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Defence versus Offence: Disclosure and Media in Takeovers

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Abstract

This paper analyzes a target firm's decision to voluntarily disclose information during a takeover event and the effect of such disclosures on the outcome of the takeover. In the model the acquirer may also run a media campaign. The model predicts that a voluntary disclosure of positive information by the target decreases the likelihood that the takeover succeeds. The empirical analysis confirms this prediction by showing that positive earnings forecasts by target firms during takeover events increase the probability of takeover failure. Overall, it is shown that information dissemination through voluntary disclosures by target firms is an important factor affecting takeover outcomes.

Keywords: takeovers, target firm, voluntary disclosures, earnings forecasts, takeover success

1. Introduction

Some takeovers may be classified as win-lose games played between the target firm and the acquirer. This is especially true for hostile takeovers. Various tactics are intended to lure the shareholders to their own sides. They do so because target shareholders determine the outcome of a takeover by voting. One of the frequently employed tactics by the acquirer is the financial media. Buehlmaier (2011) both theoretically and empirically shows that financial press coverage about the acquirer can predict takeover outcomes. In particular, positive media content about the acquirer gives rise to takeover success. On the other hand, one of the popular defence weapons employed by the target is voluntary disclosures in the form of earnings/profit forecasts. Target firms send these profit forecasts to shareholders with other takeover documents. The aim may be to show that the shares are worth more than the bid price or to illustrate that the current management is better at running the company than the potential acquirer. Gray et al. (1991) give evidence from the UK that more forecasts are voluntarily disclosed during hostile takeovers. Similarly, Sudarsanam (1994) finds that targets disclose a profit forecast in 45% of hostile and competing bids in UK. There are also some well-known examples of this phenomenon from the US, like Avon Products Inc. forecasting good news after a hostile takeover bid by Amway in 1989 which finally failed (Ruland et al., 1990). Thus, an interesting question is whether profit/earnings forecast disclosures, which seem to be preferred by target firms as a defence instrument, really have an effect on the takeover outcomes.

Previous literature argues that investors regard voluntary disclosures as credible because they have been part of the Securities and Exchange Commission (SEC) filings since 1973. According to the Private Securities Reform Act of 1995, forecasts that are not prepared in good faith and with a reasonable basis would be subject to liability. (Pincus, 1996) Although the term 'good faith' may sound very general, this federal securities law would prevent firms from providing fraudulent voluntary disclosures. Another reason why voluntary disclosures are found to be credible is their ex-post verifiability. If a firm sends false information to the market, the market could react to these misleading signals by ignoring the firm's future disclosures. (Stocken, 2000) This is related to the issue of 'liar's discount'. If a firm earns a reputation for misleading information, analysts are likely to stop following this firm, which leads to a decrease in the firm's stock price and/or liquidity. (Skinner, 1994) Indeed, Brown and Caylor (2005) and Burgstahler and Eames (2006) show that managers have a tendency to provide conservative forecasts in order to prevent any negative earnings surprises afterwards and to be able to beat their forecasts. Again closely related to this issue, Rogers, Van Buskirk and Zechman (2011) provide suggesting evidence that shareholder litigation risk increases with more optimistic disclosure language. Thus, firms are not expected to be reckless about their voluntary disclosures even when they provide only qualitative statements and, also, they would be reluctant to provide an overly optimistic outlook.

This paper analyzes a target firm's decision to disclose financial information during a takeover event and the effect of these disclosures on the takeover outcome. In the model the acquirer may also run a media campaign to affect the shareholders' perception. The target firm may make informative or uninformative disclosures. The so-called informative disclosure in the model may correspond to quantitative and realistic management earnings forecasts by the target firms. This type of disclosures is an effective tool to communicate the real type of the target to shareholders. In contrast, an uninformative disclosure does not give much information. One may consider it as not disclosing or providing qualitative and 'soft' statements that are not easy to interpret. This is consistent with the idea of no disclosure does not necessarily imply keeping 'bad news'. Hence, uninformative disclosure provides noisier information about the real type of the target compared to the first alternative.

The economic intuition behind the model is as follows. Target shareholders are not always perfectly aware of the company's real worth and also do not know whether a takeover leads to value creation or destruction. Shareholders are going to approve a takeover if they only believe that in expectation the target firm value with the takeover is higher than the value without the takeover. Hence, voluntary disclosures of the target firm and financial news about the acquirer alleviate the information asymmetry problem of the shareholders. The target management chooses its disclosure policy by taking into account its interest to show the firm value under its control as valuable as possible either to maintain its private benefits of control or to increase the offer price. Thus, a high-value target has the incentive to release as much information as possible about its type. The high-value target thus makes an informative disclosure to distinguish itself from the low type. However, the low-value target that does not want to be identified but cannot provide completely false information, prefers uninformative disclosures in order to create a noisy signal and confuse shareholders. Shareholders still pay attention to voluntary disclosures since they know that the high-value target makes an informative disclosure that contains rather precise information. Shareholders also follow the financial press about the acquirer because the good and the bad type of acquirers play different media strategies. In particular, the good type runs a media campaign to separate itself from the bad type, while the bad type does not have any incentives to mimic the good type when the media campaign involves high costs.

We argue that both voluntary disclosures by the target and the financial news about the acquirer play a role in takeovers. In particular, the success probability of a takeover decreases with a positive disclosure signal and increases with a positive media signal. That is the case because shareholders know that a positive disclosure signal occurs due to the informative disclosure of the high-value target, and a positive media signal comes from the media campaign of the good type of acquirer. This consideration immediately yields the following empirical prediction: while disclosures that include positive news about the target decreases the likelihood of takeover success, disclosures with positive information in the financial media about the acquirer increases this likelihood.

This main prediction of the model is confirmed by an empirical investigation. We use the complementary log-log model specification and the 'rare events procedure' as a robustness check since the takeover outcome is a binary variable with an uneven distribution: less failed takeovers compared to the successful ones. We attain the disclosure variable by identifying the target firms in the sample that disclose positive news in the form of increasing management earnings forecasts for future years during the takeover event. The results confirm that the availability of positive news through management earnings forecasts has a significant and negative effect on the likelihood of takeover success. Including disclosure variable as an explanatory variable leads to also higher goodness of fit. Finally, the analysis also confirms that positive media content about the acquirer improves takeover success supporting Buehlmaier (2013).

The paper shows the impact of information dissemination on the likelihood of takeover success along with deal and firm characteristics that the previous literature has identified. Differently than Buehlmaier (2013), it considers the possibility of information dissemination by the target firm through voluntary disclosures. As it is with the acquirer, the information dissemination tool of the target firm also affects the takeover outcome. This paper demonstrates that the effect of voluntary disclosures in the form of earnings forecasts is not only limited to an increase in offer prices as it is shown in Brennan (1999), but it also reduces the takeover success probability. It is also observed that the voluntary disclosure practices of target firms during a takeover event seem to be in accordance with the general pattern of voluntary disclosures made in routine situations: while 'good news' is given by quantitative forecasts, target firms are likely to share 'bad news' with qualitative statements. Last but not least, the paper is also closely related to the emerging literature that analyzes the link between financial markets and corporate takeovers. Edmans, Goldstein, and Jiang (2011) show that a non-fundamental undervaluation of the target firm creates a profit opportunity for acquirers and so triggers takeovers. Our paper supports this view by showing that voluntary disclosures in the form of management earnings forecasts can be an effective way to alleviate such undervaluations for target firms. Our finding is also consistent with Safieddine and Titman (1999) showing that after failed takeovers target firms have higher stock returns in the years following the resolution date. This result is consistent with the overall story of the current paper. The target firm with high real worth reveals this information by earnings forecasts, which leads to takeover failure. And, the stock price of the company moves towards its real worth in the long run.

The remainder of the paper is structured as follows: Section 2 presents the details of the model. Section 3 includes the solution of the model as well as its empirical implications, which constitute the basis of the empirical analysis that comes in the next section. Accordingly, section 4 presents the data used for the empirical analysis, details of the empirical methodology and estimation results. Section 5 concludes and some of the proofs for section 3 are in the appendix.

2. Model

This paper builds on Buehlmaier (2013) by adding a signalling stage for the target firm through voluntary disclosures. With this extra stage, the paper aims to find out whether voluntary disclosures of the target firm as its information dissemination tool play a role in the takeover outcome as it happens with the acquirer's. The model of the shareholder voting game stems from Bagnoli and Lipman (1988). I follow Buehlmaier (2011) regarding the model assumptions about the acquirer's media campaign. The timeline of the game is illustrated in Figure 1. There are two companies, the acquirer and the target. The acquirer is either of a good G or of a bad B type. The good type increases the value of the target after a successful takeover, whereas the bad type is inefficient and leads to a loss of value. Similarly, the target is of a type with either a high H or a low L value of share p_t, where $t \in \{H, L\}$ and $p_L < p_H$. After a successful takeover, $p_{t,\tau}$ is the value of a share when the firm is controlled by the acquirer of type $\tau \in \{G,B\}$. Since the bad type decreases and the good type increases managerial efficiency, it holds that $p_{t,B} < p_t < p_{t,G}$. A successful takeover generates less value creation in relative terms for the high-value target, meaning that its loss to gain ratio (relative loss) is larger than the loss to gain ratio (relative loss) of the low-value type such that $\frac{p_H - p_{H,B}}{p_{H,G} - p_H} > \frac{p_L - p_{L,B}}{p_{L,G} - p_L}$.

