# Debt, Information Acquisition and the Takeover Threat

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June 1998

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**Abstract**

In this paper we formalize the information acquisition process by a potential bidder and its relationship with the target firm's capital structure. We show that debt increases prior to an acquisition are negatively related to the precision of the bidder's information. Incumbent managers, by means of leverage, offset shareholders' losses derived from information acquisition about the firm's prospects by potential acquirors. This explanation for the use of capital structure to deter rivals for control complements the ones provided by the existent literature. We test our model with a sample of 739 U.S. targets of hostile tender offers, and show that informational variables (such as toehold size and nature of target and bidder industries) are significant determinants of the decision to adjust leverage. Additionally, we provide evidence on the effects of capital structure on bid prices. The paper shows that target firms display slightly higher debt levels than their industry peers, and that target firms significantly reduce leverage in the year prior to the tender offer announcement. The latter result indicates that leverage favors entrenchment prior to battles for control, although incumbent managers use gearing to benefit from the takeover when its announcement is imminent.

# 1 Introduction

Extant literature on takeovers has tried to investigate the role of the target firm's financial policy in deterring or, at least taking advantage of potential acquirors. The first effect of a debt increase in the dates preceding battles for control is on the firm's ownership structure. Leverage is a way for the incumbent management to increase its proportional equity ownership and thus its control over the takeover outcome (Harris and Raviv (1988), Stulz (1988), Israel (1992)).

On the other hand, it is said, leverage affects the distribution of cash flows to the target securityholders. Since the market price of debt reflects the potential gains accruing to the target firm if a control contest succeeds, a portion of the synergistic gains are captured by incumbent shareholders because of the effect of debt on the total firm value. Therefore the probability of a change in control is negatively related to leverage (Israel (1991)).

A third effect of debt has been identified by Stulz (1988). As the firm increases its debt to equity ratio, equityholders bear more risk since the probability of default increases. At the same time, debt reduces the total value of equity, so it becomes cheaper for the bidder to get control. These two opposite effects must be balanced by target management in order to deter rivals for control or to maximize firm value.

This paper explores another possible consequence of leverage changes before acquisitions. Our basic idea is that incumbent managers favor information acquisition about the firm by potential rivals when it is in the incumbent shareholders' best interest. One possible way of allowing such information gathering is by means of direct negotiation between target and rival managers. Through leverage, incumbent managers affect the riskiness of the equity, and thus the accuracy of the rival's valuation of the deal. At the same time, the additional debt that is taken on directly affects stock prices as a result of the trade-off between risk and probability of default. Therefore the optimal debt level is chosen so as to mitigate the cost of debt (deterrence of potential acquirors) with its benefits (bid price increases). The degree of leverage displayed by target firms upon tender offer announcements should then be closely related to the quality of the information in the bidder's hand regarding the target firm's growth opportunities, as well as the target information about the bidder's characteristics (and their effects on the potential synergies accruing to the target firm).

We posit a model in which capital structure is designed once the firm faces a takeover threat, and we assume that the party in control derives private benefits that are decreasing in leverage. Potential acquirors gather the same information as incumbents, but they are able to monitor the firm's prospects and therefore the expected value of equity they intend to acquire. Once securities are priced, we assume that the rival firm is able to ascertain the future cash flows more accurately than can incumbents. In real life, investment banks play a key role in acquisitions and acquirors are in general of a bigger size when compared to targets (Mørck et Al.. (1988)). On the other hand, bidders very often become target shareholders before launching a bid, which is a first indication of their willingness to learn about their targets.

We show that bidder estimation of the equity value, and therefore the bid profitability, are affected by the precision of the information the bidder gets. The better the signal, the lower the difference between what the rival gets and what she pays (in expected terms), because as a residual claimant, the acquiror benefits from the riskiness of the firms assets. The relationship between signal precision and shareholders' perception about the likelihood of a contest for control is, however, non monotonic. For low precisions, probability of the bid and information quality are negatively related. However, at a certain level of accuracy, the bidder gets to know the target firm's prospects so precisely that the bid price she has to pay becomes considerably burdensome, thus reducing the likelihood of an acquisition. The rival for control is willing to acquire information though, because a perceived reduction in the probability of a takeover pushes down the expected bid price, thus making the bid more attractive.

Financial policy serves as a way of modulating the negative consequences of information acquisition on incumbents' profits. Firstly, an increase in leverage makes the bid cheaper by reducing the total value of equity. This is the negative effect (from the incumbent shareholders' point of view) of debt identified by Stulz (1988). Secondly, debt reduces the gains to acquirors via a transfer of cash flows to current bondholders, as in Israel (1991). Additionally, leverage affects the rival's ability to investigate the target firm and thus the effectiveness of her signal. In fact, it reduces the range of values of the synergy for which a bid is profitable and increases rival's expectations about equity value under her control. Consequently, incumbent managers select the optimal level of gearing that compensates shareholders for the losses derived from information acquisition. We prove that the optimal debt level is negatively related to the precision of the bidder's signal.

The latter result implies that firms adjust their capital structures when facing battles for control and that such adjustments depend on target and bidder firm characteristics. In particular, the bidder's ability to monitor the target's performance determines leverage and therefore the bid outcome. We test these hypotheses using a sample of 739 U.S. targets of hostile tender offers in the period 1990-1995. For every target in the sample, we select a matching company with similar size and in the same industry, that is not a tender offer target in the sample period. The methodology allows us to control for significant determinants of the decision to acquire another firm different from that firm's leverage (in particular, Tobin's q), and provides us with results of debt changes driven solely by takeover activity.

Our methodology is similar to Palepu (1986), who uses a probit model with a group of 163 targets and 256 non-targets in order to approximate the population over which the model is tested. However, leverage is measured as the average of the debt to equity ratios in the last three years preceding the event date, so the dynamics of adjustment are not observed. Raad and Ryan (1995) also test for changes in capital structure during control contests, but they do not provide comparisons with either non-target firms or industry averages, which call into question their interpretation of the results. Related literature on this topic also includes Dann and DeAngelo (1988), Mørck et al. (1988), Dennis and McConnel (1986) and Franks and Mayer (1996).

We show that target firms are highly levered when compared to their industry peers, especially one or two years before the tender offer announcement. However, target firms significantly reduce leverage (7,19%) relative to the matching firms in the year immediately preceding announcement. The result says that high levels of debt are an indication of managerial entrenchment to restrain potential bidders from takeover attempts. Interestingly, when the battle for control is about to happen, incumbent managers reduce leverage to benefit from the tender offer (through increases in the bid price) at the cost of decreasing their private benefits.

As a second step, we estimate an econometric model for the determination of capital structure. We obtain that, especially for the smallest firms in our sample, informational variables significantly explain the decision to adjust leverage. In particular, leverage decreases when bidder and target belong to the same industry, that is, when the quality of the bidder is easier to assess, as predicted by the theoretical model. Additionally, we show that toehold size and debt increases are positively related. Therefore, when the bidder's ability to investigate the target increases as a result of a stake purchase, incumbent managers increase the target's debt level to make shareholders better off in potential control contests. We provide as well a detailed analysis by industry. Finally, we show that bid price and leverage changes are related as predicted by the model. That is, by altering capital structure, information acquisition is less effective and bid price becomes higher.

The paper proceeds as follows: in section 2 we develop our theoretical model; in section 2.1 we describe the basic ingredients; section 2.2 analyzes capital structure of the target firm; in section 2.3 we completely determine bid price and probability of takeover; in section 3 we analyze the relationship between informational and financial variables, and in section 4 we consider the optimal amount of information selected by a potential raider. Section 5 establishes the empirical implications derived from the theoretical model, which are then tested in the next sections. In sections 4.1 and 4.2 we study differences in leverage across targets, and in sections 4.3 and 4.4 we test our econometric model. We conclude in section 5 with some extensions and final remarks. All proofs are in the Appendix.

# 2 Theory

## 2.1 The model

The model consists of two periods. At the beginning of the the first period ($t = 1$ ) an entrepreneur issues debt (with face value $F$) and equity to finance a project (firm T) whose expected net cash flow is $v$. The riskiness of the project is modelled by assuming that $v$ is normally distributed with mean $\mu$ and variance $\sigma^2$, $v \sim N(\mu, \sigma^2)$, $\mu > 0$. The manager does not have either private information or an equity stake in the firm.

We assume that both debt and equity are fairly priced and, for simplicity, the risk free rate is zero. The project can only be implemented if it is totally funded, which means that the size of the firm is exogenous in our framework.

Also at $t = 1$, the firm is targeted by a potential bidder (firm A) who is willing to acquire the company's equity and run it. At this point in time all the parties share the same information, namely the distribution of $v$. The potential bidder, if she succeeds in gaining control of the firm, is able to increase the expected net cash flows from the project to $v + s$,where $s$ stands for synergy. The value of $s$ is only known to the bidder, and for the rest of the world, $s$ is drawn from a normal distribution with zero mean and variance $\sigma_s^2$. Later in the paper we simplify this assumption by restricting the values of $s$ to be in the set $\{s_l,\ s_h\ \}$.With a potential bidder threatening firm T's management, target shareholders perceive that, with some positive probability, the firm will be acquired and managed more efficiently. Notice that in the absence of private control benefits or dilution to incumbent shareholders, the potential bidder will only launch the bid if the efficiency gain compensates her for the bid price to be paid. We further assume that the party in control enjoys private benefits $C(F)$, where $C'(F) \leq 0$, $C'(0) = 0$. This assumption stresses the disciplinary role of debt financing because it reduces free cash flow.

Another interpretation of the bidder's identity would say that there exists a population of potential acquirors for the firm and only those for which the acquisition is profitable will compete in a control contest.

The intention to acquire the target may be revealed to incumbent shareholders in a variety of ways. The rival may directly publish such an intention in order to take soundings regarding incumbent managers reaction to the announcement. Section 13(d) of the Williams Act requires any person who has acquired more than 5 per cent of any equity security to disclose certain information to the issuer of the security and to the exchanges on which the security is traded. In particular the purchaser must divulge her intention to acquire such issuer. Thus toeholders may easily be identified as potential acquirors[1].

[1] Empirical literature on the announcement effects of 13(d) filings includes Choi (1991), who tries to

The firm may also become a takeover target when some other firms are competing to enter the company's industry (because of diversification motives or empire-building). Finally, takeover being a disciplinary device, incumbent shareholders associate a positive probability of being taken over to mismanagement relative to other firms in the industry.

In either case, the potential bidder is willing to reveal her identity only when, by so doing, she is able to monitor the potential target more closely. Toeholds are a clear example of this situation. By becoming a large shareholder, acquisition of information is much easier. The downside of this strategy is that, at the same time, target shareholders get to know the identity of a potential raider. Therefore we assume that at the beginning of the second period ($t = 2$), the acquiror receives a signal about the project cash flows, $\widetilde{\theta}$, where

$$corr(\widetilde{\theta}, \widetilde{v}) \begin{cases} = 1 & \text{with probability } p \\ \\ = 0 & \text{with probability } 1 \Leftrightarrow p \end{cases}$$

that is, the signal is perfect with probability $p$, otherwise the bidder learns nothing regarding the firm's asset value. The probability $p \in [0, 1]$ will be referred to as the signal precision. The realization of $\widetilde{\theta}$ is not observed by the incumbent managers, and it costs $I(p)$ for the potential acquiror to obtain information with precision $p$, where $I'(p) > 0$, $I(1) = +\infty$, $I'(0) = +\infty$. However $p$, the probability that the bidder enjoys perfect information, is common knowledge. The additional information conveyed by the signal is the result of costly investigation, large shareholder monitoring or cross-communication potential bidder-target firm.

The arrival of new information determines the decision on whether to bid or not. Clearly, firm A will launch the offer when $E[\Pi_A \,|I] > 0$,where $\Pi_A$ denotes bidder profits after takeover completion. From the shareholders point of view, the decision to tender their shares is contingent upon the bid price. Here we assume that bids are not contested and incumbent shareholders follow their management advice. Bid price is the result of negotiation between the raider and the target managers.

Finally, at the end of the second period ($t = 3$), a conditional bid for a hundred percent of the target firm's shares is announced, and payoffs are given to the parties. The timing outlined above is depicted in Figure 1.

[Insert Figure 1]

isolate the effect of toehold trading using a sample of 13d filings in the period 1982-1985, accounting for a positive valuation effect. Eysell (1990) quantifies it calculating abnormal returns on the day of 13d filing announcement, finding a significant 4.79% excess return. With a different sample, Mikkelson and Ruback (1985) find a 3.40% abnormal return.

We assume no taxes or bankruptcy costs. This assumption implies that, as of $t = 1$, the firm capital structure is irrelevant, so any amount of debt can be issued without affecting firm value. However, as leverage increases, so does the riskiness of equity. If a risk-averse, potential acquiror, is seeking to purchase all of firm T's equity, higher leverage will be a useful tool to deter A, since equity becomes riskier. The point we make in this paper is that, even with risk-neutral bidders, debt affects the rival's ability to monitor the target firm because equity is now more volatile. Capital structure is no longer irrelevant (when firm A enters), and the incumbent manager must balance the positive effect of leverage (entry deterrence) against its costs (default).

