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Source: *The Journal of Finance*, Vol. 48, No. 2 (Jun., 1993), pp. 747-760
Published by: Blackwell Publishing for the American Finance Association
Stable URL: http://www.jstor.org/stable/2328922
Accessed: 25/11/2009 11:31

THE JOURNAL OF FINANCE • VOL. XLVIII, NO. 2 • JUNE 1993

Disagreements among Shareholders over a Firm's Disclosure Policy

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ABSTRACT

This paper examines the issue of voluntary disclosure of information by firms with heterogeneous shareholders. It shows that in a rational expectations setting, better informed shareholders prefer less disclosure than less well-informed shareholders. This is due to differences in the adverse risk-sharing effect and the beneficial cost-saving effect of disclosure among shareholders with different risk tolerances and information acquisition cost functions. The presence of individual liquidity shocks is shown to reduce shareholder disagreements regarding a firm's disclosure policy.

MANY FIRMS VOLUNTARILY DISCLOSE information beyond levels mandated by financial and accounting regulations. Still other firms seem to disclose as little information as they can. The paper seeks to explain this difference. Prior studies dealing with disclosure typically are concerned with whether firms would disclose too little or too much information in the absence of mandatory rules.[1] Results differ across models depending on whether positive or negative externalities are considered. For example, in a model where disclosure only adversely affects shareholders' risk-sharing opportunities, the optimal level of disclosure is zero and mandatory disclosure rules make all shareholders worse off.[2] In contrast, mandatory disclosure rules are viewed in this paper as a result of conflicts among firms' shareholders with different risk attitudes and different access to inside information. In general there is no optimal disclosure policy that is best for all shareholders.[3]

This paper is based on the model of Diamond (1985). Diamond considers two opposing effects (a positive externality and a negative externality) of disclosure to explain the existence of voluntary disclosure when acquiring private information is costly. First, disclosure adversely affects risk sharing.

* Anderson Graduate School of Management, University of California, Los Angeles. I gratefully acknowledge the comments of Kirsten Ely, Michael Firth, Bruce Miller, Joshua Ronen, and Robert E. Verrecchia. I also thank the editor, Stephen A. Buser, and two anonymous referees for many valuable suggestions.

[1] See, for example, Easterbrook and Fischel (1984) and Fishman and Hagerty (1989).

[2] A classic example of the adverse risk-sharing effect of disclosure is finding out who in society has cancer before individuals can contract for life insurance. See Hirshleifer (1971) and Verrecchia (1982b) among others for detailed discussions.

[3] There is no optimal disclosure policy because shareholders are heterogeneous and because both a positive and a negative externalities are present in the model as explained below.

Second, disclosure reduces costly private acquisition of information.[4] The homogeneous shareholders in his model unanimously choose a policy that provides an optimal tradeoff between the two effects.

In this paper shareholders are assumed to have different tolerances for risk and arbitrary (thus individually different) but well-behaved information acquisition cost functions. These differences lead to different risk-sharing and cost-saving effects among individuals.[5] Those with greater tolerances for risk and/or lower information acquisition cost functions acquire more private information. The differences in private information acquisition activities, in turn, give rise to differential preferences regarding disclosure policy. The importance of the assumption of well-behaved cost functions is that, ceteris paribus, shareholders' desired levels of disclosure can be ranked solely by the quality of their acquired information. That is, the better informed desire less disclosure than the less well informed. It reflects the fact that increased disclosure makes investors more evenly informed and weakens the informational advantage (or disadvantage) of the better (or the less well) informed. It thus supports a familiar notion that, in general, investors who may not have a good access to the inside information of a firm and whose preferences may not be well reflected in the firm's disclosure decision, may try to exert pressure on the regulatory bodies to impose mandatory accounting rules in order to increase the level of disclosure.[6]

