Two-sided Information Dissemination in Takeovers: Disclosure and Media

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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 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 about 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.

EFM classification: 150, 160.

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A Introduction

The market for takeovers and mergers and acqusitions (M&As) constitutes a big part of the corporate finance world. The importance of this market can be easily grasped by considering the fact that the total combined value of takeovers is measured in multi-trillion dollars. That is why a large body of literature has paid great attention to understanding the key determinants of takeover success or deal completion. It has largely focused on various deal and firm characteristics in order to identify which of those play a more important role for takeover success. However, the role of information and its dissemination in takeovers has been mainly neglected. Clearly, each takeover event involves two parties: the target and the acquirer. Both of these two parties have different ways to disseminate information to the target shareholders, who actually determine the outcome of a takeover by voting. One of the most frequently employed tools by the acquirer to disseminate information about itself and influence shareholders' beliefs 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. The other side of the story, which is the target firm, may also make some moves to disseminate information from its point of view. One of the popular means employed by the target for this purpose is voluntary disclosures in the form of earnings/profit forecasts. Target firms send these profit forecasts to shareholders with other takeover documents. The potential aim of these voluntary disclosures is to provide additional information regarding the management's perception about the real worth of the company so that the target shareholders can compare this to the acquirer's bid. Brennan (1999) thus shows that there is a positive relationship between disclosure of forecasts and offer prices, meaning that offer prices are likely to increase after disclosure of forecasts. By finding such a strong relationship between offer prices and forecasts, Brennan (1999) makes it clear that the voluntary disclosure of management's earnings forecasts carries some information effects that would take the target shareholders' attention and so influence the takeover dynamics. Hence, one other interesting follow-up question is whether the disclosure of profit/earnings forecasts also has an effect on the likelihood of takeover success additional to its effect on offer prices. The current paper deals with this question. Compared to Buehlmaier (2011), which looks at the story only from the acquirer's side by analyzing whether its main information dissemination tool, which is the financial media, has an effect on takeover outcomes, this paper additionally considers the effect of the target's information revelation through earnings/profit forecasts on takeover outcomes.

Management earnings forecasts that are published by the target during a takeover event differ from the usual quarterly earnings forecasts that are also made on a voluntary basis in the US and Europe (Amel-Zadeh, Evans, Meeks (2008)). The first type of forecasts cover a longer time period, which can sometimes be several years. Although the effect of voluntary disclosures during a takeover event has been largely overlooked, there is extensive research about the earnings forecasts that are made quarterly on a routine base. Earlier studies like Milgrom (1981) and Grossman (1981) interpret management's earnings forecasts within a signalling or screening framework. In such a scenario, those managers with positive information, which implies the firm value to be higher than the average, disclose credibly and their stock prices increase. Conversely, those managers with negative information will not disclose and this will lead to a decrease in their share prices. Moreover, some other studies like Verrecchia (1983) and Dye (1985) propose that uninformed investors are not able to distinguish between firms with 'no-news' and with 'negative news' and so cannot conclude that silent firms are the ones witholding negative information. These predictions by theoretical studies have been widely tested in order to find out whether voluntary disclosures are really viewed as credible by investors and associated with changes in stock prices. Most of the empirical work agrees that voluntary forecasts do have credible information content since there are significant changes in the stock prices of forecasting firms (see Penman (1980, 1983), Waymire (1984)). Especially, they document that firms with 'good news' forecasts experience a significant increase in their stock prices as predicted. However, the prediction about non-disclosing or 'silent' firms, that they will be perceived as keeping 'negative' information, does not seem to hold, consistent with Verrecchia (1983) and Dye (1985). Lev and Penman (1990) show that stock prices of nondisclosing firms that are in the same industry as forecasting firms are not negatively affected by staying silent. That means investors do not necessarily deduce that non-disclosing firms are the firms with 'bad news' but they are more likely to interpret nondisclosure as 'no-news' or neutral news. Another empirical fact about voluntary disclosures is that firms are more likely to disclose 'good news' compared to 'bad news', yet 'bad news' voluntary disclosures do occur. However, while 'good news' disclosures tend to be point or range estimates of annual earnings-per-share (EPS), 'bad news' disclosures tend to be qualitative and 'soft' statements. (Skinner (1994), Lev and Penman (1990)).

The 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 evidence that the shareholder litigation risk increases with the usage of 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 in order to affect shareholders' ideas about itself. The target firm may choose to 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 which are not easy to interpret. This is consistent with the idea that 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 only if they believe that in expectation the target firm value with the takeover is higher than the value without the takeover. In this situation, 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. With this interest, the high-value target has incentives 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 disclosure in order to create a noisy signal and to confuse shareholders. Shareholders still pay attention to voluntary disclosures since they know that the high-value target makes an informative disclosure which 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 and separates 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.

Thus, both voluntary disclosures by the target and the financial news about the acquirer play a role in takeovers. In particular, the success probability of the takeover decreases with a positive disclosure signal and it 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 acquirer. This consideration immediately yields the following empirical prediction: disclosures that include positive news about the target decrease the likelihood of takeover success but positive information in the financial media about the acquirer increases this likelihood.

This main prediction of the model is confirmed by an empirical analysis that employs binary outcome models: the takeover outcome is a binary variable that is either success or failure. The disclosure variable is obtained by identifying the target firms in the sample which provide positive news by issuing increasing management earnings forecasts for future years during the takeover event. It turns out that takeover success depends negatively on the availability of positive news through management earnings forecasts. Namely, takeover attempts are more likely to fail for target firms that provide increasing management earnings forecasts. The inclusion of the disclosure variable as an explanatory variable increases the goodness of fit and its coefficient is statistically significant. As a further robustness check, shareholders’ reactions to voluntary disclosures by target firms are examined with an event study. The aim is to understand whether the stock market sees them as credible and there is a significant change in the target’s stock price on the announcement date of the disclosure. As a final remark, the analysis also confirms that positive media content about the acquirer entails takeover success as in Buehlmaier (2011).