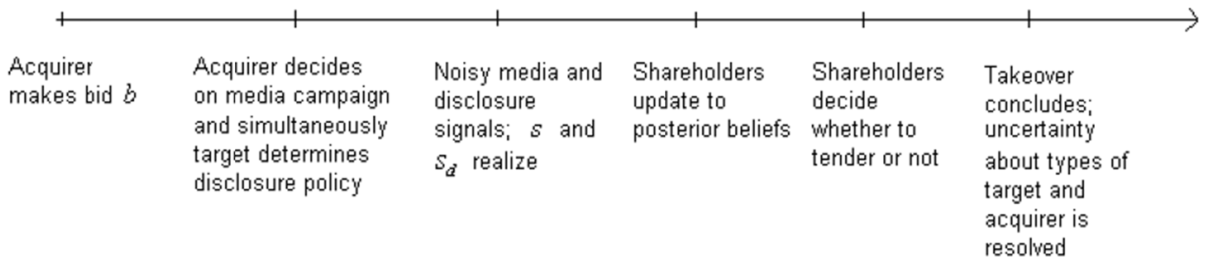

Figure 1. Timeline of events in the model

The n target shareholders do not know either the acquirer's or the target's type. The common priors about the acquirer's and the target's types in the game are as follows:

$$\beta = P(\tau = G) \in (0,1)$$

$$\alpha = P(t = H) \in (0,1)$$

The game starts with the acquirer deciding on an any-and-all bid price $b \geq 0$ without knowing its type. Later on, the acquirer privately learns its type and decides whether to run or not to run a media campaign. Simultaneously, the target, which already privately knows its type, decides on its disclosure policy whether to make an informative disclosure about its real worth or not. The acquirer's behavior starategy is modelled by

$$\xi_G = P(m = 1 | \tau = G) \text{ and } \xi_B = P(m = 1 | \tau = B)$$

where the event $\{m = 1\}$ corresponds to running a media campaign and $\{m = 0\}$ corresponds to no media campaign. Similary, the target decides on its behavior strategy whether to make an informative disclosure, $\{d = i\}$ or an uninformative disclosure, $\{d = \neg i\}$ such that

$$\xi_H = P(d = i | t = H) \text{ and } \xi_L = P(d = i | t = L).$$

The media campaign costs $c > 0$ for the acquirer, whereas the target can disclose without incurring any cost.

Target shareholders cannot observe the decision of the acquirer regarding the media campaign. However, they get a noisy signal $s \in \{0,1\}$ on the occurrence of a media campaign through the press. The precision of the signal is given by,

$$\delta = P(s = 0|m = 0) = P(s = 1|m = 1) > 1 / 2.$$

In addition, shareholders receive a noisy signal $s_d \in \{h, l\}$ about the type of the target based on its disclosure policy. The probability that the shareholders observe the correct signal about the type of the target is higher if the target makes an informative disclosure. In particular,

$$P(s_d = h|d = \neg i,t = H) = 1 / 2 \text{ and } P(s_d = h|d = i,t = H) = 1 - \epsilon,$$
$$P(s_d = l|d = \neg i,t = L) = 1 / 2 \text{ and } P(s_d = l|d = i,t = L) = 1 - \epsilon$$

where $0 < \epsilon < 1 / 2$. Hence, the precision of the signal increases with an informative disclosure. The reader may think of an informative disclosure as a quantitative accounting statement like a management's earnings forecast by which the target tries to convey its type. Alternatively, the target may provide no statements at all or may assert some vague qualitative statements about its future prospects.

Shareholders then update their priors by using all recently available information revealed by both signals. Accordingly, their posterior beliefs about the acquirer and the target after observing the signal realizations are denoted by, respectively,

$$\beta^1 = P(\tau = G|s = 1) \text{ and } \beta^0 = P(\tau = G|s = 0),$$
$$\alpha^h = P(t = H|s_d = h) \text{ and } \alpha^l = P(t = H|s_d = l).$$

The purpose of noisy signals is to have a more realistic model. There is always the chance that target shareholders misinterpret what they read in the voluntary disclosure documents. But the misinterpretation risk gets smaller with the informativeness of the target´s disclosure. A similar comment is applied to the media signal. Target shareholders may think that the media content that they read is due to a media campaign when no such media campaign was initiated (and vice versa).

At the final stage of the model, shareholders decide whether or not to tender their shares in a simultaneous-move game. Each shareholder owns one share. The acquirer needs to obtain at least k shares to get control of the company. Otherwise, the takeover fails. Conditional on having observed the noisy disclosure signal s_d, the shareholders expect the target's share price to be worth p^{s_d}, where

$$p^{s_d} = \alpha^{s_d} p_H + (1 - \alpha^{s_d}) p_L$$

under the current management. Moreover, having also observed the media signal s, they expect the share price after a successful takeover to be

$$\begin{aligned} p^{s,s_d} &= P(\tau = G,t = H|s_d,s)p_{H,G} + P(\tau = G,t = L|s_d,s)p_{L,G} \\ &+P(\tau = B,t = H|s_d,s)p_{H,B} + P(\tau = B,t = L|s_d,s)p_{L,B} \end{aligned} \tag{1}$$

where $s \in \{0,1\}$, $s_d \in \{h,l\}$ and $P(.,.|s_d,s)$ are the joint posterior probabilities about the types of the acquirer and the target. Accordingly, if a shareholder does not tender and the takeover goes through, her expected payoff is $p^{s,s_d} - p^{s_d}$, whereas if she tenders and the takeover goes through her expected payoff is $b - p^{s_d}$. If the takeover fails, each shareholder obtains a zero payoff. The acquirer obtains non-monetary private benefits of control z by taking over the target. Even the bad type-B acquirer has an incentive to take over the target even though it will destroy value since in expectation it benefits:

$$k[\alpha(p_H - p_{H,B}) + (1 - \alpha)(p_L - p_{L,B})] < z.$$

The final payoff of the acquirer's management is then

$$-c1_{m=1} + [z + j(p_{t,\tau} - b)]1_{j\geq k}. \tag{2}$$

where j is the number of shares tendered by the shareholders and 1 is the indicator function. On the other hand, the target management loses its private benefits of control y in case the takeover succeeds.

3. Model Solution

Our first lemma determines how target shareholders utilize the new information conveyed through both the target's disclosure policy and the acquirer's media campaign to update their beliefs to,

$$\beta^s = P(\tau = G|s) \text{ and } \alpha^{s_d} = P(t = H|s_d).$$

Lemma 1. Shareholders' posterior beliefs about the target are

$$\alpha^h = \alpha\frac{\xi_H(1-\epsilon)+(1-\xi_H)\frac{1}{2}}{\eta},$$

$$\alpha^l = \alpha\frac{\xi_H\epsilon+(1-\xi_H)\frac{1}{2}}{1-\eta},$$

and about the acquirer are

$$\beta^1 = \beta\frac{\xi_G\delta+(1-\xi_G)(1-\delta)}{\zeta},$$

$$\beta^0 = \beta\frac{\xi_G(1-\delta)+(1-\xi_G)\delta}{1-\zeta},$$

where $\eta = P(s_d = h) = \alpha[\xi_H(1-\epsilon) + (1-\xi_H)\frac{1}{2}] + (1-\alpha)[\xi_L\epsilon + (1-\xi_L)\frac{1}{2}]$ *and* $\zeta = P(s = 1) = \beta[\xi_G\delta + (1-\xi_G)(1-\delta)] + (1-\beta)[\xi_B\delta + (1-\xi_B)(1-\delta)]$.

The economic intuition of Lemma 1 follows from the following observations, which are

$$\alpha^{s_d}_{\xi_H}\begin{cases} <0, & s_d = l \\ >0, & s_d = h \end{cases}, \quad \alpha^{s_d}_{\xi_L}\begin{cases} <0, & s_d = l \\ >0, & s_d = h \end{cases} \tag{3}$$

and

$$\beta^{s}_{\xi_G}\begin{cases} <0, & s = 0 \\ >0, & s = 1 \end{cases}, \quad \beta^{s}_{\xi_B}\begin{cases} >0, & s = 0 \\ <0, & s = 1 \end{cases} \tag{4}$$

where $\alpha^{s_d}_{\xi_t}$ and $\beta^{s}_{\xi_\tau}$ denote the partial derivatives of posterior beliefs with respect to ξ_t and ξ_τ, respectively.

Start with the partial derivatives of posterior beliefs about the target in (3) and consider for example the implications of $\alpha^h_{\xi_H} > 0$. Shareholders observe the disclosure signal realization as $s_d = h$. This type of signal is most positively correlated with the informative disclosure of the high-value target but is also correlated with uninformative disclosures of each type. Suppose that the high-value target makes an informative disclosure with a high probability. That is to say, ξ_H is close to one. Since the realized disclosure signal $s_d = h$ is very much correlated with the informative disclosure of the high-value target and since shareholders actually know that the high type is very likely to make an informative disclosure, they become pretty sure that they face a high-value target. Hence, α^h is quite large. In simpler terms, if the high-value target is more likely to make an informative disclosure, then target shareholders are more likely to believe that they are facing a high type when they observe the disclosure signal as $s_d = h$. This argument shows us why the posterior α^h is an increasing function of ξ_H.

Similar arguments would explain the rest of the relationships in equations (3) and (4).

