicly announced in conjunction with the bid.[6] As the disclosure of this information may affect the target shareholders'

[4] This is the setting considered in Grossman and Hart (1980), Shleifer and Vishny (1986), Hirshleifer and Titman (1990), and Burkart, Gromb, and Panunzi (1998). The optimal choice of the medium of exchange in acquisitions (cash, shares, or debt) is discussed in a related but separate strand of the literature (e.g. Hansen 1987; Fishman 1989; Eckbo, Giammarino, and Heinkel 1990).

[5] By "relevant control majority", we mean the fraction of shares necessary to engage in a merger with the target. For instance, in Delaware where more than half of the Fortune 500 firms are incorporated, the raider can effect a merger with the target if he owns at least 85 percent of the target's shares.

[6] Tender offer regulation typically requires the disclosure of this information. For instance, in the United States, Section 14(d) of the Williams Act requires that any party making a tender offer must

tender decision, we require that the shareholders are not fooled. That is, we require that after the shares are tendered, the raider has no incentive to deviate from his initial announcement. Finally, capital markets are assumed to be perfectly competitive, which implies that the holders of any securities issued by the raider must break even on average.

Stage 2:

In stage 2, the target shareholders simultaneously and non-cooperatively decide whether to tender their shares. The fraction of tendered shares is denoted by $\beta \in [0, 1]$. If $\beta < \hat{\beta}$, the takeover fails and no costs are incurred. If $\beta \geq \hat{\beta}$, the takeover succeeds and the raider pays $\beta b + c$, where $c > 0$ denotes the transaction cost associated with the takeover. In equilibrium, the funds raised in stage 1 must equal or exceed $\beta b + c$. To select among multiple equilibrium outcomes, we follow Burkart, Gromb, and Panunzi (1998) and use the Pareto-dominance criterion. In the context of atomistic shareholders, this criterion appears sensible as it eliminates "unreasonable" Nash equilibrium outcomes (e.g. where the takeover fails even though the raider bids strictly more than the posttakeover share value, or where the takeover succeeds even though the raider bids strictly less than the target's initial net worth).

Stage 3:

In stage 3, the raider chooses an effort level $e \geq 0$ (which represents the increase in the value of the target's assets) at private cost $\psi(e)$. If the raider is indifferent between two effort levels, we assume that he selects the higher effort level. The cost function $\psi(\cdot)$ is strictly increasing (except at $e = 0$) and strictly convex with $\psi(0) = 0$, $\psi'(0) = 0$, $\psi''(0) > 0$, and $\psi'(e) = 1$ for some $e > 0$. The following assumption ensures that a closed-form solution to the raider's problem of finding an optimal bid in stage 1 exists.

Assumption 1: $\frac{[\psi'(e)]^2}{\psi''(e)} < \psi(e)$ for all $e \geq 0$.

2.2 Equity or Cash Financing

If the acquisition is financed with equity or cash, the target's capital structure remains unchanged, except that a fraction β of the equity is now held by the raider. Consequently, any value improvement brought about by the raider is fully reflected in the posttakeover share value and must be passed to the target shareholders to induce them to tender (Grossman and Hart 1980). As the raider bears the full effort and transaction cost, this implies that the takeover is unprofitable and does not take place.

file a Schedule 14D-1 with the SEC where it describes in detail how the offer is financed.

2.3 Debt Financing

If the acquisition is financed with debt, the raider organizes a shell corporation that issues the debt and acts as the legal entity making the acquisition.[7] The debt issued by the shell corporation is denoted by D. Since the shell corporation has no assets, the debt must be backed by the assets of the target firm. Legally, this requires that after the target firm is acquired, the shell corporation and the target merge. In fact, "the merger is ... essential to permit the buyer to restructure the assets of the target company and use them to repay acquisition debt" (Scharf, Shea, and Beck 1991, p.331). Thus, the basic difference between equity or cash financing and debt financing is that debt financing affects the target firm's capital structure. More precisely, if the acquisition is financed with cash or equity, the posttakeover share value is $w + e$, whereas if the acquisition is financed with debt, the posttakeover share value is $\max\left[w + e - D, 0\right]$. To rule out that the claims of the target's existing debtholders are diluted by the merger, we assume that any debt taken on by the target firm prior to the merger is senior. Moreover, we restrict attention to standard debt contracts. Thus, if the posttakeover value of the target firm's (more precisely: merged firm's) assets net of senior debt is less than D, the shell corporation's debtholders get $w + e$ and the raider gets zero. Conversely, if $w + e \geq D$, the shell corporation's debtholders get D and the raider gets $\beta\left(w + e - D\right)$. For convenience, we assume that the interest rate is zero.

Denote by $V\left(e, D\right) = \max\left[w + e - D, 0\right]$ the posttakeover value of the target firm's (i.e. merged firm's) shares. The raider's overall payoff in stages 1-3 is then

$$\Pi = D - \beta b + \beta V\left(e, D\right) - \psi\left(e\right) - c. \tag{1}$$

The raider's problem is to find values of e, b, and D that maximize this expression subject to the zero-profit constraint of the shell corporation's debtholders and the constraint that the debt issued by the shell corporation must be sufficiently large to pay for the tendered shares and to cover the transaction cost. The game is solved by backward induction.

Stage 3:

In stage 3, the raider chooses an effort level e to maximize the value of his shares net of effort cost. He solves

$$\max_{e} \beta V\left(e, D\right) - \psi\left(e\right). \tag{2}$$

The solution to the raider's problem follows readily from inspection.

[7] This procedure is standard and is employed in most leveraged buyouts and acquisitions by corporate raiders. The advantage of a shell corporation is that the outcome of the tender offer is independent of the raider's personal wealth. Alternatively, we could have assumed that the raider is penniless.

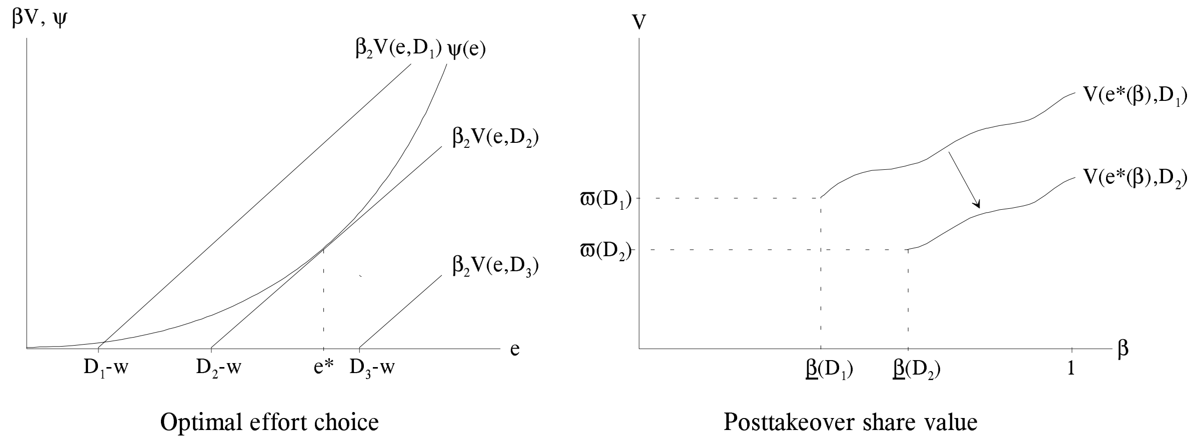


Figure 1: Illustration of Lemma 1

Lemma 1: *If $\psi(e) > \beta V(e,D)$ for all $e > 0$, the optimal effort level is $e^* = 0$. Conversely, if $\psi(e) \leq \beta V(e,D)$ for some $e > 0$, the optimal effort level is strictly positive and satisfies $\psi'(e^*) = \beta$.*

Lemma 1 is illustrated in Figure 1. The left picture shows the optimal effort choice for given values of D and β. Holding β fixed, an increase in the debt level from D_1 to D_2 does not affect the optimal effort choice. More generally, for any debt level $D \leq D_2$, the optimal effort choice is independent of D and uniquely characterized by the raider's first-order condition $\psi'(e^*) = \beta$. If, however, D is increased to D_3, the optimal effort choice is zero as most of the value improvement goes to the debtholders.