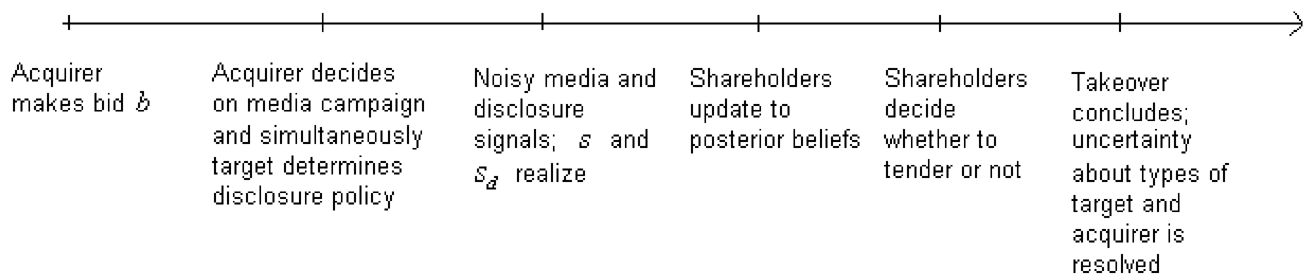
The paper shows the important role of information and its dissemination in the likelihood of takeover success along with deal and firm characteristics that the previous literature dwells on. Differently than Buehlmaier (2011), it considers the possibility of information dissemination by the target firm through voluntary disclosures. As it is with the acquirer, the information dissemination tool of the target firm also affects the takeover outcome. It 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 also goes as far as the takeover success probability. It is also observed that the voluntary disclosure practices of target firms 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. Moreover, 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. In this respect, voluntary disclosures in the form of management earnings forecasts would stand as an effective way to communicate and remove this undervaluation for target firms. On the other hand, Safieddine and Titman (1999) find that target firms of failed takeovers 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 term.

The remainder of the paper is structured as follows: The next section B presents the details of the model. Section C includes the solution of the model as well as its empirical implications, which constitute the basis of the empirical analysis of the following section. Accordingly, section D presents the data used for the empirical analysis, details of the empirical methodology and estimation results. Section E considers an alternative robustness analysis to supplement the ones of section D. Section F concludes and some of the proofs for section C are in the appendix.

B The Model

This paper builds on Buehlmaier (2011) 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

Figure 1: Timeline of events in the model



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 $\frac{p_H - p_{H,B}}{p_{H,G} - p_H} > \frac{p_L - p_{L,B}}{p_{L,G} - p_L}$.

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 fixes its strategy 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. Thus, the acquirer decides on its behavior strategy

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

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 $0 < \epsilon < 1/2$. Thus, the precision of the signal increases if the target issues an informative disclosure. At this point, one may consider an informative disclosure as a quantitative accounting statement like a management's earnings forecast by which the target tries to convey its type. As the other alternative, the target may provide no statements at all or it may assert qualitative and vague statements about its future prospects. Shareholders update their priors by using all recently available information through 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 if the target firm issues much more precise information. A similar comment is also valid for the media signal. Target shareholders may believe that the media content that they read is due to a media campaign while in fact it was not (and vice versa).

At the final stage, 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 in order 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. On the other hand, 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 although it destroys value since in expectation it benefits:

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

The final payoff of the acquirer's management is then

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

where j is the number of shares tendered by the shareholders and $\mathbf{1}$ is the indicator function. On the other hand, the target management undergoes a loss of private benefit y from losing control over the company in case the takeover succeeds.

C Model Solution

The next 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,
$\beta^s = P(\tau = G|s)$ 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 $\eta = P(s_d = h) = \alpha\left[\xi_H(1-\epsilon) + (1-\xi_H)\frac{1}{2}\right] + (1-\alpha)\left[\xi_L\epsilon + (1-\xi_L)\frac{1}{2}\right]$ *and* $\zeta = P(s = 1) = \beta\left[\xi_G\delta + (1-\xi_G)(1-\delta)\right] + (1-\beta)\left[\xi_B\delta + (1-\xi_B)(1-\delta)\right]$.

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 determines 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,*

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

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

C.1 Shareholders' Tendering Decision

Backwards induction is used in order to determine the Perfect Bayesian-Nash equilibria of the whole 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 all 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 this would lead to absolute 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 until it is equal to p^{s_d}. This leads us to Lemma 3, which shows formally the acquirer's utility being 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 it becomes only relevant for shareholders whether the expected posterior price after a successful takeover, p^{s,s_d}, is above or below 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. So, the shareholders approve the takeover only if they feel certain that in expectation the target's value with the takeover is higher than the value without the takeover.

Another conclusion from 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

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

holds for the rest of the paper.

C.2 Equilibria

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

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

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

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

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

and also the lower threshold for the cost of the media campaign,
$\underline{c} = (2\delta - 1)\left[\alpha[z - k(p_H - p_{H,B})] + (1-\alpha)[z - k(p_L - p_{L,B})]\right]$ 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 $\beta \in \left[0, \beta^{l,1}\right)$ because they are quite certain that they face a bad type. On the other hand, shareholders are most optimistic about the acquirer if $\beta \in \left[\beta^{h,0}, 1\right]$. In the middle range $\beta \in \left[\beta^{l,1}, \beta^{h,0}\right)$, shareholder's uncertainity 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[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.

[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.

Theorem 1. *If* $\beta \in [\beta^{l,1}, \beta^{h,0})$*,* $c_1 = (2\delta - 1)[\alpha\epsilon[z - k(p_H - p_{H,G})] + (1-\alpha)0.5[z - k(p_L - p_{L,G})]] \in [\underline{c}, \bar{c}]$ *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 1 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