As the next step, target shareholders form joint posterior beliefs about the types of the acquirer and the target in order to evaluate the expected share price p^{s,s_d} if the takeover succeeds in accordance with equation (1). Accordingly, Lemma 2 below derives the joint posterior probabilities by employing the conditional law of total probability.

Lemma 2. The joint posterior probabilities about the types of the acquirer and the target *$P(\tau = x, t = z | s_d = k, s = n)$ are given by,*

$$=: \frac{P(\tau=x)P(t=z)}{P(s_d=k,s=n)}[\xi_x P(s=n|m=1)+(1\text{-}\xi_x)(s=n|m=0)][\xi_z P(s_d=k|d=i,t=z)+(1\text{-}\xi_z)0.5] \tag{5}$$

where $x \in \{G, B\}$, $z \in \{H, L\}$, $k \in \{h, l\}$ and $n \in \{0, 1\}$.

3.1 Shareholders' Tendering Decision

Given the posterior probabilities, backwards induction is used to determine the Perfect Bayesian-Nash equilibria of the game. First, pure strategy equilibria of the shareholders' tendering decision are determined. Depending on the acquirer's bid b, the shareholders' tendering decision falls into the following four different cases: (i) If the acquirer's bid b is such that $max\{p^{s_d}, p^{s,s_d}\} < b$, all shareholders strictly prefer to tender and the takeover succeeds. (ii) Next, consider the case that $b < min\{p^{s_d}, p^{s,s_d}\}$. No shareholder tenders and the takeover fails. (iii) Third, consider the more interesting case such that $p^{s_d} < b < p^{s,s_d}$. Under this case, shareholders tender exactly k shares and the takeover succeeds. Each tendering shareholder obtains $b - p^{s_d}$ in expectation, whereas each non-tendering shareholder obtains $p^{s,s_d} - p^{s_d}$ in expectation. Non-tendering shareholders have no incentive to deviate since if they instead tendered, the takeover would still succeed but they would obtain a lower payoff. Shareholders who tender have also no incentive to deviate because if they did not tender, the takeover would fail and they would obtain a zero payoff. (iv) Last but not least, suppose that $p^{s,s_d} < b < p^{s_d}$. Then, there are two different equilibria. Either all shareholders tender or no shareholder tenders. From the equilibrium with no shareholder tendering, noone has an incentive to deviate because if she instead tendered, the takeover would still fail and the payoff would stay the same. Similarly, noone has an incentive to deviate from the equilibrium where all shareholders tender. If a shareholder were to deviate and not tender, the takeover would still succeed but she would obtain a lower payoff. The last equilibrium with each shareholder tendering shares a similar logic with the well-known bank run equilibrium of Diamond and Dybvig (1983). However, the equilibrium with no shareholder tendering is more sensible in a takeover context, especially considering the fact that shareholders obtain negative payoff if they all tender. The paper concentrates on the type of equilibrium with no shareholder tendering.

Given the four different scenarios, one may deduce that target shareholders tender k shares if $b = p^{s_d} \leq p^{s,s_d}$ or if $b = p^{s,s_d} > p^{s_d}$. It is clear that the acquirer has no incentives to bid less than p^{s_d} since doing so would lead to failure of the takeover. If the acquirer bids more than p^{s_d}, the takeover succeeds. But the acquirer can do better by lowering the bid to p^{s_d}. Lemma 3 below shows formally that the acquirer's utility is a decreasing function of the bid price for $b \geq p^{s_d}$.

Lemma 3. The acquirer bids optimally $b^* = p^{s_d}$ in equilibrium.

Lemma 3 implies that shareholders care only whether the expected posterior price after a successful takeover, p^{s,s_d}, exceeds the expected price under the current management, p^{s_d}. In other words, shareholders tender k shares and the takeover succeeds if $b = p^{s_d} \leq p^{s,s_d}$. On the other hand, no shareholder tenders and the takeover fails if $b = p^{s_d} > p^{s,s_d}$. This result is intuitive: Shareholders compare the expected values of the target with and without the takeover. They approve the takeover only if they feel certain that in expectation the target's value with the takeover is higher than its value without the takeover.

Another implication of Lemma 3 is that target shareholders tender at most k shares. This means that the acquirer's final payoff is at most $[z + k(p_{t,\tau} - p^{s_d})]$ by recalling equation (2). The model would be interesting only if the cost of the media campaign is lower than the maximal expected amount that the acquirer gains from the takeover. Otherwise there would be no incentives for any type of the acquirer to run a media campaign. In this respect, suppose that

$$c<(2\delta-1)[\alpha[z-k(p_H-p_{H,G})]+(1-\alpha)[z-k(p_L-p_{L,G})]]=:\bar{c}$$

holds for the rest of the paper.

3.2 Equilibria

This section determines the optimal disclosure and media campaign decisions by the target and the acquirer. Define

$$\beta^{l,1}=\frac{(1-\delta)[(1-\alpha)(p_{L,B}-p_L)+2\alpha\epsilon(p_{H,B}-p_H)]}{(1-\alpha)(p_{L,B}-p_L)(1-\delta)+(1-\alpha)\delta(p_L-p_{L,G})+2\alpha\epsilon(1-\delta)(p_{H,B}-p_H)+2\alpha\epsilon\delta(p_H-p_{H,G})},$$

$$\beta^{h,1}=\frac{(1-\delta)[(1-\alpha)(p_{L,B}-p_L)+2\alpha(1-\epsilon)(p_{H,B}-p_H)]}{(1-\alpha)(p_{L,B}-p_L)(1-\delta)+(1-\alpha)\delta(p_L-p_{L,G})+2\alpha(1-\epsilon)(1-\delta)(p_{H,B}-p_H)+2\alpha(1-\epsilon)\delta(p_H-p_{H,G})}$$

$$\beta^{l,0}=\frac{\delta[(1-\alpha)(p_{L,B}-p_L)+2\alpha\epsilon(p_{H,B}-p_H)]}{(1-\alpha)(p_L-p_{L,G})(1-\delta)+(1-\alpha)\delta(p_{L,B}-p_L)+2\alpha\epsilon(1-\delta)(p_H-p_{H,G})+2\alpha\epsilon\delta(p_{H,B}-p_H)}$$

$$\beta^{h,0}=\frac{\delta[(1-\alpha)(p_{L,B}-p_L)+2\alpha(1-\epsilon)(p_{H,B}-p_H)]}{(1-\alpha)(p_L-p_{L,G})(1-\delta)+(1-\alpha)\delta(p_{L,B}-p_L)+2\alpha(1-\epsilon)(1-\delta)(p_H-p_{H,G})+2\alpha(1-\epsilon)\delta(p_{H,B}-p_H)},$$

and also the lower threshold for the cost of the media campaign,

$\underline{c} = (2\delta - 1)[\alpha[z - k(p_H - p_{H,B})] + (1 - \alpha)[z - k(p_L - p_{L,B})]]$ where $\underline{c} < \bar{c}$ since $p_{t,B} < p_{t,G}$.

Lemma 4. It holds that $0 < \beta^{l,1} \leq \beta^{h,1} < \beta^{l,0} \leq \beta^{h,0}$.

Proof. It is clear that $\beta^{l,1} = \beta^{h,1}$ when $\alpha = 0$ and $\alpha = 1$. For the values of $0 < \alpha < 1$ there exists a positive difference between $\beta^{l,1}$ and $\beta^{h,1}$, which follows from $\delta \in (1/2,1)$, $\epsilon \in (0,1/2)$, $p_{t,B} < p_t < p_{t,G}$ and $\frac{p_H - p_{H,B}}{p_{H,G} - p_H} > \frac{p_L - p_{L,B}}{p_{L,G} - p_L}$. The same argument is at work for the part $\beta^{l,0} \leq \beta^{h,0}$. Finally, $\beta^{h,1}$ is strictly smaller than $\beta^{l,0}$ for all values of $0 \leq \alpha \leq 1$ given that all previous conditions are true.

One may interpret these four different β thresholds presented above as the different levels of shareholders' prior belief or, in other words, their optimism (pessimism) about the acquirer. Shareholders are most pessimistic about the acquirer in the region $\beta \in [0, \beta^{l,1})$ because they are quite certain that they face a bad type. On the other hand, shareholders are most optimistic about the acquirer if $\beta \in [\beta^{h,0}, 1]$. In the middle range $\beta \in [\beta^{l,1}, \beta^{h,0})$, shareholder's uncertainty about the acquirer's type is relatively high and while their pessimism increases moving in the direction of $\beta^{l,1}$, their optimism increases in the direction of $\beta^{h,1}$. The interpretation of the thresholds for the cost of the media campaign is as follows: For the existence of a separating media equilibrium by the acquirer in general (Note 1), the cost of the media campaign should lie in an intermediate range ($c \in [\underline{c}, \bar{c}]$). A media campaign should be expensive enough that the bad B type of the acquirer is not able to afford it. It does not pay off to spend money for the expensive media campaign, since the costs of a media campaign together with the destruction in the target's value by the bad B type surpass the private benefits of control. On the other hand, the cost of a media campaign should not be too high, so that it does not even pay off for the good G type of acquirer.