For any given debt level, there exists a value of β such that the payoff function $\beta V(e,D)$ is tangent to the effort cost function $\psi(e)$. Denote this value by $\underline{\beta}(D)$. By Lemma 1, the optimal effort level is then zero for all $\beta < \underline{\beta}(D)$, and strictly positive and increasing in β for all $\beta \geq \underline{\beta}(D)$. This relationship is depicted in the right picture in Figure 1. There, we assumed that $D_2 > D_1 > w$, from which it follows that the posttakeover share values $V(e^*(\beta), D_1)$ and $V(e^*(\beta), D_2)$ are zero if $\beta < \underline{\beta}(D_1)$ and $\beta < \underline{\beta}(D_2)$, respectively, and strictly positive and increasing in β for all other β.[8] The posttakeover share value at the point $\beta = \underline{\beta}(D)$ can be computed straightforwardly. For instance, in the case of D_2, the posttakeover share value at $\beta = \underline{\beta}(D_2)$ is

$$V(e^*(\underline{\beta}(D_2), D_2) = e^* - (D_2 - w) = \frac{\psi(e^*)}{\beta_2}\,. \tag{3}$$

[8] Incidentally, if $D < w$, the optimal effort level is strictly positive for all $\beta > 0$, which implies that $V(e^*(D), \beta)$ has no discontinuity (in other words, the critical level $\underline{\beta}(D)$ is zero).

For arbitrary values of D, the posttakeover share value at $\beta = \underline{\beta}(D)$ is then

$$V(e^*(\underline{\beta}(D), D) = \frac{\psi(e^*(\underline{\beta}(D))}{\underline{\beta}(D)} = \varpi(D). \tag{4}$$

Finally, consider the effect of an increase in the debt level on the posttakeover share value. First, observe that an increase in the debt level must shift the critical threshold $\underline{\beta}(D)$ to the right. For instance, if D increases from D_2 to D_3, the optimal effort level in the left picture in Figure 1 becomes zero. To make the raider again indifferent between exerting effort and exerting no effort, his equity share must increase from $\beta_2 = \underline{\beta}(D_2)$ to $\underline{\beta}(D_3)$ (not in the picture) such that the new payoff function $\beta V(e, D_3)$ is just tangent to the effort cost function. Second, for any given value of β such that $e^*(\beta, D_1) = e^*(\beta, D_2) > 0$, an increase in the debt level from D_1 to D_2 unambiguously reduces the posttakeover share value as it increases the value of the firm's liabilities while it leaves the value of the assets net of senior debt unchanged. Both effects of an increase in the debt level are depicted in the right picture in Figure 1.

To summarize, if the debt taken on by the raider exceeds the target's initial net worth, the posttakeover share value has a discontinuity at $\underline{\beta}(D) > 0$. If $\beta < \underline{\beta}(D)$, the raider's value improvement is zero. Since $D > w$, the posttakeover share value $V(e, D)$ is then also zero. On the other hand, if $\beta \geq \underline{\beta}(D)$, both the value improvement and the posttakeover share value are strictly positive. Moreover, the posttakeover share value is then strictly increasing in β, which reflects the fact that a greater share in the target firm induces the raider to choose a higher level of effort.

By inspection of the left picture in Figure 1, the maximum amount that the raider can borrow for any given value of β is the debt level at which $\beta V(e, D)$ is just tangent to the effort cost function. Hence, the raider can borrow any amount up to

$$\overline{D}(\beta) = w + e^*(\beta) - \frac{\psi(e^*(\beta))}{\beta}, \tag{5}$$

where $e^*(\beta)$ is defined by the raider's first-order condition. Note that $\overline{D}(\beta)$ is strictly less than the posttakeover value of the target's assets net of senior debt $w + e^*(\beta)$, which can be thought of as "collateral" for the raider's debt. The reason why the raider cannot borrow against the full value of the collateral is that he must have sufficient incentives in the form of residual income to produce this value in the first place. Accordingly, the shell corporation's debtholders' zero-profit condition is satisfied if and only if $D \leq \overline{D}(\beta)$. Any value of D that satisfies this constraint is called *feasible*.

We conclude with some comparative statics. Differentiating $\overline{D}(\beta)$ yields

$$\frac{d}{d\beta}\overline{D}(\beta) = \frac{d}{d\beta}e^*(\beta) - \frac{\psi'(e^*(\beta))}{\beta}\frac{d}{d\beta}e^*(\beta) + \frac{\psi(e^*(\beta))}{\beta^2} > 0, \tag{6}$$

where the inequality follows the raider's first-order condition. Hence, the maximum amount that the raider can borrow is strictly increasing in his share in the target firm. Intuitively, a higher share in the target firm improves the raider's incentives and thus the value of the assets that constitute the collateral for the raider's debt.

Stage 2:

In stage 2, the target shareholders non-cooperatively decide whether to tender their shares. Given that the tender decision of any individual shareholder does not affect the outcome of the bid, the price offered by the raider must equal or exceed the expected posttakeover share value for the bid to succeed. While this condition is necessary, it is not sufficient. If the raider's bid is less than the value of the target's initial net worth, the target shareholders are collectively better off if the bid fails. In other words, if $b < w$, "failure" is the unique Pareto-dominant Nash equilibrium outcome (recall that there always exists a Nash equilibrium where nobody tenders). Accordingly, for the bid to succeed, the price offered by the raider must also equal or exceed the target's initial net worth. The following lemma characterizes the set of Pareto-dominant Nash equilibrium outcomes for each possible bid b. It is shown that except when $b = w$, this set is a singleton. For convenience, let us write $V(e^*(\beta), D) = V(\beta, D)$.