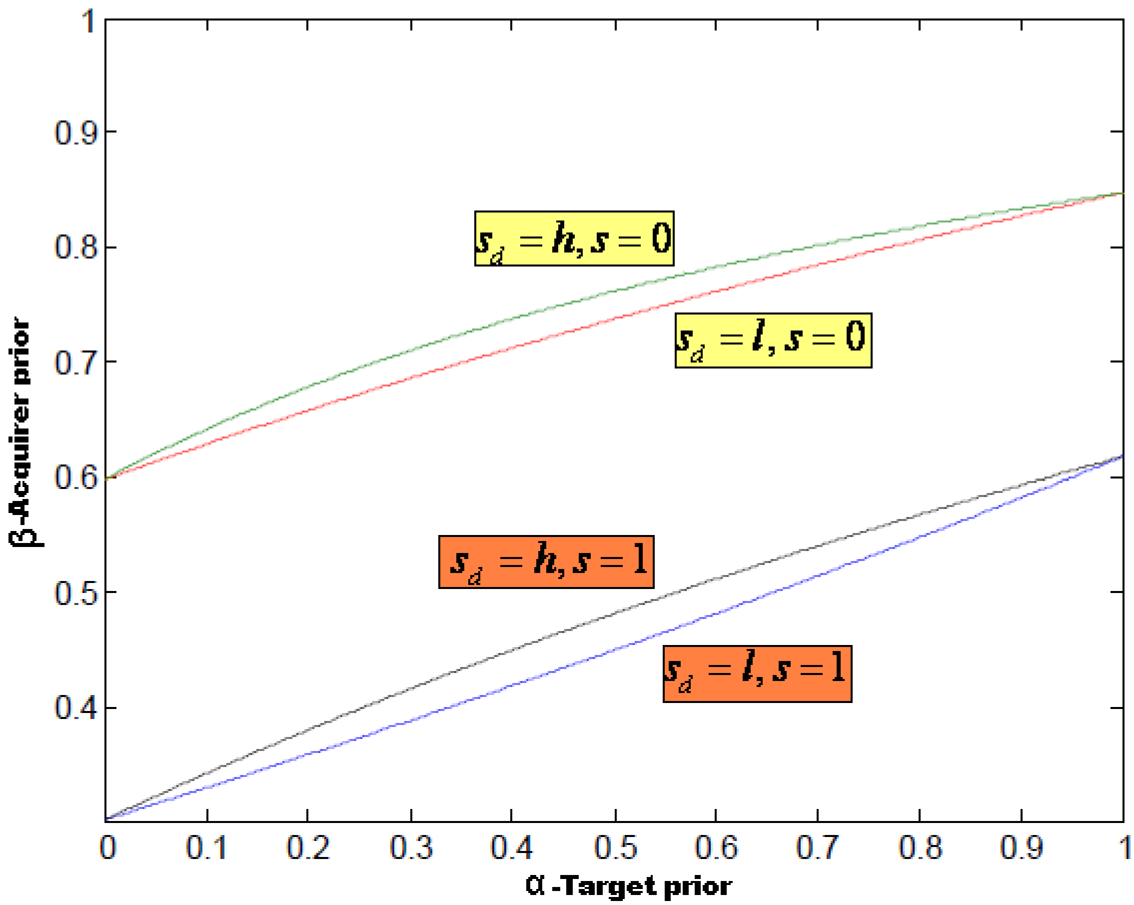


Figure 1

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. $\frac{\partial \beta^{s_d,s}}{\partial \alpha} > 0$ as seen in Figure 1. 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.

C.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 determininig the sole effect of positive disclosures on the likelihood of takeover success.

Another testable implication of the model is that the likelihood of having an equilibrium where acquirers separate decreases given that the information dissemination possibility by the target is integrated and targets play separating disclosure equilibrium strategies. This result arises because the region of the cost of a media campaign in which the separating media equilibrium exists becomes smaller and shifts leftwards then. However, this prediction is not easily testable.

D Data and Empirical Analysis

Takeover data includes takeover attempts with announcement dates between January 1, 2000 and December 31, 2006 from the SDC Platinum Mergers & Acquisitions database as in Buehlmaier (2011). This sample does not include the industries of "energy and power", "financials" and "government and agencies". It includes only the takeover attempts where the target's value is at least $500 million at the announcement date in order to reduce the sample to large deals. Inclusion of large deals is critical because the financial press covers large deals more, both from the acquirer's and the target's sides, compared to rather small ones. With the same reasoning, only publicly traded acquirers and targets are included in the sample. The sample excludes cross-border deals, which are usually subject to more confounding issues due to the involved countries' differences in regulatory, political and economic environments. These issues are difficult to control and constitute obstacles to focusing on the effects of media and voluntary disclosures. Finally, the sample includes only M&A transactions that are in the form of majority/remaining interest and tender offers. The final sample contains 314 takeover attempts, of which 286 succeeded and 28 failed.

Deal and firm characteristics of targets and acquirers[2] are from SDC. These are standard control

[2]Deal characteristics include the number of days between the announcement date and the resolution date (effective date

Table 1: Summary Statistics of (Significant) Explanatory Variables

Variable	Min	1st. Q.	Median	Mean	3rd Q.	Max	Std. Dev.
media	0.06	0.92	0.97	0.92	0.99	1	0.15
aCash(mil. $)	0.67	125.7	428.6	1472	1244	21971	2784.53
aBookToMarket	0	0.13	0.26	0.35	0.46	2.64	0.35
aReturn	-0.67	-0.09	-0.02	-0.02	0.06	0.61	0.18
days	1	73	102	130.7	162.8	764	93.01

The *media* variable of Buehlmaier (2011) shows the positivity or negativity of news articles about the acquirer. A value close to one indicates that most articles are positive about the acquirer, whereas a value close to zero indicates that most articles are negative. *aCash* denotes the acquirer's cash and the temporary investment vehicles for cash, including commercial paper and short-term government securities, as of the date of the most current financial information prior to the announcement day (mil. $). *aBookToMarket* is the book-to-market ratio of the acquirer. *aReturn* is the acquirer's share price return between the announcement date and the date four weeks prior to the announcement day. *days* is the number of days between the announcement date and the resolution day (effective date in case of takeover success or date withdrawn in case of takeover failure). The columns labeled *1st Q.* and *3rd Q* show the first and third quartiles. The column labeled *Std. Dev.* shows the standard deviation.

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). This *media* variable is constructed by using the news articles about the acquirer between the announcement date and one day prior to the effective date or the date withdrawn in Dow Jones Factiva. A naive Bayes model is employed to quantify text-based information in these articles.[3] A *media* value close to one indicates that most news articles are positive about the acquirer, whereas a value close to zero indicates that most articles are negative. Tables 1 and 2 present summary statistics and definitions of those explanatory variables that are found to be statistically significant in the following empirical analysis.

Data on voluntary disclosures in order to test the main prediction of the current paper, which is positive prospects about the target hinder takeover success, are from Dow Jones Factiva and the SEC EDGAR Database. Disclosures about firm's future profitability and management earnings forecasts are most of the time part of a press release issued by the target firm. That means, they may be found in news services. Thus, as a start the Factiva news database is searched for the dates between the announcement date and one day prior to the effective date or the date withdrawn by using keywords like "name of the target", "earnings", "income", "loss", "forecast", "guidance", "estimate"... If a clear statement is found in Factiva that the target is not providing any forward-looking statements, i.e. "We do not plan to provide

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.

[3]Please refer to the paper for further details.

