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Voluntary disclosure of information when firms are uncertain of investor response[☆]

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Abstract

A firm may prefer not to disclose its private information if it is uncertain of investor response. In the setting under consideration, a firm needs to acquire capital from an investor. The investor can choose to invest in the firm, the risk free asset or in some alternative risky investment opportunity. It is shown that in a partial disclosure equilibrium, the firm discloses average information and withholds bad and good information. Disclosure of average information arises to attract the investor's capital away from the risk free asset.

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1. Introduction

The purpose of this paper is to show that the usual unraveling argument leading to full disclosure need not apply if firms are uncertain about investor response to the disclosed information. Such response uncertainty can arise for several reasons.¹ First, a firm may have imperfect information about investors' prior expectations, in which case the firm does not know whether investors will respond favorably or unfavorably to disclosure of its private information.² Second, investors can interpret the disclosed information in different ways. Dutta and Trueman (2002) present the disclosure of order backlog as an example. Investors can interpret a high-order backlog favorably if they believe that it signals high demand for the firm's product. Alternatively, they can interpret a high-order backlog unfavorably if they believe that it signals problems with the firm's production facilities or management's lack of control over operations. Finally, response uncertainty can arise if investor response depends not only on the firm's disclosure but also on other factors that are beyond the firm's control, such as disclosure by competitors.

The model that I consider consists of a single (representative) investor and a single firm. The investor has a limited amount of capital available which he can invest in three different projects, namely the firm, the risk free asset and some alternative risky investment project henceforth referred to as the outside option. The firm's objective is to acquire as much of the investor's capital as possible. The return of the firm is private information to the firm. The investor, on the other hand, has private information regarding the return of the outside option. The firm can credibly disclose its return before the investor makes his investment decision. The crucial feature of the model is that both the firm and the investor are imperfectly informed in the sense that they do not know which of the two risky projects is the better one. Consequently, the firm faces uncertainty regarding the investor's response to disclosure. If disclosure by the firm reveals that its return is worse than the investor's outside option, the investor responds unfavorably by investing more of his capital in the outside option and less in the firm (compared to the investments made if the firm had not disclosed). Similarly, if disclosure by the firm reveals that its return is better than the investor's outside option, the investor responds favorably by increasing his investment in the firm.

The main results of the paper are the following. First, an equilibrium with full disclosure exists and is supported by skeptical beliefs of the investor (i.e., the investor interprets non-disclosure as a signal of poor quality). Second, an equilibrium with no disclosure exists if the risk of an unfavorable response by the investor is sufficiently high.

¹To cite Dye (1998), uncertainty regarding the response of investors is

...the typical situation that firms and investors actually face: managers cannot predict exactly the price reactions attending their disclosures or nondisclosures of information to capital market participants, in part because they do not know the capital market participants' entire information set, and investors may not know either what rival investors know or whether the firms they follow are withholding value-relevant information.

²One could claim that the publicly observable forecasts issued by financial analysts serve as a proxy for investors' expectations. These forecasts, however, are usually confined to (a subset of) information that is subject to mandatory disclosure regulation; they do not concern pieces of information that the firm can disclose voluntarily. Alternatively, one can use the variation in the forecasts by different analysts to justify the uncertainty regarding investors' expectations.

Third, an equilibrium with partial disclosure may exist in which average (i.e., neither exceptionally high nor exceptionally low) returns are disclosed. More precisely, when firm return is below the risk free rate no disclosure is made. Of all profitable returns, or returns that exceed the risk free rate, only sufficiently high returns are not disclosed.

It is straightforward to see that the firm conceals *unprofitable* returns. By disclosing a return below the risk free rate, the firm knows for sure that it will not acquire any capital. Profitable firms only disclose relatively low returns because of the investor's incentive to invest in the risk free asset when the firm does not disclose. Since investing in the risky projects can yield a return below the risk free rate, risk diversification induces the investor to allocate part of his capital to the risk free asset. In particular, the lower his expectations regarding the returns of the risky projects, the more he invests in the risk free asset. Disclosure then serves the purpose of attracting the investor's capital away from the risk free asset. In making its disclosure decision, the firm trades off the gain from a favorable response against the loss from an unfavorable response. Since a profitable, high-return firm can still acquire a relatively large amount of capital with no disclosure, it has a lot to lose from disclosure and little to gain. Hence, nondisclosure is optimal. A profitable but low-return firm, on the other hand, acquires only a small amount of capital with no disclosure. Disclosure is thus optimal because the firm has a lot to gain from disclosure and little to lose.

Equilibrium disclosure behavior is consistent with the observed disclosure behavior of firms that are seeking external financing. For example, [Mak \(1996\)](#) documents that IPO firms with relatively low expected short-term earnings provide more earnings forecasts. [Jog and McConomy \(2003\)](#) show that firms that include earnings forecasts in their IPO prospectuses have slightly lower revenues and income than firms that do not include such forecasts in their IPO prospectuses. [Lang and Lundholm \(2000\)](#) find that firms that dramatically increase their disclosure activity prior to an equity offering suffer large price declines at and after the offering announcement. Their explanation is that these firms provide more disclosure so as to 'hype' their stock and to obtain a lower cost of equity capital. In other words, these firms disclose in the hope of acquiring more of the investors' capital.

The general prediction of the model is that firms provide more disclosure when alternative investment opportunities (e.g., risk free asset) are more attractive to investors. Since nondisclosure could cause investors to take their capital elsewhere, a firm has more to gain from disclosure than to lose. One empirical setting for testing this prediction is to compare the disclosure behavior of firms within industries and across industries. Within industries, one expects the better-performing firms to provide less disclosure because they face less competition for investor capital than the lower-performing firms from the same industry. Across industries, one expects the level of disclosure to be lower for the better-performing industries because investment in other industries offers a less attractive alternative to investors.

The paper proceeds as follows. Section 2 presents an overview of the related literature on voluntary disclosure. Section 3 provides a formal description of the model. Section 4 presents the equilibrium analysis, including a detailed analysis of the investor's investment decision and a firm's disclosure decision. Section 5 discusses the empirical implications of the equilibrium results and Section 6 concludes.

2. Related literature

Accounting research on corporate disclosure policy made its start with the seminal result of Grossman (1981) and Milgrom (1981) that full disclosure arises if (i) disclosure is costless, (ii) investors know that the firm has private information, (iii) the firm can credibly disclose its private information to investors, (iv) all investors respond to the firm's disclosure decision in the same way and (v) the firm knows how investors will respond to disclosure of its private information. Full disclosure of information arises by an unraveling argument. Given the investors' prior expectations about the firm's future prospects, a firm with private information that exceeds investors' prior expectations will disclose this information because it enhances investors' beliefs about the firm. Consequently, investors perceive nondisclosure as an unfavorable signal about the firm's future prospects and accordingly lower their expectations about a nondisclosing firm. This in turn induces a firm to disclose private information that exceeds the lowered expectations of investors. The investors further reduce their expectations about a nondisclosing firm, thereby continuing the unraveling of private information until full disclosure results.

The full disclosure result is in strong contrast with empirical observations of firms that are not inclined to provide full disclosure and has led to subsequent research to seek theoretical explanations for nondisclosure. Clearly, for nondisclosure to occur in equilibrium, one needs to abandon at least one of the assumptions (i)–(v) above. For example, Verrecchia (1983), Dye (1986), Wagenhofer (1990), Darrough and Stoughton (1990) and Feltham and Xie (1992) introduce a (non) proprietary cost of disclosure so that assumption (i) no longer holds true. Dye (1985), Jung and Kwon (1988), Jorgensen and Kirschenheiter (2003) and Hughes and Pae (2004) introduce uncertainty about the existence of private information, thereby invalidating assumption (ii). Hughes (1986), Newman and Sansing (1993) and Gigler (1994) invalidate assumption (iii) by allowing for dishonest and incomplete disclosure so as to endogenize the credibility of a firm's disclosure. Fishman and Hagerty (2003)³ introduce uninformed investors who observe possible disclosures by a firm but who do not understand the meaning of such disclosures. Since uninformed investors respond differently to disclosures than informed investors do, assumption (iv) does not hold true. Verrecchia (2001) and Dye (2001) provide extensive surveys on disclosure models.