Lemma 2: *Let* $\underline{V} = \max[V(\underline{\beta}(D), D), V(\hat{\beta}, D), w]$ *denote the lowest value of* $V(\beta, D)$ *such that* i) *the posttakeover share value equals or exceeds the target's initial net worth, and* ii) $\beta \geq \hat{\beta}$. *The game in which the target shareholders decide whether to tender their shares has the following Pareto-dominant Nash equilibrium outcomes.*

Case 1. $V(1, D) \leq w$.

i) If $b < w$, *the bid fails.*

ii) If $b = w$, *either the bid fails, or the bid succeeds and all shares are tendered.*

iii) If $b > w$, *the bid succeeds and all shares are tendered.*

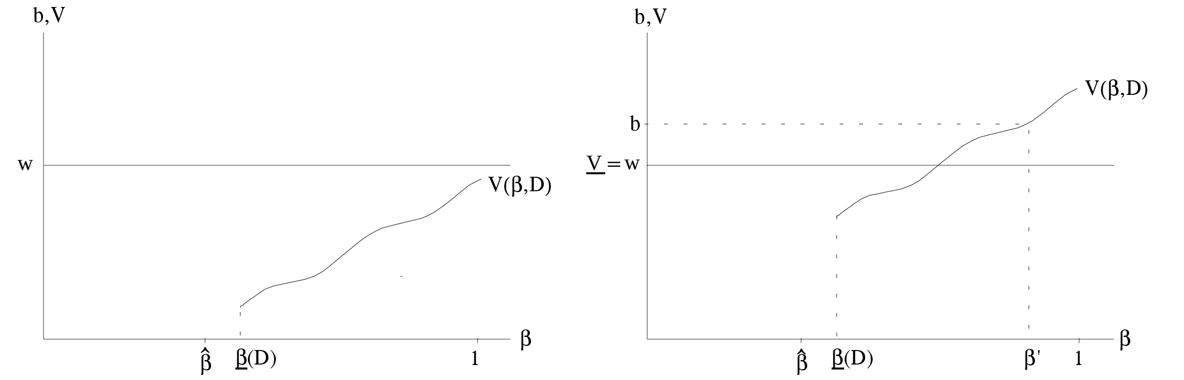
Case 2. $V(1, D) > w$.

i) If $b < \underline{V}$, *the bid fails.*

ii) If $b \in [\underline{V}, V(1, D)]$, *the bid succeeds and a fraction* β *of the shares is tendered such that* $b = V(\beta, D)$. *In the special case where* $b = w$, *there exists an additional Pareto-dominant equilibrium outcome where the bid fails.*

iii) If $b > V(1, D)$, *the bid succeeds and all shares are tendered.*

Lemma 2 is illustrated in Figure 2. In Case 1, the raider's debt is so high that the posttakeover share value is less than the target's initial net worth for all $\beta \geq \hat{\beta}$. If $b < w$, the bid must therefore fail as any Nash equilibrium where a fraction $\beta \geq \hat{\beta}$ is tendered



Case 1: Posttakeover share value is less than w for all β   Case 2: Posttakeover share value exceeds w for some β

Figure 2: Illustration of Lemma 2

is Pareto-dominated by an equilibrium where nobody tenders. If $b = w$, there exists a single Nash equilibrium where the bid succeeds. In this equilibrium, all shareholders tender with probability 1, which implies that their payoff is w. However, since "nobody tenders" yields also w, there exist two Pareto-dominant Nash equilibrium outcomes. Finally, if $b > w$, the raider's bid is strictly higher than the posttakeover share value for all $\beta \geq \hat{\beta}$. Accordingly, the game has a unique Pareto-dominant Nash equilibrium where the bid succeeds and all shareholders tender with probability 1.

In Case 2, the posttakeover share value exceeds the target's initial net worth for certain values of $\beta \geq \hat{\beta}$. If the raider's bid is lower than the lowest possible posttakeover share value under any of these β (Case 2 i)), there either exists no Nash equilibrium where the bid succeeds, or any Nash equilibrium where the bid succeeds yields strictly less than w and is therefore Pareto-dominated by an equilibrium where the bid fails. On the other hand, if the bid is higher than the highest possible posttakeover share value (Case 2 iii)), there exists a unique Pareto-dominant Nash equilibrium where all shareholders tender with probability 1. Finally, in the intermediate case where $b = V(\beta', D) \geq \underline{V}$ for some $\beta' \geq \hat{\beta}$ (Case 2 ii), there exists a Pareto-dominant Nash equilibrium outcome where the bid succeeds and a fraction $\beta = \beta'$ of the shares is tendered such that $b = V(\beta, D)$. This case is depicted in the right picture in Figure 2. The intuition is the same as in Burkart, Gromb, and Panunzi (1998). A special case arises if $b = w$. In this case, the equilibrium payoff is $\beta b + (1 - \beta) V(\beta, D) = w$, which implies that there exists an additional Pareto-dominant Nash equilibrium outcome where the bid fails.

Stage 1:

In stage 1, the raider chooses a debt level and a bid that maximize his expected utility, subject to two constraints: i) the debt level must be feasible, i.e. $D \leq \overline{D}(\beta)$, where β is the (rationally anticipated) fraction of tendered shares in stage 2, and ii) the funds raised must be sufficiently high to pay for the tendered shares and the transaction cost, i.e. $D \geq \beta b + c$. Analogous to Grossman and Hart (1983), the raider's optimization problem can be decomposed into two steps. In the first step, the raider determines for each possible value of $\beta \geq \hat{\beta}$ the values of D and b that implement β at the lowest possible cost. Recall from Lemma 1 (right picture in Figure 1) that each value of D uniquely defines a function $V(\beta, D)$. In conjunction with the raider's bid, this function induces a particular value of β. In the second step, the raider determines the value of β that maximizes his expected utility. As the following proposition shows, the solution to the raider's problem depends critically on the size of the target's initial net worth.

Proposition 1: *The tender offer game with debt financing has the following subgame perfect Nash equilibrium outcomes.*

Case 1. $\psi(e^*(1)) \leq w$ (*high initial net worth*).

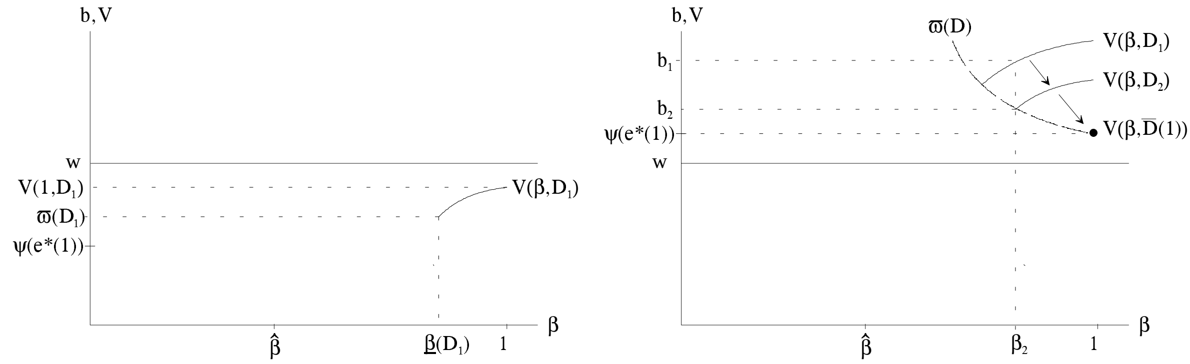
Equilibrium Outcome 1. If $e^*(1) - \psi(e^*(1)) \geq c$, *the raider chooses* D *such that* $V(1, D) \leq w$ *and offers* $b = w$. *All shares are tendered, and the raider chooses the efficient effort level* $e^*(1)$. *If* $e^*(1) - \psi(e^*(1)) < c$, *the takeover does not take place.*

Equilibrium Outcome 2. If $e^*(1) - \psi(e^*(1)) > c$, *the raider chooses* D *such that* $V(1, D) \leq w$ *and offers* $b = w + \varepsilon$, *where* ε *is small. All shares are tendered, and the raider chooses the efficient effort level* $e^*(1)$. *If* $e^*(1) - \psi(e^*(1)) \leq c$, *the takeover does not take place.*

Case 2. $\psi(e^*(1)) > w$ (*low initial net worth*).