## 2.2 Capital Structure without the threat of a takeover

After securities are issued, but before $t = 2$ and without a takeover threat, equity value is only affected by the firm expected cash flows and leverage. Let $F$ denote the face value of debt issued at $t = 1$ .We assume $F \geq 0$ (note that this assumption is not trivial since $v$ is normally distributed). Let $K$ be the equity value. Then $K$ after equity is issued is:

$$\begin{aligned} E_{t=1}[K] &= E_{t=1}[\max\{0, v \Leftrightarrow F\}] = \\ &= 0 \Pr[v < F] + E_{t=1}[v \Leftrightarrow F \,|v \geq F] \Pr[v \geq F] = \\ &= (E_{t=1}[v\,|v \geq F] \Leftrightarrow F) \Pr[v \geq F] \end{aligned}$$

Now it suffices to use the properties of the normal density:

$$E_{t=1}[K] = \left[ \int_F^{+\infty} \frac{x f(x)}{1 \Leftrightarrow \Phi\left[\frac{F-\mu}{\sigma}\right]} dx \Leftrightarrow F \right] \left[ 1 \Leftrightarrow \Phi\left(\frac{F \Leftrightarrow \mu}{\sigma}\right)\right]$$

where $\Phi(\cdot)$ is the distribution function for the standard normal and $f(\cdot)$ is the unconditional density function for $v$. After some algebra[2] this yields:

$$E_{t=1}[K] = [\mu \Leftrightarrow F + \sigma H(F, \mu, \sigma)] \left[ 1 \Leftrightarrow \Phi\left(\frac{F \Leftrightarrow \mu}{\sigma}\right)\right] \tag{1}$$

The last term, $H(F, \mu, \sigma)$, is the hazard ratio at $F$, where

$$H(F, \mu, \sigma) = \frac{\phi\left(\frac{\mu - F}{\sigma}\right)}{\Phi\left(\frac{\mu - F}{\sigma}\right)} = \frac{\phi\left(\frac{F-\mu}{\sigma}\right)}{1 \Leftrightarrow \Phi\left(\frac{F-\mu}{\sigma}\right)} \tag{2}$$

[2]First note that $f(x) = \frac{1}{\sigma}\phi\left(\frac{x-\mu}{\sigma}\right)$, where $\phi(x) = \Phi'(x)$. After changing variable to $\epsilon = \frac{x-\mu}{\sigma}$, use the fact that, in a standard normal, $x\phi(x) = -\phi'(x)$.

The hazard ratio[3] at $F$ represents the probability that the firm defaults if leverage increases infinitesimally from $F$, given that the firm is solvent[4] at $F$. So $H(F, \mu, \sigma)$ is a measure of default risk that depends on gearing.. Lemma 1 in the Appendix shows that $H(F, \mu, \sigma)$ is an increasing function: future default is more likely for high levels of debt, given that the firm is currently able to meet such payments.

Expression (1) says that equityholders require the expected cash flows to the project less debt payments, plus a default premium that depends positively on the cash flows volatility and the debt level. Two remarks are in order: first, from the results in Lemma 1, $E_{t=1}[K]$ is always positive, which means that shareholders finance the cost of the project when it is less than $\mu$. Second, equity value is decreasing in $F$, i.e. compensation for default risk increase does not offset the share of the project that is given to bondholders.

Equity value at $t = 1$ is decreasing and convex in $F$ and increasing and concave in $\sigma$.

The previous result is not new, although expression (1) shows clearly the two effects of leverage on shareholders wealth.

For the next sections, it will be useful to denote by $M(x, y, z)$ the expected value of equity for a company with normally distributed cash flows (mean $y$, standard deviation $z$) given that cash flows exceed $x$. Hence, in (1):

$$E_{t=1}[K] = M(F, \mu, \sigma) = [\mu \Leftrightarrow F + \sigma H(F, \mu, \sigma)] \left[1 \Leftrightarrow \Phi\left(\frac{F \Leftrightarrow \mu}{\sigma}\right)\right]$$

## 2.3 Bid price determination

Consider now the following scenario: incumbent shareholders are disperse and homogeneous, incumbent managers have no shares in the firm. The first assumption guarantees that shareholders will not tender unless they are offered the expected stock price if the bid takes place. The second assumption is made without any loss of generality and the following results can easily extended to the case in which target managers own shares in the target firm. Firm $A$ approaches target management and offers a bid price equal to the current stock price. Incumbent managers try to extract all the profits. Then the bid price is determined as follows:

[3] For an exhaustive analysis of hazard ratios under different distributional assumptions, see Kiefer (1988).

[4] More precisely,

$$H(F, \mu, \sigma) = \lim_{\Delta \to 0} \frac{\Pr[F \leq v \leq F + \Delta \,|F \geq v]}{\Delta}$$

$$B(s,p) = \gamma M + (1 \Leftrightarrow \gamma) M_A(s,p) \tag{3}$$

where $M = M(F, \mu, \sigma)$ from the previous section, and $M_A$ represents expected (by uninformed shareholders) equity value under the rival's control, given the synergy level $s$ and the information precision $p$. Although a bid price lower than the expected value of the firm upon a change in control may induce target shareholders to reject the bid (free-riding problem), we assume that target equityholders always accept a tender offer above the current market value of the firm ($M$). Kale and Noe (1997), in an experimental setting, show that tendering probabilities for bid prices between current and expected stock price range from around 0.5 to 0.75. Additionally, the free-riding equilibrium that predicts that all takeovers can be easily ruled out by assuming a two-tier offer, in which a price equal to $M$ is paid to those equityholders that do not tender in a first tier with a bid price $B$ (see Ravid and Spiegel (1993))

Israel (1991) interprets $\gamma$ as the bidder's bargaining power. Alternatively it can be interpreted as the market perceived probability that the bid will fail. The parameter $\gamma$ depends on the relative size of the target, the rival management expertise and legal considerations.

Underlying expression (3) it is our assumption that all synergistic gains are split between initial and new securityholders of the target firm. Debt is fairly priced and represents a zero NPV investment for bondholders. Thus, bond price at $t = 1$ captures any takeover gain reflected in a higher expected debt payoff. Consequently, through financing at $t = 1$, incumbent shareholders get all the synergistic gains that correspond to target securityholders.

At $t = 1$, when the capital structure is designed, uninformed parties calculate their expectations about the future bid price under the assumption that the bidder possesses better information, that is:

$$E^s_{t=1}\left[B(s,p)\,|\Pi_A(s,p) \geq 0, p\right] = E^s_{t=1}\left[\gamma M + (1 \Leftrightarrow \gamma) M_A(s,p)\,|E^v_{t=1}\left[\Pi_A(s,p)\right] \geq 0, p\right] \tag{4}$$

where the superscripts denote the distribution under which expectations are taken, and where $\Pi_A(s)$ denotes bidder's profits given $s$.

To evaluate the last expression, first consider the bidder's profits conditional on the tender offer occurring and succeeding:

$$\Pi_A(s,p) = M_A(s,p) \Leftrightarrow B(s,p) + C(F) \Leftrightarrow I(p) \tag{5}$$

Substituting $B(s,p)$ from (3):

$$\Pi_A(s,p) = \gamma M_A(s,p) \Leftrightarrow \gamma M + C(F)$$

where:

$$M_A(s,p) = p\left[\mu \Leftrightarrow F + s + \sigma H(F \Leftrightarrow s, \mu, \sigma)\right] + (1 \Leftrightarrow p) M(F \Leftrightarrow s, \mu, \sigma)$$

The last expression results from the fact that, with probability $1 \Leftrightarrow p$, bidder's information is the same as that of the incumbent shareholder's. However, with probability $p$, the bidder learns the true $v$. In the last case, shareholders expect bidder's valuation to be $v + s \Leftrightarrow F$ whenever $v + s > F$, zero otherwise. Since firm A would not be willing to acquire firm T if firm T's equity value were zero, it is inferred from the fact that the acquisition takes place that $v + s > F$ . Therefore, with probability $p$,incumbent shareholders expect that the equity value given by the acquiror's better information will be $E[v + s \Leftrightarrow F \,|v > F \Leftrightarrow s]$. This is the first term in the right hand side of the last expression.

Therefore, conditional on the bid taking place:

$$\Pi_A(s,p) = \gamma\left[p + (1 \Leftrightarrow p)\left(1 \Leftrightarrow \Phi\left(\frac{F \Leftrightarrow s \Leftrightarrow \mu}{\sigma}\right)\right)\right] \frac{M(F \Leftrightarrow s, \mu, \sigma)}{1 \Leftrightarrow \Phi\left(\frac{F-s-\mu}{\sigma}\right)} \Leftrightarrow \gamma M + C(F) \Leftrightarrow I(p)$$

The probability of a bid occurring will then be the probability that the raider makes positive profits, which implies:

$$\Pr[\Pi_A(s,p) \geq 0] = \Pr{}^s\left[s \geq s_0\right]$$

where $s_0$ is the synergy level for which bidder profits are zero, $\Pi_A(s_0, p) = 0$

Finally, in (4):

$$E^s_{t=1}\left[B(s,p)\,|\Pi_A(s,p) \geq 0, p\right] = \gamma M + (1 \Leftrightarrow \gamma) E\left[\left[p + (1 \Leftrightarrow p)\left(1 \Leftrightarrow \Phi\left(\frac{F \Leftrightarrow s \Leftrightarrow \mu}{\sigma}\right)\right)\right] \frac{M(F \Leftrightarrow s, \mu, \sigma)}{1 \Leftrightarrow \Phi\left(\frac{F-s-\mu}{\sigma}\right)} |s \geq s_0\right] \quad (6)$$

The expected bid price includes two terms: the first one is the stock price if the bid fails; second, when the bid succeeds (with probability $1 \Leftrightarrow \gamma$) current shareholders get the expected equity value conditional on the bid being profitable. Again, this last term can be rewritten in terms of hazard rates.

Indeed, the expected bid price will be the actual bid price at $t = 3$,since any flow of information that occurs between $t = 1$ and $t = 3$ has already been considered. Henceforth, $B = E_{t=1}\left[B(s,p)\,|\Pi_A(s,p) \geq 0, p\right].$

The next proposition illustrates some comparative statics relative to the bid price.

Bid price is:

-Increasing in $\sigma_s$

-Increasing in $p$ for $p > \overline{p}$, where $\overline{p}$ satisfies $I'(\overline{p}) = \gamma \frac{\Phi\left(\frac{F-s-\mu}{\sigma}\right)}{1-\Phi\left(\frac{F-s-\mu}{\sigma}\right)} M(F \Leftrightarrow s, \mu, \sigma)$

When information about the bidder's quality is disperse, the probability that she is a high type rival increases given that she is willing to bid and at the same time a takeover becomes more likely. Intuitively, when stockholders are uncertain about the identity of the bidder, they will require a bid price that compensates them if the bidder is of very high ability. Shareholders know that their downside uncertainty (probability that the rival's synergy is too low) is resolved when the low quality raider abstains from bidding. Another final implication of Proposition 1 is that potential acquirors gain from secrecy both in their intentions and in the synergies of the acquisition.

More interestingly, bid price increases with the signal precision, when $p$ is sufficiently high precision[5]. As the signal becomes less informative, takeover profits get lower for the bidder, since the target is then less valuable for her. Therefore, incumbent shareholders require a lower bid price. If the signal precision is too low, however, target equityholders perceive that the average synergy is high enough to make the bid profitable for the acquiror, even when she remains uninformed. Hence a further reduction in the signal precision increases the bid price. The second effect of information acquisition is on the market perceived probability of a future takeover.

The probability of a takeover is decreasing (increasing) in the signal's precision, for $p < \overline{p}$ ( $p > \overline{p}$ ).

When launching a bid, the raider is buying stock volatility. Since A knows more about the firm's cash flows, her valuation of the equity is higher than that of the stockholders, since she knows more precisely whether the firm will default or not given the current leverage. Such a difference imposes a loss on the target's account, that must be compensated by a higher bid price. Otherwise, incumbent managers oppose the bid. From the bidder's perspective, more precise information has two opposite effects: on the one hand, the probability of a change in control (probability that the synergy accrues today to stockholders) increases (for $p > \overline{p}$ ); this is the positive effect of the signal. On the other hand, better information implies higher bid price (for $p > \overline{p}$ ) at $t = 3$ (this is a negative effect of the signal on the bidder's profits)[6].

[5]The maximum value of $\frac{\Phi\left(\frac{F-s-\mu}{\sigma}\right)}{1-\Phi\left(\frac{F-s-\mu}{\sigma}\right)} M(F - s, \mu, \sigma)$ is lower than 0.5, which implies that at most, $I(\overline{p}) = 0.5\gamma$, hence $\overline{p}$ is close enough to zero.

[6]The intuition is the reverse for $p < \overline{p}$

The next proposition highlights the relationship between leverage and managerial objectives:

[Israel (1991)] The probability of a takeover is decreasing in $F$

In other words, by increasing leverage, the threshold value of the synergy $s_0$ such that a takeover becomes profitable for the bidder increases.

# 3 Information acquisition and capital structure

In this section we analyze how incumbent managers can affect the outcome of the contest for control through capital structure, and in particular the influence of leverage on the raider's decision to acquire information on the target when such information is costly.

Since debt is fairly price, the face value of bonds that maximize the value of the firm is the same as the one that maximizes the value of equity. The potential synergy $s$ is captured by incumbent shareholders, target bondholders and the bidder. Hence, assuming that the manager's objective function is equity maximization, managers will choose $F$ so as to force the potential raider to pay the maximum price while making the bid profitable.

Furthermore, managers receive private benefits for being in control at $t = 3$. Such benefits are decreasing in the firm's gearing. Hence, leverage affects the managerial objective function, first, by determining the ex-ante probability of a bid occurring, and therefore the probability that equity value rises; second, because bid price depends on the stock volatility and thus on leverage; third, through private benefits of control.