This paper focuses on assumption (v) and analyzes the disclosure behavior of firms that face uncertainty regarding investor response to disclosed information. In this respect, the paper is similar to Dye (1998) and Dutta and Trueman (2002), except that in those studies it is investor uncertainty about the endowment of private information (assumption (ii)) rather than response uncertainty that is driving nondisclosure. In Dye (1998), response uncertainty arises because the firm does not perfectly know whether or not investors are sophisticated. The difference between sophisticated and unsophisticated investors is that sophisticated investors know when the firm has private information. Hence, sophisticated investors know that when a firm does not disclose, it does so because it has unfavorable private information. Unsophisticated investors, on the other hand, do not know whether a nondisclosing firm has unfavorable private information or no information at all. Dye's

³Fishman and Hagerty (2003) actually consider a setting where a firm can disclose information about product quality to consumers. Their results, however, also apply to a setting where a firm can disclose information about firm value to investors.

main result is that firms increase disclosure if more investors are sophisticated. In Dutta and Trueman (2002), response uncertainty arises because firms do not know how investors will interpret the firm's private information. In this study, response uncertainty serves to influence which types of firms disclose and which types do not. In contrast to Dye (1998) and Dutta and Trueman (2002), however, it is only response uncertainty that drives nondisclosure in this paper, because the model satisfies assumptions (i)–(iv).

3. Model description

The model considers a single investor and a single firm. The investor has an endowment of capital $c > 0$ and, without loss of generality, I assume that $c = 1$. The investor can allocate this capital to the firm, a risky outside option and the risk free asset. The firm and the outside option are constant returns to scale investment projects with return ϕ and ϕ_o , respectively. The return of the risk free asset is normalized to 1. The vector (x, x_o, x_f) denotes the investor's capital allocation decision with x , x_o and x_f representing the amount of capital allocated to the firm, the outside option and the risk free asset, respectively. A feasible investment decision satisfies $x + x_o + x_f = 1$ and $x, x_o, x_f \geq 0$ and yields the investor a payoff $x\phi + x_o\phi_o + x_f$. I exclude short selling and borrowing in the risk free asset to ensure that the investor is constrained by his limited amount of capital $c = 1$.

The investor's private information is represented by the parameter v which is randomly distributed with probability density function denoted by h and support V . The support of V is unbounded from above by assumption. Firm return ϕ can be either good or bad relative to the investor's private information v ; that is, $\tilde{\phi} = v + \tilde{\Delta}$ where $\tilde{\Delta}$ equals $+\Delta$ with probability p and $-\Delta$ with probability $1 - p$. The return of the outside option is defined in a similar way, that is $\phi_o = v + \tilde{\Delta}_o$ with $\tilde{\Delta}_o$ equal to $+\Delta$ with probability p and equal to $-\Delta$ with probability $1 - p$. It is further assumed that $\Delta > 0$, Δ and p are common knowledge and $\tilde{\Delta}$ and $\tilde{\Delta}_o$ are independently distributed. The return ϕ is private information of the firm and the return ϕ_o of the outside option is unknown to both the investor and the firm. At this point, it is useful to stress my use of terminology in the remainder of this paper. When I speak of a high-return (low-return) firm, I mean the absolute value of the firm's return, or the value of ϕ . When I speak of a good firm (bad firm), I mean the value of firm return ϕ relative to v . So, a high-return firm is a good firm if $\phi = v + \Delta$ and a bad firm if $\phi = v - \Delta$, and similarly for a low-return firm. Furthermore, the firm is called profitable if the return ϕ exceeds the return of the outside option (i.e., $\phi > \phi_o$) and it is called unprofitable otherwise.

Prior to the investor's investment decision, the firm can voluntarily disclose the return ϕ of its investment project to the investor. I assume that all disclosures are truthful⁴ and that the investor is not able to credibly disclose his prior expectations v to the firm.⁵ The

⁴This assumption is common in this strand of disclosure research. It can be justified on the basis of ex post verifiability of the disclosed information and the existence of an antifraud rule that makes misrepresenting the information prohibitively costly. Note, however, the subtle difference in assuming truthful disclosures and assuming that investors can verify the disclosed information ex post. Korn and Schiller (2003) take the latter approach in a disclosure setting that is otherwise similar to Grossman (1981) and Milgrom (1981). The interesting feature of this setup is that although equilibrium disclosures are still truthful, the out-of-equilibrium disclosures need not be truthful. This then gives rise to a plethora of partial disclosure equilibria where relatively bad information is withheld.

⁵This assumption can be justified on the basis of the following two arguments. First, notice that the investor has a strong incentive to understate v , for revealing a low v induces more disclosure by the firm as it more likely

investor's objective is to maximize his expected utility from the investments' payoffs. The utility function is denoted by U_I and is assumed to be increasing (i.e., $U'_I > 0$) and concave (i.e., $U''_I \leq 0$). The compensation of the manager of the firm is assumed to be dependent on the amount of capital acquired. The manager is risk averse and maximizes the expected utility of his compensation (i.e., the amount of capital that he acquires). The utility function of the firm's manager is denoted by U . It is further assumed that $U(0) = 0$, $U' > 0$ and $U'' \leq 0$.

Three important observations should be made. First, since the investor knows v , he knows more about the return of the outside option than the firm. This information advantage may result for several reasons. The investor may have acquired costly private information on the outside option, he may be more sophisticated in analyzing financial and other available information than the firm as investors are specialized in doing just that or the outside option may be privately available to the investor. Second, the investor strictly prefers investing in a good firm over investing in the outside option, which in turn he strictly prefers over investing in a bad firm. Consequently, if disclosure by the firm reveals that its return is good, the investor responds by investing more of his capital in the firm and less in the outside option (compared to the investments made if the firm had not disclosed). Similarly, if disclosure by the firm reveals that its return is bad, the investor responds by decreasing his investment in the firm. Third, since v is private information of the investor, the firm only knows its own rate of return ϕ but *not* whether it is good or bad. It is this distinction that drives response uncertainty.

4. Equilibrium analysis

The equilibrium concept that I will use to analyze the disclosure behavior of the firm is that of a Bayesian equilibrium. For a formal description of a Bayesian equilibrium, some additional notation is necessary. Let $D \subset \mathbb{R}$ denote the disclosure set of the firm with the interpretation that the firm discloses the return ϕ when $\phi \in D$ and that it does not disclose ϕ when $\phi \notin D$. Following the disclosure decision of the firm, the investor updates his beliefs about firm return. Since the investor knows that conditional on his private information v , the return of the firm equals either $v - \Delta$ or $v + \Delta$, the posterior beliefs, which I denote by β , can be represented by the posterior probability that the firm is good, that is, $\beta = \mathbb{P}(\tilde{\phi} = v + \Delta | \cdot)$.

Let $\tilde{x}^d$ denote the capital that the firm receives when it discloses its return ϕ and let $\tilde{x}^{nd}$ denote the capital that the firm receives when it does not disclose. Notice that $\tilde{x}^d$ is a random variable as, by definition of the model, the firm is uncertain about the investor's

(footnote continued)

believes to be a good firm (i.e., $\phi = v + \Delta$). Although a similar argument applies to the firm, which is that the firm has an incentive to overstate its private information, the argument that justifies truthful disclosure does not apply to the investor because the investor's private information lacks the possibility of ex post verification. Furthermore, there exist no pre-IPO market price that could reveal the investor's private information.