If $w + e^*(1) - 2\psi(e^*(1)) \geq c$, *the raider chooses* $D = \overline{D}(1)$ *and offers* $b = V(1, \overline{D}(1)) = \psi(e^*(1))$. *All shares are tendered, and the raider chooses the efficient effort level* $e^*(1)$. *If* $w + e^*(1) - 2\psi(e^*(1)) < c$, *the takeover does not take place.*

Proposition 1 is illustrated in Figure 3. In Case 1, the raider can always find a debt level such that the posttakeover share value $V(1, D)$ is less than or equal to the target's initial net worth. To see this, suppose the raider chooses the maximum possible debt level $\overline{D}(1)$. In this case, the function $V(\beta, \overline{D}(1))$ is zero if $\beta < 1$ and equal to $\psi(e^*(1)) \leq w$ if $\beta = 1$. If $\psi(e^*(1))$ is strictly less than w, the raider can also push $V(1, D)$ below the target's initial net worth by choosing a debt level that is smaller than $\overline{D}(1)$. This is illustrated in the left picture in Figure 3, where the debt level $D_1 < \overline{D}(1)$ is chosen. Given that $V(1, D)$ is less than or equal to w, any equilibrium where the takeover succeeds must have $\beta = 1$ by Lemma 2, Case 1. To implement $\beta = 1$, the raider therefore either offers $b = w$ (if the bid succeeds at $b = w$), or $b = w + \varepsilon$,



Case 1: $\psi(e^*(1))$ is less than or equal to *w*

Case 2: $\psi(e^*(1))$ is greater than *w*

Figure 3: Illustration of Proposition 1

where ε is small (if the bid fails at $b = w$).[9] If the raider offers $b = w$, his payoff is

$$\Pi = e^* (1) - \psi (e^* (1)) - c. \tag{7}$$

Analogously, if the raider offers $b = w + \varepsilon$, his payoff is $\Pi - \varepsilon$. Observe that (7) constitutes the first-best efficiency gain and thus the maximum payoff that can be attained by the raider under any possible parameter constellation.

In Case 2, the raider cannot push the posttakeover share value below the target's initial net worth. In the right picture in Figure 3, the posttakeover share value $V(\beta, D)$ is drawn for three different debt levels: D_1, D_2 $(= \overline{D}(\beta_2))$, and $\overline{D}(1)$. Consider the problem of implementing β_2 at the lowest possible cost. The picture shows two possible ways of implementing β_2. Either the raider chooses $D = D_1$ and offers $b = b_1$, or he chooses $D = D_2$ and offers $b = b_2$. In either case, a fraction $\beta = \beta_2$ of the shares is tendered (Lemma 2, Case 2 ii). The raider's payoff is then

$$\begin{aligned} \Pi &= D_i - \beta_2 b_i + \beta_2 V(\beta_2, D_i) - \psi(e^*(\beta_2)) - c \\ &= D_i - \psi(e^*(\beta_2)) - c, \end{aligned} \tag{8}$$

where $i = 1, 2$. Since $D > D_1$, the raider's payoff under (D_2, b_2) is strictly greater than under (D_1, b_1). More generally, to implement a given value β at the lowest possible cost, the raider chooses the maximum debt level $D = \overline{D}(\beta)$ (in which case the posttakeover share value has a discontinuity at β) and offers $b = V(\beta, \overline{D}(\beta))$. This yields

$$\Pi = w + e^* (\beta) - \psi (e^* (\beta)) / \beta - \psi (e^* (\beta)) - c. \tag{9}$$

[9] Strictly speaking, the raider's problem has no solution as for any bid $b = w + \varepsilon > 0$, there exists a bid $b = w + \varepsilon/2$ that makes the raider strictly better off. In practive, this is no problem though as there always exists a smallest unit of payment.

Since the expression $\psi(e^*(\beta))/\beta$ is nonincreasing in β, the payoff function (9) is strictly increasing, which implies that the raider's payoff is maximized at $\beta = 1$.[10] The optimal solution in Case 2 is therefore $D = \overline{D}(1)$ and $b = V(1, \overline{D}(1))$.

Inserting $D = \overline{D}(1)$ and $b = V(1, \overline{D}(1))$ in the raider's payoff function (9) gives

$$\Pi = w + e^*(1) - 2\psi(e^*(1)) - c. \tag{10}$$

As $\psi(e^*(1)) > w$, this implies that the equilibrium payoff in Case 2 is strictly less than in Case 1 (cf. (7)). Intuitively, in both cases the efficiency gain is $e^*(1) - \psi(e^*(1)) - c$. However, in Case 1 the bid premium (i.e. the difference $b - w$) is either zero or ε (where ε is negligible), while in Case 2 the bid premium is equal to

$$b - w = \psi(e^*(1)) - w, \tag{11}$$

which is strictly positive. Accordingly, in Case 1 the raider can (almost) extract the full efficiency gain, whereas in Case 2 he must share part of the efficiency gain with the target shareholders. This is due to the fact that in Case 2 the raider cannot push the posttakeover share value below the target's initial net worth as his ability to borrow against the target's assets is limited by postttakeover moral hazard. Recall from (5) that the maximum amount that the raider can borrow is $\overline{D}(1) = w + e^*(1) - \psi(e^*(1))$, which yields a posttakeover share value of $V(1, \overline{D}(1)) = \psi(e^*(1)) > w$. However, because of the free-rider problem, any amount by which the posttakeover share value exceeds the target's initial net worth must be passed to the target shareholders in the form of a bid premium. The situation is different if there is no posttakeover moral hazard on the part of the raider. If the raider can contractually commit to choose the first-best effort $e^*(1)$, he can borrow any amount up to $w + e^*(1)$, which implies that he can always push the posttakeover share value below the target's initial net worth.

Finally, let us point out that the outcome characterized in Proposition 1 is socially inefficient. In Case 2, the takeover fails whenever $w + e^*(1) - 2\psi(e^*(1)) - c$ is negative. Thus, if the target's initial net worth is sufficiently low, the takeover may fail even though the efficiency gain $e^*(1) - \psi(e^*(1)) - c$ is strictly positive.

3 Exogenous Value Improvements

If there is no posttakeover moral hazard on the part of the raider, the equilibrium bid premium no longer depends on the size of the target's initial net worth. To see this, suppose the value improvement (net of effort cost) is given by some constant amount

[10] To see that $\psi(e^*(\beta))/\beta$ is nonincreasing in β, note that $d[\psi(e^*(\beta))/\beta]/d\beta = 1/\psi''(e^*(\beta)) - \psi(e^*(\beta))/\beta^2$, where $\beta = \psi'(e^*(\beta))$. By Assumption 1, this expression is either zero or negative.