In order to ease the calculations in the following sections, let us assume that $s$, the increase in firm's value induced by the acquisition, can take only two possible values:

$$s \begin{cases} = s_h & \text{with probability } q(F) \\ \\ = s_l & \text{with probability } 1 \Leftrightarrow q(F) \end{cases}$$

where $s_l < 0$ is such that it is never profitable for the bidder to attempt to acquire firm T, i.e. $\Pi_A(s_l, p) < 0 \ \forall p$, and where $s_h > s_l$ is high enough to guarantee positive expected profits for the bidder regardless of the quality of her information, $\Pi_A(s_h, p) > 0$ $\forall p$. This assumption implies that $q(F)$ represents the probability of firm T being taking over as well, and from previous sections $q'(F) < 0$, $0 \leq q(F) \leq 1$, $\lim_{F \to \infty} q(F) = 0$. We further assume that $q(F)$ is such that $\Leftrightarrow q'(F) < \sigma q(F)$ . Finally, conditional on the bid being announced, the expected bid price becomes now:

$$B = \gamma M + (1 \Leftrightarrow \gamma) \left[ p + (1 \Leftrightarrow p) \left( 1 \Leftrightarrow \Phi \left( \frac{F \Leftrightarrow s_h \Leftrightarrow \mu}{\sigma} \right) \right) \right] \frac{M(F \Leftrightarrow s_h, \mu, \sigma)}{1 \Leftrightarrow \Phi \left( \frac{F - s_h - \mu}{\sigma} \right)} \qquad (7)$$

(notice that, under this simplification, the bid price increases[7] with $\sigma$)

Let $E^s \left[ \Pi_T(F) \right]$ be the incumbent manager's objective function. It consists of the expected increase in the equity value at $t = 1$ plus private benefits. From previous sections, expected value of equity will be as in (1) if A decides not to bid for T, otherwise target shareholders receive an amount equal to the bid price (with probability $q(F)$). Additionally, target managers only enjoy private control benefits in the firm is not acquired at $t = 3$. Therefore:

$$E^s \left[ \Pi_T(F) \right] = \left[ 1 \Leftrightarrow q(F) \right] \left[ C(F) + M \right] + q(F) B \Leftrightarrow M \qquad (8)$$

And managers will choose the level of debt $F^*$,such that:

$$F^* \in \arg\max_F E^s \left[ \Pi_T(F) \right] \qquad (9)$$

Debt negatively affects the return on equity by reducing the probability of the firm being acquired and therefore being managed more efficiently. Additionally, the use of free cash flow for private purposes is less likely. Finally, equity claim on the target firm is lower with high leverage, and therefore both equity value without takeover threat and bid price get lower too. However, debt provides entrechment to incumbent managers and increase the probability that they remain in control and enjoy private benefits. Therefore there exists a debt level $F^*$ that trades off optimally the gains and losses from leverage.

There exists an optimal debt level, $F = F^* > 0$, that maximizes $\Pi_T(F)$.

The bidder's information affects the optimal capital structure in the following way. Under the simplifying assumption that $p$ affects only the acquiring firm perception regarding the target asset value, but not the probability that the acquisition takes place, bid price gets higher the more accurate such information is. Therefore target managers are likely to substitute debt for equity in order to increase the probability $q(F)$. However, as the firm increases its leverage, the value of the equity in case the takeover threat is not realized decreases. The former effect depends on the quality of the information the bidder may acquire, while the latter is independent of it. Which effect prevails is resolved in the next proposition.

Optimal leverage and signal precision are negatively related .

To provide further insight into the relationship between information quality of leverage, suppose firm A is perfectly informed about firm T's asset value. Being that the

[7]Additionally, although clearly the conditional bid price decreases with leverage, the unconditional bid price, $q(F)B$, might increase or decrease with $F$.

case, the acquiror knows with certainty whether the target firm will default, and the only effect of the target's high leverage is that the expected value of the residual claim on firm T if the takeover takes place reduces, and so does the expected bid price. Suppose instead that information precision $p$ equals zero. In this case the acquiror gathers the same information as target shareholders do. A leverage increase both reduces the value of the residual claim on the target firm for the acquiror, and increases her perceived probability that the target firm will default. Therefore the increase in the bid price will now be smaller. Hence, we intuitively expect that as firm A acquires better information, the debt level that maximizes incumbent manager's profits decreases.

# 4 Extension: endogenous information acquisition

In the previous analysis, we were considering the particular case in which $p$, the quality of the information the bidder may acquire, is constant and cannot be strategically chosen by the potential acquiror. In what follows, we concentrate on the simultaneous decision faced by target managers and the bidding firm regarding the optimal level of debt and the optimal information precision, respectively.

The analysis assumes that once the takeover threat is identified by firm T's managers, the bidding firm optimally selects the quality of the information to be acquired. Simultaneously, the target management decides to alter the firm's capital structure. Such a one-shot game is a proper generalization of a more realistic situation in which there would be dynamic adjustments both in leverage and information accuracy.

Once the decision to acquire information about firm T is taken, and considering that such acquisition is costly, the potential acquiror is aware that the final choice on whether to announce a bid or not is contingent upon the signal received. Therefore, the expression for the bidder's expected profits is:

$$
\begin{aligned}
E^s\left[\Pi_A(s,p,F)\right] = \; & \Leftrightarrow I(p) \\
& + q(F)C(F) \\
& + q(F)\left[\frac{p}{1 \Leftrightarrow \Phi\left(\frac{F-s_h-\mu}{\sigma}\right)} + 1 \Leftrightarrow p\right] M(F \Leftrightarrow s_h, \mu, \sigma) \\
& \Leftrightarrow q(F)B
\end{aligned} \tag{10}
$$

The cost $I(p)$ is paid even when the bidder decides not to initiate the acquisition. However, only with probability $q(F)$ will the acquiror pay the bid price $B$, enjoy control benefits $C(F)$ and gain control over the target firm. The expected equity value if firm T is taken over depends, as in the previous section, on the information precision. Note that the effect of leverage on bidder's profits is twofold: debt reduces the probability of the acquisition, the amount of private benefits and the expected bid price. However, leverage enhances the gains from acquiring information, since the marginal gain from increasing $p$ is higher the more levered firm T is.

Being $p$ an endogenous variable, we need conditions to guarantee that any simultaneous choice is optimal (i.e. Nash equilibrium) and stable. Such conditions relate the slopes of both firm's reaction functions given the other firm's optimal strategy. Using results from Seade (1980), we can express our stability condition as:

$$\frac{\partial^2 E^s\left[\Pi_T(F,p)\right]}{\partial F^2}\frac{\partial^2 E^s\left[\Pi_A(s,p,F)\right]}{\partial p^2} > \frac{\partial^2 E^s\left[\Pi_T(F,p)\right]}{\partial F \partial p}\frac{\partial^2 E^s\left[\Pi_A(s,p,F)\right]}{\partial F \partial p} \tag{11}$$

Suppose firms T and A simultaneously choose $F$ and $p$. Then, if $C(F)\left[1 \Leftrightarrow q(F)\right]$ is increasing in $F$, the pair $(F^*, p^*)$ is a Nash equilibrium such that:

$$\begin{aligned} E^s\left[\Pi_T(F^*,p)\right] &> E^s\left[\Pi_T(F,p)\right] \quad \forall p \\ E^s\left[\Pi_A(s,p^*,F)\right] &> E^s\left[\Pi_A(s,p,F)\right] \quad \forall F \end{aligned}$$

The equilibrium $(F^*, p^*)$ is stable and satisfies (11).

Therefore, an equilibrium exists if $C(F)\left[1 \Leftrightarrow q(F)\right]$, expected control benefits under a takeover threat, are increasing in $F$. The equilibrium breaks down, for instance, when the bidder knows with certainty that she will never launch a bid even when she acquires very precise information. In this situation there is no link between information precision and leverage, and thus a Nash equilibrium fails to exist. If, in the other hand, the expected benefits of control decrease with leverage, then it may happen that firm T takes on infinite amounts of debt, thus driving the probability of the acquisition down to zero. A Nash equilibrium does not exist in such a case.

# 5 Testable implications

In this section we analyze the empirical implications of the model already presented, establishing a formal link between the theory and the actual financial policy of takeover targets.

Our results highlight the importance that the identity of the bidder has in determining the optimal financial policy of the firm. We have shown that a leverage increase and the bidder's information about the target quality affect target shareholders wealth in opposite directions. Additionally, while bidders are always willing to hide their type (namely the takeover synergies), target shareholders tend to prefer information disclosures that would allow a potential bidder to value their firm accurately.

Therefore, changes in financial policy of firms that become takeover targets are closely related to the ability of potential bidders to acquire information about the firm. In particular, growing firms for which cash flows are riskier will display lower levels of gearing[8]. Additionally, those targets in high technology industries need less debt to benefit from forthcoming battles for control.

Notice that our model does not postulate leverage as a means of preventing takeovers, but as a way of maximizing target shareholders' gains. Financial policy encourages takeovers by increasing firm value, and at the same time makes shareholders better off by an increase in the price to be paid for the target stock. Thus, we have shown that, *ceteris paribus*, target firms use less leverage when the bidder is able to monitor the target firm more closely. In particular, toeholds and leverage should be negatively related. This is similar to a situation where acquiror includes management of the target company. The level of expertise of both target and bidder managers affect the amount of debt issued by the target firm: long-lived target firms will issue more debt; efficient bidders will face low-levered target firms.

The empirical study we carry out in the next section tries to shed some light on the testable implications listed in the preceding paragraphs. We are interested in studying the financial policy of target firms relative to industry peers, and the relationship between changes in leverage in the years immediately before the control contest and variables measuring the bidder's ability to acquire information, surprises concerning the identity of the bidder, and the position of the firm in the industry. Furthermore, and since our model provides us with closed form solutions for the tender offer variables, we will analyze the relationship between leverage and bid price, and between leverage and the probability of becoming a takeover target.

# 6 The evidence

## 6.1 Data and methodology

We identify a final sample of 739 U.S. firms in the Security Data Corporation (SDC) databases that face non-friendly tender offers during 1990-1995. We only consider hostile or unsolicited deals to ensure the strategic role of leverage before the acquisition. Comment and Schwert (1997) have studied the characteristics that differentiate hostile versus friendly targets, and conclude that there is evidence supporting entrenchment and bargaining strategy as explanations for hostility. Our theoretical model applies to managers that enjoy private control benefits and who therefore behave strategically when dealing with a potential acquiror.

[8]As $\sigma$ increases, bid price gets higher and therefore there is less need for leverage as a means of transfering gains from the potential acquiror to the target firm.

The preliminary sample consists of those cases classified as tender offers, tender-mergers or two-tier offers by SDC. For those deals for which managerial attitude was not available, we checked with the Wall Street Journal for any reference to the target managers' response. Our initial sample consisted of 942 takeover announcements. Our sample includes an announcement only if it corresponds to the first attempt to acquire control of the target. We therefore eliminate 203 announcements from the initial sample because they correspond either to second or subsequent bids made by the same initial bidders, or to competing bids.

Since, in previous sections, we postulate that defensive restructuring in capital structure should anticipate takeover attempts, we checked in the Wall Street Journal for articles describing the bidder's interest in acquiring the target. Only in nine cases did we find reported interest dating from one year before the tender offer announcement. Amongst these articles we do not consider references to 13d filings detailing large block acquisitions. Thus we infer that only initial stakes are employed by potential bidders to reveal their intentions.

We estimate our econometric model using successful bids, as well as failed bids. The latter category includes targets sold to a white knight, to other bidder, and targets that remain independent. A bid is considered successful when the raider acquires eighty per cent of the shares sought. We obtain accounting variables for the individual firms in the sample from Compustat files. In particular, we measure leverage as the ratio of total debt to shareholders' equity. Total debt is calculated as total long term debt[9] plus debt in current liabilities, which is defined as the total amount of short-term notes and the current portion of long term debt (due in one year). Shareholders' equity includes common and preferred shareholders' interest in the company[10]. Palepu (1986) and Ambrose and Megginson (1992), for instance, measure leverage as the ratio of long term debt of a firm to its equity. Dann and DeAngelo calculate the ratio of book value of long term debt to total assets. Mørck et al. (1988) use the value of long term debt on total market value.

Additionally, we retrieve data on earnings before interest and taxes, total assets, return on assets and stock price performance. Descriptive statistics on all these measures are reported in Table 1, where we show the median sample values relative to the population of firms in the S&P500. The targets in our sample display relatively low profitability but insignificant stock price outperformance. Franks and Mayer (1996) show that successful hostile bid targets record almost identical price performance to that of comparable non-targets in the same industry. We also show that earnings per share are consistently negative two years before the takeover announcement, but they are positive one year prior to the bid, in anticipation of price runups when the bid takes place. Fo-

[9] Debt obligations due more than one year from the company's balance sheet date.

[10] Capital surplus, common stock, non-redeemable and redeemable preferred stock, retained earnings and treasury stock minus total dollar amount.

cusing on years $t = -3$ to $t = -1$ relative to the offer announcement, Table I shows that target firms' prices outperform the market index, while displaying negative earnings per share. This is an indication of market perceived growth opportunities but inefficient management. Finally, when compared to the S&P500, our average target firm is small in size.

[Insert Table I]

To provide further insight into these results, we make pairwise comparison by selecting, for each target firm in our final sample, a non-target matching firm. For a matching firm to be chosen, we rank by size all the firms with the same four SIC code digits in the Compustat files in the year preceding the takeover announcement and we choose the firm closest in size, above or below, to the firm in our sample. We checked that the selected company was not a takeover target in the 5 years preceding the announcement date and in the 5 years following that date. In order to do that, we search for references in WSJ to bids launched for the chosen firm's stock. A new matching firm is chosen if there is a bid outstanding in the aforementioned period. We obtain a sample of 738 matching firms that parallels the financial structure of those in the original sample.

Table II displays accounting variables for targets and non-targets with data available in the Compustat files. In contrast with the evidence in Comment and Schwert (1995), we find a statistically significant difference in market to book ratios for target firms (2.11) vs. non-targets (1.91, with $p-value$ for the difference 0.06), reflecting higher-than-median growth opportunities for target firms. Our procedure is different to the aforementioned authors' since we do not compare our sample of target firms to the whole population, but only to a subsample. Additionally, such differences can be motivated by different time periods (1977 to 1991 in Comment and Schwert (1995)).

Consistent with Table I, target firms earn negative return on equity relative to non-targets, but stock returns are significantly higher in the five years preceding the offer announcement.

[Insert Table II]

Finally, data on toeholds are obtained from SDC together with Wall Street Journal references. Since stake purchases are only reported at announcement date and only at purchase date if larger than 5%, we generally ignore the date at which the bidder-target relationship started. However, SDC reports stakes 6 months prior to the bid. In 732 cases out of 739, the bidder approaches the target in the six months preceding the bid announcement.

## 6.2 Capital Structure of Target Firms

To assess significant variations in capital structure due to the takeover threat, we need to measure leverage relative to a subset of non-target firms. We are tempted to use industry averages as comparable items. However, this introduces a bias in our study since some industries strategically time their offers to take advantage of misvaluations. We could easily be comparing our target firms to a population of target and non-target firms, something that would clearly distort our results and our ability to detect significant restructuring.