It is shown that the arbitrariness of individual endowments (which reflects the presence of individual liquidity shocks) makes shareholder's preferences closer to a common level of disclosure, namely, the level preferred by the shareholder with the average amount of information. This is because individual shareholders with arbitrary endowments must rebalance their portfolios in a market where the price reflects the information of the average shareholder. Accordingly, when the adopted disclosure policy reflects more closely the preferences of the better (or less well) informed, those with riskier endowments prefer more (or less) disclosure than those with less risky endowments. At an extreme in which shareholders' risk attitudes and cost functions are identical, shareholders' disagreements over disclosure policy completely disappear despite the differences in risky endowments, and an optimal policy for the firm (and for all shareholders) can be defined. A comparative static analysis of the optimal disclosure policy reveals the following. When the optimal policy is to voluntarily disclose some positive amount of information, an increase in the amount of prior information is exactly offset by a reduction in disclosure by the same amount. As a result, investors

[4] Also, see Allen (1984), Bushman (1991), and Alles and Lundholm (1990) for variations of Diamond (1985).

[5] No separation theorem holds in this model, i.e., differences among shareholders extend well beyond the differences in the demand for the risky asset. This is because they differ among themselves in their cost functions as well as their risk attitudes.

[6] Related to this result, Lev (1988) considers disclosure regulation as equity oriented. Also see Hakansson (1977), Gonedes (1980), and Ohlson and Buckman (1981) among others for theoretical studies that hint at some of the ideas in this paper.

have the same level of information. When the optimal policy is not to disclose any information, more prior information leads to less information acquisition but more overall information.

The paper is organized as follows. Section I explains the model and obtains market equilibrium given exogenous information decisions in the economy. Section II investigates the preferred levels of disclosure by heterogeneous shareholders. It also deals with a special case of homogeneous shareholders and examines the properties of the unanimously chosen disclosure policy. Section III offers some concluding remarks. All the proofs are provided in an Appendix.

I. The Model and Market Equilibrium

The securities market model of this study is a standard noisy rational expectations model of pure exchange, a countably infinite number of investors, and three time periods, referred to as periods 0, 1, and 2. There is one risky asset and one riskless bond. The riskless bond pays off one unit of consumption good in period 2. The return of the risky asset is a random variable, denoted by $\tilde{u}$, and is realized in period 2. It is assumed that $\tilde{u}$ is normally distributed with mean $\bar{u}$ and precision (inverse of variance) h. Investors are risk averse and their preferences can be represented by negative exponential utility functions with risk tolerances r_i's where $0 < \underline{r} \leq r_i \leq \bar{r} < \infty$ for all i, i.e., $U_i(W_i) = -\exp(-W_i/r_i)$, where W_i is investor i's final wealth.

In period 0 investor i is endowed with E_i riskless bonds and x_i risky asset. The aggregate (per capita) supply of the risky asset, denoted by $\tilde{x}$, is not known to individual investors, and is normally distributed with mean $\bar{x}$ and precision t. The assumption of arbitrary individual risky endowments captures the idea that they are subject to random liquidity shocks. Three events occur in period 1. First, the firm represented by the risky asset publicly releases a signal $\tilde{y} = \tilde{u} + \tilde{\eta}$, where $\tilde{\eta}$ is normally distributed with mean 0 and precision m. It is assumed that such a release is costless.[7] Second, investor i acquires a private signal $\tilde{z}_i = \tilde{u} + \tilde{\epsilon}_i$, where $\tilde{\epsilon}_i$ is independently and normally distributed with mean 0 and precision s_i, where $0 < \underline{s} \leq s_i \leq \bar{s} < \infty$ for all i. In this model the precisions m and s_i's can be interpreted as either the quality or the amount of information conveyed by the respective information signals. It is assumed that investor i's cost of acquiring $\tilde{z}_i$ with precision s_i is a function of only s_i, i.e., $C_i(\tilde{z}_i) = C_i(s_i)$, and

ASSUMPTION 1: *$C_i(\cdot)$ is strictly increasing, strictly convex, and thrice continuously differentiable,*

ASSUMPTION 2: *$C_i'(s_i)$ approaches zero as s_i approaches zero.*

[7] Diamond (1985) shows that as long as the cost of the public release is negligible compared to the sum of the costs of investors individually acquiring private information of the same quality, the results are unaffected.

Assumption 1 is made for convenience to rule out corner solutions to individual information acquisition problems. The final event in period 1 is that the market opens and investors buy and sell securities at the competitive market prices. In period 2 the return of the risky asset is realized and investors consume their final wealth from their portfolios.