Second, consider the more realistic case in which the firm faces multiple investors instead of a single investor. In that case, even if investors can credibly disclose their private information, disclosure by one investor is of little use for the firm, as it only reveals the future response of this particular investor and not the future response of all investors. For disclosure to be useful, a large body of investors should disclose their private information *and* the firm should collect and process all this information. This approach is likely to be very costly and subject to cognitive constraints, so firms remain imperfectly informed about investors' private information.

response to disclosure. That $\tilde{x}^{\text{nd}}$ is a random variable will become clear later on. The disclosure strategy D^* , the investment decision x^* and the investor's posterior beliefs β^* constitute a Bayesian equilibrium if

- (i) The disclosure strategy D^* of the firm is an optimal disclosure strategy, that is,

$$D^* = \{\phi | E(U(\tilde{x}^{\text{d}})) \geq E(U(\tilde{x}^{\text{nd}}))\}.$$

- (ii) The investment decision (x^*, x_o^*, x_f^*) is optimal given the disclosure strategy D^* and the posterior beliefs β^* , that is,

$$\begin{aligned} (x^*, x_o^*, x_f^*) = \arg \max \quad & E_{\beta^*}(U_I(x\tilde{\phi} + x_o\tilde{\phi}_o + x_f)) \\ \text{s.t.} \quad & x + x_o + x_f = 1, \\ & x, x_o, x_f \geq 0. \end{aligned}$$

- (iii) The investor's posterior beliefs β^* are rational with respect to the disclosure strategy D^* .

Condition (i) requires that the disclosure strategy maximizes the firm's expected utility given the investor's investment decision and the investor's posterior beliefs. Condition (ii) requires that the investment decision maximizes the expected utility of the investor with respect to his posterior beliefs β^* , which are determined by his prior beliefs v and the firm's disclosure strategy D^* . Condition (iii) requires that the investor's posterior beliefs following nondisclosure by the firm follow Bayes' rule whenever possible, that is, $\beta^* = \mathbb{P}(\tilde{\phi} = v + \Delta | \tilde{\phi} \notin D^*)$.

Notice that for an unprofitable firm (i.e., $\phi \leq 1$), nondisclosure (weakly) dominates disclosure because disclosing an unprofitable return yields zero capital from the investor.⁶ Henceforth, I focus only on the disclosure decision of a profitable firm (i.e., $\phi > 1$) and assume that an unprofitable firm does not disclose, that is, $\phi \notin D$ for all $\phi \leq 1$. An equilibrium is called a full disclosure equilibrium if a profitable firm always reveals its private information to the investor (i.e., $\phi \in D$ for all $\phi > 1$). Conversely, an equilibrium is called a full nondisclosure equilibrium if a profitable firm always withholds its private information (i.e., $\phi \notin D$ for all $\phi > 1$). In all other cases, an equilibrium is called a partial disclosure equilibrium.

4.1. The optimal investment decision

The investment decision is determined by the investor's posterior beliefs concerning firm return. Since the firm's disclosure strategy only influences the investment decision indirectly through the investor's posterior beliefs, one can derive the optimal investment decision as a function of the investor's posterior beliefs β . Table 1, which I explain in more detail below, summarizes the optimal investment decisions for all feasible posterior beliefs β .

⁶Throughout the paper I assume that if $\phi = 1$, the investor does not invest in the firm. Such an investment decision arises endogenously if the investor is risk averse and the firm yields a risky return $\phi + \tilde{\varepsilon}$ where the firm only knows the expected return ϕ and the random variable $\tilde{\varepsilon}$ represents (firm-specific) risk.

Table 1
The optimal investment decision given the investor’s posterior beliefs β

β	(x^*, x_o^*, x_f^*)
1	$(1, 0, 0)$
p	$(\frac{1}{2}(1 - x_f^*), \frac{1}{2}(1 - x_f^*), x_f^*)$
0	$(0, 1 - x_f^*, x_f^*)$

$p(\beta)$ represents the investor’s prior (posterior) beliefs of the firm being good. x^*, x_o^* and x_f^* represent the respective investments in the firm, the outside option and the risk free asset.

Observe that given his private information v , the investor knows that the return of a bad firm equals $v - \Delta$ and the return of a good firm equals $v + \Delta$. By construction of the model, the information that the investor may receive on the return of the firm is either perfect or nothing at all. Hence, posterior beliefs that are feasible equal $\beta = 1$ when the investor learns that firm return is good, $\beta = p$ when the investor learns no new information on firm return and $\beta = 0$ when the investor learns that firm return is bad. For posterior beliefs $\beta = 1$, the investor believes that the firm is good. Since the firm is profitable, the investor does not invest in the risk free asset, that is, $x_f^* = 0$. Furthermore, since the outside option can be bad with probability $1 - p$, it is optimal for the investor to allocate all his capital to the firm, that is, $x^* = 1$ and $x_o^* = 0$.

Next, consider posterior beliefs $\beta = p$ so that investor beliefs for the firm and the outside option are identical. For analyzing the investment decision, suppose the value of v is relatively low (i.e., $v - \Delta < 1 < v + \Delta$). Then compared to investing in the risk free asset, investing in a risky project yields a loss of $1 - (v - \Delta)$ if the project turns out to be bad and a gain of $(v + \Delta) - 1$ if it turns out to be good. To diversify this risk, the investor will allocate part of his capital to the risk free asset. Hence, only $1 - x_f^*$ remains for investing in the risky projects. Optimal risk sharing then implies that this amount is invested equally across the two projects so that $x^* = x_o^* = \frac{1}{2}(1 - x_f^*)$. Notice that the investment x_f^* in the risk free asset decreases with the investor’s private information v (i.e., $dx_f^*/dv \leq 0$). For higher values of v , investing in the risk free asset becomes less attractive as the potential loss from investing in a bad risky project reduces and the potential gain from investing in a good risky project increases. Eventually, when the value of v is sufficiently large (i.e., $v - \Delta > 1$), no investment in the risk free asset is made (i.e., $x_f^* = 0$) as even a bad project yields a profitable return.

Finally, for posterior beliefs $\beta = 0$, the investor knows that the firm is bad. Hence, he will not invest in the firm as the outside option yields at least the return of the firm. Consequently, $x^* = 0$. Since depending on the value of v the outside option can perform worse than the risk free asset, optimal risk sharing yields that the investor allocates x_f^* to the risk free asset and $1 - x_f^*$ to the outside option.

4.2. The firm’s disclosure decision

The firm prefers to disclose its return ϕ if the expected utility from disclosure $E(U(\tilde{x}^d))$ exceeds the expected utility from nondisclosure $E(U(\tilde{x}^{nd}))$. Recall that the firm faces uncertainty with respect to the investor’s private information v . Given its return ϕ , the firm knows that the investor’s prior expectations are either $v = \phi - \Delta$ (i.e., the firm is good) or

$v = \phi + \Delta$ (i.e., the firm is bad). Following Bayes' rule, the posterior probability that the firm assigns to being a good firm (i.e., $v = \phi - \Delta$) equals

$$p(\phi) = \frac{h(\phi - \Delta)p}{h(\phi - \Delta)p + h(\phi + \Delta)(1 - p)} \quad (1)$$

for all ϕ . Notice that $p(\phi) > p$ if and only if $h(\phi - \Delta) > h(\phi + \Delta)$; that is, the firm revises its beliefs about being a good firm upwards if the investor's private information is more likely to be $v = \phi - \Delta$ than $v = \phi + \Delta$.

The disclosure payoff $\tilde{x}^d$ equals 1 with probability $p(\phi)$ and 0 with probability $1 - p(\phi)$. This follows from the fact that with probability $p(\phi)$ firm return is good, in which case the investor allocates all his available capital to the firm as the outside option yields a return that is at best equal to firm return (cf. $\beta = 1$ in Table 1). With probability $1 - p(\phi)$ firm return is bad, in which case the investor allocates no capital to the firm as the outside option yields a return that is at least equal to the return of the firm (cf. $\beta = 0$ in Table 1).