Extant literature on capital structure and takeovers characterizes target firms relative to comparable companies. Palepu (1986) concludes that the firms in his study display low growth and low leverage, because the coefficients of these two variables in a probit model where the likelihood of being a target is the explanatory variable are negative. Ambrose and Meggingson (1992), Mikkelson and Partch (1989) and Mørck et al. (1988) follow the same approach. The methodology employed here enhances the reliability of our results. Further, by adjusting leverage measures by matching firms, we are able to furnish some empirical evidence on the dynamic adjustments in capital structure of firms facing battles for control.

[Insert Table III]

Table III shows the median debt to equity ratios and matching company adjusted debt to equity ratios for the firms in the sample with availability of data in the Compustat files. We provide ratios for the five years preceding the offer as well as the debt to equity ratio at announcement date. As shown in the Table, firms in our sample are slightly more levered when compared to non-targets. The result is inconsistent with Palepu (1986), who does not provide a separate analysis, and Comment and Schwert (1995), who only report *mean* debt-to-equity ratios. Mørck et al. (1988), on the other hand, do not find significant differences between the debt ratios of target firms of hostile takeovers and the ones for 454 Fortune 500 non-target companies. Whilst this may seem contradictory, notice that both Mørck et al. (1988) and Palepu (1986) only consider long term debt in their measures of leverage.

Particularly interesting is the fact that the differences in leverage reduce over the years preceding the announcement and are relatively small (0,38%) at announcement date. By industry, results are not significant in general due mainly to a lack of degrees of freedom. In spite of this, the differences across industries at announcement date are not negligible. Wholesale and Retail Trade are the highest levered industries, while Agriculture, Forestry, Fishing and Mining display a ratio of 46%. The general result is also illustrated in Figure 2.

In Table 3 we analyze changes in leverage for the same window. Raad and Ryan (1996) report non-significant changes of leverage in the last three years preceding the takeover announcement and including the announcement year. We obtain similar results in nominal terms, namely that targets do not adjust leverage in the last three years, although leverage increases significantly in years -5 and -4. When compared to their industry peers, it turns out that target firms reduce their debt levels in the year before the offer. If we consider that bidders approach a potential target as much as one year before launching a bid, the results in Table 3 highlight the strategic role of leverage in control contest.

[Insert Table IV]

By industry, only Agriculture, Forestry, Fishing and Mining display significant changes in year -1. In absolute terms there are not significant changes in leverage, the same result as we have obtained for the overall sample.

The rationale for our results is, in the light of the theoretical implications, as follows. If probability of being a takeover target and leverage are negatively related, then takeover targets, that is, those firms that really become involved in battles for control, should display low leverage when compared with the situation in which the market for corporate control is non-existent. As Stulz (1988) suggests, high leverage makes a firm a good takeover target because of the reduction in the equity stake to be acquired (for a given firm size). The evidence is also consistent with Israel (1992) and Harris and Raviv (1988), since a leverage increase also increases the management control over a potential acquisition. High debt ratios refelct as well an intent by the target of offsetting the positive effects on bidder's profits of acquiring information regarding the firms they acquire. As shown in Sections 3 and 4, by levering up the firm, target managers increase the riskiness of the equity and avoid information acquisition by future rivals for control.

Besidesr, Table IV also shows that takeover targets adjust their capital structures by debt reductions when a potential bidder shows her intentions to acquire the target's equity. Once the control contest becomes imminent, debt reductions benefit target shareholders because: they make the bidder's information more valuable, they increase the acquiror's bid, and they are a means of transferring synergistic gains from the acquiror to the current bondholders (Israel (1991)).

[Insert Table V]

In Table 4 we analyze leverage ratios by year of announcement. Years 1993-1994 are a hot period in the market for corporate control. Previous years display a completely different pattern: target firms heavily adjust their capital structure (34,80% reduction in leverage ratios with respect to the matching companies). Afterwards there are not significant differences between targets and non-targets. By size, results are significant especially for the largest firms in the sample (see Table VI).

[Insert Table VI]

### 6.3 Cross-sectional analysis

We are interested in this subsection in the determinants of the changes in capital structure for target firms in our sample. Matching company adjusted differences only illustrates the role of leverage as a managerial device to make shareholders better off when facing takeover threats. In what follows, we provide some evidence on the differences across target firms.

For a given level of bidder's knowledge regarding the target's value, Section 2 in the paper shows, in line with Israel (1991), that a firm is more likely to be taken over the lower its debt level. We intend to test this proposition as a first statge in the analysis, particularly because it is of a great interest to analyze how changes in leverage affect the probability that a firm faces a battle for control.

We replicate Palepu's (1986) logit estimation of the likelihood of an acquisition with our sample of targets and matching firms (we estimate a probit regression). Results are reported in Table VII. Unlike Palepu (1986), we are controllin for size and consequently for size-related variables, as market-to-book ratio and trading volume. It is not surprising, however, that the coefficients for these two variables are not significant in explaining the probability of being acquired. Leverage one year before tender offer announcement is negatively related to the likelihood of an acqusition, in line with Palepu (1986), and we find that stock price performance of a company in the year preceding the tender offer is a significant determinant of the decision to acquire such firm. Bidders tend to target cheap firms that perform poorly in the market. Together with the pairwise comparisons in Table II, Table VII reflects a strong skewness in the distribution of abnormal returns[11].

[Insert Table VII]

To sum up, empricial results are consistent with the theoretical statements in Israel (1991) and this paper, that negatively relate debt to the probability of an acquisition. Our next objective is to clarify the cross-sectional determinants of the decision to adjust debt-to-equity ratios preciding tender offers.

Three are the main determinants of the decision to alter capital structure that arise from the theoretical part of this paper. First we have shown that the higher the leverage

[11] Note as well that, although non-significant, the coefficients for Tobin's q (market-to-book ratio) in the probit regression (mean values) are negative, consistent with the evidence in Comment and Schwert (1995)

the lower the probability of being a takeover target. The statement has been tested in the previous subsections: target firms reduce significantly their debt levels when control contests are imminent. However, the causality between this two variables is still not clear.

Second, the uncertainty about the bidder's quality is indirectly related to leverage through the bid price and thus the willingness of the rival to bid. Proposition 2 says that a takeover is less likely the lower the accuracy of shareholders' perception about the firm's prospects after a change in control. Therefore, incumbent managers alter capital structure towards more leverage to maximize shareholders' gain.

Finally, leverage and the bidder's signal quality are negatively related. Intuitively, targets will increase leverage when the ability of the potential rival to monitor the firm is high. A high-levered company is riskier; therefore the outcome of the bidder's screening is of low quality, and so are her profits.

Measuring those variables is not an easy task. To implement the econometric analysis, we proxy the uncertainty about the bidder quality using two variables. The first variable measures the participation of target firm managers both as bidder and target. That is, we consider those bids for which the bidding company includes in its board of directors some member of the target's board. In 27,32% of the announcements we consider some target managers have active participation as bidders. Intuitively, this variable is a double-edged sword because it is an indication on how precisely the bidder is informed about the target, as well as how accurately the target can forecast the bidder's synergies. The results will depend on whether target-and-bidder board members play as raiders or saviors for the target firm. The second proxy is a dummy variable that takes value 1 for high technology companies. High-tech firms have higher risk exposure and so their future profitability is more difficult to forecast. In our sample, 9,97% of the targets have this feature.

To measure the quality of the bidder's signal we identify those announcements for which both bidder and target belong to the same industry. In these situations synergies are higher and the bidder's ability to assess them is also higher. We expect the relationship between debt changes and industry identity to be negative if we assume that bidders in the same industry as their targers know more about the target's value. However, we can also expect that in such a situation, target shareholders are better aware of the motives for the acquisition and therefore better informed about the potential synergies, in which case the coefficient for the variable should be positive.. The regressor takes value 1 when the SIC codes for target and bidder (four digits) are identical. It so happens in 62,29% of the cases.

Additionally, it is clear that the best way to monitor a firm closely is to become a large shareholder. One reason why bidders may be interested in purchasing the target's stock in the open market before launching a bid is that by doing so, they have access to some information that only accrues to shareholders, and secondly they participate in corporate decisions. On the other hand, acquisitions of big stakes by potential raiders signals to incumbent shareholders the possibility of imminent takeover. This is one reason why we observe toeholds being acquired generally in the six months that precede the bid announcement.

We measure toeholds through a dummy variable that takes value 1 when it has been acquired, independently of the size of the stake. Further, we consider the size of the stake itself. We expect the dummy variable to be positively related to leverage changes. The reason is that having a stake in the target firm identifies the owner as a potential acquiror and reduces incumbents' uncertainty regarding the possible synergies (reducint $\sigma_s$ in Section 2 terminology). Therefore, bid price gets lower and the increase in the likelihood of a battle for control must be compensated by a higher debt to equity ratio. The effect of the initial stake on the ability of the bidder to acquire information is captured by the toehold size variable. Therefore, we expect the coefficient for this variable to be negative.

Table VIII displays the estimates for the regression of abnormal changes in leverage in the two years preceding the offer, on the explanatory variables we have selected. We adjust for cross-sectional heteroskedasticity and use non-parametric tests that are insensitive to the variables' distribution.

[Insert Table VIII]

Except for the industry identity variable and the high-tech dummy, all the explanatory variables are significant and with the expected signs. Notice that the size of the initial stake is negatively related to increments in leverage, which means that through toeholds incumbent shareholders learn more about the bidder than does the bidder about the target firm. This could be a reason why most bidders do not buy stock in open market purchases before tender offers. Industry dummies are not significant except for financial corporations, where debt increases are higher when facing takeover threats.

Since we obtain a significant positive relation between target-and-bidder board members existence and leverage changes, (and together with the observation by Mørck et al. (1988) that targets are relatively smaller) we can conclude that the common directors behave in favor of the bidding firm by providing it with information on the company to be taken over. Notice that following the same intuition, we however obtain the opposite result for the subsample of largest targets.

We also provide results of the estimation by target size. Panels B to E in Table VIII show that the results do not differ dramatically accross firms.

# 7 Conclusion

This paper examines the adjustments in capital structure induced by takeover threats. We provide a theoretical framework to analyze the potential acquiror's decision whether to acquire information about their targets and the incumbent management response to the bidder's strategy. Our main insight is that, by increasing leverage, shareholders benefit from future battles for control by transferring cash flows from the rival to current bondholders, by making the bid more expensive and by increasing the riskiness of the equity. Additionally, leverage affects the effectiveness of the bidder's monitoring on the target cash flows. Managers choose the optimal debt level that makes the bid profitable for the acquiror whilst extracting the maximum possible gain. The model provides implications for the relationship between debt level preceding a takeover and variables measuring the quality of the acquiror's information.

We carry out an empirical analysis of the results above and show that, on average, target firms are relatively more levered than comparable companies in the same industry and with the same size, but not under takeover pressure. More interestingly, our results confirm that leverage is reduced immediately before a hostile tender offer announcement, which indicates that leverage is used by managers to facilitate a change in control while maximizing shareholders' gains. Such evidence provides significant support for the managerial entrenchment hypothesis. Although the theoretical model predicts that it is the adjustment in capital structure that facilitates the change in control, still the question of the direction of this causality remains. Therefore, we test for the determinants of the decision to reduce leverage in the last two years preceding the tender offer announcement. We confirm that target firms do reduce leverage when the bidder has the ability to investigate the profitability of the combined merging firms more efficiently. Two main conclusions arise from the study: first, bidders may be interested in becoming target shareholders because of the information they can acquire as owners; second, when bidder and target belong to the same industry, target shareholders learn more about their rival than the reverse.

A fundamental issue that has not been discussed here is the role of managerial ownership in the target firm, particularly the different incentives that result when incumbent managers are also target shareholders. We neither consider the determinants of the takeover success, nor the effect of information acquisition on the number of bidders. These elements will be considered in our future work.

# A Appendix

## A.1 Lemma 1. Properties of $H(\cdot)$

Let $H(x)$ be:

With our previous notation, $H(x) = H(x, 0, 1)$, or $H(x, \mu, \sigma) = H\left(\frac{x-\mu}{\sigma}\right)$

$$H(x) = \frac{\phi(x)}{1 - \Phi(x)}$$

1. $H(x)$ is continuous, increasing and convex in $x$.
2. $\lim_{x \to +\infty} H(x) = x$
3. $H(x) > x$
4. $H'(x) < 1$
5. $H(x) \geq \Phi(x)$

Deriving $H(x)$:

$$\begin{aligned} H'(x) &= \frac{\phi'(x)[1 - \Phi(x)] + \phi^2(x)}{[1 - \Phi(x)]^2} = \\ &= \frac{\phi'(x)}{1 - \Phi(x)} + [H(x)]^2 \end{aligned}$$

Using $-x\phi(x) = \phi'(x)$,

$$H'(x) = H(x)[H(x) - x] \tag{12}$$

Hence $H(x)$ is increasing if and only if $H(x) > x$. In fact:

$$\mu + \sigma H(x) = E\left[z \,|z > x\right] > x$$

being $z \sim N(\mu, \sigma)$.

Thus $H(x, \mu, \sigma) > \frac{x-\mu}{\sigma}$ or $H(x) > x$. $H(x)$ is continuous because $\phi(x)$ and $\Phi(x)$ are continuous.

Part 2.

$$\begin{aligned}
\lim_{x\to+\infty}[H(x)-x] &= \lim_{x\to+\infty}H(x)-\lim_{x\to+\infty}x= \\
&= \lim_{x\to+\infty}\frac{\phi'(x)}{-\phi(x)}-\lim_{x\to+\infty}x=\lim_{x\to+\infty}(x-x)=0
\end{aligned}$$

Part 3. Follows directly from Part 1.