Each investor in this model makes three decisions. He takes part as a shareholder in the choice of the precision of the signal publicly released by the firm, chooses the precision of his private signal, and selects the amount of the risky asset to buy or sell. In a rational expectations equilibrium each choice is made correctly taking into account all other decisions made in the economy. For convenience, the strategy of this paper is to start with demand decisions given fixed precisions of the signals and to express investors' utility as functions of the precisions. This allows for a clean analysis of the information decisions separate from demand decisions.

The derivation of the market equilibrium is fairly standard and the results are summarized in the following lemma without proof.[8]

LEMMA 1: *Given s_i's and m there is a unique rational expectations equilibrium characterized by*

$$\tilde{P} = \frac{1}{K}\left[h\bar{u} + m\tilde{y} + (s + r^2s^2t)\tilde{u} - rst(\tilde{x} - \bar{x}) - \frac{\tilde{x}}{r}\right]$$

and

$$\tilde{D}_i = r_i\left[h\bar{u} + m\tilde{y} + s_i\tilde{z}_i + r^2s^2t\tilde{u} - rst(\tilde{x} - \bar{x}) - K_i\tilde{P}\right],$$

where $\tilde{P}$ and $\tilde{D}_i$ are, respectively, the market price of and investor i's gross demand for the risky asset; $K_i \equiv \mathrm{Var}^{-1}(\tilde{u}|\tilde{y}, \tilde{z}_i, \tilde{P}) = h + m + s_i + r^2s^2t$ is the precision of investor i's information in period 1; $r \equiv Avr(r_i)$, $s \equiv Avr(r_is_i/r)$, and $K \equiv Avr(r_iK_i/r) = h + m + s + r^2s^2t$, where the operator Avr is defined such that $Avr(\cdot) \equiv \lim_{N\to\infty}\sum_{i=1}^{N}(\cdot)$ (The limits, r, s, and K, exist if the r_i's and the s_i's are uniformly bounded).

Investors choose the precisions of their private information and the information released by the firm before making demand decisions. Thus, the analysis of the choice of s_i's and m is conducted using the expected utility of investors over $\tilde{u}$, $\tilde{y}$, $\tilde{z}_i$'s and $\tilde{P}$ given m and s_i's. The following lemma gives an expression for the expected utility. The proof is a straightforward integration, and is thus omitted.[9]

[8] See, for example, Diamond and Verrecchia (1981).

[9] See Verrecchia (1982a) and Admati and Pfleiderer (1987) among others for calculations of expected utility in similar models.

LEMMA 2: *The expected utility of investor i given m, s_i and s_j's, $j \neq i$, can be written as*

$$EU_i = \frac{-1}{\sqrt{K_i L}} \exp\left[-\frac{E_i - C_i}{r_i} - \left\{ \frac{x_i \bar{u}}{r_i} - \frac{1}{2h}\left(\frac{x_i}{r_i}\right)^2 \right\} - \frac{1}{2K^2 L}\left(\frac{x_i}{r_i} - \frac{\bar{x}}{r}\right)^2 \right],$$

where $L = \text{Var}(\tilde{u} - \tilde{P}) = K^{-2}(K + s + r^{-2}t^{-1})$.

The expected utility if he does not trade equals $-\exp[-(E_i - C_i)/r_i - \{x_i \bar{u}/r_i - (1/2h)(x_i/r_i)^2\}]$. The gains from trade are represented by two terms. First, he expects to gain by moving from his position of a random endowment to one in which his holding of the risky asset is aligned with his risk tolerance. (If investors were allowed to trade before the arrival of public and private information, this would be the equilibrium, which is Pareto efficient.) This is captured by the term $(1/2K^2L)(x_i/r_i - \tilde{x}/r)^2$. Second, the term that contains $K_i L$ captures the gains due to informed trading. Note that $K_i L = L/K_i^{-1}$ and that $L = \text{Var}[\tilde{u} - \tilde{P}]$ and $K_i^{-1} \equiv \text{Var}[\tilde{u} | \tilde{y}, \tilde{z}_i, \tilde{P}] = \text{Var}[\tilde{u} - \tilde{P} | \tilde{y}, \tilde{z}_i, \tilde{P}]$, where $\tilde{u} - \tilde{P}$ represents the market opportunity. Therefore, $K_i L$ measures how investor i's market opportunities increase due to the arrival of information ($\tilde{y}$, $\tilde{z}_i$'s, and the informative price $\tilde{P}$).