$v \geq 0$. As there are no incentive constraints, the maximum amount that the raider can borrow is $w + v$, which implies that he can always push the posttakeover share value below the target's initial net worth. By Proposition 1 (Case 1), the bid premium is then either zero or ε and therefore independent of w. Denote the posttakeover share value for the case where the raider's value improvement is exogenous by $V_X = \max[w + v - D, 0]$. The following results are the counterparts to Lemma 2 and Proposition 1, respectively. The proofs are analogous to those of Lemma 2 and Proposition 1.

Lemma 3: *If the raider's value improvement is exogenous, the game in which the target shareholders decide whether to tender their shares has the following Pareto-dominant Nash equilibrium outcomes.*

Case 1. $V_X < w$.

i) If $b < w$, the bid fails.
ii) If $b = w$, either the bid fails, or the bid succeeds and all shares are tendered.
iii) If $b > w$, the bid succeeds and all shares are tendered.

Case 2. $V_X \geq w$.

i) If $b < V_X$, the bid fails.
ii) If $b = V_X$, the bid succeeds and a fraction $\beta \in [\hat{\beta}, 1]$ of the shares is tendered. In the special case where $b = w$, there exists an additional Pareto-dominant equilibrium outcome where the bid fails.
iii) If $b > V_X$, the bid succeeds and all shares are tendered.

Observe that in Case 2 ii), there exists a continuum of Pareto-dominant Nash equilibrium outcomes. If the raider offers $b = V_X$, each individual shareholder is indifferent between tendering and not tendering conditional upon the fact that the bid succeeds. Accordingly, each $\beta \in [\hat{\beta}, 1]$ is a Pareto-dominant Nash equilibrium outcome.

Proposition 2: *The tender offer game with debt financing and exogenous value improvements has the following subgame perfect Nash equilibrium outcomes.*

Equilibrium Outcome 1. If $v \geq c$, the raider chooses D such that $w + v - D \leq w$ and offers $b = w$. Either all shares are tendered (if $D > v$), or a fraction $\beta \in [\hat{\beta}, 1]$ of the shares is tendered (if $D = v$). If $v < c$, the takeover does not take place.

Equilibrium Outcome 2. If $v > c$, the raider chooses D such that $w + v - D \leq w$ and offers $b = w + \varepsilon$, where ε is small. Subsequently, all shares are tendered. If $v \leq c$, the takeover does not take place.

Incidentally, in the first equilibrium outcome, the raider's payoff is always $v - c$ regardless of whether $D = v$ and a fraction $\beta \in [\hat{\beta}, 1]$ of the shares is tendered, or $D > v$

and all shares are tendered. The reason is that, unlike in the case where the raider's value improvement is endogenous, the posttakeover share value conditional upon the fact that the takeover succeeds does not depend on the fraction of tendered shares β.

4 Defensive Capital Structure Changes

Up to this point, we have assumed that the incumbent management remains passive when it faces a tender offer. Clearly, this is a strong assumption since by controlling the target's capital structure (more precisely: by controlling the target's net worth w), the management can affect the profitability of the tender offer (cf. Proposition 1). For instance, the incumbent management can increase w by issuing new equity, and it can reduce w through a leveraged recapitalization or special dividend payout. This section investigates the optimal choice of the target's initial net worth by the incumbent management under two alternative scenarios: i) the incumbent management acts in the interest of its shareholders, and ii) the incumbent management acts in its own interest.

4.1 Management Acts in the Interest of Shareholders

If the incumbent management acts in the interest of its shareholders, we assume that it maximizes the bid premium. As was shown in Proposition 1, the size of the bid premium depends crucially on the relation between the target's initial net worth and the posttakeover share value $V(1, \overline{D}(1)) = \psi(e^*(1))$. If w is equal to or greater than $\psi(e^*(1))$, the bid premium is either zero or ε, whereas if w is less than $\psi(e^*(1))$, the bid premium is $\psi(e^*(1)) - w > 0$ (cf. (11)). Thus, by reducing the target's net worth, the incumbent management can raise the bid premium. An upper bound for the bid premium (and hence a lower bound for the target's net worth) is given by the raider's equilibrium payoff (10). If $w < -e^*(1) + 2\psi(e^*(1)) + c$, the takeover fails and the gains realized by target shareholders are zero. This provides us with the following Proposition.

Proposition 3: *Denote by $E = e^*(1) - \psi(e^*(1)) - c$ the equilibrium efficiency gain if the tender offer is financed with debt. If the incumbent management acts in the interest of its shareholders, the optimal choice of the target's net worth is*

i) $w = 0 + \varepsilon$, *where ε is small, if* $E \geq \psi(e^*(1))$,
ii) $w = \psi(e^*(1)) - E$ *if* $\psi(e^*(1)) > E > 0$, *and*
iii) $w \geq 0$ *if* $0 \geq E$.

In case i), the efficiency gain is so large that the raider's equilibrium payoff is non-negative for all values of w. Given that the takeover takes place at any rate, the payoff to the target shareholders is maximized if w is chosen as low as possible (for technical reasons, we have ruled out the case where w can be zero). The bid premium is then $\psi(e^*(1)) - \varepsilon$,which is strictly positive. Consequently, the raider's equilibrium payoff is

$$\Pi = E - \psi(e^*(1)) + \varepsilon, \tag{12}$$

which implies that he must share a strictly positive fraction of the efficiency gain with the target shareholders. Intuitively, by reducing the target's net worth, the incumbent management limits the raider's ability to borrow against the target's assets as it reduces the collateral for the raider's debt. In particular, the raider cannot raise enough debt to push the posttakeover share value below the target's initial net worth. But as was argued earlier, any amount by which the posttakeover share value exceeds the target's initial net worth must be passed to the target shareholders in the form of a bid premium. Thus, reducing the target's net worth to zero (plus ε) is optimal.

In case ii), the efficiency gain is still positive, but the takeover fails for low values of w because the raider's ability to borrow against the target's assets is limited by posttakeover moral hazard. In this case, setting the target's net worth equal to zero is not optimal. However, if w is set equal to $\psi(e^*(1)) - E > 0$, the raider can raise just enough funds so that his equilibrium payoff is zero. Consequently, the takeover (just) takes place. The bid premium is then $b - w = E$, which implies that the target shareholders can extract the full efficiency gain. This case is of particular interest because it shows that it need not always be optimal to reduce the target's net worth. On the contrary, if the target's initial net worth is low, it may be optimal to increase w (e.g. through a new equity issue) to ensure that the takeover takes place.

Finally, in case iii) the raider's equilibrium payoff is zero if both $E = 0$ and $w \geq \psi(e^*(1))$, and strictly negative for all other values of E and w. In the former case, the takeover materializes and the bid premium is zero, whereas in the latter case, the takeover fails.[11] Accordingly, the payoff to the target shareholders is zero for all $w \geq 0$, which implies that the choice of the target's net worth is irrelevant.