Part 4. First note that, since $H(x)>0$ and $\lim_{x\to+\infty}H(x)=x$, $H''(x)>0\Rightarrow H'(x)<1$. From (12), $H''(x)=H'(x)[2H(x)\Leftrightarrow x]\Leftrightarrow H(x)$. Suppose $H'(x)>1$. It implies $H''(x)>0$, hence $H'(x)<1$,which is absurd. Hence, by contradiction, it has to be $H'(x)<1$ .

Part 5. Suppose $H(x)<\Phi(x)$.

Therefore H(x)=$\frac{\phi(x)}{1-\Phi(x)}>\frac{\phi(x)}{1-H(x)}\Rightarrow H(x)(1\Leftrightarrow H(x))>\phi(x)\Leftrightarrow\phi(x)\frac{1-\phi(x)-\Phi(x)}{1-\Phi(x)}>\phi(x)$, which is absurd because $\frac{1-\phi(x)-\Phi(x)}{1-\Phi(x)}<1$

## A.2 Proof of Lemma 2.

Consider the function $M(x)=M(x,0,0)=M(F,\mu,\sigma)$ where $x=\frac{F-\mu}{\sigma}$. Therefore, $M(x)=[H(x)\Leftrightarrow x]\left(1\Leftrightarrow\Phi\left(x\right)\right)$,and using the results in Lemma 1:

$$\begin{aligned}
M'(x) &= [H'(x)\Leftrightarrow 1]\left(1\Leftrightarrow\Phi\left(x\right)\right)\Leftrightarrow\phi\left(x\right)[H(x)\Leftrightarrow x] \\
&= [H(x)\left[H(x)\Leftrightarrow x\right]\Leftrightarrow 1]\left(1\Leftrightarrow\Phi\left(x\right)\right)\Leftrightarrow\phi\left(x\right)[H(x)\Leftrightarrow x] \\
&= \left(1\Leftrightarrow\Phi\left(x\right)\right)\left(H(x)\left[H(x)\Leftrightarrow x\right]\Leftrightarrow 1\Leftrightarrow H(x)\left[H(x)\Leftrightarrow x\right]\right) \\
&= \Leftrightarrow\left(1\Leftrightarrow\Phi\left(x\right)\right)<0
\end{aligned}$$

And clearly:

$$\frac{\partial}{\partial F}M(x)=M'(x)\frac{\partial}{\partial F}x\leq 0$$

$$\frac{\partial}{\partial\sigma}M(x)=M'(x)\frac{\partial}{\partial\sigma}x\geq 0$$

Additionally:

$$M''(x)=\phi\left(x\right)>0$$

Hence:

$$\frac{\partial^2}{\partial F^2}M(x) = M'(x)\frac{\partial^2}{\partial F^2}x + M''(x)\frac{\partial}{\partial F}x > 0$$

$$\frac{\partial^2}{\partial \sigma^2}M(x) = M'(x)\frac{\partial^2}{\partial \sigma^2}x + M''(x)\frac{\partial}{\partial \sigma}x < 0$$

.

## A.3 Proof of Proposition 1.

To prove the first part, note that $s_0$ does not depend on $\sigma_s$. Then, since $E[f(s)\,|s \geq s_0]$ is increasing in $\sigma_s$ , results $\frac{\partial B}{\partial \sigma_s} > 0$.

To prove the second part, let us use the implicit function theorem:

$$sign\left(\frac{\partial s_0}{\partial p}\right) = sign\left(-\frac{\frac{\partial \Pi_A(s_0,p)}{\partial p}}{\frac{\partial \Pi_A(s_0,p)}{\partial s_o}}\right)$$

Clearly, $\frac{\partial \Pi_A(s_0,p)}{\partial s_0} > 0$. Besides:

$$\frac{\partial \Pi_A(s_0,p)}{\partial p} = \gamma\frac{\Phi\left(\frac{F-s-\mu}{\sigma}\right)}{1 \Leftrightarrow \Phi\left(\frac{F-s-\mu}{\sigma}\right)}M(F \Leftrightarrow s, \mu, \sigma) \Leftrightarrow I'(p)$$

which is negative for $p > \overline{p}$,where $\overline{p}$ satisfies $\gamma\frac{\Phi\left(\frac{F-s-\mu}{\sigma}\right)}{1-\Phi\left(\frac{F-s-\mu}{\sigma}\right)}M(F \Leftrightarrow s, \mu, \sigma) \Leftrightarrow I'(\overline{p}) = 0$.

Then,

$$\frac{\partial B}{\partial p} = (1 \Leftrightarrow \gamma)\frac{\partial}{\partial p}\left[E\left[\left[p + (1 \Leftrightarrow p)\left(1 \Leftrightarrow \Phi\left(\frac{F \Leftrightarrow s \Leftrightarrow \mu}{\sigma}\right)\right)\right]\frac{M(F \Leftrightarrow s, \mu, \sigma)}{1 \Leftrightarrow \Phi\left(\frac{F-s-\mu}{\sigma}\right)}\,|s \geq s_0\right]\right]$$

which is positive for $p > \overline{p}$ because $\left[p + (1 \Leftrightarrow p)\left(1 \Leftrightarrow \Phi\left(\frac{F-s-\mu}{\sigma}\right)\right)\right]\frac{M(F-s,\mu,\sigma)}{1-\Phi\left(\frac{F-s-\mu}{\sigma}\right)}$ and $s_0$ are then increasing in $p$.

## A.4 Proof of Proposition 2

From Proposition 2, sign$\left(\frac{\partial s_0}{\partial p}\right) = sign\,(p \Leftrightarrow \overline{p}) \Rightarrow sign\left(\frac{\partial \Pr(s \geq s_0)}{\partial p}\right) = sign\,(\overline{p} - p)$

## A.5 Proof of Proposition 3

First suppose $p = 0$. Hence $s_0$ solves now:

$$\begin{aligned}\Pi_A(s_0, 0) &= \gamma M(F \Leftrightarrow s, \mu, \sigma) \\ &\quad \Leftrightarrow \gamma M + C(F)\end{aligned}$$

And $\frac{\partial \Pi_A(s_0,0)}{\partial F} = \frac{1}{\sigma}\left[\Phi\left(\frac{F-\mu-s}{\sigma}\right) \Leftrightarrow \Phi\left(\frac{F-\mu}{\sigma}\right)\right]\gamma + C'(F) < 0$ using the results from Lemma 2.

Suppose $p > 0$. Now:

$$\begin{aligned}\frac{\partial \Pi_A(s_0, p)}{\partial F} &= \gamma \frac{M(F \Leftrightarrow s, \mu, \sigma)}{1 \Leftrightarrow \Phi\left(\frac{F-s-\mu}{\sigma}\right)} \Phi\left(\frac{F \Leftrightarrow s \Leftrightarrow \mu}{\sigma}\right) \\ &\quad + \gamma \frac{\partial}{\partial F} \frac{M(F \Leftrightarrow s, \mu, \sigma)}{1 \Leftrightarrow \Phi\left(\frac{F-s-\mu}{\sigma}\right)}\left[p + (1 \Leftrightarrow p)\left(1 \Leftrightarrow \Phi\left(\frac{F \Leftrightarrow s \Leftrightarrow \mu}{\sigma}\right)\right)\right] \Leftrightarrow \\ &\quad \Leftrightarrow \gamma \frac{\partial}{\partial F} \frac{M(F, \mu, \sigma)}{1 \Leftrightarrow \Phi\left(\frac{F-\mu}{\sigma}\right)}\left[1 \Leftrightarrow \Phi\left(\frac{F \Leftrightarrow \mu}{\sigma}\right)\right] + \\ &\quad + \gamma \frac{M(F, \mu, \sigma)}{1 \Leftrightarrow \Phi\left(\frac{F-\mu}{\sigma}\right)}\left[\Leftrightarrow \frac{\phi\left(\frac{F-\mu}{\sigma}\right)}{\sigma}\right] + C'(F)\end{aligned}$$

And:

$$\frac{\partial^2 \Pi_A(s_0, p)}{\partial F \partial p} = \gamma \frac{\partial}{\partial F} \frac{M(F \Leftrightarrow s, \mu, \sigma)}{1 \Leftrightarrow \Phi\left(\frac{F-s-\mu}{\sigma}\right)} \Phi\left(\frac{F \Leftrightarrow s \Leftrightarrow \mu}{\sigma}\right) < 0$$

Hence $\frac{\partial \Pi_A(s_0,p)}{\partial F} < 0$ for $p \geq 0$, and $\frac{\partial \Pr(s \geq s_0)}{\partial F} < 0$

## A.6 Proof of Proposition 4

The first order conditions for the problem are:

$$\begin{aligned}\frac{\partial}{\partial F} E^s\left[\Pi_T(F)\right] &= C'(F^*) \Leftrightarrow q'(F^*) C(F^*) \Leftrightarrow q'(F^*) M + \frac{1}{\sigma}\left(1 \Leftrightarrow \Phi\left(\frac{F^* \Leftrightarrow \mu}{\sigma}\right)\right)\left[1 + q(F^*)(1 \Leftrightarrow \gamma)\right] \\ &\quad + q(F^*)(1 \Leftrightarrow \gamma)(1 \Leftrightarrow p)\phi\left(\frac{F^* \Leftrightarrow \mu \Leftrightarrow s_h}{\sigma}\right)\left[H\left(F^*, \mu + s_h, \sigma\right) \Leftrightarrow \frac{F^* \Leftrightarrow \mu \Leftrightarrow s_h}{\sigma}\right]\frac{1}{\sigma}\end{aligned}$$

$$\Leftrightarrow q(F^*)(1 \Leftrightarrow \gamma)\left[p + (1 \Leftrightarrow p)\left(1 \Leftrightarrow \Phi\left(\frac{F^* \Leftrightarrow \mu \Leftrightarrow s_h}{\sigma}\right)\right)\right]\left[\frac{\partial}{\partial F}H\left(F^*, \mu + s_h, \sigma\right) \Leftrightarrow 1\right]\frac{1}{\sigma}$$

$$+q'(F^*)\gamma M + q'(F^*)(1 \Leftrightarrow \gamma)\left[\frac{p}{1 \Leftrightarrow \Phi\left(\frac{F^* - \mu - s_h}{\sigma}\right)} + 1 \Leftrightarrow p\right]\frac{1}{\sigma}M(F^* \Leftrightarrow s_h, \mu, \sigma) = 0$$

First, note that $\lim_{F \to \infty} \frac{\partial}{\partial F}E^s\left[\Pi_T(F)\right] = 0$. Additionally, $\lim_{F \to \infty} E^s\left[\Pi_T(F)\right] = 0$, and $E^s\left[\Pi_T(F)\right]$ is, from Lemmas 1 and 2, a continuous function. Hence, to prove the statement it suffices to show that $E^s\left[\Pi_T(0)\right] > 0$ and $\frac{\partial}{\partial F}E^s\left[\Pi_T(F)\right]|_{F=0} > 0$.

From (8), $E^s\left[\Pi_T(0)\right] > 0$. To show that $\frac{\partial}{\partial F}E^s\left[\Pi_T(F)\right]|_{F=0}$, we first show that $\frac{\partial^2}{\partial F \partial p}E^s\left[\Pi_T(F)\right] < 0$:

$$\frac{\partial^2}{\partial F \partial p}E^s\left[\Pi_T(F)\right] = q'(F)\frac{\partial B}{\partial p} + q(F)\frac{\partial^2 B}{\partial F \partial p}$$

where:

$$\frac{\partial B}{\partial p} = (1 \Leftrightarrow \gamma)\frac{\Phi\left(\frac{F - \mu - s_h}{\sigma}\right)}{1 \Leftrightarrow \Phi\left(\frac{F - \mu - s_h}{\sigma}\right)}M(F \Leftrightarrow s_h, \mu, \sigma)$$

and

$$\begin{aligned}
\frac{\partial^2 B}{\partial F \partial p} &= (1 \Leftrightarrow \gamma)\frac{\phi\left(\frac{F - \mu - s_h}{\sigma}\right)}{1 \Leftrightarrow \Phi\left(\frac{F - \mu - s_h}{\sigma}\right)}\frac{1}{\sigma}M(F \Leftrightarrow s_h, \mu, \sigma) \\
&\quad +(1 \Leftrightarrow \gamma)\Phi\left(\frac{F \Leftrightarrow \mu \Leftrightarrow s_h}{\sigma}\right)\frac{1}{\sigma}\left[\frac{\partial}{\partial F}H\left(F, \mu + s_h, \sigma\right) \Leftrightarrow 1\right]
\end{aligned}$$

Hence:

$$\begin{aligned}
\frac{\partial^2}{\partial F \partial p}E^s\left[\Pi_T(F)\right] &= q'(F)(1 \Leftrightarrow \gamma)\frac{\phi\left(\frac{F - \mu - s_h}{\sigma}\right)}{1 \Leftrightarrow \Phi\left(\frac{F - \mu - s_h}{\sigma}\right)}M(F \Leftrightarrow s_h, \mu, \sigma) \\
&\quad +q(F)(1 \Leftrightarrow \gamma)\frac{\phi\left(\frac{F - \mu - s_h}{\sigma}\right)}{1 \Leftrightarrow \Phi\left(\frac{F - \mu - s_h}{\sigma}\right)}\frac{1}{\sigma}M(F \Leftrightarrow s_h, \mu, \sigma) \\
&\quad +q(1 \Leftrightarrow \gamma)\Phi\left(\frac{F \Leftrightarrow \mu \Leftrightarrow s_h}{\sigma}\right)\left[\frac{\partial}{\partial F}H\left(F, \mu + s_h, \sigma\right) \Leftrightarrow \frac{1}{\sigma}\right]
\end{aligned}$$

$$
\begin{aligned}
&= q'(F)(1-\gamma)\frac{\phi\left(\frac{F-\mu-s_h}{\sigma}\right)}{1-\Phi\left(\frac{F-\mu-s_h}{\sigma}\right)}M(F-s_h,\mu,\sigma) \\
&\quad +q(F)(1-\gamma)\left[\frac{\partial}{\partial F}H\left(F,\mu+s_h,\sigma\right)-\frac{1}{\sigma}\Phi\left(\frac{F-\mu-s_h}{\sigma}\right)\right] \\
&= q'(F)(1-\gamma)\frac{\phi\left(\frac{F-\mu-s_h}{\sigma}\right)}{1-\Phi\left(\frac{F-\mu-s_h}{\sigma}\right)}M(F-s_h,\mu,\sigma) \\
&\quad +q(F)(1-\gamma)\frac{1}{\sigma}\left[H\left(F,\mu+s_h,\sigma\right)\left(H\left(F,\mu+s_h,\sigma\right)-(F-\mu-s_h)\right)-\Phi\left(\frac{F-\mu-s_h}{\sigma}\right.\right.
\end{aligned}
$$

And, since we have assumed $-q'(F) < \sigma q(F)$, then

$$
\frac{1}{\sigma} < -\frac{q'(F)}{q(F)} < -\frac{q'(F)}{q(F)}\frac{\phi\left(\frac{F-\mu-s_h}{\sigma}\right)}{H\left(F,\mu+s_h,\sigma\right)}
$$

(from Lemma 1).