Table 2: Summary Statistics of Nominal Explanatory Variables

Variable	Yes	No
stockswap	196 (62.4%)	118 (37.6%)
unsolicited	26 (8.3%)	288 (91.7%)

stockSwap indicates whether or not the acquiring company exchanges its equity for equity in the target. The acquirer must be acquiring at least 50% of the target's equity or the remaining interest up to 100% of the target's equity, and at least 50% of the consideration offered must be in the form of equity. unsolicited indicates whether or not an acquiring company makes an offer for another company without the target management's support (prior negotiations).

future earnings guidance in light of the pending merger.", this target firm is classified as providing "no disclosure". If not, SEC filings of the target at the SEC EDGAR Database and its press releases/earnings announcements in Factiva between the announcement date and one day prior to the effective date or the date withdrawn are inspected in order to identify whether the target makes any disclosure about its future earnings/profitability. Such voluntary disclosures about future earnings/profitability are generally found in the "Management's Discussion and Analysis (MD&A)" section of quarterly and annual reports and/or in separate SEC filings[4]. A target firm is classified as providing positive (news) disclosure if the following conditions are met (Clarkson et al. (1994), Brennan (1999)): (i) the provided earnings forecasts should be increasing in the whole forecast period (usually 2 to 4 years) from year to year (ii) and the earnings forecast for the immediate next year should be higher than the previous year's earnings. On the other hand, a target firm is identified to have negative (news) disclosure if it provides either any decreasing earnings forecast(s) for the next year(s) compared to the previous year's earnings or forward-looking qualitative negative statements about its future profitability in MD&A, i.e. "we expect to generate operating and net losses and negative cash flows for at least the next few years.". No case has been found in the sample where target firms provide negative news through decreasing earnings forecasts. Any remaining target firms that do not provide any disclosure about their future earnings/profitability are classified as target firms with "no disclosure". The resulting disclosures of target firms with respect to their types are presented in Table 3. Table 3 shows that there are more "positive disclosures" (increasing earnings forecasts) by target firms in failed takeovers. On the other hand, a large part of target firms provide "no disclosure" in completed takeovers. There are also quite a number of target firms providing "negative disclosures" in completed takeovers.

D.1 Binary Outcome Model

Takeover outcome is a binary variable: 1 for completed takeovers and 0 for failed ones. The general binary outcome model is suitable in order to check the main empirical prediction of the model

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

[4] Business and communications filings under the name "Form 425".

Table 3: Summary Statistics of Disclosure Variable

	Takeovers	
	Failed	Completed
Positive (forecasts)	15	8
Negative	1	71
No disclosure	12	207
Observations	28	286
%	8.9	91.1

The row *Positive (forecasts)* shows the number of target firms that provide increasing earnings forecasts for future years as described in the main body of the paper. The row *Negative* shows the number of target firms that provide forward looking qualitative negative statements about their future earnings/profitability. The row *No disclosure* shows the number of target firms that do not provide any disclosure about their future earnings/profitability either in the form of earnings forecasts or qualitative (negative) statements.

The function F is the inverse of probit, logit and complementary log-log link functions, $\mathbf{x_i}$ 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") as described in the previous section and 0 for target firms with "no disclosure" and "negative disclosure". 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.

D.2 Results

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

Table 4 presents the estimation results of the probit and logit models. It includes the coefficients of the explanatory variables that remain to be statistically significant following a standard stepwise regression. In this procedure, all explanatory variables are included at the beginning. But at each new step the least significant explanatory variable is eliminated and then the model is reestimated until all explanatory variables are significant. The coefficent of the disclosure variable d_i is found to be negative and highly significant. This result is in accordance with the model's prediction. Marginal effects are useful to interpret the key result in binary outcome models: An increase of one unit of *disclosure* (providing "positive disclosure") yields a decrease of approximately 0.08 units in the probability that the takeover succeeds. Furthermore, the inclusion of the disclosure variable d_i into the model specification leads to an increase in the goodness of fit: McFadden's R^2 increases from 0.60 to 0.66 and from 0.59 to 0.65 in probit and logit models, respectively. The coefficient of *media* is positive and highly significant as expected. This implies that positive media content leads to an increase in the probability that the takeover succeeds. The coefficients of all other remaining variables are as anticipated. The takeover is more likely to succeed if the acquirer has plenty of cash reserves, if it has a low book-to-market ratio and if its stock performance is good prior to the takeover attempt. On the other hand, the takeover is more likely to fail if the acquirer intends to exchange its equity for equity of the target or if the takeover attempt is unsolicited. Finally, successful takeovers pend for a longer time period compared to unsuccessful takeover attempts.

Table 4: Voluntary Disclosures by the Target Firm Affect Takeover Outcomes

	Probit		Logit	
Variable	Coeff.	Marg. Effect	Coeff.	Marg. Effect
intercept	-5.99***		-11.47***	
	(-2.72)		(-2.62)	
disclosure	-1.54***	-0.08	-2.81***	-0.08
	(-3.30)		(-3.31)	
media	4.62***	0.25	8.76***	0.25
	(4.45)		(4.30)	
log(aCash)	0.24**	0.01	0.47**	0.01
	(2.32)		2.39	
aBookToMarket	-1.36***	-0.07	-2.51**	-0.07
	(-2.69)		(-2.50)	
aReturn	3.73***	0.20	6.63***	0.19
	(3.07)		(2.88)	
stockswap=yes	-1.82**	-0.10	-3.46**	-0.10
	(-2.56)		(-2.53)	
unsolicited=yes	-1.91***	-0.10	-3.57***	-0.10
	(-3.22)		(-3.08)	
log(days)	1.07***	0.06	2.01***	0.06
	(2.91)		(2.69)	
McFadden's R^2	0.66		0.65	
Likelihood ratio test-p value	< 0.0001		< 0.0001	
Observations	314		314	

This table presents the results of the maximum likelihood estimation of model (11) with probit and logit specifications. 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.

As a robustness check, the model (6) is estimated with a complementary log-log model specification. This specification is preferred if binary outcome data is unevenly distributed: the positive (or negative) outcome is rare. Table 3 shows that this is the case here. The number of failed takeovers is much smaller compared to the number of successful ones. Complementary log-log models capture this effect by being asymmetric around zero. Table 5 presents the results of this specification together with the results of the probit model to ease the comparison. The results are very similar. The significance of some variables slightly changes and averages of the sample marginal effects of most variables increase in absolute value. McFadden's R^2 increases by 1%. This shows that the results are robust even though the negative outcome is rare in the data.