To summarize, a reduction in the target's net worth benefits the target shareholders up to the level where the raider's profit is zero. If the target's net worth is reduced beyond this level, the raider's profit becomes negative and the takeover does not take place. A similar point is made by Israel (1991), who examines the choice of the target's capital structure by an incumbent management which acts in the interest of its shareholders. As in our model, an increase in the debt level (i.e. a reduction in the target's net worth) lowers the likelihood that the takeover materializes, but increases the gains to the target

[11] Incidentally, if $E = 0$ and $w \geq \psi(e^*(1))$, there exists a second equilibrium outcome where the raider's equilibrium payoff is $-\varepsilon$ and the takeover fails (cf. Proposition 1, Case 1).

shareholders if the takeover materializes. Unlike in our model, however, the gains to the target shareholders come from an appreciation in the value of the target's debt. Since the appreciation is fully anticipated and debt is sold at a fair price, the target shareholders can extract these gains ex ante from potential debtholders.

4.2 Management Acts in Its Own Interest

If the incumbent management acts primarily in its own interest, we assume that it maximizes its tenure. Hence, whenever the success of the takeover depends on the size of the target's initial net worth, the incumbent management chooses w sufficiently low to ensure that the takeover fails. On the other hand, if the takeover either fails or takes place at any rate, the incumbent management is indifferent with respect to its choice of w. The proof of the following proposition is analogous to that of Proposition 3.

Proposition 4: *Denote by* $E = e^*(1) - \psi(e^*(1)) - c$ *the equilibrium efficiency gain if the tender offer is financed with debt. If the incumbent management acts in its own interest, the optimal choice of the target's net worth is*

i) $w \geq 0$ *if either* $E \geq \psi(e^*(1))$ *or* $E < 0$, *and*
ii) $w < \psi(e^*(1))$ *if* $\psi(e^*(1)) > E \geq 0$.

In case ii), the incumbent management reduces the target's net worth to ensure that the raider cannot borrow enough funds for the takeover to materialize. A simple way of doing this is by issuing additional debt and distributing the proceeds to the target shareholders. Our model therefore provides a rationale for the use of debt as a takeover defense which differs from both Stulz (1988) and Harris and Raviv (1988). In both papers, the incumbent management increases the firm's debt to repurchase equity from outsiders, thereby concentrating the voting power in the hands of the management.

5 Empirical Implications

One of the most robust findings in the empirical takeover literature is the existence of substantial bid premia (Jensen and Ruback 1983; Jarrell, Brickley, and Netter 1988). In Section 2, the equilibrium bid premium can assume any value from zero to the maximum possible value $e^*(1) - \psi(e^*(1)) - c$. From a theoretical perspective, the possibility of a zero bid premium is interesting because it shows that, contrary to what is commonly believed, the presence of atomistic shareholders alone is not necessarily sufficient to obtain substantial bid premia.[12] From a practical viewpoint, however, this result is unsatisfactory. As is shown in Section 4, the problem largely disappears if we allow the incumbent management to adjust the target's net worth when it faces a concrete takeover threat. In this case, the bid premium is always strictly bounded away from zero. Moreover, if the efficiency gain is not too large, the target shareholders can even extract the full efficiency gain, which is consistent with the empirical observation that the gains to the acquiring firm's shareholders are typically negligible. A second factor that drives up bid premia which is not considered here is bidding competition. The positive effect of bidding competititon on the returns to target shareholders is documented in several empirical studies (Bradley, Desai, and Kim 1988; Stulz, Walkling, and Song 1990). Besides, our model provides the following testable empirical implications.

Implication 1: *The return to the target shareholders is decreasing in both the raider's leverage and the target's initial net worth.*

Implication 1 follows from Proposition 1. In Case 1 the bid premium is either zero or ε, whereas in Case 2 the bid premium is $\psi(e^*(1)) - w$, which is decreasing in w. Additionally, in Case 2 an increase in the debt level from $D < \overline{D}(1)$ to the upper bound $\overline{D}(1)$ unambiguously reduces the bid premium. Observe, however, that the monotonic relationship between D and the bid premium only holds for sufficiently low values of D. If the debt level is so high that the posttakeover share value $V(1, D)$ is strictly less than the target's initial net worth (Case 1), a small change in the debt level has no effect on the bid premium. Empirical support for Implication 1 comes from Lang, Stulz, and Walkling (1991), who find that the returns to the target shareholders are negatively correlated with both the raider's debt and the market value of the target firm.

Implication 2: *The return to the raider is inreasing in both his leverage and the target's initial net worth.*

Implication 2 is the counterpart to Implication 1. Empirical support for Implication 2 is provided by Maloney, McCormick, and Mitchell (1993), who report a positive relation between the return to the raider and his long-term debt-equity ratio, and Lang, Stulz, and Walkling (1991), who show that the return to the raider is positively correlated with the market value of the target firm.

Implication 3: *The probability of becoming a takeover target is greater for firms with a high initial net worth.*

[12] In most models of tender offers with atomistic shareholders, the bid premium is large because of the implicit assumption that the acquisition is financed with cash from the raider's own pocket.

Implication 3 is an immediate consequence of Proposition 1. Empirical support for this implication comes from Palepu (1986), who finds that an increase in the target firm's leverage leads to a lower probability of being taken over.[13]

Implication 4: *On average, the value added by a takeover is greater for target firms with a low initial net worth.*

The logic is the same as in Implication 3. If the target's initial net worth is greater than or equal to $\psi(e^*(1))$, the value improvement brought about by the raider must equal or exceed $\psi(e^*(1)) + c$ for the takeover to take place. Conversely, if the target's initial net worth is less than $\psi(e^*(1))$, the value improvement must equal or exceed $2\psi(e^*(1)) + c - w$, which is strictly greater than $\psi(e^*(1)) + c$.

Implication 5: *Capital structure changes can be used to deter takeovers.*

Implication 5 follows from our discussion of defensive capital structure changes in Section 4. Empirical support for this implication is provided by DeAngelo and DeAngelo (1985), and Dann and DeAngelo (1988).

6 Concluding Remarks

The central result of this paper is that the profitability of (cash) tender offers for widely held firms depends greatly on the way the tender offer is financed. If the tender offer is financed with either equity or cash from the raider's own pocket, any gains from future value improvements must be passed to the target shareholders in the form of a bid premium to induce them to tender their shares. Thus, in the absence of sufficiently large toeholds (Shleifer and Vishny 1986), private benefits of control (Burkart, Gromb, and Panunzi 1998), or means to dilute the property rights of minority shareholders (Grossman and Hart 1980; Bradley 1980), the takeover is unprofitable and does not take place. In contrast, if the tender offer is financed with debt, the additional leverage introduced into the merged firm's capital structure reduces the posttakeover share value and thereby allows the raider to extract at least part of the efficiency gain.

Consistent with our story, leverage played a major role in the 1980's takeover wave in the United States. In particular, highly leveraged transactions such as LBOs gained increasing importance. In the period between 1980 and 1988, the volume of LBOs

[13] See also Proposition 3. Note that an increase in the target firm's debt per se does not reduce the target's net worth. What is needed is that the proceeds from the debt issue are somehow distributed to the target shareholders, e.g. in the form of a special dividend payout or equity repurchase.

increased from \$236 million to \$71.9 billion (U.S. Bureau of the Census 1990, 1993; the \$71.9 billion include the \$24.8 billion from the RJR Nabisco deal). But also the relative importance of LBOs rose steadily. In 1986, two years before the takeover wave reached its peak, LBOs already represented 39 percent of all public acquisitions (Jensen 1988). Also consistent with our story is the fact that the takeover wave experienced a sharp decline when the junk bond market collapsed in 1990. Between 1989 and 1990, the value of LBOs fell by 62 percent and that of all transactions by 51 percent.