The next theorem states the conditions and the characteristics of a separating equilibrium both by the target and the acquirer. Under this separating equilibrium, the information dissemination tools of both the acquirer and the target have an effect on the takeover outcome. In other words, both voluntary disclosures by the target and financial news about the acquirer play an important role. The high-value target H strictly prefers to make an informative disclosure if shareholders are relatively uncertain about the acquirer's type, i.e. $\beta \in [\beta^{l,1}, \beta^{h,0})$. In contrast, the low- value target L chooses noisy or non-informative disclosure to confuse shareholders. However, shareholders still pay attention to voluntary disclosures since they know that the high-value target H makes an informative disclosure. If an informative disclosure involved (high) costs and became unaffordable for the high-value H target, then voluntary disclosures would have no effect on the takeover outcome. Yet it is plausible to assume that releasing a voluntary disclosure, containing useful information about the company, has a negligible cost. Moreover, now due to the informational effects of voluntary disclosures by the target, the media campaign should cost less so that the good G type of the acquirer still finds running a media campaign worth paying for (see below $c_1 < \bar{c}$). To say it differently, now the cost of the media campaign should be less for the existence of a separating media equilibrium by the acquirer since the voluntary disclosure of the target firm is also informative, which decreases the marginal benefit of a media campaign. The underlying reason is that shareholders get informed about the target firm by looking at the disclosure signal and move already to influence the takeover result. The important take-away of this theorem is that while positive media content about the acquirer may entail takeover success, positive disclosure about the target may decrease its likelihood.

Theorem 1. If $\beta \in [\beta^{l,1}, \beta^{h,0})$, $c_1 = (2\delta - 1)[\alpha[z - k(p_H - p_{H,G})] + (1 - \alpha)0.5[z - k(p_L - p_{L,G})]] \in [\underline{c}, \bar{c}]$ and $\underline{c} \leq c \leq c_1$, then $(\xi_G^*, \xi_B^*) = (1,0)$ and $(\xi_H^*, \xi_L^*) = (1,0)$. In the region $\beta \notin [\beta^{l,1}, \beta^{h,0})$, $(\xi_G^*, \xi_B^*) = (0,0)$ and $(\xi_H^*, \xi_L^*) = (0,0)$.

- For $\beta \in [\beta^{l,1}, \beta^{h,1})$ the takeover succeeds only after $(s_d = l, s = 1)$ and fails otherwise.
- For $\beta \in [\beta^{h,1}, \beta^{l,0})$ the takeover succeeds after $(s_d = l, s = 1)$, $(s_d = h, s = 1)$ and fails after $(s_d = l, s = 0)$, $(s_d = h, s = 0)$.
- For $\beta \in [\beta^{l,0}, \beta^{h,0})$ the takeover fails only after $(s_d = h, s = 0)$ and succeeds otherwise.

First, evaluate the separating equilibrium, $(\xi_G^*, \xi_B^*) = (1,0)$ and $(\xi_H^*, \xi_L^*) = (1,0)$. Shareholder uncertainty about the acquirer is high ($\beta \in [\beta^{l,1}, \beta^{h,0})$). The information that the shareholders obtain through voluntary disclosures is especially important because they face great uncertainty about the acquirer's type. If the shareholders were instead quite certain that the acquirer was a good type G (bad type B) of acquirer, they approved (prevented) the takeover already and the voluntary disclosures were pointless. The high-value target H thus prefers an informative disclosure to separate itself from the low-value target L, which opts for the non-informative disclosure to create noise and to confuse shareholders. Additionally, the acquirers play a separating media equilibrium now in a smaller region of the cost of a media campaign, which has moved towards the left due to the information dissemination through voluntary disclosures by the target. The bad B type of the acquirer has no incentives to mimic the good G type also in this region ($\underline{c} \leq c \leq c_1$), as it has been before. As a result, shareholders learn from both disclosure and media signals. Shareholders believe that they deal with a high-value target H after observing a positive disclosure signal $s_d = h$ and a good type G of acquirer after observing a positive media signal $s = 1$. Shareholders' beliefs affect the outcome in return. That is why a positive disclosure signal causes takeover failure since acquisition destroys value for the high-value target H. On the other hand, a positive media signal triggers takeover success since being taken over by a good type G of acquirer increases value.

Consider now the case when shareholders are pretty sure about the type of acquirer ($\beta \notin [\beta^{l,1}, \beta^{h,0})$). Shareholders already have a clear idea whether the takeover improves the target value or not depending on whether the prior lies in the bottom or the top range. Hence, they act accordingly about the tendering decision. Neither targets nor acquirers have thus incentives to provide additional information through voluntary disclosures and financial news since they cannot affect the outcome. All these ideas translate into finding a fixed point of optimal strategies, which is shown in the proof of the theorem in the appendix.

The theorem provides many insightful results. It shows that both news in the financial media about the acquirer and voluntary disclosures by the target may affect the result of a takeover. Although the low-value L target sends noisy information to the market to confuse shareholders, the high-value H target can still differentiate itself by making an informative disclosure. That is why shareholders pay attention to voluntary disclosures made by the target firm and a positive (negative) disclosure signal leads to takeover failure (success). On the other hand, the good type G of acquirer prefers to run a media campaign to differentiate itself from the bad type B of acquirer. This is because the good type G of acquirer knows that it is too costly for the bad type B to mimic. Accordingly, shareholders are willing to approve a takeover only if they observe a positive media signal. They are aware of the fact that this positive media signal stems from a media campaign of the good type G of acquirer. Figure 2 illustrates these results: The takeover is more likely to fail after a positive disclosure signal $s_d = h$, i.e. it requires a higher prior about the acquirer so that the takeover succeeds ($\beta^{h,1} \geq \beta^{l,1}$ and $\beta^{h,0} \geq \beta^{l,0}$). Besides, the takeover is more likely to succeed after a positive media signal $s = 1$, i.e a lower prior about the acquirer suffices for takeover success ($\beta^{l,1} < \beta^{l,0}$ and $\beta^{h,1} < \beta^{h,0}$). Another interesting result is that when the high-value H target makes an informative disclosure and shareholders start to pay attention to voluntary disclosures by the target firm, the region of the cost of a media campaign in which the separating media equilibrium by the acquirer exists, becomes smaller and shifts leftward. The intuitive explanation behind this result is as follows: Since shareholders now also care about voluntary disclosures made by the target firm, the acquirer finds it optimal to run a media campaign only if the cost is small enough. Another interpretation is that the marginal benefit from a media campaign decreases for the acquirer, since shareholders get informed about the target firm and take action already to affect the takeover outcome. If they receive a negative disclosure signal about the target, they do not care much whether the firm could be taken over. Not suprisingly, the prior belief (α) about the target plays a role in takeover outcomes as well. To be precise, β thresholds denoted by $\beta^{s_d,s}$, from which onwards a takeover succeeds after signals (s_d, s) are increasing in α, i.e. $\partial\beta^{s_d,s}/\partial\alpha > 0$ as seen in Figure 2. The interpretation is clear. As the prior belief about the target being a high-value H target increases, it gets more difficult to take over the firm.

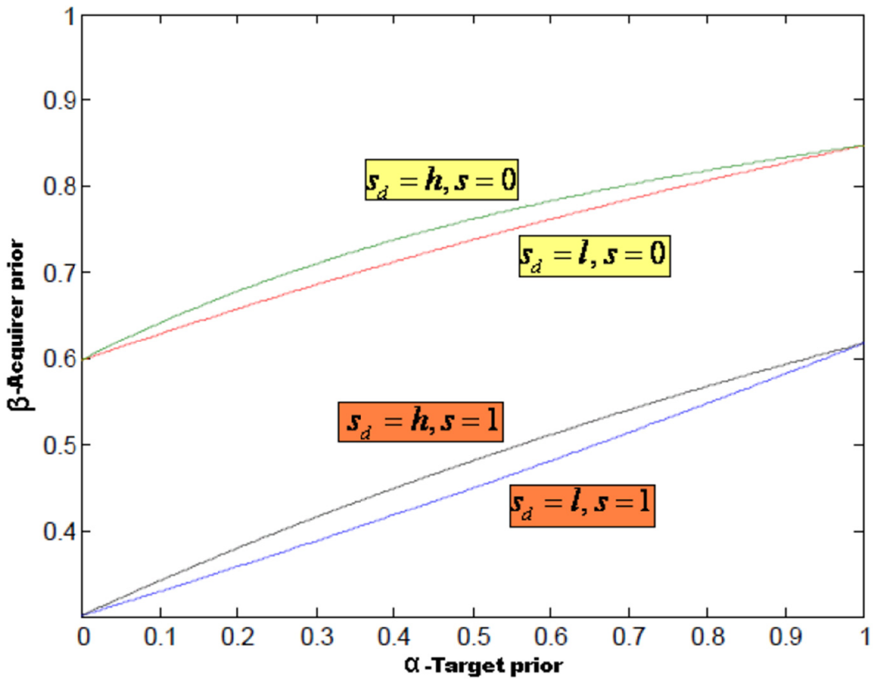

Figure 2. Results

3.3 Empirical Implications

The model predicts that voluntary disclosures by the target firm during a takeover event may influence the outcome together with the financial press coverage about the acquirer. In particular, a voluntary disclosure containing positive prospects ($s_d = h$) about the target decreases the likelihood that the takeover succeeds. Empirically, target firms may release management's earnings forecasts for the upcoming periods in their voluntary disclosure documents. Those target firms that announce increasing earnings forecasts compared to the previous year's earnings are the ones providing positive prospects. On the other hand, those firms that announce decreasing earnings forecasts (not expected in equilibrium) and/or qualitatively negative forward-looking statements about the next periods are the ones providing negative news ($s_d = l$). The likelihood that the takeover fails (succeeds), is expected to be higher for those firms with positive (negative) news. On the other hand, it is not very uncommon that some target firms do not provide either earnings forecasts or qualitative statements. In the following empirical analysis, those targets with no disclosure are classified together with the firms announcing negative news. By doing this, the empirical analysis focuses on determining the sole effect of positive disclosures on the likelihood of takeover success.