II. Individual Preferences Regarding Disclosure Policy

Investor i's private information acquisition problem given m is to maximize his expected utility as given in Lemma 2 with respect to s_i. Taking a monotonic transformation $V_i \equiv -2\ln(-EU_i)$ and dropping terms which do not contain s_i, s, or m, it can be written as

$$\max_{s_i} V_i = \ln K_i L - \frac{2C_i(s_i)}{r_i} + \frac{1}{K^2 L}\left(\frac{x_i}{r_i} - \frac{\bar{x}}{r}\right)^2.$$

The first-order condition can be written as

$$K_i - \frac{r_i}{2C_i'(s_i)} = 0. \tag{1}$$

Under Assumptions 1 and 2 there always exists a unique solution to (1).[10]

The following lemma shows how an exogenous change in the level of disclosure affects private information acquisition and investors' informedness.

LEMMA 3: *An exogenous increase in the amount of disclosure results in a decrease in individual (and average) private acquisition of information and an increase in individual (and average) informedness, i.e.,* $ds_i/dm < 0$, $ds/dm < 0$, $dK_i/dm > 0$, *and* $dK/dm > 0$.[11]

[10] A similar result was first proven by Verrecchia (1982a).
[11] A similar result was first proven by Verrecchia (1982b).

Lemma 3 says that disclosed information and privately acquired information are always substitutes in this model. The reduction in private acquisition induced by an increase in disclosure, however, has a smaller effect than the increase in disclosure itself on investors' informedness. So they become better informed as more information is disclosed.

It is interesting to note that Lemma 3 is in contrast to Diamond (1985). In his model, each investor can either acquire private information of a fixed precision with a fixed cost or acquire no private information with zero cost. It can be shown that, in his model, investors become on average less well informed as the amount of public disclosure increases, because the induced reduction in the average private acquisition more than offsets the direct increase in information due to disclosure. It seems that this difference is caused by Diamond's restrictive assumption on the cost function. However, his basic intuition about the beneficial cost-saving effect of disclosure turns out to be intact in the present model.

The following lemma explicitly shows the differences in investors' preferences regarding disclosure policy in terms of marginal utility.

LEMMA 4: *Investor i's marginal utility with respect to the amount of disclosure, m, can be written as*

$$\frac{DV_i}{dm} = -\left(\frac{dK}{dm} + \frac{ds}{dm}\right)\frac{KL-1}{K^2L} - \left(\frac{dK}{dm} + \frac{ds}{dm}\right)\frac{1}{K^4L^2}\left(\frac{x_i}{r_i} - \frac{\bar{x}}{r}\right)^2 + \left(\frac{dK}{dm} - \frac{ds}{dm}\right)\left(\frac{1}{K_i} - \frac{1}{K}\right).$$

Lemma 4 gives a simple and intuitive expression for investors' marginal utility with respect to disclosure policy. Disclosure has two effects, namely, the adverse risk-sharing effect and the beneficial cost-saving effect as demonstrated by Diamond (1985). The expression in Lemma 4 can be rearranged as the sum of two terms, a multiple of dK/dm and a multiple of ds/dm, that correspond to the two effects. First, more disclosure results in an increase in the average amount of information ($dK/dm > 0$) which reduces risk-sharing opportunities and makes investors worse off. Second, more disclosure leads investors to acquire on average less information ($ds/dm < 0$) and allows them to save acquisition costs. The magnitudes of these two effects vary across individual shareholders due to the differences in risky endowments, risk attitudes, and information acquisition cost functions.