Therefore:

$$
\begin{aligned}
\frac{\partial^2}{\partial F\partial p}E^s\left[\Pi_T(F)\right] &< q'(F)(1-\gamma)\frac{\phi\left(\frac{F-\mu-s_h}{\sigma}\right)}{1-\Phi\left(\frac{F-\mu-s_h}{\sigma}\right)}M(F-s_h,\mu,\sigma) \\
&\quad -q'(F)(1-\gamma)\phi\left(\frac{F-\mu-s_h}{\sigma}\right)\left(H\left(F,\mu+s_h,\sigma\right)-(F-\mu-s_h)\right) \\
&\quad +q'(F)(1-\gamma)\frac{\phi\left(\frac{F-\mu-s_h}{\sigma}\right)}{H\left(F,\mu+s_h,\sigma\right)}\Phi\left(\frac{F-\mu-s_h}{\sigma}\right) \\
&= q'(F)(1-\gamma)\frac{\phi\left(\frac{F-\mu-s_h}{\sigma}\right)}{H\left(F,\mu+s_h,\sigma\right)}\Phi\left(\frac{F-\mu-s_h}{\sigma}\right) \\
&< 0
\end{aligned}
$$

Hence, existence of the equilibrium is proven if $\frac{\partial}{\partial F}E^s\left[\Pi_T(F)\right]|_{F=0,p=1} > 0$:

$$
\begin{aligned}
\frac{\partial}{\partial F}E^s\left[\Pi_T(F)\right]|_{F=0,p=1} &= C'(0)(1-q(0))-q'(0)C(0)-q'(0)(1-\gamma)M(0,\mu,\sigma) \\
&\quad +\frac{1}{\sigma}\left[1-\Phi\left(-\frac{\mu}{\sigma}\right)\right]\left[1+q(0)(1-\gamma)\right] \\
&\quad -q(0)(1-\gamma)\frac{\partial}{\partial F}\left[H\left(F,\mu+s_h,\sigma\right)-\frac{F-\mu-s_h}{\sigma}\right]|_{F=0} \\
&> 0
\end{aligned}
$$

because $C'(0) = 0$

## A.7 Proof of Proposition 5

Follows directly from Proposition 4

## A.8 Proof of Proposition 6

Deriving with respect to $p$ in (10):

$$\begin{aligned}\frac{\partial}{\partial p}E^s\left[\Pi_A(s,p,F)\right] &= \Leftrightarrow I'(p) \\ &\quad +q(F)\gamma\frac{\Phi\left(\frac{F-s_h-\mu}{\sigma}\right)}{1\Leftrightarrow\Phi\left(\frac{F-s_h-\mu}{\sigma}\right)}M(F\Leftrightarrow s_h,\mu,\sigma)\end{aligned}$$

Hence $p^*$ satisfies:

$$I'(p^*)=q(F)\gamma\frac{\Phi\left(\frac{F-s_h-\mu}{\sigma}\right)}{1\Leftrightarrow\Phi\left(\frac{F-s_h-\mu}{\sigma}\right)}M(F\Leftrightarrow s_h,\mu,\sigma)$$

And second order conditions are satisfied since:

$$\frac{\partial^2}{\partial p^2}E^s\left[\Pi_A(s,p,F)\right]|_{p=p^*}=\Leftrightarrow I''(p^*)<0$$

Consider now the target's objective function:

$$E^s\left[\Pi_T(F)\right]=\left[1\Leftrightarrow q(F)\right]\left[C(F)+M\right]+q(F)B\Leftrightarrow M$$

where $B$ is as in (7). Therefore:

$$\begin{aligned}E^s\left[\Pi_T(F)\right] &= (1\Leftrightarrow q(F))C(F)\Leftrightarrow q(F)(1\Leftrightarrow\gamma)M \\ &\quad (1\Leftrightarrow\gamma)q(F)\frac{M(F\Leftrightarrow s_h,\mu,\sigma)}{1\Leftrightarrow\Phi\left(\frac{F-s_h-\mu}{\sigma}\right)}\left[p+(1\Leftrightarrow p)\left[1\Leftrightarrow\Phi\left(\frac{F\Leftrightarrow s_h\Leftrightarrow\mu}{\sigma}\right)\right]\right]\end{aligned}$$

Since $F^*$ satisfies $\frac{\partial}{\partial F}E^s\left[\Pi_T(F)\right]|_{F=F^*}=0$, and since $(1\Leftrightarrow q(F))C(F)\Leftrightarrow q(F)(1\Leftrightarrow\gamma)M$ is increasing in $F$, $\left[p+(1\Leftrightarrow p)\left[1\Leftrightarrow\Phi\left(\frac{F-s_h-\mu}{\sigma}\right)\right]\right]$ is decreasing in $F$, then it must be that $q(F)\frac{M(F-s_h,\mu,\sigma)}{1-\Phi\left(\frac{F-s_h-\mu}{\sigma}\right)}$ is increasing in $F$ at $F^*$.

From (8):

$$B = M + \frac{1}{q(F)} \left[ E^s \left[ \Pi_T(F,p) \right] \Leftrightarrow (1 \Leftrightarrow q(F)) C(F) \right]$$

And using this expression into (10):

$$\begin{aligned} E^s \left[ \Pi_A(s,p,F) \right] &= \Leftrightarrow I(p) \\ & +q(F)C(F) \\ & +q(F) \left[ \frac{p}{1 \Leftrightarrow \Phi\left( \frac{F-s_h-\mu}{\sigma} \right)} + 1 \Leftrightarrow p \right] M(F \Leftrightarrow s_h, \mu, \sigma) \\ & \Leftrightarrow q(F)M \Leftrightarrow E^s \left[ \Pi_T(F,p) \right] + (1 \Leftrightarrow q(F))C(F) \end{aligned}$$

And, deriving with respect to $p$ :

$$\begin{aligned} \frac{\partial}{\partial p} E^s \left[ \Pi_A(s,p,F) \right] &= \Leftrightarrow I''(p) \\ & +q(F) \frac{\Phi\left( \frac{F-s_h-\mu}{\sigma} \right)}{1 \Leftrightarrow \Phi\left( \frac{F-s_h-\mu}{\sigma} \right)} M(F \Leftrightarrow s_h, \mu, \sigma) \\ & \Leftrightarrow \frac{\partial}{\partial p} E^s \left[ \Pi_T(F,p) \right] \end{aligned}$$

Hence:

$$\frac{\partial^2}{\partial p \partial F} E^s \left[ \Pi_A(s,p,F) \right] = \frac{\partial}{\partial F} \left[ q(F) \frac{\Phi\left( \frac{F-s_h-\mu}{\sigma} \right)}{1 \Leftrightarrow \Phi\left( \frac{F-s_h-\mu}{\sigma} \right)} M(F \Leftrightarrow s_h, \mu, \sigma) \right] \Leftrightarrow \frac{\partial^2}{\partial F \partial p} E^s \left[ \Pi_T(F,p) \right]$$

From Proposition 5, $\frac{\partial^2}{\partial F \partial p} E^s \left[ \Pi_T(F,p) \right] < 0$. Besides, $\Phi\left( \frac{F-s_h-\mu}{\sigma} \right)$ is increasing in $F$, and we have just shown that $q(F) \frac{M(F-s_h,\mu,\sigma)}{1-\Phi\left( \frac{F-s_h-\mu}{\sigma} \right)}$ is increasing in $F$ at $F^*$. Therefore:

$$\frac{\partial^2}{\partial p \partial F} E^s \left[ \Pi_A(s,p,F) \right] > 0$$

And from Proposition 4, in (11):

$$
\begin{aligned}
& \left[\frac{\partial^2 E^s\left[\Pi_T(F,p)\right]}{\partial F^2}\frac{\partial^2 E^s\left[\Pi_A(s,p,F)\right]}{\partial p^2}\right]|_{F=F^*,p=p*} \\
> \quad & 0 \\
> \quad & \left[\frac{\partial^2 E^s\left[\Pi_T(F,p)\right]}{\partial F \partial p}\frac{\partial^2 E^s\left[\Pi_A(s,p,F)\right]}{\partial F \partial p}\right]|_{F=F^*,p=p*}
\end{aligned}
$$

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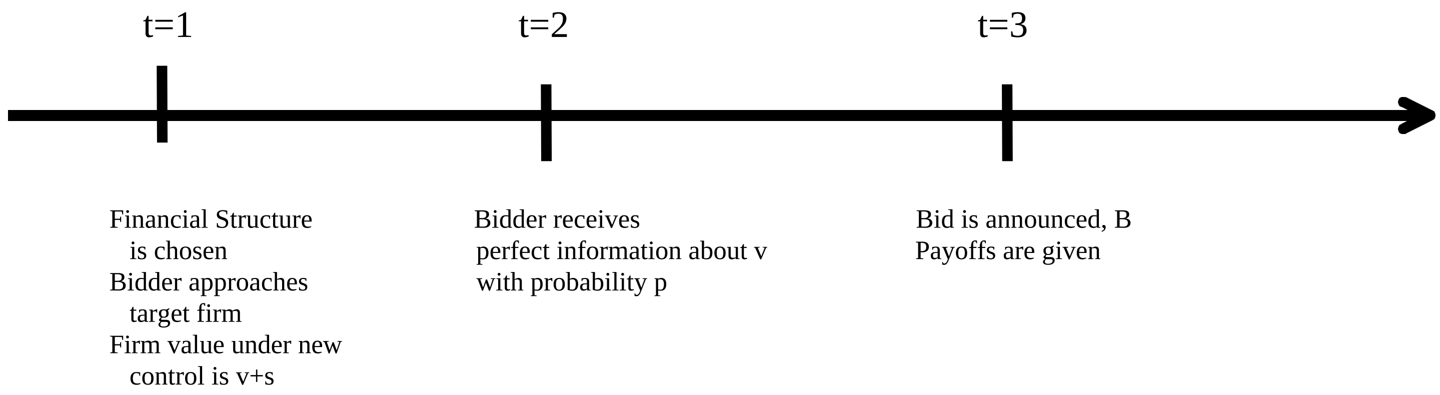


**Figure 1. Timing of the game**. At t=1 target firm selects its capital structure. A potential acquiror approaches the firm. Firm value withouth takeover is v, where v is normally distributed with mean $\mu$ and variance $\sigma^2$. Firm value under the rival's control is v+s, where s is only known to the bidder. For incumbent managers and shareholders, $s \sim N(0,\sigma^2_s)$. At t=2 the potential acquiror receives a noisy signal about the synergy and decides whether to bid or not. Finally, payoffs are given at t=2

| | | YEARS TO ANNOUNCEMENT YEAR | | | | | |
|---|---|---|---|---|---|---|---|
| | | **5** | **4** | **3** | **2** | **1** | **0** |
| **N=519** | | | | | | | |
| **TOTAL ASSETS** | Value | 2855.16 | 2882.59 | 2963.74 | 3329.26 | 3667.20 | |
| | S&P 500 Adjusted | -6819.98 | -7647.19 | -8473.15 | -9142.75 | -9776.50 | |
| **EBIT** | Value | 165.85 | 158.85 | 157.09 | 169.32 | 176.26 | |
| | S&P 500 Adjusted | -561.03 | -583.40 | -604.03 | -605.93 | -631.38 | |
| **EBIT / TOTAL ASSETS** | Value | 6.93% | 6.53% | 6.36% | 5.78% | 5.44% | |
| | S&P 500 Adjusted | -0.61% | -0.60% | -0.42% | -0.57% | -0.65% | |
| **EARNINGS PER SHARE** | Value | -59.26 | -65.66 | -28.22 | -81.50 | 36.62 | |
| | S&P 500 Adjusted | -52.55 | -92.73 | -68.94 | -116.84 | 26.95 | |
| **STOCK RETURN (1 YEAR)** | Value | 9.16% | 15.28% | 20.56% | 32.68% | 23.90% | 21.30% |
| | S&P 500 Adjusted | -9.79% | -4.96% | 0.68% | 11.54% | 5.50% | 2.50% |

**Table I. Description of the Sample**. Accounting variables for target firms of takeover announcements in the period 1990-1995. For every individual in the sample, variables are compared to the corresponding average variables for S&P 500 firms in the year of reference. The results are then averaged out.

| | TARGET FIRMS | MATCHING FIRMS | DIFFERENCE | N | p-value |
|---|---|---|---|---|---|
| **EBIT** | 14.59 | 13.05 | -0.30 | 300 | 0.6225 |
| **Market to Book Ratio** | 2.11 | 1.91 | 0.24 | 207 | 0.0695 |
| **PE ratio** | 13.94 | 12.02 | 1.79 | 223 | 0.0697 |
| **ROE** | 7.92 | 10.29 | -2.72 | 333 | 0.0014 |
| **TRADING VOLUME** | 63.33 | 56.53 | 6.18 | 236 | 0.6557 |
| **CUMULATIVE ABNORMAL RETURN** | 53.13 | 47.44 | 16.57 | 206 | 0.0220 |