Table 5: Robustness Check with Complementary Log-Log Model

	Probit		Comp. Log-log	
Variable	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	

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 complementary log-log model specification, if one deals with such 'rare events' data, is proposed by political scientists King and Zeng (2001*a*, 2001*b*). 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 (2001*a*, 2001*b*) 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')[5]. 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 (2001*a*, 2001*b*) 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:

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

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 6 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 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 (2001*a*, 2001*b*) 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.

The next section performs a further robustness check: Stock price reactions at the announcement date of "positive" (increasing earnings forecasts) and "negative" disclosures by target firms are determined in order to check the credibility of these disclosures.

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

Table 6: Robustness Check with the 'Rare Events' Procedure

	Logit-Original		Logit-New	
Variable	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	

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.

E A Further Robustness Analysis

This section examines the credibility of "positive" and "negative" disclosures by target firms. The model predicts that shareholders pay attention to disclosures by target firms in equilibrium. If this is true, the stock price of the disclosing target firm is expected to change accordingly: While the stock price is expected to increase on the announcement date of "positive disclosures" (increasing earnings forecasts), it is expected to decrease on the announcement date of "negative disclosures". This hypothesis is tested by an event study that uses the standard Mean Adjusted Returns technique of Brown and Warner (1983).

The abnormal returns of the disclosing target firms' stocks are tested in the interval from five days before through five days after the announcement date (i.e. the event window). The analysis utilizes 109 daily returns immediately preceding day -5 as the estimation period.

The daily stock returns are denoted as $R_{i,t}$ ($t = -114$ to -6) for stock i in the sample of disclosing target firms. The average of the $R_{i,t}$ is used to calculate the "normal returns" from the estimation period for each stock i. Then the "normal returns" are computed as follows:

$$\bar{R}_i = \frac{1}{T} \sum_{t=-114}^{t=-6} R_{i,t} \tag{7}$$

where $T = -6-(-114)+1 = 109$ equals the length of the estimation period. In the next step the abnormal (residual) returns for stock i are calculated by substracting the $\bar{R}_i$ from actual daily returns of stock i in the event period. Thus, the abnormal returns are given as follows:

$$AR_{i,t^*} = R_{i,t^*} - \bar{R}_i \tag{8}$$

where t^* is from -5 to $+5$. These abnormal returns are averaged across companies in the event period:

$$\overline{AR}_{t^*} = \frac{\sum_{i=1}^{N} AR_{i,t^*}}{N} \tag{9}$$

The average abnormal returns are then added up over a specified number of days in the event period to obtain cumulative average abnormal returns ($CAAR$s):

$$CAAR = \sum_{t^*=t_1}^{t_2} \overline{AR}_{t^*} = \frac{1}{N} \sum_{i=1}^{N} CAR_i \qquad -5 \leq t_1 \leq t_2, \qquad t_2 = t_1, ..., +5 \tag{10}$$

where $CAR_i = AR_{i,t_1} + ... + AR_{i,t_2}$. Additional to mean-adjusted abnormal returns, standardized mean adjusted abnormal returns are also computed by following Gordon et al. (1984)[6]:

$$ASR_{i,t^*} = AR_{i,t^*}/\sigma_i \tag{11}$$

where σ_i is the standard deviation of stock i's daily returns in the estimation period. Analogous to the computation of average and cumulative average abnormal returns, average standardized abnormal returns and cumulative average standardized abnormal returns are calculated respectively as follows:

$$\overline{ASR}_{t^*} = \frac{\sum_{i=1}^{N} ASR_{i,t^*}}{N} \tag{12}$$

$$CASR = \sum_{t^*=t_1}^{t_2} \overline{ASR}_{t^*} \qquad -5 \leq t_1 \leq t_2, \qquad t_2 = t_1, ..., +5 \tag{13}$$

The null hypothesis is that there is no abnormal return. The abnormal returns in the event period are tested by using a t-test to check whether they are statistically significantly different from zero. Two types

[6] It is known that the latter is likely to follow more closely a t distribution.

of t-tests are used to observe statistical significance. The first t-test uses the cross-sectional standard error of the abnormal returns in the event period for each t^*. On the other hand, the second method uses the time series standard error of abnormal returns during the estimation period (-114 to -6 days). The first method generally provides more robust results if the return volatility changes a lot in the event study period. [7] In a similar manner, the significance of cumulative average abnormal return, $CAAR$, over an arbitrary event interval $[t_1, t_2]$ is tested by using the first method of t-test. Finally, the significance of a particular $CASR$ is tested by calculating the t-statistic (degrees of freedom=$N - 1$) as in Brown and Warner (1980):

$$t = CASR\sqrt{N/(t_2 - t_1 + 1)} \tag{14}$$

In addition, several non-parametric tests, such as Sign Test, Wilcoxon Signed Rank Test (SRT) and Corrado Rank Test[8], are carried out for the robustness of the results.

Table 7 shows that positive abnormal return on the announcement date is statistically significant at the 1% level for target firms that provide "positive disclosures". Parametric and non-parametric tests agree on this finding. A similar result holds for target firms with "negative disclosures" in Table 8: there is a negative abnormal return on the announcement date and tests show that it is highly significant. Parametric and non-parametric tests seem to disagree on the significance of negative abnormal returns that occur on days 2 and 3 after the announcement day.

The significance results for some selected $CASR$s and $CAAR$s are presented in Table 9. $CASR[-1, 0]$ and $CAAR[-1, 0]$ are significant for both types of target firms. This shows that there is a significant change in returns on the announcement date of disclosures. Thus, overall results show that shareholders react to the voluntary disclosures by the target firms and this significantly affects the stock prices in return.

[7] Please refer to Campbell, Lo and MacKinlay (1997), Jong (2007) and Serra (2002) for the details of two types of t-tests.
[8] Please refer to Corrado (1989) for the details of the test.