The three terms of the expression in Lemma 4 show how differences in shareholder characteristics lead to disagreements over disclosure policy. The first term is the portion that is common to all investors. The second and the third terms represent differential effects. The second term arises from the fact that individual investors are subject to random liquidity shocks. They start the period with arbitrary risky endowments, and expect to align their relative risky holdings with their relative risk tolerances. (Note that if they were allowed to trade before the arrival of information, their risky holdings would be in proportion to their risk tolerances.)

The third term captures the differential effect of disclosure due to the differences in the quality of information. Ignoring the second term which is independent of quality differences, this third term shows that heterogeneous risk tolerances and cost functions are neatly translated into differences in the (equilibrium) quality of individual information alone. This is a very clean expression considering that *any* functions satisfying Assumptions 1 and 2 are allowed. This result is due to the assumption of well-behaved cost functions which allows investors to acquire information until the marginal utility is equal to the marginal cost. Exogenous differences are thus translated into endogenous differences through the self-selection process of individual information acquisition activities. This third term is negative for investors with superior information ($K_i > K$) and is positive for those with inferior information ($K_i < K$). This reflects the fact that the relative advantage (or disadvantage) in informedness is weakened by more disclosure. That is, more disclosure makes investors more evenly informed.

Before examining how liquidity shocks (arbitrary endowments) interact with differences in risk attitudes and cost functions in generating disagreements, it is useful to consider first a special case in which investors are not subject to liquidity shocks. This occurs, for example, if there is an extra round of trade before the arrival of information. In this case the second term in Lemma 4 is zero. Then, the differences in investors' preferences can be attributed to the term, $1/K_i - 1/K$, alone, which has the same sign as $s - s_i$. Let m_i^* be the most preferred level of disclosure by investor i. If $K_i > K_{i'}$ (or $s_i > s_{i'}$) and $dV_i/dm = 0$, then $dV_{i'}/dm > 0$. In other words, if investor i is better informed than i' and if an increased disclosure does not benefit nor hurt i, it makes i' better off. This observation leads to the following proposition.

PROPOSITION 1: *Suppose investors have reached an equilibrium before the arrival of (public and private) information.*[12] *If m_i^* and $m_{i'}^*$ exist and are unique and interior, then $m_i^* < m_{i'}^*$ if and only if $K_i > K_{i'}$.*[13] *That is, the better informed desire less disclosure than the less well informed.*

Proposition 1 gives a simple ordering among shareholders with regard to their preferred levels of the firm's information disclosure. If a certain regularity condition is imposed on investors' cost functions so that one can be said to have a higher or lower cost function than another, their preferences regard-

[12] One can show that in this case $x_i = (r_i/r)\tilde{x}$ for all i, and the second term is zero. Even after investors have reached this Pareto-efficient equilibrium before the arrival of public information $\tilde{y}$ and private information $\tilde{z}_i$'s, the arrival causes trades because investors' beliefs are not concordant with respect to $\tilde{y}$ and $\tilde{z}_i$'s. See Milgrom and Stokey (1982) and Hakansson, Kunkel, and Ohlson (1982). The post-arrival equilibrium is Pareto inefficient. Kim and Verrecchia (1991) show that, for this reason, the arrival of additional public information also causes trades.

[13] A sufficient condition for the existence of a unique solution in a special case is provided later in this section.

ing disclosure policy can be linked to their risk tolerances and the levels of their cost functions as in the following corollary.

COROLLARY 1: *Suppose the assumptions of Proposition 1 are satisfied. If, in addition,* $C_i(\cdot) = \alpha_i C(\cdot)$, *where* $0 < \underline{\alpha} < \alpha_i < \bar{\alpha} < \infty$ *for all i, then* $m_i^* < m_{i'}^*$ *if and only if* $r_i/\alpha_i > r_{i'}/\alpha_{i'}$. *That is, shareholders with greater tolerance for risk and/or lower cost functions desire less disclosure than those with less tolerance for risk and/or higher cost functions.*