4. Data and Empirical Analysis

Takeover data consists of takeover attempts with announcement dates between January 1, 2000 and December 31, 2006 from the SDC Platinum Mergers & Acquisitions database as in Buehlmaier (2011). Deal and firm characteristics of targets and acquirers (Note 2) are also from SDC and they are standard control variables used in the literature. The prediction that positive news about the acquirer in the financial press leads to takeover success is kept and further tested in the analysis by including the *media* variable of Buehlmaier (2011). Data on voluntary disclosures required to test the main prediction of the current paper, which is positive prospects about the target decreases the takeover success probability, are obtained from Dow Jones Factiva and the SEC EDGAR Database. The details and the summary statistics of deal and firm characteristics as well as the details regarding how the voluntary disclosures data are obtained could be found in Orhun (2013).

The general binary outcome model is suitable in order to check the main empirical prediction of the model since takeover outcome is a binary variable: 1 for completed takeovers and 0 for failed ones. In particular, we choose complementary log-log model specification. This specification is preferred if binary outcome data is unevenly distributed: the positive (or negative) outcome is rare. The number of failed takeovers is much smaller compared to the number of successful ones: 28 failed vs. 286 successful takeovers. (Orhun, 2013) Complementary log-log models capture this effect by being asymmetric around zero.

$$P(status_i{=}completed|(d_i,media_i,x_i))=F((1,d_i,media_i,x_i)\cdot\beta) \quad (6)$$

The function F is the complementary log-log link function, x_i is a $1 \times K$ vector of control variables and β is the $(K+3) \times 1$ parameter vector to be estimated. $media_i$ is the media variable of Buehlmaier (2011). d_i is the disclosure variable, which is 1 for target firms that provide increasing earnings forecasts ("positive disclosure") and 0 for target firms with "no disclosure" and "negative disclosure" as it is explained in Orhun (2013). The parameter β_2 shows the effect of positive (news) disclosure by the target firm in the form of management's earnings forecasts on takeover outcome. If the empirical prediction of the model is valid, β_2 is negative and significant and also the sample average of the marginal effect is negative.

4.1 Results

The model (6) is estimated with maximum likelihood. The control variables x_i include deal characteristics and firm characteristics of target firms and acquirers. In addition, *prevtakeovers*, which is the number of successful takeovers in the previous 100 days for each takeover attempt in the sample, is also included. The latter variable is necessary to account for the effect of merger waves and macroeconomic factors.

Table 1 presents the estimation results of the complementary log-log specification together with the results of the classic probit model to highlight the difference. The table includes the coefficients of the explanatory variables that remain to be statistically significant after a standard stepwise regression procedure. In this procedure, all explanatory variables are included at the start. But at each new step the least significant explanatory variable is dropped and then the model is re-estimated until all explanatory variables are significant. The results of the two different models are very similar. The significance of some variables slightly changes and averages of the sample marginal effects of most variables increase in absolute value with complementary log lof model. McFadden's R^2 also increases by 1%. The coefficient of the disclosure variable d_i is negative and is statistically significant at 1% level. This result is supportive of the model's prediction. Last but not least, the marginal effect of *disclosure* (providing "positive disclosure") changes from -0.08 to -0.09 with complementary log-log model. This implies an increase of one unit of *disclosure* yields a (larger) decrease of approximately 0.09 units in the probability that the takeover succeeds. The coefficient of *media* is positive and significant. This means that positive media content about the acquirer increases the probability that the takeover succeeds. The coefficients of all other remaining variables are as expected (Note 3). The results of the complementary log-log model confirm the main prediction of the model even when the uneven distribution of the takeover data is taken into consideration.

Table 1. Complementary Log-Log model results together with the Probit model

Variable	Probit		Comp. Log-log	
	Coeff.	Marg. Effect	Coeff.	Marg. Effect
intercept	-5.99***		-6.47***	
	(-2.72)		(-2.91)	
disclosure	-1.54***	-0.08	-1.46***	-0.09
	(-3.30)		(-3.14)	
media	4.62***	0.25	4.71***	0.27
	(4.45)		(4.15)	
log(aCash)	0.24**	0.01	0.24**	0.02
	(2.32)		(2.35)	
aBookToMarket	-1.35***	-0.07	-1.45***	-0.08
	(-2.69)		(-2.97)	
aReturn	3.73***	0.20	4.35***	0.22
	(3.06)		(3.23)	
stockswap=yes	-1.81**	-0.10	-2.06***	-0.10
	(-2.55)		(-2.58)	
unsolicited=yes	-1.91***	-0.10	-2.12***	-0.12
	(-3.22)		(-2.99)	
log(days)	1.07***	0.06	1.13***	0.06
	(2.91)		(3.04)	
McFadden's R^2	0.66		0.67	
Likelihood ratio test-p value	< 0.0001		< 0.0001	
Observations	314		314	

Note. * This table shows the maximum likelihood estimation results of the complementary log-log model together with the probit model. The dependent variable is one if the takeover status is completed and zero if the status is failed. Explanatory variables are described in Tables 1-3. Columns labeled Coeff. show the estimated parameters for each variable, columns labeled Marg. Effect show the average of the sample marginal effects. "yes" indicates that the dummy variable takes the value of one if the nominal variable is equal to yes and zero otherwise. t statistics are in parentheses. *, **, *** indicate significance at 10%, 5%, 1%, respectively. The last three rows show McFadden's R^2, p value of Likelihood ratio test and the number of observations.

One other alternative to the complementary log-log model specification if one deals with such 'rare events' data, is proposed by political scientists King and Zeng (2001a, 2001b). Political scientists, who generally deal with very unevenly distributed binary dependent variables, with dozens to thousands of times fewer ones (events such as wars, coups, etc.) than zeros (non-events), have become aware that logit and probit models underestimate the probability of an event with very few observations. In their situation with very rare ones (events), $Pr(y_i = 1)$ will be systematically underestimated. This result occurs due to classification errors: the ability to accurately find a 'cutting point' to distinguish zeros $y_i = 0|x$ from ones $y_i = 1|x$ is biased in the direction of favoring zeros at the expense of ones. This result arises naturally since the model has better information about the distribution of zeros than ones and so is better at classifying zeros than ones. To summarize, the probability of the outcome with very few observations is underestimated. This means that in our situation $Pr(y_i = 0)$ will be underestimated since there are fewer zeros (failures) than ones (successes). This problem especially affects the constant term $\hat{\beta}_0$, which turns out to be biased although the rest of the estimates of $\beta_1 ... \beta_k$ are consistent. Accordingly, King and Zeng (2001a, 2001b) outline an alternative procedure to cope with these issues. Their strategy is to select on the dependent variable Y by collecting all those very few observations available for which $Y = 0$ (the 'cases') and a random selection of observations for which $Y = 1$ (the 'controls') (Note 4). In econometrics, this method is called *choice-based* or *case control* sampling. Their suggestion is not to collect more than 2-5 times as many ones ('frequent outcome') as zeros ('rare outcome'). In order not to lose many observations, here the upper boundary will be preferred, meaning that 5 times as many ones (successes) as zeros (failures) will be randomly selected. This translates into selecting a nearly 50% random sample of ones (successes). After this step, the procedure of King and Zeng (2001a, 2001b) prescribes to run a logit analysis on the new sample and then correct for the bias. The easiest way to correct for the bias of $\hat{\beta}_0$ is called *prior correction*. In this regard, the following prior-corrected estimate is consistent for the constant term β_0:

$$\hat{\beta}_0 - ln[(\frac{1-\tau}{\tau})(\frac{\bar{y}}{1-\bar{y}})]$$

where $\hat{\beta}_0$ is the estimate that results from the logistic regression on the newly selected sample, τ is the fraction of zeros ('rare outcome') in the original data and $\bar{y}$ is the fraction of zeros ('rare outcome') in the new sample. As stated before, all usual estimates for $\beta_1...\beta_k$ are statistically consistent with case control sampling. The results of the logit regression after case control sampling and prior correction for $\hat{\beta}_0$ are presented in Table 2 together with the results of the original logit regression for comparison purposes. The first observation is that the estimated intercept and its significance change considerably as expected. The significance of all other variables also slightly changes and averages of the sample marginal effects of all variables increase significantly in absolute value. As with the previous specifications while the coefficient of *disclosure* is significant and negative, the coefficient of *media* is significant and positive. The 'rare events' analysis outlined by King and Zeng (2001a, 2001b) is quite useful when positive (or negative) outcome is very rare. However, it should be kept in mind that this procedure was originally designed and works best for very large data sets.