Table 7: Results of Parametric and Non-parametric Tests and Their Significance for Targets with "Positive Disclosures"

				Wilcoxon SRT	Sign Test		Corrado Test	
Day	$\overline{AR}_{t^*}$	t-stats (CS)	t-stats (TS)	R / NR	Z	p value (2-tailed)	Z	p value (2-tailed)
-5	0.0002	+0.0286	+0.0248	NR	-0.2581	0.7963	-0.3076	0.7584
-4	-0.0089	-1.3910	-0.9322	NR	-1.5491	0.1214	-1.3344	0.1821
-3	-0.0164	-1.4091	-1.7654*	NR	-0.7745	0.4386	-0.6485	0.5167
-2	0.0293	+1.1624	+1.6920	NR	+0.2581	0.7963	+0.7153	0.4744
-1	-0.0054	-0.7056	-0.5713	NR	-0.2581	0.7963	-0.3965	0.6917
0	0.0384	+2.6122***	+3.0692***	R**	+2.3237**	0.0201	+2.8723***	0.0041
1	0.0007	+0.1483	+0.0825	NR	+0.7745	0.4386	+0.5818	0.5607
2	-0.0047	-1.1922	-0.4920	NR	-0.7745	0.4386	-0.7820	0.4342
3	0.0012	+0.1509	+0.1274	NR	-0.2581	0.7963	+0.2186	0.8270
4	0.0001	+0.0276	+0.0172	NR	-0.7745	0.4386	-0.3002	0.7640
5	0.0001	+0.0329	+0.0168	NR	-0.2581	0.7963	+0.1519	0.8793

This table shows the average abnormal returns for each day in the event window. The columns t-stats (CS) and t-stats (TS) show the results of the first type and the second type of *t*-tests that use the cross-sectional standard error of the abnormal returns in the event period and the time series standard error of the abnormal returns during the estimation period, respectively. In the fifth column, R stands for rejecting and NR stands for not rejecting the null hypothesis of the Wilcoxon Signed Rank Test, which is the abnormal returns are not significantly different from zero. The final columns show test statistics (Z-scores) of the Sign Test and the Corrado Rank Test and their corresponding p-values.
*** 1% significance, ** 5% significance, * 10% significance

Table 8: Results of Parametric and Non-parametric Tests and Their Significance for Targets with "Negative Disclosures"

				Wilcoxon SRT	Sign Test		Corrado Test	
Day	$\overline{AR}_{t^*}$	t-stats (CS)	t-stats (TS)	R / NR	Z	p value (2-tailed)	Z	p value (2-tailed)
-5	0.0053	+0.6339	+0.8308	NR	-0.8307	0.4061	-0.0708	0.9436
-4	-0.0028	-0.4851	-0.4526	NR	-1.0681	0.2855	-1.0780	0.2810
-3	0.0102	+1.2810	+1.3572	NR	-0.3560	0.7218	+0.3181	0.7504
-2	-0.0010	-0.1806	-0.1610	NR	-1.3054	0.1918	-0.8578	0.3910
-1	0.0107	+1.3491	+1.4091	NR	+1.3054	0.1918	+1.2522	0.2105
0	-0.0293	-3.0875***	-3.5935***	R***	-3.6790***	0.0002	-3.7989***	0.0001
1	0.0161	+1.3205	+1.3658	NR	+1.0681	0.2855	+1.1352	0.2563
2	-0.0087	-1.6547	-1.3731	R**	-2.9669***	0.0030	-1.2649	0.2059
3	-0.0090	-1.8311	-1.4144	R**	-3.4416***	0.0006	-1.1232	0.2614
4	-0.0033	-0.8430	-0.5183	NR	-3.2043***	0.0014	-1.2046	0.2284
5	0.0009	+0.2057	+0.1417	NR	-0.5933	0.5530	+0.3060	0.7596

This table shows the average abnormal returns for each day in the event window. The columns t-stats (CS) and t-stats (TS) show the results of the first type and the second type of *t*-tests that use the cross-sectional standard error of the abnormal returns in the event period and the time series standard error of the abnormal returns during the estimation period, respectively. In the fifth column, R stands for rejecting and NR stands for not rejecting the null hypothesis of the Wilcoxon Signed Rank Test, which is the abnormal returns are not significantly different from zero. The final columns show test statistics (Z-scores) of the Sign Test and the Corrado Rank Test and their corresponding p-values.
*** 1% significance, ** 5% significance, * 10% significance

Table 9: Values and Significance of $CASR$s and $CAAR$s

	Positive Disclosures		Negative Disclosures	
	Value	t-stats	Value	t-stats
CASR[-1,0]	1.4884	4.0763***	-0.1419	-2.5456***
CASR[-1,1]	1.4829	3.3159***	0.0373	+0.1819
CASR[-2,2]	1.8047	3.1259***	-0.1517	-0.5718
CASR[-5,5]	0.6741	0.7872	-0.1254	-0.3187
CAAR[-1,0]	0.0330	2.4123**	-0.0185	-2.0566**
CAAR[-1,1]	0.0337	2.083**	-0.0024	-0.1643
CAAR[-2,2]	0.0583	1.5245	-0.0122	-0.7402
CAAR[-5,5]	0.0346	0.4628	-0.0109	-0.4905

This table shows the values of $CASR$s and $CAAR$s for some selected time periods in the event window. Corresponding t-statistics are also presented.
*** 1% significance, ** 5% significance, * 10% significance

F Conclusion

This paper deals with the question of "What is the role of voluntary disclosures by target firms during a takeover event in the likelihood of takeover success?". It approaches this question 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. In the next step, the prediction of the model is tested empirically with different binary outcome models. Results confirm that positive earnings forecasts by target firms increase the probability of takeover failure. This is consistent and adds to the earlier evidence that shows information dissemination by target firms through voluntary disclosures affects offer prices and so takeover dynamics in general (Brennan (1999)). In conclusion, the paper stresses the key role of information and its dissemination on takeover outcomes by focusing especially on the effect of voluntary disclosures by target firms.

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H Appendix

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

$$\begin{aligned}\alpha^h &= P(t=H|s_d=h)\\ &= P(t=H|d=i,s_d=h)P(d=i|s_d=h) + P(t=H|d=\neg i,s_d=h)P(d=\neg i|s_d=h)\\ &= \tfrac{P(t=H,d=i,s_d=h)}{P(d=i,s_d=h)}\tfrac{P(d=i,s_d=h)}{\eta} + \tfrac{P(t=H,d=\neg i,s_d=h)}{P(d=\neg i,s_d=h)}\tfrac{P(d=\neg i,s_d=h)}{\eta}\\ &= \tfrac{1}{\eta}\left[P(s_d=h|d=i,t=H)P(d=i,t=H) + P(s_d=h|d=\neg i,t=H)P(d=\neg i,t=H)\right]\\ &= \tfrac{1}{\eta}\left[(1-\epsilon)\xi_H\alpha + \tfrac{1}{2}(1-\xi_H)\alpha\right] = \alpha\tfrac{(1-\epsilon)\xi_H+\frac{1}{2}(1-\xi_H)}{\eta},\end{aligned}$$