An important implication of Proposition 1 is that for any given choice of disclosure policy there always will be discontented shareholders. If the disclosure policy chosen more closely reflects the preferences of the better informed, the relatively uninformed desire more disclosure and may try to increase disclosure using other means, such as shaping public opinion and exerting political pressure. The existence of financial and accounting regulatory bodies and the fact that most disclosure rules mandate firms to disclose rather than not to disclose information may be partly explained in this light. The better informed who control the firm will naturally resist this attempt and this conflict will be manifested as one between general investors and the firm. Following this line of argument, Proposition 1 may have bearings on the stylized fact that larger firms tend to disclose more information.[14] This may be because the decisions of larger firms more closely represent the interest of general shareholders due to the (presumably) more decentralized internal political structure.[15] This implication of the model may be tested by examining firms' ownership structures and the levels of voluntary disclosure.[16]

Even in the general case in which there are liquidity shocks, captured by the term $(x_i/r_i - \bar{x}/r)^2$, the intuition from the above special case is largely unchanged. Moreover, whether a firm's disclosure policy reflects the preferences of the better informed or of the more poorly informed determines the manner in which the arbitrariness of the endowments of the risky asset affects shareholders' preferences.

PROPOSITION 2: *If a shareholder with an average quality of information prefers more (or less) disclosure than the current level, those with a greater liquidity shock prefer more (or less) disclosure than those with a less liquidity shock.*

Proposition 2 says that if the better (or more poorly) informed shareholders dominate in making disclosure decisions of the firm, i.e., if the average shareholder (with $K_i = K$) thinks there is too little (or too much) disclosure, an increase in the size of the liquidity shock makes an individual shareholder desire more (or less) disclosure. When liquidity shocks increase for shareholders with differing quality of information, attaining an optimal tradeoff be-

[14] See Richardson (1984).

[15] See Diamond and Verrecchia (1991) for an alternative explanation based on the effect of disclosure on liquidity and the cost of capital.

[16] It may be difficult to measure the level of corporate disclosure. Some authors use the frequency of voluntary management forecasts as a proxy. See Penman (1980) and Waymire (1985).

tween the average risk-sharing and the average cost-saving effects ($dK/dm + ds/dm$ in the first and the second terms in Lemma 4) becomes more important (weighted more heavily) relative to individual differences in the two effects (the third term).[17] Thus, the presence of individual liquidity shocks tends to reduce shareholder disagreements, whereas individual differences in risk attitudes and cost functions contribute to disagreements. When the latter differences disappear, shareholders can reach a complete consensus despite the differences in risky endowments, as discussed below.

When investors have the same risk tolerances and cost functions, from (1) they all acquire the same amount of information, i.e., $s_i = s$ and $K_i = K$ for all i. This is essentially the situation considered by Diamond (1985) except that cost functions are continuous in this model. It is easy to see that the third term in Lemma 4 is zero. Moreover, the sign of the sum of the first and the second terms are determined solely by that of $-(dK/dm + ds/dm)$. This implies that shareholders can reach a consensus regarding disclosure policy despite their differences in risky endowments. The following additional assumption is sufficient for the existence of a unique disclosure policy.

ASSUMPTION 3: $C'C''' - 2C''^2 < 0$ *for all* $s > 0$.[18]

PROPOSITION 3: *Under Assumptions* 1, 2, *and* 3 *and that* $r_i = r$ *and* $C_i(\cdot) = C(\cdot)$ *for all* i, *there always exists a unique information disclosure policy denoted by* m^* *which is desired by all shareholders. There are two cases*: (1) $0 < m^* < \infty$ *and* $rC''/2C'^2 = 1$; (2) $m^* = 0$ *and* $rC''/2C'^2 \geq 1$.

In Case (1) the solution is interior and the firm voluntarily engages in some positive level of disclosure, where the marginal risk-sharing effect exactly offsets the marginal cost-saving effect. Case (2) is a corner solution where the firm does not release any information voluntarily because it would make all its shareholders worse off. This occurs when the savings of information acquisition costs induced by disclosure are not large enough to cover lost risk-sharing opportunities.

Given the equilibrium configurations of Proposition 3, a comparative static analysis is provided. Let the equilibrium values of s and K be s^* and K^*, respectively. The following corollary shows the effect of a small change in h or t on m^*, s^*, and K^*.

COROLLARY 2:

1. $dm^*/dh = -1$, $ds^*/dh = 0$, *and* $dK^*/dh = 0$ *in an interior solution*,
2. $dm^*/dh = 0$, $ds^*/dh < 0$, *and* $dK^*/dh > 0$ *in a corner solution*.