Table 2. Robustness check with the 'rare events' procedure

Variable	Logit-Original		Logit-New	
	Coeff.	Marg. Effect	Coeff.	Marg. Effect
intercept	-11.47***		-15.97***	
	(-2.62)		(-3.20)	
disclosure	-2.81***	-0.08	-3.10***	-0.13
	(-3.31)		(-3.04)	
media	8.76***	0.25	9.84***	0.42
	(4.30)		(3.93)	
log(aCash)	0.47**	0.01	0.56**	0.02
	(2.39)		(2.25)	
aBookToMarket	-2.51**	-0.07	-2.20**	-0.09
	(-2.50)		(-2.00)	
aReturn	6.63***	0.19	7.69***	0.33
	(2.88)		(2.79)	
stockswap=yes	-3.46**	-0.10	-3.61**	-0.15
	(-2.53)		(-2.14)	
unsolicited=yes	-3.57***	-0.10	-2.82**	-0.12
	(-3.08)		(-2.25)	
log(days)	2.01***	0.06	2.57***	0.11
	(2.69)		(2.84)	
McFadden's R^2	0.65		0.67	
Likelihood ratio test-p value	< 0.0001		< 0.0001	
Observations	314		171	

Note. * This table presents the maximum likelihood estimation results of the logit model after case control sampling (Logit-New) together with the original logit model of Table 4. There are 171 observations after case control sampling, which includes all 28 observations of zeros (failures) and a randomly selected 143 observations of ones (successes). As before, the dependent variable is one if the takeover status is completed and zero if the status is failed. Explanatory variables are described in Tables 1-3. Columns labeled Coeff. show the estimated parameters for each variable where the estimate of the intercept under Logit-New is prior corrected. Columns labeled Marg. Effect show the average of the sample marginal effects. "yes" indicates that the dummy variable takes the value of one if the nominal variable is equal to yes and zero otherwise. t statistics are in parentheses. *, **, *** indicate significance at 10%, 5%, 1%, respectively. The last three rows show McFadden's R^2, p value of Likelihood ratio test and the number of observations.

5. Conclusion

This paper tries to find out the role of voluntary disclosures by target firms during a takeover event on the likelihood of takeover success. It approaches to this issue both from theoretical and empirical angles. Target shareholders who determine the outcome of the takeover are not always perfectly aware of the company's real worth. The target firm may provide informative or uninformative disclosures in order to affect the shareholders' approval decision. In this situation, the high-value target has strong incentives to distinguish itself with an informative disclosure. On the other hand, the low-value target prefers an uninformative disclosure because this increases the chances that it stays unidentified. Yet voluntary disclosures do have an effect on the shareholders' approval decision due to the following consideration: if shareholders observe a positive disclosure signal, they are less likely to tender because they believe that this signal is due to the informative disclosure of the high-value target. In addition, shareholders pay attention to the financial press about the acquirer because the good and the bad type of acquirers may play a separating equilibrium. The prediction of the model is tested empirically with complementary log-log model and rare events procedure. Our findings confirm that positive earnings forecasts by target firms decrease the probability of takeover success once after the uneven distribution of the takeover outcome data is taken into account. This result implies that voluntary disclosures by a target firm in the form of earnings forecasts during a takeover event convey useful information for shareholders. In this regard, shareholders pay attention to these disclosures by target firms to decide for the outcome of the takeover since such disclosures reduce the information asymmetry problem.

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Notes

Note 1. It is meant that if the target firm had no opportunity to provide voluntary disclosures and/or there was no effect of information revelation by the target firm, a separating media equilibrium by the acquirer exists only in the region of $c \in [\underline{c}, \bar{c}]$. Thus, the thresholds for the cost of the media campaign $\underline{c}$ and $\bar{c}$ are analogous to the thresholds defined in Buehlmaier (2011), except that here they involve the expectation with respect to target types.

Note 2. Deal characteristics include the number of days between the announcement date and the resolution date (effective date or date withdrawn), a stock swap dummy, a dummy indicating the presence of anti-takeover devices, a tender offer dummy, a dummy indicating whether or not negotiations are supported by the target management (unsolicited dummy), a proxy fight dummy, deal value, deal value to EBITDA, deal value to net sales, toehold, runup, markup, and premium (runup + markup). Firm characteristics of the acquirer and the target include price to earnings ratio, earnings per share, EBITDA to total assets, working capital to total assets, net income to net sales, price to sales, cash, cash to total assets, common equity, market value of equity, book to market, leverage, size, and share price return between the announcement date and the date four weeks prior to announcement.

Note 3. Refer to Orhun (2013) for more detailed interpretations of the remaining variables' coefficients.

Note 4. In King and Zeng (2001a, 2001b), the 'cases' are $Y = 1$ with very few observations and the 'controls' are $Y = 0$.

Appendix A

Proof of Lemma 1. Evaluate the posterior of the target being a high H type conditional on the disclosure signal, $s_d = h$

$$= \alpha^h = P(t = H|s_d = h)$$

$$= P(t = H|d = i, s_d = h)P(d = i|s_d = h) + P(t = H|d = \neg i, s_d = h)P(d = \neg i|s_d = h)$$

$$= \frac{P(t=H,d=i,s_d=h)}{P(d=i,s_d=h)}\frac{P(d=i,s_d=h)}{\eta} + \frac{P(t=H,d=\neg i,s_d=h)}{P(d=\neg i,s_d=h)}\frac{P(d=\neg i,s_d=h)}{\eta}$$

$$= \frac{1}{\eta}[P(s_d = h|d = i, t = H)P(d = i, t = H) + P(s_d = h|d = \neg i, t = H)P(d = \neg i, t = H)]$$

$$= \frac{1}{\eta}[(1-\epsilon)\xi_H\alpha + \frac{1}{2}(1-\xi_H)\alpha] = \alpha\frac{(1-\epsilon)\xi_H + \frac{1}{2}(1-\xi_H)}{\eta}$$

In a similar fashion, one obtains the posterior $\alpha^l = P(t = H|s_d = l)$.

Next consider the posterior of the acquirer being a good G type conditional on the media signal, $s = 1$:

$$\beta^1 = P(\tau = G|s = 1)$$

$$= P(\tau = G|m = 1, s = 1)P(m = 1|s = 1) + P(\tau = G|m = 0, s = 1)P(m = 0|s = 1)$$

$$= P(\tau = G|m = 1, s = 1)\frac{P(m=1,s=1)}{\zeta} + P(\tau = G|m = 0, s = 1)\frac{P(m=0,s=1)}{\zeta}$$

$$= \frac{P(s=1,m=1,\tau=G)}{P(s=1,m=1)}\frac{P(m=1,s=1)}{\zeta} + \frac{P(s=1,m=0,\tau=G)}{P(s=1,m=0)}\frac{P(m=0,s=1)}{\zeta}$$

$$= \frac{1}{\zeta}[P(s = 1, m = 1, \tau = G) + P(s = 1, m = 0, \tau = G)]$$

$$= \frac{1}{\zeta}[P(s = 1, \tau = G|m = 1)P(m = 1) + P(s = 1, \tau = G|m = 0)P(m = 0)]$$

Media signal s depends only on media campaign decision m and media campaign decision m is conditional only on τ. In other words, media signal s does not directly depend on type of the acquirer τ. That implies s and τ are independent given media campaign decision m. Then, the expression becomes

$$= \frac{1}{\zeta}[P(s = 1|m = 1)P(\tau = G|m = 1)P(m = 1) + P(s = 1|m = 0)P(\tau = G|m = 0)P(m = 0)] =$$

$$\frac{1}{\zeta}\left[P(s = 1|m = 1)\frac{P(m=1|\tau=G)P(\tau=G)}{P(m=1)}P(m = 1) + P(s = 1|m = 0)\frac{P(m=0|\tau=G)P(\tau=G)}{P(m=0)}P(m = 0)\right]$$

$= \frac{1}{\zeta}[\delta\xi_G\beta + (1-\delta)(1-\xi_G)\beta] = \beta\frac{\xi_G\delta+(1-\xi_G)(1-\delta)}{\zeta}$

The posterior $\beta^0 = P(\tau = G|s = 0)$ is calculated analogously.

Proof of Lemma 2. The joint posterior probabilities are given by the conditional law of total probability as,

$P(\tau = x, t = z|s_d = k, s = n) = P(\tau = x, t = z|s_d = k, s = n, m = 1, d = i)P(m = 1, d = i|s_d = k, s = n) +$
$P(\tau = x, t = z|s_d = k, s = n, m = 1, d = \neg i)P(m = 1, d = \neg i|s_d = k, s = n) +$
$P(\tau = x, t = z|s_d = k, s = n, m = 0, d = i)P(m = 0, d = i|s_d = k, s = n) +$
$P(\tau = x, t = z\,|\,s_d = k, s = n, m = 0, d = \neg i)P(m = 0, d = \neg i\,|\,s_d = k, s = n)$

where $x \in \{G, B\}$, $z \in \{H, L\}$, $k \in \{h, l\}$ and $n \in \{0,1\}$. Using the independence assumption between acquirer and target related events:

$$= \frac{P(\tau=x,t=z,s_d=k,s=n,m=1,d=i)}{P(s_d=k,s=n,m=1,d=i)}\frac{P(m=1,d=i,s_d=k,s=n)}{P(s_d=k,s=n)} + \frac{P(\tau=x,t=z,s_d=k,s=n,m=1,d=\neg i)}{P(s_d=k,s=n,m=1,d=\neg i)}\frac{P(m=1,d=\neg i,s_d=k,s=n)}{P(s_d=k,s=n)} +$$
$$\frac{P(\tau=x,t=z,s_d=k,s=n,m=0,d=i)}{P(s_d=k,s=n,m=0,d=i)}\frac{P(m=0,d=i,s_d=k,s=n)}{P(s_d=k,s=n)} + \frac{P(\tau=x,t=z,s_d=k,s=n,m=0,d=\neg i)}{P(s_d=k,s=n,m=0,d=\neg i)}\frac{P(m=0,d=\neg i,s_d=k,s=n)}{P(s_d=k,s=n)}$$
$$= \frac{P(\tau=x,s=n,m=1)P(t=z,s_d=k,d=i)}{P(s_d=k,s=n)} + \frac{P(\tau=x,s=n,m=1)P(t=z,s_d=k,d=\neg i)}{P(s_d=k,s=n)}$$
$$+ \frac{P(\tau=x,s=n,m=0)P(t=z,s_d=k,d=i)}{P(s_d=k,s=n)} + \frac{P(\tau=x,s=n,m=0)P(t=z,s_d=k,d=\neg i)}{P(s_d=k,s=n)}$$
$$= \frac{P(\tau=x,s=n|m=1)P(m=1)P(s_d=k|d=i,t=z)P(d=i,t=z)}{P(s_d=k,s=n)} + \frac{P(\tau=x,s=n|m=1)P(m=1)P(s_d=k|d=\neg i,t=z)P(d=\neg i,t=z)}{P(s_d=k,s=n)}$$
$$+ \frac{P(\tau=x,s=n|m=0)P(m=0)P(s_d=k|d=i,t=z)P(d=i,t=z)}{P(s_d=k,s=n)} + \frac{P(\tau=x,s=n|m=0)P(m=0)P(s_d=k|d=\neg i,t=z)P(d=\neg i,t=z)}{P(s_d=k,s=n)}$$