**Table II. Description of the Sample**. Accounting variables for target firms of takeover announcements in the year preceeding the takeover announcement, and for the corresponding matching firm in the same period. 'Difference'equals the difference between the corresponding variable for the target company and the corresponding variable for the matching company, where a matching company is chosen among the firms in the same industry (four SIC code digits) and closest in size at tender offer announcement date. Trading Volume is calculated as the average of the Common Shares Traded - Monthly for the years t-3 through t-1 relative to tender offer announcement, divided by the number of all common shares outstanding at yearend. Abnormal Return is calculated as the 5 Year Total Return divided by the 5 Year Total Return for the S&P 500 x 100, calculated one year before tender offer announcement. The total sample of target firms contains all the target firms of hostile tender offers from the US for which data were available in the period 1990-1995 Significance levels are based on two-tailed Wilcoxon signed rank tests.

| | | YEAR TO EVENT | | | | | |
|---|---|---|---|---|---|---|---|
| | | 5 | 4 | 3 | 2 | 1 | 0 |
| **TOTAL SAMPLE** | Debt/Equity ratio | 66,51 | 63,13 | 63.92 | 60.03 | 59.91 | 57.58 |
| | Matching Company Adjusted | 6,73** | 8,36** | 9,49** | 6,29** | 9,84** | 0,38** |
| | N | 400 | 417 | 386 | 359 | 372 | 372 |
| Agriculture, Forestry, Fishing and Mining | Debt/Equity ratio | 63.29 | 66.68 | 62.79 | 53.58 | 46.72 | 46.02 |
| | Matching Company Adjusted | -0.59 | 18.77 | 15,17* | 0.21 | -2.31 | -5.22 |
| | N | 27 | 29 | 30 | 28 | 27 | 38 |
| Construction | Debt/Equity ratio | 12.41 | 29.06 | 43.81 | 45.59 | 52.17 | 6.97 |
| | Matching Company Adjusted | 7.78 | 7.96 | -8.17 | -9.89 | -6.69 | -12.54 |
| | N | 3 | 2 | 2 | 2 | 2 | 3 |
| Manufacturing | Debt/Equity ratio | 53.88 | 56.02 | 56.94 | 51.88 | 52.36 | 48.03 |
| | Matching Company Adjusted | 5,76** | 11,51** | 5,88** | 6,36* | 7.57 | 0.38 |
| | N | 157 | 162 | 158 | 148 | 142 | 210 |
| Transporation, Communications, Electric, | Debt/Equity ratio | 100.77 | 95.36 | 95.06 | 92.50 | 92.02 | 73.41 |
| Gas and Sanitary Services | Matching Company Adjusted | 25.64 | 1.19 | 1.23 | 30,35* | 2.76 | -12.54 |
| | N | 25 | 25 | 28 | 25 | 23 | 37 |
| Wholesale Trade | Debt/Equity ratio | 81.45 | 80.97 | 47.32 | 77.61 | 133.36 | 95.63 |
| | Matching Company Adjusted | -1.43 | 1.10 | -17.96 | -4.15 | 60,96* | 13.58 |
| | N | 8 | 9 | 10 | 9 | 9 | 19 |
| Retail Trade | Debt/Equity ratio | 64.70 | 65.25 | 60.63 | 48.20 | 45.91 | 81.58 |
| | Matching Company Adjusted | -2.76 | 4.44 | 17.10 | 5.00 | -0.37 | 23.83 |
| | N | 29 | 26 | 23 | 20 | 17 | 35 |
| Finance, Insurance and Real Estate | Debt/Equity ratio | 91.35 | 85.52 | 81.07 | 95.54 | 99.51 | 72.76 |
| | Matching Company Adjusted | 18,86** | 25,93** | 3,08* | 6.41 | 13,28* | 0.38 |
| | N | 48 | 56 | 53 | 45 | 31 | 89 |
| Services | Debt/Equity ratio | 56.93 | 58.61 | 54.77 | 67.87 | 72.81 | 66.00 |
| | Matching Company Adjusted | 19,59** | 2,28* | 24,17** | 10,79* | 24,52* | 8.52 |
| | N | 43 | 44 | 39 | 39 | 39 | 68 |

* Significant at 10% level

** Significant at 5% level

**Table III. Leverage ratios by industry**. Median Debt/Equity Ratio and Matching Company Adjusted Debt/Equity Ratio for Target Firms in Takeovers that take place in the period 1990-1995, classified by industry. Debt to Equity Ratio equals Total Debt over the sum of Common and Preferred Equity. Matching Company Adjusted ratio equals the difference between the ratio for the target company and the ratio for the matching company, where a matching company is chosen among the firms in the same industry (four SIC code digits) and closest in size at tender offer announcement date. Significance levels are based on two-tailed Wilcoxon signed rank tests.

| | | FROM YEAR i TO YEAR j | | | | |
|---|---|---|---|---|---|---|
| | | 5 to 4 | 4 to 3 | 3 to 2 | 2 to 1 | 1 to 0 |
| **TOTAL SAMPLE** | Percentage Change | 5,00%** | 5,62%** | 2.91% | 3,08%* | -1,36% |
| | Matching Company Adjusted | 4.72% | -1.28% | -2.11% | -0.45% | -7,19%* |
| | N | 400 | 417 | 386 | 359 | 372 |
| Agriculture, Forestry, Fishing and Mining | Percentage Change | 8.07% | -5.14% | -2.71% | -15,93%** | 0.51% |
| | Matching Company Adjusted | 8.07% | -8.78% | -0.62% | -12,21%** | -1.04% |
| | N | 35 | 37 | 32 | 31 | 32 |
| Construction | Percentage Change | 84.21% | 21.25% | 11.34% | 14.43% | -86.18% |
| | Matching Company Adjusted | -4.90% | -1125.93% | 33.98% | -1134.06% | -75.56% |
| | N | 3 | 3 | 3 | 3 | 3 |
| Manufacturing | Percentage Change | 6,56%** | 3.72% | -2.73% | 4,48%* | -5.18% |
| | Matching Company Adjusted | 10.23% | -5.36% | -8.29% | -0.59% | -3.56% |
| | N | 172 | 175 | 167 | 163 | 167 |
| Transporation, Communications, Electric, | Percentage Change | -2.34% | 7,32%** | 5,35%** | 10,10%* | -6.72% |
| Gas and Sanitary Services | Matching Company Adjusted | 2.34% | 11,53%** | 3.52% | 12.82% | 2.39% |
| | N | 31 | 32 | 31 | 29 | 33 |
| Wholesale Trade | Percentage Change | 1.48% | -28.99% | -5.22% | 36,11%* | 0.52% |
| | Matching Company Adjusted | -46.92% | -57.66% | 9.13% | 49.24% | 31.41% |
| | N | 8 | 10 | 11 | 10 | 11 |
| Retail Trade | Percentage Change | 15,65%* | 3.72% | -8.57% | 2.89% | 7.72% |
| | Matching Company Adjusted | 16.05% | 8.65% | -47,50%** | 0.99% | -18.79% |
| | N | 30 | 27 | 26 | 23 | 22 |
| Finance, Insurance and Real Estate | Percentage Change | -1.06% | 811%** | 3.90% | -1.22% | -0.21% |
| | Matching Company Adjusted | 0.34% | 21.87% | 0.04% | 4.55% | -4.34% |
| | N | 66 | 77 | 67 | 52 | 56 |
| Services | Percentage Change | -0.64% | 14,19%** | 10,04%* | 4.96% | -1.25% |
| | Matching Company Adjusted | -11,89%* | 11.99% | 12.05% | 2.40% | -16.91% |
| | N | 55 | 56 | 49 | 48 | 48 |

* Significant at 10% level

** Significant at 5% level

**Table IV. Leverage changes by industry**. Median Percentage Change and Matching Company Adjusted Percentage Change in Debt to Equity Ratio for Target Firms in Takeovers that take place in the period 1990-1995, classified by industry. Debt to Equity Ratio equals Total Debt over the sum of Common and Preferred Equity. Matching Company Adjusted change equals the difference between the change for the target company and the change for the matching company, where a matching company is chosen among the firms in the same industry (four SIC code digits) and closest in size at tender offer announcement date. Significance levels are based on two-tailed Wilcoxon signed rank tests.

| | | YEAR TO EVENT | | | | | |
|---|---|---|---|---|---|---|---|
| | | 5 | 4 | 3 | 2 | 1 | 0 |
| 1990 | Debt/Equity Ratio | 80.18 | 77.74 | 70.68 | 58.37 | 55.45 | 45.70 |
| | D/E Ratio (Matching C. Adjusted) | 43,15%** | 33.26%** | 16,55%** | 7,26%* | 1,96%* | 2.04 |
| | Percentage Change from previous year | | -1.89% | 5,52%* | -0.19% | 4,18%* | -13.35% |
| | % Change (Matching C. Adjusted) | | 0,59% | -3,43% | 0,78% | -0,18% | -30,61% |
| | N | 85 | 87 | 89 | 85 | 79 | 113 |
| 1991 | Debt/Equity Ratio | 64.05 | 69.21 | 60.40 | 64.43 | 56.95 | 55.14 |
| | D/E Ratio (Matching C. Adjusted) | 5.23 | 21,35%** | 4,25%* | 7.94 | 12.49 | -7.01 |
| | Percentage Change from previous year | | 22,86%** | -7.72% | -1.33% | -10,90%* | 0.52% |
| | % Change (Matching C. Adjusted) | | 25,36%* | -3,31% | -11,76% | -9.03% | -0.09% |
| | N | 66 | 68 | 66 | 63 | 59 | 87 |
| 1992 | Debt/Equity Ratio | 62.49 | 66.26 | 70.79 | 77.50 | 63.24 | 52.17 |
| | D/E Ratio (Matching C. Adjusted) | -2.22 | 4.50 | 21,17%** | 21,22%** | 11,85%** | 0.14 |
| | Percentage Change from previous year | | 6,43%** | 3.33% | 2.46% | 0.12% | -5.18% |
| | % Change (Matching C. Adjusted) | | 8.77% | -1.01% | -6,36% | -9,99% | -34,80%** |
| | N | 72 | 78 | 76 | 72 | 66 | 92 |
| 1993 | Debt/Equity Ratio | 73.52 | 56.02 | 59.38 | 62.91 | 75.99 | 68.88 |
| | D/E Ratio (Matching C. Adjusted) | 6,42%* | 4,87%* | 14,72%* | 8,86%* | 13,29%* | 6.96 |
| | Percentage Change from previous year | | 3.05% | 7,81%* | 8,43%** | 8,59%* | -7.61% |
| | % Change (Matching C. Adjusted) | | 3.52% | 0.32% | 4.05% | 7.80% | -9.09% |
| | N | 97 | 97 | 97 | 90 | 76 | 108 |
| 1994 | Debt/Equity Ratio | 73.45 | 57.57 | 63.73 | 58.82 | 61.55 | 59.96 |
| | D/E Ratio (Matching C. Adjusted) | 25,48%** | 3,44% | -2,21% | -15,97% | -26,56% | -13.11 |
| | Percentage Change from previous year | | -3.10% | 10,43%* | 5.33% | 3.79% | 3.30% |
| | % Change (Matching C. Adjusted) | | -4.73% | -6.26% | -9.51% | -0.62% | 5.70% |
| | N | 60 | 62 | 61 | 49 | 48 | 75 |
| 1995 | Debt/Equity Ratio | 53.64 | 41.65 | 43.69 | 34.29 | 49.02 | 53.31 |
| | D/E Ratio (Matching C. Adjusted) | -4.80 | 0.83 | 3.72 | 1.86 | 13.52 | 16.47 |
| | Percentage Change from previous year | | 2.24% | 6,29%** | -4.04% | 11,20%* | 8,87%** |
| | % Change (Matching C. Adjusted) | | -6.38% | 9.72% | 2.10% | 35,45%** | 9.93% |
| | N | 58 | 61 | 56 | 49 | 49 | 68 |

* Significant at 10% level

** Significant at 5% level

**Table V. Leverage ratios and changes by year**. Median Percentage Change and Matching Company Adjusted Percentage Change in Debt to Equity Ratio for Target Firms in Takeovers that take place in the period 1990-1995, classified by year of announcement. Debt to Equity Ratio equals Total Debt over the sum of Common and Preferred Equity. Matching Company Adjusted change equals the difference between the change for the target company and the median change for the matching company, where a matching company is chosen among the firms in the same industry (four SIC code digits) and closest in size at tender offer announcement date. Significance levels are based on two-tailed Wilcoxon signed rank tests.

| | | FROM YEAR i TO YEAR j | | | | |
|---|---|---|---|---|---|---|
| | | 5 to 4 | 4 to 3 | 3 to 2 | 2 to 1 | 1 to 0 |
| **TOTAL SAMPLE** | Percentage Change | 5,00%** | 5.62%** | 2.91% | 3.08%* | -1.36% |
| | Matching Company Adjusted | 4.72% | -1.28% | -2.11% | -0.45% | -7.19%* |
| | N | 400 | 417 | 386 | 359 | 372 |
| Size Quartile 1 | Percentage Change | 7.57%** | 4.79% | -0.34% | -0.17% | 0.20% |
| | Matching Company Adjusted | 2.33% | -2.32% | -9.50% | -9.3%* | -3.58% |
| | N | 114 | 113 | 106 | 95 | 103 |
| Size Quartile 2 | Percentage Change | 11.55%* | 14.46%** | 1.57% | 4.93%* | 4.87% |
| | Matching Company Adjusted | 25.38% | -2.17% | -2.42% | 15.08% | 2.93% |
| | N | 84 | 88 | 76 | 74 | 75 |
| Size Quartile 3 | Percentage Change | 6.25% | 11.85%** | 7.12% | 8.48%* | -4.69% |
| | Matching Company Adjusted | 5.69% | 1.87% | 8.44% | 13%* | -7.1%* |
| | N | 94 | 99 | 92 | 85 | 88 |
| Size Quartile 4 | Percentage Change | -2.07% | -0.27% | 3.41% | 0.99% | -8.76%** |
| | Matching Company Adjusted | -3.00% | -1.20% | -8.28% | -1.91% | -10.62% |
| | N | 108 | 117 | 112 | 105 | 106 |

* Significant at 10% level

** Significant at 5% level

**Table VI. Leverage changes by size**. Median Percentage Change and Matching Company Adjusted Percentage Change in Debt to Equity Ratio for Target Firms in Takeovers that take place in the period 1990-1995, classified by size. Size Quartile 1 corresponds to the smallest firms in the sample. Debt to Equity Ratio equals Total Debt over the sum of Common and Preferred Equity. Matching Company Adjusted change equals the difference between the change for the target company and the median change for the matching company, where a matching company is chosen among the firms in the same industry (four SIC code digits) and closest in size at tender offer announcement date. Significance levels are based on two-tailed Wilcoxon signed rank tests.