For the nondisclosure payoff $\tilde{x}^{nd}$ no further specification is possible as the investor's posterior beliefs regarding a nondisclosing firm depend on his private information v and the disclosure strategy D , which is yet unspecified. Hence, I denote by x_g^{nd} and x_b^{nd} the nondisclosure payoff when firm return is good and bad, respectively, so that a nondisclosing firm receives the payoff x_g^{nd} with probability $p(\phi)$ and the payoff x_b^{nd} with probability $1 - p(\phi)$. Notice that the payoffs x_g^{nd} and x_b^{nd} may differ because the investor's private information v differs; $v = \phi - \Delta$ when firm return is good and $v = \phi + \Delta$ when firm return is bad.

Then the firm weakly prefers disclosure to nondisclosure if and only if

$$p(\phi)U(1) + (1 - p(\phi))U(0) \geq p(\phi)U(x_g^{nd}) + (1 - p(\phi))U(x_b^{nd}). \quad (2)$$

Rearranging terms in (2) yields that disclosure is weakly preferred to nondisclosure if and only if

$$p(\phi) \geq \frac{u_b}{u_b + u_g}, \quad (3)$$

where $u_b = U(x_b^{nd}) - U(0) = U(x_b^{nd})$ represents the manager's decrease in utility following a negative response to disclosure and $u_g = U(1) - U(x_g^{nd})$ represents the manager's increase in utility following a positive response. The firm prefers disclosure to nondisclosure if its posterior beliefs about being a good firm are sufficiently high. The intuition for this is clear. Conditional on knowing its own type, the firm would disclose if it is good and would not disclose if it is bad. Notice that an increase in u_b increases the threshold $u_b/(u_b + u_g)$. Since a stronger negative response makes disclosure less attractive compared to nondisclosure, the firm must be more certain about being a good firm for disclosure to be optimal. An increase in u_g , on the other hand, decreases the threshold $u_b/(u_b + u_g)$. Since a stronger positive response makes disclosure a more attractive option, the firm can be less certain about being a good firm for disclosure to be optimal.

Observe that condition (3) completely characterizes the optimal disclosure strategy by

$$D^* = \left\{ \phi \mid p(\phi) \geq \frac{u_b}{u_b + u_g} \right\}.$$

4.3. Equilibrium disclosure strategies

Skeptical beliefs on the part of the investor always give rise to a full disclosure equilibrium. Skeptical beliefs imply that if the investor observes nondisclosure by the firm, he believes that the firm is bad. Hence, independent of whether the firm is good or bad, the firm (weakly) prefers disclosure to nondisclosure as disclosure can only improve the investor's beliefs about firm return. In other words, skeptical beliefs imply that for the negative response $u_b = 0$, so that disclosure is optimal if $p(\phi) \geq 0$ (cf. expression (3)).

In a full nondisclosure equilibrium, $D^* = \emptyset$. Given such a disclosure strategy, the investor's rational posterior beliefs regarding nondisclosure equal his prior beliefs, that is, $\beta^* = p$. Hence, a nondisclosing firm can be good or bad. For an out-of-equilibrium disclosure by the firm, the investor's rational posterior beliefs are consistent with the disclosed return ϕ , that is, $\beta^* = 1$ when $\phi = v + \Delta$ and $\beta^* = 0$ when $\phi = v - \Delta$. Observe that the presumption of full nondisclosure excludes any other rational posterior beliefs by the investor.

When firm return is good (i.e., $v = \phi - \Delta$), nondisclosure yields capital of $x^* = \frac{1}{2}(1 - x_f^*)$ as the investor has identical posterior beliefs concerning the returns of the firm and the outside option (cf. $\beta = p$ in Table 1). When firm return is bad (i.e., $v = \phi + \Delta$), it follows by the same argument that $x^* = \frac{1}{2}(1 - x_f^*)$. However, for this case it holds that $x_f^* = 0$ so that $x^* = \frac{1}{2}$. The reason for this is the following. If the firm believes that it is a bad firm, then it believes that the investor's private information equals $v = \phi + \Delta$. Since this implies that $v - \Delta = \phi > 1$, the investor knows that both a good and a bad firm are profitable so that he does not allocate any capital to the risk free asset.

Observe that nondisclosure can also impose some response uncertainty on the firm. Since the firm does not know the investor's private information v , the firm also does not know how much the investor will invest in the risk free asset upon observing nondisclosure by the firm. The capital allocation x_f^* in the risk free asset decreases in the investor's private information v . The better his private information, the less attractive investing in the risk free asset becomes. In particular, if his private information is good enough (i.e., $v - \Delta > 1$), he will not allocate any capital to the risk free asset. This then implies that for sufficiently high returns (i.e., $\phi > 1 + 2\Delta$), the firm *knows* that the investor will not allocate any capital to the risk free asset so that nondisclosure yields a certain investment of $\frac{1}{2}$.

Summarizing, the negative response equals $u_b = U(\frac{1}{2})$ and the positive response equals $u_g = U(1) - U(\frac{1}{2}(1 - x_f^*))$. Applying expression (3) then yields sufficient conditions for nondisclosure to be optimal.

Proposition 1. *A full nondisclosure equilibrium exists if the firms' posterior beliefs of being a good firm are sufficiently low, that is, if*

$$p(\phi) \leq p^{\text{nd}}(\phi) := \frac{U(1/2)}{U(1/2) + U(1) - U(1/2(1 - x_f^*))} \quad (4)$$

for all $\phi > 1$.

Nondisclosure is sustainable in equilibrium because the firm believes that the likelihood of being a good firm is too low, implying that the risk of receiving a negative response to disclosure is too high. Whether or not the condition in Proposition 1 can be met depends on the properties of $p(\phi)$. Fig. 1 shows for various classes of probability distributions the posterior probability $p(\phi)$ as a function of ϕ . Since $p^{\text{nd}}(\phi) \geq U(\frac{1}{2})/(U(1) + U(\frac{1}{2})) \geq \frac{1}{3}$, a full

Gamma distribution with parameters (λ, m) :

$$h(v) = \frac{\lambda^m}{\Gamma(m)} v^{m-1} e^{-\lambda v}, v > 0$$

$$p(\phi) = \begin{cases} 0, & \phi \leq \Delta, \\ \frac{p}{p + \left(\frac{\phi - \Delta}{\phi - \Delta}\right)^{m-1} e^{-2\lambda\Delta}(1-p)}, & \phi > \Delta. \end{cases}$$

Pareto distribution with parameter v_0 :

$$h(v) = \frac{mv_0^m}{v^{m+1}}, v > v_0 > 0$$

$$p(\phi) = \begin{cases} 0, & \phi \leq v_0 + \Delta, \\ \frac{p}{p + \left(\frac{\phi - \Delta}{\phi + \Delta}\right)^{m+1}(1-p)}, & \phi > v_0 + \Delta. \end{cases}$$

Normal distribution with parameters (μ, σ) :

$$h(v) = \frac{1}{\sigma\sqrt{2\pi}} e^{-0.5\left(\frac{v-\mu}{\sigma}\right)^2}, v \in \mathbb{R}$$

$$p(\phi) = \frac{p}{p + e^{-\frac{\Delta(\phi-\mu)}{\sigma^2}}(1-p)}, \phi \in \mathbb{R}.$$

Cauchy distribution with parameters (α, δ) :

$$h(v) = \frac{\delta}{\pi} \frac{1}{\delta^2 + (v - \alpha)^2}, v \in \mathbb{R}$$

$$p(\phi) = \frac{p}{p + \frac{\delta^2 + (\phi - \Delta - \alpha)^2}{\delta^2 + (\phi + \Delta - \alpha)^2}(1-p)}, \phi \in \mathbb{R}.$$

$h(v)$ is the probability distribution function of the investor's private information v . Firm return ϕ equals $v + \Delta$ with probability p and equals $v - \Delta$ with probability $1 - p$. $p(\phi)$ equals the firm's posterior probability of being a good firm (i.e. $p(\phi) = \mathbf{P}(\tilde{v} = \phi - \Delta | \phi)$).