As stated in the proof of lemma 1, τ and s are independent given the media campaign decision. This takes us to the following step,

$$= \frac{P(\tau=x|m=1)P(s=n|m=1)P(m=1)P(s_d=k|d=i,t=z)P(d=i|t=z)P(t=z)}{P(s_d=k,s=n)} + \frac{P(\tau=x|m=1)P(s=n|m=1)P(m=1)P(s_d=k|d=\neg i,t=z)P(d=\neg i|t=z)P(t=z}{P(s_d=k,s=n)}$$
$$+ \frac{P(\tau=x|m=0)P(s=n|m=0)P(m=0)P(s_d=k|d=i,t=z)P(d=i|t=z)P(t=z)}{P(s_d=k,s=n)} + \frac{P(\tau=x|m=0)P(s=n|m=0)P(m=0)P(s_d=k|d=\neg i,t=z)P(d=\neg i|t=z)P(t=z)}{P(s_d=k,s=n)}$$
$$= \frac{P(\tau=x)P(m=1|\tau=x)P(s=n|m=1)P(s_d=k|d=i,t=z)P(d=i|t=z)P(t=z)}{P(s_d=k,s=n)} + \frac{P(\tau=x)P(m=1|\tau=x)P(s=n|m=1)P(s_d=k|d=\neg i,t=z)P(d=\neg i|t=z)P(t=z)}{P(s_d=k,s=n)}$$
$$+ \frac{P(\tau=x)P(m=0|\tau=x)P(s=n|m=0)P(s_d=k|d=i,t=z)P(d=i|t=z)P(t=z)}{P(s_d=k,s=n)} + \frac{P(\tau=x)P(m=0|\tau=x)P(s=n|m=0)P(s_d=k|d=\neg i,t=z)P(d=\neg i|t=z)P(t=z)}{P(s_d=k,s=n)}$$

After inserting for the behavior strategies of the acquirer and the target, it becomes as follows:

$$= \frac{P(\tau=x)P(t=z)\xi_x P(s=n|m=1)\xi_z P(s_d=k|d=i,t=z)}{P(s_d=k,s=n)} + \frac{P(\tau=x)P(t=z)\xi_x P(s=n|m=1)(1-\xi_z)0.5}{P(s_d=k,s=n)}$$
$$+ \frac{P(\tau=x)P(t=z)(1-\xi_x)P(s=n|m=0)\xi_z P(s_d=k|d=i,t=z)}{P(s_d=k,s=n)} + \frac{P(\tau=x)P(t=z)(1-\xi_x)P(s=n|m=0)(1-\xi_z)0.5}{P(s_d=k,s=n)}.$$

Rearranging the above term gives us the final result:

$$\frac{P(\tau=x)P(t=z)}{P(s_d=k,s=n)}\left[\xi_x P(s=n|m=1)+\left(1\text{-}\xi_x\right)(s=n|m=0)\right]\left[\xi_z P(s_d=k|d=i,t=z)+\left(1\text{-}\xi_z\right)0.5\right].$$

Proof of Lemma 3. It follows as a result of the four possible cases discussed prior to Lemma 3. The acquirer knows that the takeover is going to fail if it bids less than p^{s_d}, which is not optimal for itself. If the acquirer bids more than p^{s_d}, it has incentives to lower the bid. The formal proof is as follows: The acquirer's expected payoff without knowing its own type at the start of the game is $\pi = \beta\pi^G + (1-\beta)\pi^B$ where

$$\begin{aligned}\pi^G =&\alpha[P(s_d = h, s = 1|\tau = G, t = H)\pi^{G,H}_{h,1} + P(s_d = l, s = 1|\tau = G, t = H)\pi^{G,H}_{l,1} +\\ &P(s_d = h, s = 0|\tau = G, t = H)\pi^{G,H}_{h,0} + P(s_d = l, s = 0|\tau = G, t = H)\pi^{G,H}_{l,0}]+\\ &(1-\alpha)[P(s_d = h, s = 1|\tau = G, t = L)\pi^{G,L}_{h,1} + P(s_d = l, s = 1|\tau = G, t = L)\pi^{G,L}_{l,1} +\\ &P(s_d = h, s = 0|\tau = G, t = L)\pi^{G,L}_{h,0} + P(s_d = l, s = 0|\tau = G, t = L)\pi^{G,L}_{l,0}]\end{aligned} \quad (7)$$

and

$$\begin{aligned}\pi^B =&\alpha[P(s_d = h, s = 1|\tau = B, t = H)\pi^{B,H}_{h,1} + P(s_d = l, s = 1|\tau = B, t = H)\pi^{B,H}_{l,1} +\\ &P(s_d = h, s = 0|\tau = B, t = H)\pi^{B,H}_{h,0} + P(s_d = l, s = 0|\tau = B, t = H)\pi^{B,H}_{l,0}]+\\ &(1-\alpha)[P(s_d = h, s = 1|\tau = B, t = L)\pi^{B,L}_{h,1} + P(s_d = l, s = 1|\tau = B, t = L)\pi^{B,L}_{l,1} +\\ &P(s_d = h, s = 0|\tau = B, t = L)\pi^{B,L}_{h,0} + P(s_d = l, s = 0|\tau = B, t = L)\pi^{B,L}_{l,0}].\end{aligned} \quad (8)$$

In equation (7), $\pi^{G,H}_{s_d,s}$ and $\pi^{G,L}_{s_d,s}$ are given by the following:

$$\pi^{G,H}_{s_d,s} = -c\xi_G + z(1_{p^{s_d}\le b\le p^{s,s_d}} + 1_{max\{p^s_d,p^{s,s_d}\}<b}) + (p_{H,G} - b)(k1_{p^{s_d}\le b\le p^{s,s_d}} + n\mathbf{1}_{max\{p^{s_d},p^{s,s_d}\}<b});$$

$$\pi^{G,L}_{s_d,s} = -c\xi_G + z(1_{p^{s_d}\le b\le p^{s,s_d}} + 1_{max\{p^{s_d},p^{s,s_d}\}<b}) + (p_{L,G} - b)(k1_{p^{s_d}\le b\le p^{s,s_d}} + n1_{max\{p^{s_d},p^{s,s_d}\}<b}).$$

where $s_d \in \{h, l\}$ and $s \in \{0,1\}$.

Similarly, $\pi^{B,H}_{s_d,s}$ and $\pi^{B,L}_{s_d,s}$ in equation (8) are as follows:

$$\pi^{B,H}_{s_d,s} = -c\xi_B + z(1_{p^{s_d}\le b\le p^{s,s_d}} + 1_{max\{p^{s_d},\mathbf{p}^{s,s_d}\}<b}) + (p_{H,B} - b)(k1_{p^{s_d}\le b\le p^{s,s_d}} + n1_{max\{p^{s_d},p^{s,s_d}\}<b});$$

$$\pi^{B,L}_{s_d,s} = -c\xi_B + z(1_{p^{s_d}\le b\le p^{s,s_d}} + 1_{max\{p^{s_d},p^{s,s_d}\}<b}) + (p_{L,B} - b)(k1_{p^{s_d}\le b\le p^{s,s_d}} + n1_{max\{p^{s_d},p^{s,s_d}\}<b}).$$

In equations (7) and (8), $P(s_d = k, s = n|\tau = x, t = z) = P(\tau = x, t = z|s_d = k, s = n)P(s_d = k, s = n) / P(\tau = x, t = z)$ by Bayes' rule where $x \in \{G, B\}$ $z \in \{H, L\}$, $k \in \{h, l\}$ and $n \in \{0,1\}$. By the independence assumption between acquirer and target types, it becomes

$$P(s_d = k, s = n|\tau = x, t = z) = \frac{P(\tau=x,t=z|s_d=k,s=n)P(s_d=k,s=n)}{P(\tau=x)P(t=z)}$$

After inserting the expression for $P(\tau = x, t = z|s_d = k, s = n)$ from the proof of lemma 2, one realizes that π as a function of the acquirer's bid b is piecewise linear and piecewise continuous. There is discontinuity only at $b = p^{s_d}$. Other potential discontinuities that might occur at $b = p^{s,s_d} > p^{s_d}$ cancel out. The derivative $\partial\pi / \partial b$ is zero in the region $[0, p^{s_d})$ and π is strictly decreasing in b in the region $[p^{s_d}, \infty)$. That means π is maximized at $b^* = p^{s_d}$.