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, $s=1$:

$$\begin{aligned}\beta^1 &= P(\tau=G|s=1)\\ &= P(\tau=G|m=1,s=1)P(m=1|s=1) + P(\tau=G|m=0,s=1)P(m=0|s=1)\\ &= P(\tau=G|m=1,s=1)\tfrac{P(m=1,s=1)}{\zeta} + P(\tau=G|m=0,s=1)\tfrac{P(m=0,s=1)}{\zeta}\\ &= \tfrac{P(s=1,m=1,\tau=G)}{P(s=1,m=1)}\tfrac{P(m=1,s=1)}{\zeta} + \tfrac{P(s=1,m=0,\tau=G)}{P(s=1,m=0)}\tfrac{P(m=0,s=1)}{\zeta}\\ &= \tfrac{1}{\zeta}\left[P(s=1,m=1,\tau=G) + P(s=1,m=0,\tau=G)\right]\\ &= \tfrac{1}{\zeta}\left[P(s=1,\tau=G|m=1)P(m=1) + P(s=1,\tau=G|m=0)P(m=0)\right]\end{aligned}$$

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

$$\begin{aligned}&= \tfrac{1}{\zeta}\left[P(s=1|m=1)P(\tau=G|m=1)P(m=1) + P(s=1|m=0)P(\tau=G|m=0)P(m=0)\right]\\ &= \tfrac{1}{\zeta}\left[P(s=1|m=1)\tfrac{P(m=1|\tau=G)P(\tau=G)}{P(m=1)}P(m=1) + P(s=1|m=0)\tfrac{P(m=0|\tau=G)P(\tau=G)}{P(m=0)}P(m=0)\right]\\ &= \tfrac{1}{\zeta}\left[\delta\xi_G\beta + (1-\delta)(1-\xi_G)\beta\right] = \beta\tfrac{\xi_G\delta+(1-\xi_G)(1-\delta)}{\zeta}\end{aligned}$$

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,

$$\begin{aligned}P(\tau=x,t=z|s_d=k,s=n) = &P(\tau=x,t=z|s_d=k,s=n,m=1,d=i)P(m=1,d=i|s_d=k,s=n)+\\ &P(\tau=x,t=z|s_d=k,s=n,m=1,d=\neg i)P(m=1,d=\neg i|s_d=k,s=n)+\\ &P(\tau=x,t=z|s_d=k,s=n,m=0,d=i)P(m=0,d=i|s_d=k,s=n)+\\ &P(\tau=x,t=z|s_d=k,s=n,m=0,d=\neg i)P(m=0,d=\neg i|s_d=k,s=n)\end{aligned} \tag{15}$$

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

The following steps can be performed by keeping in mind the independence assumption between acquirer and target related events:

$$\begin{aligned}&= \tfrac{P(\tau=x,t=z,s_d=k,s=n,m=1,d=i)}{P(s_d=k,s=n,m=1,d=i)}\tfrac{P(m=1,d=i,s_d=k,s=n)}{P(s_d=k,s=n)} + \tfrac{P(\tau=x,t=z,s_d=k,s=n,m=1,d=\neg i)}{P(s_d=k,s=n,m=1,d=\neg i)}\tfrac{P(m=1,d=\neg i,s_d=k,s=n)}{P(s_d=k,s=n)} +\\ &\tfrac{P(\tau=x,t=z,s_d=k,s=n,m=0,d=i)}{P(s_d=k,s=n,m=0,d=i)}\tfrac{P(m=0,d=i,s_d=k,s=n)}{P(s_d=k,s=n)} + \tfrac{P(\tau=x,t=z,s_d=k,s=n,m=0,d=\neg i)}{P(s_d=k,s=n,m=0,d=\neg i)}\tfrac{P(m=0,d=\neg i,s_d=k,s=n)}{P(s_d=k,s=n)}\\ &= \tfrac{P(\tau=x,s=n,m=1)P(t=z,s_d=k,d=i)}{P(s_d=k,s=n)} + \tfrac{P(\tau=x,s=n,m=1)P(t=z,s_d=k,d=\neg i)}{P(s_d=k,s=n)}\\ &+ \tfrac{P(\tau=x,s=n,m=0)P(t=z,s_d=k,d=i)}{P(s_d=k,s=n)} + \tfrac{P(\tau=x,s=n,m=0)P(t=z,s_d=k,d=\neg i)}{P(s_d=k,s=n)}\end{aligned}$$

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

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

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

$$\begin{aligned}\pi^G =&\alpha[P(s_d = h, s = 1|\tau = G, t = H)\pi^{G,H}_{h,1} + P(s_d = l, s = 1|\tau = G, t = H)\pi^{G,H}_{l,1} +\\ &P(s_d = h, s = 0|\tau = G, t = H)\pi^{G,H}_{h,0} + P(s_d = l, s = 0|\tau = G, t = H)\pi^{G,H}_{l,0}]+\\ &(1-\alpha)[P(s_d = h, s = 1|\tau = G, t = L)\pi^{G,L}_{h,1} + P(s_d = l, s = 1|\tau = G, t = L)\pi^{G,L}_{l,1} +\\ &P(s_d = h, s = 0|\tau = G, t = L)\pi^{G,L}_{h,0} + P(s_d = l, s = 0|\tau = G, t = L)\pi^{G,L}_{l,0}]\end{aligned} \tag{16}$$

and

$$\begin{aligned}\pi^B =&\alpha[P(s_d = h, s = 1|\tau = B, t = H)\pi^{B,H}_{h,1} + P(s_d = l, s = 1|\tau = B, t = H)\pi^{B,H}_{l,1} +\\ &P(s_d = h, s = 0|\tau = B, t = H)\pi^{B,H}_{h,0} + P(s_d = l, s = 0|\tau = B, t = H)\pi^{B,H}_{l,0}]+\\ &(1-\alpha)[P(s_d = h, s = 1|\tau = B, t = L)\pi^{B,L}_{h,1} + P(s_d = l, s = 1|\tau = B, t = L)\pi^{B,L}_{l,1} +\\ &P(s_d = h, s = 0|\tau = B, t = L)\pi^{B,L}_{h,0} + P(s_d = l, s = 0|\tau = B, t = L)\pi^{B,L}_{l,0}].\end{aligned} \tag{17}$$