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 | Model 11 | Model 12 | Model 13 | Model 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 722 | 582 | 458 | 455 | 454 | 451 | 426 | 650 | 956 | 846 | 871 | 1048 | 902 | 806 |
| Intercept | 0.595** | 0.693** | 0.724** | 0.738** | 0.736** | 0.713** | 0.712** | 0.351** | 0.278** | 0.269** | 0.288** | 0.277** | 0.338** | 0.356** |
| | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) | (0.0001) |
| D/E ratio t=0 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | | | | | |
| | (0.8808) | (0.8589) | (0.9907) | (0.9450) | (0.8795) | (0.8876) | (0.8868) | | | | | | | |
| D/E ratio t=-1 | -0.001* | -0.001* | -0.002 | -0.002 | -0.001 | -0.002 | -0.002 | | | | | | | |
| | (0.0503) | (0.0858) | (0.1423) | (0.1399) | (0.1266) | (0.1272) | (0.1368) | | | | | | | |
| D/E ratio t=-2 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 | | | | | | | |
| | (0.1573) | (0.3160) | (0.4292) | (0.3615) | (0.3655) | (0.4036) | (0.1933) | | | | | | | |
| D/E ratio t=-3 | -0.002 | -0.002 | -0.002 | -0.002 | -0.003 | -0.003 | -0.003 | | | | | | | |
| | (0.1305) | (0.2839) | (0.2360) | (0.1965) | (0.2067) | (0.2203) | (0.1832) | | | | | | | |
| D/E ratio t=-4 | 0.003** | -0.004** | -0.002 | -0.001 | -0.002 | -0.002 | -0.002 | | | | | | | |
| | (0.0267) | (0.0222) | (0.3980) | (0.3597) | (0.4142) | (0.4492) | (0.4551) | | | | | | | |
| D/E ratio t=-5 | -0.001 | 0.001 | -0.001 | -0.001 | -0.001 | -0.001 | -0.001 | | | | | | | |
| | (0.4627) | (0.6398) | (0.6727) | (0.7057) | (0.6196) | (0.6363) | (0.5888) | | | | | | | |
| EBIT | | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | | | |
| | | (0.2526) | (0.1566) | (0.1540) | (0.1516) | (0.1546) | (0.2947) | (0.7565) | (0.7564) | | | | | |
| Market to Book Ratio | | | -0.001 | -0.002 | -0.001 | 0.000 | -0.003 | 0.002 | | 0.002 | | | | |
| | | | (0.8869) | (0.8066) | (0.8984) | (0.8987) | (0.6989) | (0.5731) | | (0.4927) | | | | |
| PE Ratio | | | | -0.001 | -0.001 | -0.001 | 0.000 | 0.000 | | | -0.001 | | | |
| | | | | (0.3451) | (0.3455) | (0.3350) | (0.8119) | (0.9178) | | | (0.2869) | | | |
| ROE | | | | | 0.000 | 0.000 | 0.000 | 0.000 | | | | 0.000 | | |
| | | | | | (0.4167) | (0.4153) | (0.3867) | (0.4374) | | | | (0.4006) | | |
| Trading Volume | | | | | | 0.000 | 0.000 | 0.000 | | | | | 0.002 | |
| | | | | | | (0.6796) | (0.7067) | (0.5005) | | | | | (0.5628) | |
| Abnormal Return | | | | | | | -0.001* | -0.001** | | | | | | -0.002** |
| | | | | | | | (0.0833) | (0.0186) | | | | | | (0.0010) |

* Significant at the 10% level

** Significant at the 5% level

**Table VII. Probit Estimation**

Probit Regressions relating the Likelihood of a Tender Offer to Leverage and Control Variables. The dependent variable is and indicator function that takes value 1 if the firm is a hostile tender offer target in the sample period 1990-1995, zero otherwise. The independent variables are the debt-to-equity ratios from 5 to 1 years before the tender offer announcement, as well as the debt-to-equity ratio in the year the tender offer is announced, and Control Variables. Trading Volume is calculated as the average of the Common Shares Traded - Monthly for the years t-3 through t-1 relative to tender offer announcement, divided by the number of all common shares outstanding at yearend. Abnormal Return is calculated as the 5 Year Total Return divided by the 5 Year Total Return for the S&P 500 x 100, calculated one year before tender offer announcement. The total sample contains all the target firms of hostile tender offers from US for which data were available and the corresponding matching firms in the period 1990-1995. For every firm in the original sample, a matching is chosen among the firms in the same industry (four SIC code digits) and closest in size at tender offer announcement date. Two-tailed p-values are displayed in parentheses.

| | Intercept | Bidder Industry | Toehold Dummy | Toehold Size | High Tech Company | Target Mgmt | Leverage Change t-2 | Industry Dummies 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PANEL A: TOTAL SAMPLE N=258** | | | | | | | | | | | | | | |
| Model 1 | -361.86 ** | 622.31 ** | -138.73 | -2.7374 * | 287.46 ** | 212.99 ** | 12.42 | | | | | | | |
| | (-9.45) | (13.43) | (-1.83) | (-2.02) | (3.19) | (3.18) | (23.16) | | | | | | | |
| Model 2 | 338.21 | 697.2 | -17.034 | -18.83 ** | 282.43 | -652.71 | | | | | | | | |
| | (0.51) | (1.20) | (-0.04) | (-5.46) | (0.44) | (-1.14) | | | | | | | | |
| Model 3 | -129.03 | 593.93 ** | -78.73 | -3.35 * | 179.57 * | 146.37 * | 12.1 ** | -204.12 | -285.86 ** | -219.04 ** | -44.6 | -501.34 ** | -329.35 * | -401.61 ** |
| | (-1.72) | (11.82) | (-0.99) | (-2.36) | (2.10) | (2.06) | (20.90) | (-1.87) | (-3.47) | (-3.48) | (-0.24) | (-4.36) | (-2.01) | (-4.65) |
| Model 4 | -1043.4 ** | 1288 ** | 2159.7 ** | -37.22 ** | 594.87 | 115.01 | | -253.72 | -245.35 | -561.22 ** | 731.57 * | 711.56 | 1482.4 ** | -416.08 |
| | (-2.91) | (4.46) | (10.61) | (-17.63) | (1.93) | (0.41) | | (-1.41) | (-0.01) | (-4.10) | (2.53) | (0.49) | (8.95) | (-1.95) |
| **PANEL B: SIZE QUARTILE 1 N=64** | | | | | | | | | | | | | | |
| Model 1 | -6.76 | 441.86 | -331.75 ** | -9.06 * | -359.49 ** | 615.68 | 13.99 ** | | | | | | | |
| | .0.01 | (0.66) | (-2.68) | (-2.27) | (-2.84) | (0.91) | (11.75) | | | | | | | |
| Model 2 | 305.98 | -552.34 | 504.85 | -50.49 ** | 253.51 | 828.39 | | | | | | | | |
| | (0.27) | (-0.61) | (0.50) | (-13.58) | (0.04) | (1.04) | | | | | | | | |
| Model 3 | 32.25 | 327.96 | 212.8 | -12.13 ** | -369.19 ** | 121.63 | 13.93 ** | -557.21 * | | 81.06 | -223.99 | -153.23 | -352.15 | -293.89 |
| | (0.11) | (1.13) | (0.92) | (-3.24) | (-3.03) | (0.33) | (12.50) | (-2.33) | | (0.88) | (-0.47) | (-0.38) | (-0.55) | (-1.92) |
| Model 4 | 279.08 | 25.44 | 779.4 | -48.6 ** | -259.31 | 561.03 | | -819.16 | | -90.19 | -285.19 | -287.84 | -303.59 | -229.38 |
| | (0.13) | (0.01) | (0.77) | (-10.99) | (-0.11) | (0.27) | | (-0.75) | | (-0.51) | (-0.08) | (-0.05) | (-0.01) | (-0.12) |
| **PANEL C: SIZE QUARTILE 2 N=64** | | | | | | | | | | | | | | |
| Model 1 | -21.88 ** | 24.19 ** | 7.012 | -0.72 | 14.93 | 9.9 | 0.8 ** | | | | | | | |
| | (-4.04) | (3.49) | (0.49) | (-0.75) | (1.49) | (1.51) | (6.38) | | | | | | | |
| Model 2 | 10.86 | -5.54 | -56.69 | 0.57 | 30.76 | 53.59 | | | | | | | | |
| | (0.07) | (-0.04) | (-0.41) | (0.16) | (0.17) | (0.38) | | | | | | | | |
| Model 3 | -24.79 ** | 20.23 ** | 10.52 | -0.85 | 1.48 | 5.96 | 0.4 ** | 5.82 | 9.82 | 14.08 ** | 22.37 | 13.84 | 12.07 | 4.62 |
| | (-5.93) | (4.71) | (0.89) | (-1.31) | (0.32) | (1.14) | (3.07) | (0.96) | (1.24) | (5.34) | (0.00) | (1.97) | (0.43) | (0.24) |
| Model 4 | -31.82 | 8.25 | -66.41 ** | -0.57 | 5.96 | 10.05 | | 79.31 ** | 22.82 | 72.61 ** | 100.11 ** | 26.52 | 67.77 | 23.53 |
| | (-1.49) | (0.39) | (-5.49) | (-0.81) | (0.31) | (0.48) | | (2.82) | (0.11) | (7.91) | (19.89) | (0.05) | (1.97) | (0.24) |
| **PANEL D: SIZE QUARTILE 3 N=64** | | | | | | | | | | | | | | |
| Model 1 | 3.81 | -5.28 | -0.81 | 0.13 | -10.17 ** | -0.98 | 0.27 * | | | | | | | |
| | (1.14) | (-1.63) | (-0.21) | (0.68) | (-10.06) | (-0.31) | (2.47) | | | | | | | |
| Model 2 | 3.25 | -5.45 * | -3.14 | 0.17 | -9.36 ** | 1.6 | | | | | | | | |
| | (1.22) | (-2.12) | (-1.03) | (1.21) | (-9.24) | (0.63) | | | | | | | | |
| Model 3 | 0.27 | -6.08 ** | 1.19 | -0.1 | -6.35 ** | -3.08 | 0.16 | 5.22 | | 6.25 ** | 4.2 | 2.44 | 3.04 | 5.54 ** |
| | (0.13) | (-3.61) | (0.58) | (-0.72) | (-4.79) | (-1.84) | (1.17) | (1.77) | | (4.90) | (0.70) | (0.78) | (1.42) | (2.68) |
| Model 4 | 1.52 | -7.36 ** | -2.03 | -0.1 | -6.06 ** | -2.64 | | 4.47 | | 6.37 ** | 4.31 | 2.61 | 2.24 | 9.07 ** |
| | (0.70) | (-4.00) | (-1.05) | (-0.85) | (-4.72) | (-1.38) | | (1.67) | | (5.03) | (0.86) | (0.23) | (1.29) | (2.84) |
| **PANEL E: SIZE QUARTILE 4 N=65** | | | | | | | | | | | | | | |
| Model 1 | 0.8 | -0.37 | -0.62 | -0.03 | 1.62 ** | -1.21 * | 1.28 ** | | | | | | | |
| | (1.64) | (-0.56) | (-0.74) | (-0.70) | (3.12) | (-1.75) | (12.60) | | | | | | | |
| Model 2 | 1.82 * | -3.94 ** | 2.13 | -0.64 | 4.09 ** | -8.31 ** | | | | | | | | |
| | (2.30) | (-3.79) | (0.75) | (-0.33) | (3.78) | (-9.48) | | | | | | | | |
| Model 3 | -0.22 | -0.11 | 0.08 | -0.07 | 2.38 ** | -1.06 | 1.19 ** | 0.86 | | 0.15 | -0.08 | | 1.38 | 1.07 |
| | (-0.24) | (-0.15) | (0.11) | (-1.49) | (4.25) | (-1.46) | (13.59) | (0.70) | | (0.22) | (-0.09) | | (1.67) | (1.27) |
| Model 4 | 0.311 | -1.49 | 2.37 | -0.37 | 5.3 ** | -4.85 ** | | 2.12 | | -1.98 | -1.12 | -3.41 | 2.55 | 2.24 |
| | (0.11) | (-1.03) | (0.77) | (-0.20) | (4.19) | (-3.36) | | (0.52) | | (-0.73) | (-0.41) | (-0.00) | (-0.85) | (0.78) |

* Significant at the 5% level
** Significant at the 1% level

**Table VIII. Econometric model estimation**. Dependent variable is matching company adjusted increment in debt to equity ratio in the last two years preceeding the takeover announcement, for target firms in the period 1990-1995. ‘Bidder Industry’ takes value 1 when SIC codes (four digits) for target and bidder firms are equal. ‘Toehold Dummy’ takes value 1 when ‘Toehold Size’ is different from zero. ‘Target Management’ is a dummy variable that equals 1 when bidder company includes target managers. Industry dummies result from the classification in Tables 1 and 2 (Group 1: Agriculture, forestry, fishing and mining; Group 2: Construction; Group 3: Manufacturing; Group 4: Transportation, communications, electric, gas and sanitary services; Group 5: Wholesale Trade; Group 6: Retail Trade; Group 7: Finance, Insurance and Real Estate; Group 8: Services). Size Quartile 1 represents the smallest firms in the sample, Size Quartile 4 represents the biggest firms in the sample. Significance levels are adjusted for heteroskedasticity with White’s estimations, and t-statistics are in parentheses