Proof of Theorem 1. This proof aims to find a fixed point $(\xi^*_G, \xi^*_B), (\xi^*_H, \xi^*_L)$ with an optimal disclosure strategy of the target and an optimal media campaign strategy of the acquirer such that $\xi^*_\tau \in argmax_{\xi_\tau}\pi^\tau(\xi_\tau)$ and $\xi^*_t \in argmax_{\xi_t}\pi^t(\xi_t)$, where p^{s_d} and $p^{s_d,s}$ in the functions $\pi^\tau(\xi_\tau)$ and $\pi^t(\xi_t)$ are evaluated at $(\xi^*_G, \xi^*_B), (\xi^*_H, \xi^*_L)$ and $\tau \in \{G, B\}$, $t \in \{H, L\}$. That is, it shows that the proposed equilibrium strategies constitute best responses for each type under the equilibrium beliefs, which are consistent with the equilibrium strategies. This procedure is only applied for a separating equilibrium in this proof.

First recall that Lemma 3 implies that $\pi^{\tau,H}_{s_d,s} = -c\xi_\tau - k(p^{s_d} - p_{H,\tau})1_{p^{s_d}\le p^{s,s_d}}$ and $\pi^{\tau,L}_{s_d,s} = -c\xi_\tau - k(p^{s_d} - p_{L,\tau})1_{p^{s_d}\le p^{s,s_d}}$ in the profit functions π^τ of the acquirer, which are given in equations 2 and 3. Resolve shareholder indifference by letting shareholders tender if $p^{s_d} = p^{s_d,s}$.

It holds that

$$\beta \ge \beta^{l,1} \Leftrightarrow p^l|_{(\xi_H,\xi_L)=(1,0)} \le p^{l,1}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)},$$

$$\beta \ge \beta^{h,1} \Leftrightarrow p^h|_{(\xi_H,\xi_L)=(1,0)} \le p^{h,1}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)},$$

$$\beta \ge \beta^{l,0} \Leftrightarrow p^l|_{(\xi_H,\xi_L)=(1,0)} \le p^{l,0}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)},$$

$$\beta \ge \beta^{h,0} \Leftrightarrow p^h|_{(\xi_H,\xi_L)=(1,0)} \le p^{h,0}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)}$$

These imply that in the region $\beta \in [\beta^{l,1}, \beta^{h,1})$ shareholders tender only after observing $(s_d = l, s = 1)$ since

$p^l|_{(\xi_H,\xi_L)=(1,0)} \leq p^{l,1}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)}$ but $p^{h,1}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)} < p^h|_{(\xi_H,\xi_L)=(1,0)}$. Given that $p^{s,s_d} = p^{s,s_d}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)}$ and $p^{s_d} = p^{s_d}|_{(\xi_H,\xi_L)=(1,0)}$, it follows that $\pi^B(1) \leq \pi^B(0)$ if and only if $c \geq c_1' = (2\delta - 1)[\alpha\epsilon[z - k(p_H - p_{H,B})] + (1-\alpha)0.5[z - k(p_L - p_{L,B})]]$ and $\pi^G(0) \leq \pi^G(1)$ if and only if $c \leq c_1$ where $c_1' < c_1$. Notice here that $c_1 < \bar{c}$. That means, given that high-value H and low-value L target firms play separating disclosure strategies and thus voluntary disclosures are informative that there is a smaller region of cost that the good G type of acquirer finds the media campaign worth paying for. In other words, a media campaign should cost much less so that the good G type of the acquirer prefers to run a media campaign.

Let $\beta \in [\beta^{h,1}, \beta^{l,0})$. Then shareholders begin to tender after observing $(s_d = h, s = 1)$ additional to $(s_d = l, s = 1)$, since now

$$p^l|_{(\xi_H,\xi_L)=(1,0)} \leq p^{l,1}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)} \text{ and } p^h|_{(\xi_H,\xi_L)=(1,0)} \leq p^{h,1}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)}.$$

With $p^{s,s_d} = p^{s,s_d}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)}$ and $p^{s_d} = p^{s_d}|_{(\xi_H,\xi_L)=(1,0)}$, in the region $\beta \in [\beta^{h,1}, \beta^{l,0})$ it follows that $\pi^B(1) \leq \pi^B(0)$ if and only if $c \geq \underline{c}$ and $\pi^G(0) \leq \pi^G(1)$ if and only if $c \leq \bar{c}$. Realize here that the region of $c \in [\underline{c}, \bar{c}]$ may alternatively be considered as the region of separating media campaign equilibrium by the acquirer, if there exists no voluntary disclosures by the target and/or they play no role in the takeover outcome. If this were the case, the takeover would succeed at the same β level after signals $(s_d = l, s = 1)$ and $(s_d = h, s = 1)$.

Finally, let $\beta \in [\beta^{l,0}, \beta^{h,0})$; now shareholders do not tender after observing $(s_d = h, s = 0)$ and they tender otherwise. With $p^{s,s_d} = p^{s,s_d}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)}$ and $p^{s_d} = p^{s_d}|_{(\xi_H,\xi_L)=(1,0)}$, it follows that $\pi^B(1) \leq \pi^B(0)$ if and only if $c \geq c_2' = (2\delta-1)[\alpha(1-\epsilon)[z - k(p_H - p_{H,B})] + (1-\alpha)0.5[z - k(p_L - p_{L,B})]]$ and $\pi^G(0) \leq \pi^G(1)$ if and only if $c \leq c_2 = (2\delta-1)[\alpha(1-\epsilon)[z - k(p_H - p_{H,G})] + (1-\alpha)0.5[z - k(p_L - p_{L,G})]]$ where $c_2' < c_2$. Notice again that $c_2 < \bar{c}$. This leads us to the same interpretation: a media campaign should cost much less compared to the case when voluntary disclosures play no role so that the good G type of acquirer would still prefer to run a media campaign.

Realize that $c_1' < c_2' < \underline{c}$ and $c_1 < c_2 < \bar{c}$. Accordingly, acquirers play a separating media equilibrium in the complete region $\beta \in [\beta^{l,1}, \beta^{h,0})$ if $c_1 \in [\underline{c}, \bar{c}]$ and $\underline{c} \leq c \leq c_1$. This implies when $c_1 \in [\underline{c}, \bar{c}]$, there is a separating media equilibrium by acquirers in a smaller region of the cost of a media campaign such that $\underline{c} \leq c \leq c_1$, given that targets play a separating disclosure equilibrium. If $c_1 \notin [\underline{c}, \bar{c}]$, acquirers do not play a separating equilibrium in the complete region of $\beta \in [\beta^{l,1}, \beta^{h,0})$.

The high-value H and low-value L target managements' expected payoffs π^H and π^L are given respectively as

$$\begin{aligned}\pi^H =& \beta[P(s_d = h, s = 1|\tau = G, t = H)\pi^H_{h,1} + P(s_d = l, s = 1|\tau = G, t = H)\pi^H_{l,1} +\\ & P(s_d = h, s = 0|\tau = G, t = H)\pi^H_{h,0} + P(s_d = l, s = 0|\tau = G, t = H)\pi^H_{l,0}] +\\ & (1-\beta)[P(s_d = h, s = 1|\tau = B, t = H)\pi^H_{h,1} + P(s_d = l, s = 1|\tau = B, t = H)\pi^H_{l,1} +\\ & P(s_d = h, s = 0|\tau = B, t = H)\pi^H_{h,0} + P(s_d = l, s = 0|\tau = B, t = H)\pi^H_{l,0}]\end{aligned}$$

and

$$\begin{aligned}\pi^L =& \beta[P(s_d = h, s = 1|\tau = G, t = L)\pi^L_{h,1} + P(s_d = l, s = 1|\tau = G, t = L)\pi^L_{l,1} +\\ & P(s_d = h, s = 0|\tau = G, t = L)\pi^L_{h,0} + P(s_d = l, s = 0|\tau = G, t = L)\pi^L_{l,0}] +\\ & (1-\beta)[P(s_d = h, s = 1|\tau = B, t = L)\pi^L_{h,1} + P(s_d = l, s = 1|\tau = B, t = L)\pi^L_{l,1} +\\ & P(s_d = h, s = 0|\tau = B, t = L)\pi^L_{h,0} + P(s_d = l, s = 0|\tau = B, t = L)\pi^L_{l,0}]\end{aligned}$$

where $\pi^H_{s_d,s} = \pi^L_{s_d,s} = (-y)1_{p^s_d \leq p^{s,s_d}}$. With $p^{s,s_d} = p^{s,s_d}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)}$ and $p^s_d = p^s_d|_{(\xi_H,\xi_L)=(1,0)}$, in the region $\beta \in [\beta^{l,1}, \beta^{h,0})$ it follows that $\pi^H(0) \leq \pi^H(1)$ since $\frac{1}{2} = P(s_d = h|d = \neg i, t = H) \leq (1-\epsilon) = P(s_d = h|d = i, t = H)$, and that $\pi^L(1) \leq \pi^L(0)$ since $\epsilon = P(s_d = h|d = i, t = L) \leq \frac{1}{2} = P(s_d = h|d = \neg i, t = L)$.