Furthermore, it was shown that a reduction in the target's net worth (e.g. through a leveraged recapitalization or special dividend payout) limits the raider's ability to borrow against the target's assets (more precisely: it limits the raider's ability to push the posttakeover share value below the target's initial net worth) and thereby makes the takeover less profitable. There exist numerous examples where firms reduced their net worth in response to a concrete takeover threat. For instance, Polaroid bought 22 percent of its shares and put them into a new employee stock ownership plan when threatened by a raider (Milgrom and Roberts 1992, p.485). Likewise, the restructurings by oil companies facing a takeover threat such as Phillips or Unocal involved substantial increases in cash dividends and the repurchase of equity in the range of 25 to 53 percent (Jensen 1986). A particularly effective way of limiting the raider's ability to borrow against the target's assets is the sale of assets that are particularly valuable ("crown jewels"). An example of a crown jewel sale is the option given by Marathon Oil to USX to acquire one of Marathon's most valuable oil fields at a bargain price if some other firm made an attempt to gain control of Marathon (Milgrom and Roberts 1992, p.516).

7 Appendix

Proof of Lemma 1: If $\psi(e) > \beta V(e, D)$ for all $e > 0$, the function $\beta V(e, D) - \psi(e)$ is strictly negative for all $e > 0$ and zero for $e = 0$. Accordingly, the optimal effort level is $e^* = 0$. Conversely, if $\psi(e) \leq \beta V(e, D)$ for some $e > 0$, $\beta V(e, D) - \psi(e)$ has a global maximum at $e^* > 0$, where e^* is implicitly defined by $\beta = \psi'(e^*)$. If $\beta V(e^*, D) > \psi(e^*)$, this maximum is unique. If $\beta V(e^*, D) = \psi(e^*)$, there exists a second global maximum at $e^* = 0$, which implies that the raider is indifferent between $e^* = 0$ and $e^* > 0$. In this case, our assumption that the raider chooses the higher effort level applies. ■

Proof of Lemma 2: First, observe that for all $\beta < \hat{\beta}$, there exists a symmetric Nash equilibrium where all shareholders tender with probability $\beta < \hat{\beta}$. Thus, "the bid fails" is always an equilibrium outcome, which implies that any equilibrium with payoff strictly less than w is Pareto-dominated by an equilibrium where the bid fails. Moreover, as $V(\beta, D)$ is positive and strictly increasing in β for all $\beta \geq \underline{\beta}(D)$ and zero for all $\beta < \underline{\beta}(D)$, Case 1 is equivalent to "$V(\beta, D) \leq w$ for all β" (with strict inequality if $\beta < 1$), and Case 2 is equivalent to "$V(\beta, D) > w$ for some (or all) β".

Case 1. If $b < w$, any Nash equilibrium where the bid succeeds has a payoff strictly less than w and is therefore Pareto-dominated by a Nash equilibrium where the bid fails. If $b = w$, there exists a

Nash equilibrium with payoff w where all shareholders tender with probability 1. Since $V(\beta, D) < w$ for all $\beta < 1$, any unilateral deviation is strictly unprofitable. Furthermore, there cannot exist a Nash equilibrium with outcome $\beta \in [\hat{\beta}, 1)$ as any single shareholder can gain by deviating and tendering with probability 1. Thus, "the bid fails" and "the bid succeeds and all shares are tendered" are the unique Pareto-dominant Nash equilibrium outcomes if $b = w$. By the same reasoning, "all shareholders tender with probability 1" is the unique Pareto-dominant Nash equilibrium outcome if $b > w$.

Case 2. If $b < \underline{V}$, there either exists no Nash equilibrium where the bid succeeds as $b < V(\beta, D)$ for all $\beta \geq \hat{\beta}$ (this is the case if $\underline{V} > w$ and $\underline{\beta}(D) < \hat{\beta}$), or any Nash equilibrium where the bid succeeds yields strictly less than w and is therefore Pareto-dominated by a Nash equilibrium where the bid fails (this is the case if $\underline{V} = w$, or if $\underline{V} > w$ and $\underline{\beta}(D) > \hat{\beta}$). If $b \in [\underline{V}, V(1, D)]$, there exists for each b a Nash equilibrium outcome where the bid succeeds and a fraction $\beta \geq \hat{\beta}$ is tendered such that $b = V(\beta, D)$ (see Burkart, Gromb, and Panunzi (1998) for details). Moreover, as $V(\beta, D)$ is strictly increasing, there cannot exist another Nash equilibrium outcome where the bid succeeds. However, in the special case where $b = w$, the equilibrium payoff is exactly equal to w, which implies that there exists an additional Pareto-dominant Nash equilibrium outcome where the bid fails. Finally, if $b > V(1, D)$, there exists a Nash equilibrium where the bid succeeds and all shareholders tender with probability 1 (any unilateral deviation is unprofitable as $b > V(1, D)$). Since $b > w$, this Nash equilibrium Pareto-dominates any Nash equilibrium where the bid fails. Furthermore, as $b > V(\beta, D)$ for all $\beta \geq \hat{\beta}$, another Nash equilibrium where the bid succeeds cannot exist. ■

Proof of Proposition 1: If the raider chooses the maximum debt level $\overline{D}(1)$, the posttakeover share value $V(\beta, \overline{D}(1))$ is zero for all $\beta < 1$ and equal to $\varpi(\overline{D}(1)) = \psi(e^*(1))$ for $\beta = 1$. Accordingly, if $\psi(e^*(1)) \leq w$ (Case 1), there must exist a debt level $D \leq \overline{D}(1)$ such that $V(1, D) \leq w$. Conversely, if $\psi(e^*(1)) > w$ (Case 2), it must hold that $V(1, D) > w$ for all $D \leq \overline{D}(1)$.

Case 1. Suppose the raider chooses $D \leq \overline{D}(1)$ such that $V(1, D) \leq w$ and offers $b = w$. By Lemma 2 (Case 1 ii)), there exist two equilibrium outcomes. Either i) all shares are tendered, or ii) the bid fails. In case i), the raider's payoff is

$$\begin{aligned} \Pi &= D - w + V(1, D) - \psi(e^*(1)) - c \\ &= e^*(1) - \psi(e^*(1)) - c, \end{aligned} \tag{13}$$

which represents the first-best efficiency gain and thus the maximum payoff that can be attained by the raider. Therefore, choosing D such that $V(1, D) \leq w$ and offering $b = w$ is indeed optimal. Moreover, this equilibrium is unique as any other choice of D or b yields strictly less than (13). If $V(1, D) \leq w$ but $b < w$, the bid fails, and if $V(1, D) \leq w$ but $b > w$, all shares are tendered and the raider's payoff is $\Pi - (b - w)$, which is strictly less than (13) (Lemma 2, Case 1 i) and iii)). The case where D is such that $V(1, D) > w$ is discussed below. In case ii), offering $b = w$ cannot be an equilibrium. However, if the raider offers $b = w + \varepsilon$, where ε is small, all shares are tendered (Lemma 2, Case 1 iii)) and the raider's profit is $\Pi - \varepsilon$, which is "almost" equal to the first-best payoff (cf. footnote 9). It remains to be shown that the raider has no incentive to deviate from the announced debt level ex post and that the constraints $D \leq \overline{D}(\beta)$ and $D \geq \beta b + c$ are both satisfied. First, note that the raider has no incentive to deviate from the announced debt level as any decrease in D increases $V(1, D)$ by the same amount and therefore leaves (13) unchanged. Moreover, as $D \leq \overline{D}(1)$ and all shares are tendered in equilibrium, the first constraint is obviously satisfied. With regard to the second constraint, suppose that $D = \overline{D}(1)$. Given that $\Pi \geq 0$ (which is the case if $b = w$), it follows that

$$\overline{D}(1) \geq \psi(e^*(1)) - V(1, \overline{D}(1)) + \beta b + c. \tag{14}$$