In equation (16), $\pi^{G,H}_{s_d,s}$ and $\pi^{G,L}_{s_d,s}$ are given by the following,

$$\pi^{G,H}_{s_d,s} = -c\xi_G + z(\mathbf{1}_{p^{s_d} \le b \le p^{s,s_d}} + \mathbf{1}_{\max\{p^{s_d},p^{s,s_d}\}<b}) + (p_{H,G} - b)(k\mathbf{1}_{p^{s_d} \le b \le p^{s,s_d}} + n\mathbf{1}_{\max\{p^{s_d},p^{s,s_d}\}<b}) \tag{18}$$

$$\pi^{G,L}_{s_d,s} = -c\xi_G + z(\mathbf{1}_{p^{s_d} \le b \le p^{s,s_d}} + \mathbf{1}_{\max\{p^{s_d},p^{s,s_d}\}<b}) + (p_{L,G} - b)(k\mathbf{1}_{p^{s_d} \le b \le p^{s,s_d}} + n\mathbf{1}_{\max\{p^{s_d},p^{s,s_d}\}<b}). \tag{19}$$

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 (17) are as follows,

$$\pi^{B,H}_{s_d,s} = -c\xi_B + z(\mathbf{1}_{p^{s_d}\leq b\leq p^{s,s_d}} + \mathbf{1}_{\max\{p^{s_d},p^{s,s_d}\}<b}) + (p_{H,B} - b)(k\mathbf{1}_{p^{s_d}\leq b\leq p^{s,s_d}} + n\mathbf{1}_{\max\{p^{s_d},p^{s,s_d}\}<b}) \quad (20)$$

$$\pi^{B,L}_{s_d,s} = -c\xi_B + z(\mathbf{1}_{p^{s_d}\leq b\leq p^{s,s_d}} + \mathbf{1}_{\max\{p^{s_d},p^{s,s_d}\}<b}) + (p_{L,B} - b)(k\mathbf{1}_{p^{s_d}\leq b\leq p^{s,s_d}} + n\mathbf{1}_{\max\{p^{s_d},p^{s,s_d}\}<b}). \quad (21)$$

In equations (16) and (17), $P(s_d = k, s = n|\tau = x, t = z) = P(\tau = x, t = z|s_d = k, s = n)P(s_d = k, s = n)/P(\tau = x, t = z)$ 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

$$P(s_d = k, s = n|\tau = x, t = z) = \frac{P(\tau = x, t = z|s_d = k, s = n)P(s_d = k, s = n)}{P(\tau = x)P(t = z)} \quad (22)$$

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 $\xi^*_\tau \in \text{argmax}_{\xi_\tau}\, \pi^\tau(\xi_\tau)$ and $\xi^*_t \in \text{argmax}_{\xi_t}\, \pi^t(\xi_t)$, 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 $\pi^{\tau,H}_{s_d,s} = -c\xi_\tau - k(p^{s_d} - p_{H,\tau})\mathbf{1}_{p^{s_d}\leq p^{s,s_d}}$ and $\pi^{\tau,L}_{s_d,s} = -c\xi_\tau - k(p^{s_d} - p_{L,\tau})\mathbf{1}_{p^{s_d}\leq p^{s,s_d}}$ 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

$$\begin{aligned}
\beta \geq \beta^{l,1} &\Leftrightarrow p^l|_{(\xi_H,\xi_L)=(1,0)} \leq p^{l,1}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)},\\
\beta \geq \beta^{h,1} &\Leftrightarrow p^h|_{(\xi_H,\xi_L)=(1,0)} \leq p^{h,1}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)},\\
\beta \geq \beta^{l,0} &\Leftrightarrow p^l|_{(\xi_H,\xi_L)=(1,0)} \leq p^{l,0}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)},\\
\beta \geq \beta^{h,0} &\Leftrightarrow p^h|_{(\xi_H,\xi_L)=(1,0)} \leq p^{h,0}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)}
\end{aligned}$$

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 $c \geq c_1^{'} = (2\delta - 1)\left[\alpha\epsilon[z - k(p_H - p_{H,B})] + (1 - \alpha)0.5[z - k(p_L - p_{L,B})]\right]$ 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 also begin to tender after observing $(s_d = h, s = 1)$ additional to $(s_d = l, s = 1)$, since now $p^l|_{(\xi_H,\xi_L)=(1,0)} \leq p^{l,1}|_{(\xi_G,\xi_B)=(1,0),(\xi_H,\xi_L)=(1,0)}$ 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 only 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

$$\begin{aligned}\pi^H =& \beta[P(s_d = h, s = 1|\tau = G, t = H)\pi^H_{h,1} + P(s_d = l, s = 1|\tau = G, t = H)\pi^H_{l,1} + \\ & P(s_d = h, s = 0|\tau = G, t = H)\pi^H_{h,0} + P(s_d = l, s = 0|\tau = G, t = H)\pi^H_{l,0}] + \\ & (1-\beta)[P(s_d = h, s = 1|\tau = B, t = H)\pi^H_{h,1} + P(s_d = l, s = 1|\tau = B, t = H)\pi^H_{l,1} + \\ & P(s_d = h, s = 0|\tau = B, t = H)\pi^H_{h,0} + P(s_d = l, s = 0|\tau = B, t = H)\pi^H_{l,0}]\end{aligned} \tag{23}$$

and

$$\begin{aligned}\pi^L =& \beta[P(s_d = h, s = 1|\tau = G, t = L)\pi^L_{h,1} + P(s_d = l, s = 1|\tau = G, t = L)\pi^L_{l,1} + \\ & P(s_d = h, s = 0|\tau = G, t = L)\pi^L_{h,0} + P(s_d = l, s = 0|\tau = G, t = L)\pi^L_{l,0}] + \\ & (1-\beta)[P(s_d = h, s = 1|\tau = B, t = L)\pi^L_{h,1} + P(s_d = l, s = 1|\tau = B, t = L)\pi^L_{l,1} + \\ & P(s_d = h, s = 0|\tau = B, t = L)\pi^L_{h,0} + P(s_d = l, s = 0|\tau = B, t = L)\pi^L_{l,0}]\end{aligned} \tag{24}$$

where $\pi^H_{s_d,s} = \pi^L_{s_d,s} = (-y)\mathbf{1}_{p^{s_d} \leq p^{s,s_d}}$. 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 $\epsilon = P(s_d = h|d = i, t = L) \leq \frac{1}{2} = P(s_d = h|d = \neg i, t = L)$. ■