Fig. 1. The posterior probability $p(\phi)$ for various classes of probability distributions.

nondisclosure equilibrium can easily be constructed by appropriately choosing p and the parameters of the distribution of v if v is gamma, Pareto or Cauchy distributed.

The threshold probability $p^{\text{nd}}(\phi)$ increases in the return ϕ .⁷ The intuition for this is that nondisclosure becomes more attractive when firm return is higher. A high-return firm can acquire more capital with nondisclosure than a low-return firm can because the high-return firm imposes less risk on the investor, which in turn makes the risk free asset a less attractive investment opportunity to the investor. Consequently, for a high-return firm disclosure comes with smaller gains u_g and larger losses u_b so that disclosure is optimal only if the firm's posterior beliefs $p(\phi)$ of being a good firm are higher.

⁷Recall that x_t^* in (4) equals the investment in the risk free asset when a good firm does not disclose (i.e., $v = \phi - \Delta$). Since x_t^* is decreasing in v , it is also decreasing in ϕ .

Table 2
The capital x^* that a nondisclosing firm acquires given the partial disclosure strategy formulated in (5)

	v :	$\phi - \Delta$	$\phi + \Delta$
(a)	$\phi - 2\Delta \geq \phi^*$ or $\phi - 2\Delta \leq 1 < \phi^* \leq \phi$	$\frac{1}{2}(1 - x_f^*)$	$\frac{1}{2}$
(b)	$1 < \phi - 2\Delta < \phi^* \leq \phi$	1	$\frac{1}{2}$
(c)	$\phi < \phi + 2\Delta \leq \phi^*$	0	0
(d)	$\phi < \phi^* \leq \phi + 2\Delta$	0	1

v represents the investor’s private information. Firm return ϕ equals $v + \Delta$ with probability p and equals $v - \Delta$ with probability $1 - p$. x_f^* denotes the investment in the risk free asset and ϕ^* is the disclosure threshold.

The observation that, *ceteris paribus*, nondisclosure is more attractive for a profitable, high-return firm than for a profitable, low-return firm drives a partial disclosure equilibrium where the firm does not disclose relatively high returns; that is, there exists some threshold return $\phi^* > 1$ such that

$$D^* = \{\phi | 1 < \phi < \phi^*\}. \tag{5}$$

Table 2 presents the capital that the firm acquires with nondisclosure assuming the partial disclosure strategy formulated in (5). Cases (a)–(d) differ in the investor’s rational posterior beliefs following nondisclosure by the firm. These posterior beliefs depend on what disclosure behavior the investor expects from a good and a bad firm and are determined by whether or not the good return $v + \Delta$ and the bad return $v - \Delta$ belong to the disclosure set D^* . In particular, for cases (c) and (d) where nondisclosure is out-of-equilibrium behavior, the investor is assumed to have skeptical beliefs. From Table 2 one can derive the magnitudes of the negative response u_b and the positive response u_g to determine the disclosure threshold. To support the partial disclosure strategy D^* in equilibrium, nondisclosure should be optimal for cases (a) and (b) where $\phi \geq \phi^*$, while disclosure should be optimal for cases (c) and (d) where $1 < \phi < \phi^*$. Proposition 2 presents the conditions when that is the case.

Proposition 2. *There exists a partial disclosure equilibrium where a profitable firm discloses low returns and withholds high returns, that is, $D^* = \{\phi | 1 < \phi < \phi^*\}$ if for some $\phi^* > 1$ it holds that*

- (2(a)) $p(\phi) \leq p^{nd}(\phi)$ for all ϕ satisfying $\phi^* \leq \phi \leq 1 + 2\Delta$ or $\phi \geq \phi^* + 2\Delta$.
- (2(b)) $p(\phi) \geq \frac{1}{2}$ for $\max(\phi^* - 2\Delta, 1) \leq \phi < \phi^*$.

The proof of Proposition 2, which explains the payoffs in Table 2 in detail, is stated in Appendix A. Condition (2(a)) ensures that nondisclosure is optimal for $\phi \geq \phi^*$ while condition (2(b)) ensures that disclosure is optimal for $1 < \phi < \phi^*$. The existence of a partial disclosure equilibrium imposes some restrictions on the posterior probability $p(\phi)$ of being a good firm. A necessary condition is that $p(\phi)$ does not converge to 1 as the return ϕ becomes infinitely large. In case of convergence, a firm that observes a sufficiently large return will disclose this return because it almost certainly knows that it is a good firm (i.e., $p(\phi)$ is close to 1). Furthermore, one can show that disclosure of high returns initiates an

unraveling process that leads to full disclosure.⁸ Fig. 1 shows that convergence of $p(\phi)$ occurs for normally distributed v . Divergence from 1 occurs for gamma, Pareto and Cauchy distributed v because of the relatively fat tails that these distributions exhibit.

In making its disclosure decision, the firm trades off the gain from a positive response against the loss from a negative response. When the firm does not disclose, the investor may believe that firm return can be less than the risk free rate. Risk diversification then induces the investor to allocate part of his capital to the risk free asset. In particular, the higher his expectations regarding firm return, the less he invests in the risk free asset and the more he invests in the firm (and the outside option). For that reason, a profitable, high-return firm can still acquire a relatively large amount of capital with no disclosure. This results in a high loss from disclosure because disclosing that the firm is bad yields no capital at all from the investor. The gain from disclosure is low because the firm already acquires a large part of the investor's limited amount of capital with nondisclosure. Consequently, a profitable high-return firm has a lot to lose from disclosure and only little to gain so that nondisclosure is optimal. In contrast, a profitable, low-return firm acquires only a small amount of capital with no disclosure. This implies a high gain from disclosure because disclosing that the firm is good acquires all of the investor's available capital. The loss from disclosure is low because nondisclosure hardly acquires any of the investor's capital. Consequently, a profitable low-return firm has a lot to gain from disclosure and only little to lose so that disclosure is optimal.

Observe that the investor does not allocate any capital to the risk free asset if the firm discloses its return. The reason for this is that the firm only considers disclosing profitable returns.⁹ Consequently, any capital that the investor allocates to the risk free asset under nondisclosure is costly to the firm in the sense that the total amount of capital allocated to the risky investment projects (i.e., the firm and the outside option) is less under nondisclosure than under disclosure. Since this cost is larger for a profitable, low-return firm than for a profitable, high-return firm, the primary factor driving disclosure in the partial disclosure equilibrium is to attract the investor's capital away from the risk free asset.

The equilibrium analysis shows that various disclosure strategies can be supported in equilibrium.¹⁰ With the existence of multiple disclosure equilibria comes the problem of equilibrium selection. None of the two parties involved can enforce a particular equilibrium nor are the preferences over the various disclosure equilibria aligned. The investor prefers an equilibrium with more disclosure over an equilibrium with less disclosure as disclosure increases the efficiency of the investor's capital allocation. The firm, on the other hand, prefers an equilibrium with less disclosure over an equilibrium

⁸This also explains why the support V of v is assumed to have no upper bound. If V is bounded from above, firm return ϕ is also bounded from above. This then implies that when the firm observes a return ϕ that is sufficiently close to the upper bound, the firm knows that it is good, that is, $p(\phi) = 1$. Hence, disclosure is optimal and a full disclosure equilibrium will result.

⁹Notice that disclosure of a profitable return does not automatically imply that the investor allocates all his capital to the firm. This depends on whether firm return is good or bad. If disclosure reveals firm return is bad, the investor puts all his capital in the outside option.

¹⁰Besides the two extreme equilibria of full disclosure and full nondisclosure, multiple partial disclosure equilibria can exist. Appendix B presents an example where the number of partial disclosure equilibria is infinite.

with more disclosure.¹¹ Hence, there is no unambiguous answer to the question of which equilibrium will emerge. Equilibrium refinements are not of much help either. The refinements proposed by Kohlberg and Mertens (1986), Grossman and Perry (1986) and Cho and Kreps (1987) do not eliminate any of the disclosure equilibria. However, the refinement of undefeatable equilibria as proposed by Mailath et al. (1993) eliminates the full disclosure equilibrium based on skeptical beliefs.