However, if $D = \overline{D}(1)$, $\psi(e^*(1))$ must equal $V(1, \overline{D}(1))$, from which it follows that $\overline{D}(1) \geq \beta b + c$. The case where $\Pi > 0$ and $b = w + \varepsilon$ is analogous.

Case 2. Suppose the raider chooses $D = \overline{D}(1)$ and offers $b = \varpi(\overline{D}(1)) = \psi(e^*(1))$. The function $V(\beta, \overline{D}(1))$ is zero for all $\beta < 1$ and equal to $\psi(e^*(1)) > w$ at $\beta = 1$ (this is the thick dot in the right picture in Figure 3). By Lemma 2 (Case 2 ii)), all shares are tendered and the posttakeover share value is equal to $V(1, \overline{D}(1)) = \psi(e^*(1))$. Therefore, the raider's payoff is

$$\begin{aligned} \Pi &= \overline{D}(1) - \psi(e^*(1)) + V(1, \overline{D}(1)) - \psi(e^*(1)) - c \\ &= w + e^*(1) - 2\psi(e^*(1)) - c. \end{aligned} \tag{15}$$

We now show that any other combination of D or b yields a payoff that is strictly less than (15). First, suppose that $D = \overline{D}(1)$ but $b > \psi(e^*(1))$. By Lemma 2 (Case 2 iii)), the bid succeeds and all shares are tendered. Accordingly, the raider's payoff is $\Pi - (b - \psi(e^*(1)))$, which is strictly less than (15). Likewise, suppose that $D = \overline{D}(1)$ but $b < \psi(e^*(1))$. By Lemma 2 (Case i)), the bid fails. Next, suppose that $D < \overline{D}(1)$ (recall that any debt level $D > \overline{D}(1)$ is not feasible). By Lemma 2 (Case 2 i)), any bid $b < \underline{V}$ fails. Moreover, from Lemma 2 (Case 2 ii) and iii)) it follows that any bid $b > V(1, D)$ is dominated by $b = V(1, D)$. Finally, if $b \in [\underline{V}, V(1, D)]$, a fraction β of the shares is tendered such that $b = V(\beta, D)$ (Lemma 2, Case 2 ii)) (note that $\underline{V} > w$ because $\varpi(\overline{D}(1)) = \psi(e^*(1)) > w$, and because $\varpi(D)$ is nonincreasing in β by Assumption 1 (cf. footnote 10)). Thus, the raider's payoff is

$$\Pi = D - \psi(e^*(\beta)) - c. \tag{16}$$

Since D must satisfy the constraint $D \leq \overline{D}(\beta)$, (16) is bounded from above by

$$\Pi = w + e^*(\beta) - \psi(e^*(\beta))/\beta - \psi(e^*(\beta)) - c. \tag{17}$$

By Assumption 1, $\psi(e^*(\beta))/\beta$ is nonincreasing in β (cf. footnote 10), which implies that (17) is strictly less than (15) for all $D < \overline{D}(1)$. It remains to be shown that the raider has no incentive to deviate from the announced debt level ex post and that the constraints $D \leq \overline{D}(\beta)$ and $D \geq \beta b + c$ are both satisfied. First, note that the raider has no incentive to deviate from $D = \overline{D}(1)$ because any decrease in D increases $V(1, D)$ by the same amount. Moreover, since $D = \overline{D}(1)$ and all shares are tendered in equilibrium, $D \leq \overline{D}(\beta)$ is obviously satisfied. Given that (15) is nonnegative, it follows that

$$\overline{D}(1) \geq -V\left(1, \overline{D}(1)\right) + \psi(e^*(1)) + \beta b + c. \tag{18}$$

However, since $V\left(1, \overline{D}(1)\right) = \psi(e^*(1))$, it must necessarily be true that $\overline{D}(1) \geq \beta b + c$.

Finally, it remains to be shown that any D such that $V(1, D) > w$ is never optimal in Case 1. Given that $V\left(1, \overline{D}(1)\right) < w$, it must be true that $D < \overline{D}(1)$. By the same argument as in Case 2, the raider's payoff is then bounded from above by (17), which is strictly less than (13) for all β. ■

Proof of Proposition 3: Remark: all results follow immediately from Proposition 1.

Case i) If $w < \psi(e^*(1))$, the raider's equilibrium payoff is $w + E - \psi(e^*(1))$, and if $w \geq \psi(e^*(1))$, the equilibrium payoff is either E or $E - \varepsilon$. Since the raider's equilibrium payoff is nonnegative in both cases, the takeover takes place regardless of the value of w. If $w \geq \psi(e^*(1))$, the bid premium is either 0 or ε, whereas if $w < \psi(e^*(1))$, the bid premium is $b - w = \psi(e^*(1)) - w$,which is maximized at $w = 0 + \varepsilon$ (cf. footnote 9).

Case ii) If $w < \psi(e^*(1)) - E$, the raider's equilibrium payoff is strictly negative and the takeover does not take place. On the other hand, if $w \geq \psi(e^*(1)) - E$, the raider's equilibrium payoff is nonnegative and the takeover materializes (if $w \geq \psi(e^*(1))$, the equilibrium payoff is either $E > 0$ or $E - \varepsilon \geq 0$, and if $\psi(e^*(1)) > w \geq \psi(e^*(1)) - E$, the equilibrium payoff is $w + E - \psi(e^*(1)) \geq 0$). The bid premium is then either zero or ε (if $w \geq \psi(e^*(1))$), or equal to $\psi(e^*(1)) - w$ (if $\psi(e^*(1)) > w \geq \psi(e^*(1)) - E$). Since $\psi(e^*(1)) - w$ is strictly decreasing in w, the optimal value of w is $w = \psi(e^*(1)) - E$.

Case iii) If $E < 0$, the takeover necessarily fails as the raider's equilibrium payoff is bounded from above by E. If $E = 0$, the takeover either fails (if $w < \psi(e^*(1))$ or if $w \geq \psi(e^*(1))$ and $b = w + \varepsilon$), or it materializes (if $w \geq \psi(e^*(1))$ and $b = w$). Since the payoff to the target shareholders is zero regardless of the value of w, any $w \geq 0$ is optimal. ■

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