4.4. Discussion

In the model, a single investor is chosen only for ease of exposition. One can extend the model to incorporate multiple investors without substantially affecting the results. For example, one can model the investors' individual prior expectations by $v_i = v + \tilde{\varepsilon}_i$, where v_i is private information of investor i and the parameter v is unknown to all parties (i.e., the firm and all investors). Since the average response to disclosure is determined by v , firms are still uncertain of the response to disclosure so that the same mechanics and intuition apply in the equilibrium analysis.

Further, the binary structure of $\tilde{A}$ is not a crucial assumption in obtaining partial disclosure. What is important is that the investor allocates less capital to the risk free asset the higher his prior information v about firm return. This still holds true if $\tilde{A}$ is assumed to be continuously distributed. To see this, note that the investor knows that the firm does not disclose either because its return is not profitable (i.e., $\phi \leq 1$) or because it exceeds the disclosure threshold (i.e., $\phi \geq \phi^*$). On observing nondisclosure by the firm, the amount of capital allocated to the risk free asset depends on the likelihood that a nondisclosing firm is unprofitable. Since higher v reduces the likelihood that a nondisclosing firm is unprofitable, the investor allocates less capital to the risk free asset.

A similar comment applies to the return of the firm. The model assumes that each firm perfectly knows its own return. This assumption is not the main driving force for the results. All that is needed is that the firm possesses some private information about its own return. For example, one could model the return of the firm as $\phi + \tilde{\varepsilon}$, where $\tilde{\varepsilon}$ represents (firm-specific) risk and the firm only knows ϕ . One should not forget though that response uncertainty is necessary to sustain nondisclosure in equilibrium and that response uncertainty depends on the firm's private information. If the firm's private information is not very informative about firm return, the investor will only marginally respond to disclosure of that information. Consequently, the firm will face little uncertainty with respect to investor response and this uncertainty may not be sufficient to sustain nondisclosure in equilibrium.

The outside option is necessary to generate response uncertainty as the amount of capital that is invested in the firm depends on how the return of the firm compares to the return of the outside option. Even when the return of the firm is high, if it is low relative to the return of the outside option, the investor allocates no capital to the firm. In the current

¹¹This follows from the definition of an equilibrium. If nondisclosure of a particular return ϕ is sustainable in equilibrium, the firm prefers nondisclosure of ϕ to disclosure of ϕ . To illustrate, suppose two partial disclosure equilibria exist with disclosure sets $D_1^* = \{\phi | 1 < \phi < \phi_1^*\}$, $D_2^* = \{\phi | 1 < \phi < \phi_2^*\}$ and $\phi_1^* < \phi_2^*$. Then, the two equilibria yield identical payoffs to the firm for return levels $1 < \phi < \phi_1^*$ and $\phi \geq \phi_2^*$. For return levels $\phi_1^* \leq \phi < \phi_2^*$, the firm prefers nondisclosure to disclosure in equilibrium D_1^* . Since disclosure of ϕ in D_1^* yields the same payoff as disclosure of ϕ in D_2^* , namely the investment 1 with probability $p(\phi)$ and the investment 0 with probability $1 - p(\phi)$, the firm prefers the nondisclosure payoff in equilibrium D_1^* over the disclosure payoff in equilibrium D_2^* .

model, however, no additional information becomes available about the return of the outside option. From the investor's perspective, additional information on the outside option could make firm disclosure irrelevant for his investment decision; for all he needs to know is which of the two risky projects yields the highest return (i.e., is a good project). One extension of the model is to think of the outside option as a second firm that can choose to disclose its return just like the single firm in the original model. In the static model where both firms simultaneously make their disclosure decision, all results remain to hold true. In particular, there may exist a partial disclosure equilibrium in which both firms only disclose relatively low-profitable returns.

Response uncertainty vanishes when the firm would learn the investor's private information v . In that case, the firm would know whether its return is good or bad. In the current model, I assume the investor is not able to credibly disclose this information to the firm (or any other party). However, if the firm's shares are traded in a perfectly competitive capital market, this value is revealed by the pre-disclosure market value of the firm. To illustrate, consider the setting with multiple investors as described above. For risk-neutral investors, the pre-disclosure market value of the firm equals $E(\tilde{x}\tilde{\phi})$. Assuming that the pre-disclosure market value perfectly reveals v which in turn induces full disclosure, it holds that $E(\tilde{x}\tilde{\phi}) = p(v + \Delta)$. To see this, observe that under full disclosure the firm discloses with probability p that it is a good firm, in which case firm return equals $\phi = v + \Delta$ and the investor invests $x = 1$; with probability $1 - p$ the firm discloses that it is a bad firm, in which case firm return equals $\phi = v - \Delta$ and the investor invests $x = 0$. Hence, the expected investment equals $E(\tilde{x}\tilde{\phi}) = p(v + \Delta)$. Since p and Δ are common knowledge, the initial conjecture is fulfilled as the firm can indeed infer v from the pre-disclosure market value. To restore the original disclosure results, one can add additional uncertainty with respect to the investors' degree of risk aversion. For instance, suppose the aggregate risk aversion of the population of investors can be either high or low. Then observing the pre-disclosure market value of the firm no longer reveals the parameter v . The observed market value is consistent with either a relatively high value of v when risk aversion is high or a relatively low value of v when risk aversion is low. The difference in the values of v offsets the difference in the risk premiums required in the high and low risk aversion cases. Since now the firm has again imperfect information about v , response uncertainty arises and the equilibrium results apply.

The assumption of response uncertainty is necessary to prevent (extremely) high returns from being disclosed, an act that would initiate the unraveling process that leads to full disclosure. In contrast, an exogenous (non)proprietary disclosure cost (see, e.g., Verrecchia, 1983; Dye, 1986; Wagenhofer, 1990) leads to nondisclosure in equilibrium by ending the unraveling process prematurely. A firm does not disclose sufficiently low returns because this information is not favorable enough to overcome the cost of disclosure. An exogenous (non)proprietary cost of disclosure has the drawback that ex ante (i.e., before the firm learns its private information) a firm would rather not receive any private information about its future prospects (see Verrecchia, 1990). The reason for this is that the exogenous disclosure cost is a deadweight loss that the firm would prefer not to incur. However, a firm knows that once having received its private information, it will disclose favorable private information and incur the disclosure cost. So, to avoid the disclosure cost, a firm is better-off not receiving any private information at all. This argument does not apply to the cost of disclosure in this paper (i.e., response uncertainty). Since the act of disclosure is costless and a firm discloses only if it is in the best interest of

the firm to do so, ex ante the firm prefers to have private information. Hence, disclosure is efficient in the sense of [Verrecchia \(2001\)](#).

Finally, observe that mandatory disclosure regulations improve the allocative efficiency of the investor's capital by enabling the investor to distinguish good investment opportunities from bad ones. The literature offers few justifications for mandatory disclosure regulations. Full disclosure is generally forthcoming voluntarily, and in situations where it is not, mandating disclosure is not desirable. [Foster \(1980\)](#), [Dye \(1990\)](#) and [Admati and Pfleiderer \(2000\)](#), however, show that if there are externalities of disclosure, then firms voluntarily disclose too little information, making mandatory disclosure socially desirable. [Pae \(2002\)](#) introduces an intrinsic value of information in a voluntary disclosure model to address efficiency issues. Nondisclosure and the subsequent inefficient allocation of resources arises because of opportunistic behavior by informed entrepreneurs. In this paper, the firm does not disclose its private information voluntarily because the risk of an unfavorable response is just too high.

5. Empirical implications

Empirical studies of voluntary disclosure behavior by firms that are acquiring external financing find results consistent with the partial disclosure equilibrium in this paper. [Ruland et al. \(1990\)](#) and [Frankel et al. \(1995\)](#) document that firms acquiring external financing are more likely to provide management earnings forecasts. Although the latter study considers legal liability to be the main driving force for these voluntary disclosures, [Mak \(1996\)](#) finds similar results in a low-litigation environment: for a sample of New Zealand IPO firms, [Mak \(1996\)](#) documents that a majority of the IPO firms include earnings forecasts in the IPO prospectuses and, furthermore, that firms with relatively low expected short-term earnings provide more earnings forecasts. [Jog and McConomy \(2003\)](#) find for Canadian IPO firms that the subsample of forecasting firms exhibits slightly lower mean and median values for revenues, net income and gross proceeds of the equity offering than the subsample of nonforecasting firms. For a sample of U.S.-listed firms, [Lang and Lundholm \(2000\)](#) find that prior to a seasoned equity offering, firms increase their disclosure activity although they do not increase the frequency of disclosure of management earnings forecasts.¹² Lang and Lundholm further find that firms that dramatically increase their disclosure activity prior to an SEO announcement suffer from large price declines at and after the offering announcement. In contrast, firms whose disclosure activity remains at a constant level prior to an SEO announcement do not suffer from such large price declines. The authors' explanation is that the former firms engage in more voluntary disclosure so as to 'hype' the firms' stock and obtain a lower cost of equity capital. In other words, these firms disclose in the hope of acquiring more of the investors' capital.

The empirical implications of the model are not confined to IPO or SEO settings. Although the model explicitly considers an equity offering, the forces driving (non)disclosure apply to more general settings. Disclosure arises from the need to attract

¹²An increase in the frequency of management earnings forecasts is expressly discouraged by Section 5(c) of the 1933 Securities Act. The aim of this regulation is to make the prospectus the major communication channel to investors. Any disclosure that might contribute to conditioning the market is in violation of Section 5(c).

investors' attention and to increase their demand for the firm's shares at the expense of alternative investment opportunities. The model thus predicts that firms will provide more disclosure when alternative investment opportunities are more attractive to investors. Since nondisclosure by such firms would induce investors to take their capital elsewhere, such firms have more to gain from disclosure. One way to test this prediction is to compare the disclosure behavior of firms within industries and across industries. Within industries, one expects better-performing firms to provide less disclosure because they face less competition from the alternative investment opportunity in attracting the investors' capital than worse-performing firms from the same industry. Similarly, one expects the frequency of disclosure across industries to be lower for the better-performing industries because alternative investment opportunities (i.e., other industries) are less attractive.

Another setting where the same disclosure incentives could apply is that of mergers and acquisitions. A merger or acquisition has substantial consequences for investors' beliefs regarding the firm's future performance. For example, when Hewlett-Packard announced its plans to acquire Compaq Computer, investors responded rather skeptically. The unsuccessful record of past technology mergers could have partly caused this response. Firms engaging in M&A activity may thus have an incentive to voluntarily disclose information that will convince investors of the benefits of the planned merger or acquisition. In line with the findings for IPOs and SEOs, one would then expect the firms that provide less disclosure during their M&A activity, to be the better mergers or acquisitions. Hence, these firms are expected to perform better once the merger or acquisition has been completed than the firms that voluntarily disclosed a lot of information during their M&A activity.

In a broader interpretation of the paper's results, we would expect firms whose future performance is surrounded by a higher degree of uncertainty to provide more disclosure. A lack of information will induce investors to go for other, safer investment opportunities. Firms that fit into this picture are, for example, relatively young firms, high-tech firms or firms entering new product markets. In this respect, [Price \(2000\)](#) shows that in franchise offerings, franchisors that impose greater investment risk on new franchisees provide more disclosure of earnings information.

On a final note, uncertainty concerning the response of investors to disclosed information can also explain the widespread objections by firms to additional disclosure requirements proposed by regulating authorities like the SEC. The sheer possibility of an unfavorable investor response to disclosure of additional information could induce firms to prefer nondisclosure of this information.

6. Conclusions

This paper shows that a firm may prefer not to disclose its private information if it is uncertain about investor response to disclosure. Nondisclosure arises if the risk of an unfavorable response by investors is too high. In this setting, the unraveling argument that yields full disclosure need not apply because the disclosure by the better firm types that is required to initiate the unraveling process may not occur. In equilibrium disclosure takes place because firms want to attract investor capital away from the risk free asset.

Appendix A

Proof of Proposition 2. For each of the cases (a)–(d), I specify the investor's posterior beliefs regarding a nondisclosing firm. Together with Table 1 this explains the payoffs presented in Table 2. I subsequently use these payoffs to derive the negative and positive responses u_b and u_g as defined in Section 4.2. The equilibrium conditions on $p(\phi)$ then follow immediately from expression (3) and the observation that nondisclosure must be optimal for cases (a) and (b) and disclosure must be optimal for cases (c) and (d).

- (a) Let $\phi - 2\Delta \geq \phi^*$ or $\phi - 2\Delta \leq 1 < \phi^* \leq \phi$. When $v = \phi - \Delta$, the posterior beliefs of the investor following nondisclosure equal $\beta^* = p$ as he expects nondisclosure by both a good firm (i.e., $v + \Delta = \phi \notin D^*$) and a bad firm (i.e., $v - \Delta = \phi - 2\Delta \notin D^*$). The resulting investment in the firm then equals $x^* = \frac{1}{2}(1 - x_f^*)$. Notice that $x_f^* = 0$ when $\phi - 2\Delta \geq \phi^*$. When $v = \phi + \Delta$, the posterior beliefs equal $\beta^* = p$ for the same reason as above. Since $v - \Delta = \phi > 1$, it follows that $x_f^* = 0$ so that the investment in the firm equals $x^* = \frac{1}{2}$.

Summarizing case (a), the negative response equals $u_b = U(\frac{1}{2})$ while the positive response equals $u_g = U(1) - U(\frac{1}{2}(1 - x_f^*))$.

- (b) Let $1 < \phi - 2\Delta < \phi^* \leq \phi$. When $v = \phi - \Delta$, the posterior beliefs following nondisclosure equal $\beta^* = 1$ as the investor expects only a bad firm to disclose (i.e., $v - \Delta = \phi - 2\Delta \in D^*$ and $v + \Delta = \phi \notin D^*$). Hence, the investment in the firm equals $x^* = 1$. When $v = \phi + \Delta$, the posterior beliefs equal $\beta^* = p$ as both a good and a bad firm are expected not to disclose (i.e., $v - \Delta = \phi \notin D^*$ and $v + \Delta = \phi + 2\Delta \notin D^*$). Since $v - \Delta = \phi > 1$ yields $x_f^* = 0$, the resulting investment in the firm equals $x^* = \frac{1}{2}$.

Summarizing case (b), the negative response equals $u_b = U(\frac{1}{2})$ while the positive response equals $u_g = 0$.

- (c) Let $\phi < \phi + 2\Delta < \phi^*$. When $v = \phi - \Delta$, the posterior beliefs following nondisclosure equal $\beta^* = 0$. For the case that $\phi - 2\Delta \leq 1$, this follows from applying Bayes' rule as only a bad firm is expected to withhold its private information (i.e., $v - \Delta = \phi - 2\Delta \notin D^*$ and $v + \Delta = \phi \in D^*$). For the case that $\phi - 2\Delta > 1$, nondisclosure is out-of-equilibrium behavior (i.e., $v - \Delta = \phi - 2\Delta \in D^*$ and $v + \Delta = \phi \in D^*$) so that $\beta^* = 0$ follows from skeptical beliefs of the investor. Hence, the resulting investment equals $x^* = 0$. When $v = \phi + \Delta$, the posterior beliefs equal $\beta^* = 0$. Since nondisclosure is out-of-equilibrium behavior (i.e., $v - \Delta = \phi \in D^*$ and $v + \Delta = \phi + 2\Delta \in D^*$), skeptical beliefs imply $\beta^* = 0$ so that no investment in the firm is made, that is, $x^* = 0$.

Summarizing case (c), the negative response equals $u_b = 0$ and the positive response equals $u_g = U(1)$.

- (d) Let $\phi < \phi^* \leq \phi + 2\Delta$. When $v = \phi - \Delta$, the posterior beliefs following nondisclosure equal $\beta^* = 0$ for the same reason as described in (c). Hence, $x^* = 0$. When $v = \phi + \Delta$, the posterior beliefs equal $\beta^* = 1$ as only a bad firm is expected to disclose (i.e., $v - \Delta = \phi \in D^*$ and $v + \Delta = \phi + 2\Delta \notin D^*$). This results in an investment $x^* = 1$.

Summarizing case (d), the negative and positive responses are identical and are equal to $u_b = u_g = U(1)$. $\square$

Fig. 2. Partial disclosure equilibrium.

Appendix B

Consider a risk-neutral investor and a risk-averse firm with utility function $U(y) = \sqrt[3]{y}$, $y \geq 0$. Take $\Delta = 0.5$ and $p = 0.4$. Let v be exponentially distributed with expectation 1.2 so that $p(\phi) = 0.6888$ for $\phi \geq \Delta = 0.5$ and $p(\phi) = 0$ for all $0 < \phi < 0.5$. Since the investor is risk neutral, he invests in a nondisclosing firm if and only if $E(v + \tilde{A}) > 1$, that is, if and only if $v > 1.1$. This implies that given nondisclosure by the firm, the capital allocated to the risk free asset equals $x_f^* = 1$ if $v \leq 1.1$ and $x_f^* = 0$ if $v > 1.1$. Hence, the firm knows for sure that the capital allocated to the risk free asset x_f^* equals 0 if and only if $\phi > 1.1 + \Delta = 1.6$. It follows that

$$p^{\text{nd}}(\phi) = \begin{cases} 0.4142 & \text{if } \phi \leq 1.6, \\ 0.7071 & \text{if } \phi > 1.6. \end{cases}$$

Fig. 2 depicts $p(\phi)$ and $p^{\text{nd}}(\phi)$. Notice that in this particular situation, any $\phi^* \geq 1.6$ can be supported by a partial disclosure equilibrium. Condition (2(a)), which ensures nondisclosure to be optimal for $\phi \geq \phi^*$, requires that $p(\phi) \leq p^{\text{nd}}(\phi)$ for all ϕ satisfying $\phi^* \leq \phi \leq 1 + 2\Delta = 2$ or $\phi \geq \phi^* + 2\Delta \geq 2.6$. Since $p(\phi) < p^{\text{nd}}(\phi)$ for all $\phi > 1.6$, this condition is satisfied for all $\phi^* > 1.6$. Condition (2(b)), which ensures that disclosure is optimal for $1 < \phi < \phi^*$, requires that $p(\phi) \geq \frac{1}{2}$ holds true for $\max(\phi^* - 2\Delta, 1) \leq \phi < \phi^*$. This follows from the facts that $\max(\phi^* - 2\Delta, 1) \geq 1$ and $p(\phi) > \frac{1}{2}$ for all $\phi \geq 1$.

References

- Admati, A., Pfleiderer, P., 2000. Forcing firms to talk: financial disclosure regulation and externalities. *Review of Financial Studies* 13, 479–519.
- Cho, I., Kreps, D., 1987. Signalling games and stable equilibria. *Quarterly Journal of Economics* 102, 179–221.
- Darrrough, M., Stoughton, N., 1990. Financial disclosure policy in an entry game. *Journal of Accounting and Economics* 12, 219–243.
- Dutta, S., Trueman, B., 2002. The interpretation of information and corporate disclosure strategies. *Review of Accounting Studies* 7, 75–96.
- Dye, R., 1985. Disclosure of nonproprietary information. *Journal of Accounting Research* 23, 123–145.
- Dye, R., 1986. Proprietary and nonproprietary disclosures. *Journal of Business* 59, 331–366.
- Dye, R., 1990. Mandatory versus voluntary disclosures: the cases of financial and real externalities. *The Accounting Review* 65, 1–24.
- Dye, R., 1998. Investor sophistication and voluntary disclosures. *Review of Accounting Studies* 3, 261–287.

- Dye, R., 2001. An evaluation of “Essays on Disclosure” and the disclosure literature in accounting. *Journal of Accounting and Economics* 32, 181–325.
- Feltham, G., Xie, J., 1992. Voluntary financial disclosure in an entry game with continua of types. *Contemporary Accounting Research* 9, 46–80.
- Fishman, M., Hagerty, K., 2003. Mandatory vs. voluntary disclosure in markets with informed and uninformed customers. *Journal of Law, Economics, and Organization* 19, 45–63.
- Foster, G., 1980. Externalities and financial reporting. *Journal of Finance* 35, 521–533.
- Frankel, R., McNichols, M., Wilson, P., 1995. Discretionary disclosure and external financing. *The Accounting Review* 70, 135–150.
- Gigler, F., 1994. Self-enforcing voluntary disclosures. *Journal of Accounting Research* 32, 224–240.
- Grossman, S., 1981. The informational role of warranties and private disclosure about product quality. *Journal of Law and Economics* 24, 461–483.
- Grossman, S., Perry, M., 1986. Perfect sequential equilibrium. *Journal of Economic Theory* 39, 97–119.
- Hughes, J., Pae, S., 2004. Voluntary disclosure of precision information. *Journal of Accounting and Economics* 37, 261–289.
- Hughes, P., 1986. Signalling by direct disclosure under asymmetric information. *Journal of Accounting and Economics* 8, 119–142.
- Jog, V., McConomy, B., 2003. Voluntary disclosure of management earnings forecasts in IPO prospectuses. *Journal of Business Finance and Accounting* 30, 125–167.
- Jorgensen, B., Kirschenheiter, M., 2003. Discretionary risk disclosures. *The Accounting Review* 78, 449–469.
- Jung, W., Kwon, Y., 1988. Disclosure when the market is unsure of information endowment. *Journal of Accounting Research* 26, 146–153.
- Kohlberg, E., Mertens, J., 1986. On the strategic stability of equilibria. *Econometrica* 54, 1003–1037.
- Korn, E., Schiller, U., 2003. Voluntary disclosure of nonproprietary information. *Journal of Business Finance and Accounting* 30, 1327–1339.
- Lang, M., Lundholm, R., 2000. Voluntary disclosure and equity offerings: reducing information asymmetry or hyping the stock. *Contemporary Accounting Research* 17, 623–662.
- Mailath, G., Okuno-Fujiwara, M., Postlewaite, A., 1993. Belief-based refinements in signalling games. *Journal of Economic Theory* 60, 241–276.
- Mak, Y., 1996. Forecast disclosure by initial public offering firms in a low litigation environment. *Journal of Accounting and Public Policy* 15, 111–136.
- Milgrom, P., 1981. Good news and bad news: representation theorems and applications. *Bell Journal of Economics* 12, 380–391.
- Newman, P., Sansing, R., 1993. Disclosure policies with multiple users. *Journal of Accounting Research* 31, 92–112.
- Pae, S., 2002. Discretionary disclosure, efficiency, and signal informativeness. *Journal of Accounting and Economics* 33, 279–311.
- Price, R., 2000. Voluntary earnings disclosures in uniform franchise offering circulars. *Journal of Accounting and Economics* 28, 391–423.
- Ruland, W., Tung, S., George, N., 1990. Factors associated with the disclosure of managers’ forecasts. *The Accounting Review* 65, 710–721.
- Verrecchia, R., 1983. Discretionary disclosure. *Journal of Accounting and Economics* 5, 179–194.
- Verrecchia, R., 1990. Information quality and discretionary disclosure. *Journal of Accounting and Economics* 12, 365–380.
- Verrecchia, R., 2001. Essays on disclosure. *Journal of Accounting and Economics* 32, 97–180.
- Wagenhofer, A., 1990. Voluntary disclosure with a strategic opponent. *Journal of Accounting and Economics* 12, 341–363.