The signs of the derivatives with respective to t *are the same as the above.*

[17] Note that riskier endowments do not imply that risk-sharing considerations are more important because the endowment risks are not shared in this model.

[18] This can be rewritten as $(C'''/C'')/(C''/C') < 2$ which basically says that the increase in the marginal cost is not too rapidly increasing as more information is acquired. It is weaker than $C'C'''/C''^2 < 1$ which is the convex counterpart of the condition of decreasing absolute risk aversion, that is, $U'U'''/U''^2 > 1$. The following classes of cost functions satisfy the assumption: $C(s) = a(b-s)^{-\rho}$, a, b, $\rho > 0$, $s < b$; $C(s) = ae^{\rho s}$, a, $\rho > 0$; $C(s) = as^{\rho}$, $a > 0$, $\rho > 1$.

The first part of Corollary 2 is interesting. Among firms which engage in positive levels of voluntary information disclosure (interior solution), the differences in the precision of the priors are exactly offset by the differences in disclosure policies. As a result, the amount of private information acquisition, s^*, and the overall informedness, K^*, are the same among such firms. Note that if m were exogenous, an increase in h would result in an increase in K. This is exactly the case in a corner solution where m^* remains zero. That is, among firms which do not voluntarily release information (corner solution) a more precise prior implies less private acquisition but more overall information.

III. Conclusion

This paper analyzes how shareholders' disagreements over firm's information disclosure policy arise from individual liquidity shocks and differences in risk attitudes and information acquisition costs. It is shown that shareholders with better information desire less disclosure than the less well informed. The presence of liquidity shocks is shown to reduce shareholder disagreements. These results may provide some insights into the political climate in financial and accounting rule making and how firms' internal political structure affects their disclosure policies.

The paper is an extension of Diamond (1985) to a case of continuous cost functions and heterogeneous shareholders. In a less restrictive setting it reestablishes his point that disclosure has a beneficial role of alleviating the free rider problem in private information acquisition and saving costs. The comparative static results regarding optimal policy in the case of homogeneous shareholders may help in understanding certain cross-sectional differences in firms' disclosure policies.

Appendix

Proof of Lemma 3: Totally differentiating (1) and

$$s \equiv \lim_{N\to\infty} \frac{1}{N} \sum_N \frac{r_i}{r} s_i$$

with respect to m, s, and s_i yields

$$1 + \frac{ds}{dm}(2r^2st) + \frac{ds_i}{dm}\left(1 + \frac{r_i C_i''}{2C_i'^2}\right) = 0$$

and

$$\frac{ds}{dm} = \lim_{N\to\infty} \frac{1}{N} \sum_N \frac{r_i}{r} \frac{ds_i}{dm},$$

respectively. Let $f_i \equiv 1/(1 + r_i C_i''/2C_i'^2)$ and $f \equiv \lim_{N\to\infty} (1/N) \sum_N (r_i/r) f_i$. Then, $0 < f_i$, $f < 1$,

$$\frac{ds_i}{dm} = -f_i\left(1 + 2r^2 st\frac{ds}{dm}\right)$$

and

$$\frac{ds}{dm} = -f\left(1 + 2r^2 st\frac{ds}{dm}\right).$$

Thus, $ds/dm = -f/(1 + 2r^2stf) < 0$ and $ds_i/dm = -f_i/(1 + 2r^2stf) < 0$. Also,

$$\begin{aligned}\frac{dK_i}{dm} &= \frac{\partial K_i}{\partial m} + \frac{ds_i}{dm}\frac{\partial K_i}{\partial s_i} + \frac{ds}{dm}\frac{\partial K_i}{\partial s}\\ &= 1 - \frac{f_i}{1 + 2r^2stf} - \frac{2r^2stf}{1 + 2r^2stf}\\ &= \frac{1 - f_i}{1 + 2r^2stf}\\ &> 0\end{aligned}$$

and

$$\frac{dK}{dm} = \frac{1 - f}{1 + 2r^2stf} > 0.$$

Proof of Lemma 4:

$$\begin{aligned}\frac{dV_i}{dm} &= \frac{\partial V_i}{\partial m} + \frac{ds}{dm}\frac{\partial V_i}{\partial s} + \frac{ds_i}{dm}\frac{\partial V_i}{\partial s_i}\\ &= \frac{1}{K_i L}\frac{1}{K^3}\{(K^2L + K_i)K - 2K_iK^2L\} - \frac{1}{K^4L^2}\left(\frac{x_i}{r_i} - \frac{\bar{x}}{r}\right)^2\\ &\quad + \frac{-f}{1 + 2r^2stf}\left[\frac{1}{K_iL}\frac{1}{K^3}\{2r^2stK^2L + (2 + 2r^2st)K_i\}K\right.\\ &\quad \left. -2K_iK^2L(1 + 2r^2st) - \frac{2 + 2r^2st}{K^4L^2}\left(\frac{x_i}{r_i} - \frac{\bar{x}}{r}\right)^2\right]\end{aligned}$$

because $\partial V_i/\partial s_i = 0$ and $K^2L = h + m + 2s + r^2s^2t + r^{-2}t^{-1}$. This can be further rewritten as

$$\frac{1}{K_iK^3L}(K_iK - K_iK^2L) + \frac{1}{K_iK^3L}(K^3L - K_iK^2L) + \frac{2f-1}{1+2r^2stf}\frac{1}{K^4L^2}$$

$$\cdot\left(\frac{x_i}{r_i} - \frac{\bar{x}}{r}\right)^2 - \frac{2(1+r^2st)f}{1+2r^2stf}\frac{1}{K_iK^3L}(K_iK - K_iK^2L)$$

$$-\frac{2r^2stf}{1+2r^2stf}\frac{1}{K_iK^3L}(K^3L - K_iK^2L)$$

$$= \frac{2f-1}{1+2r^2stf}\left[\frac{KL-1}{K^2L} + \frac{1}{K^4L^2}\left(\frac{x_i}{r_i} - \frac{\bar{x}}{r}\right)^2\right] + \frac{1}{1+2r^2stf}\left(\frac{1}{K_i} - \frac{1}{K}\right).$$

The equality now follows from Lemma 3.

Proof of Corollary 1: The result is obtained by using Proposition 1 and the fact that $K_i > K_{i'}$ if and only if $r_i/\alpha_i > r'_i/\alpha_{i'}$, which follows from (1): (1) can be written in this case as $K_i - r_i/2\alpha_iC'(s_i) = 0$, and thus $dK_i/d(r_i/a_i) > 0$.

Proof of Proposition 2: For an investor with an average quality of information, $K_i = K$. Therefore, the third term in Lemma 4 is zero. If he prefers an increased disclosure, $V_i > 0$. Since $KL - 1$ is positive, it follows that $-(dK/dm + ds/dm) > 0$. Similarly, if he prefers a reduced disclosure, $-(dK/dm + ds/dm) > 0$.

Proof of Proposition 3: First calculate $ds/dm = -1/(1 + 2r^2st + rC''/2C'^2)$ and $dK/dm = (rC''/2C'^2)/(1 + 2r^2st + rC''/2C'^2)$ which follow from Lemma 3 and the fact that $f = f_i = 1/(1 + rC''/2C'^2)$ for all i. Using this and Lemma 4 the marginal utility of investor i with respect to the level of the firm's disclosure, m, is

$$\frac{dV_i}{dm} = \frac{1 - rC''/2C'^2}{1 + 2r^2st + rC''/2C'^2}\frac{KL-1}{K^2L} = -\left(\frac{dK}{dm} + \frac{ds}{dm}\right)\frac{KL-1}{K^2L}. \quad (2)$$

Under Assumption 3

$$\frac{d^2V_i}{dm^2} = \frac{ds}{dm}\frac{d^2V_i}{dmds} = \frac{-1}{1 + 2r^2st + rC''/2C'^2}$$

$$\cdot\left\{\frac{d(rC''/2C'^2)}{ds}\frac{-2 - 2r^2st}{(1 + 2r^2st + rC''/2C'^2)^2}\frac{KL-1}{K^2L}\right.$$

$$\left. + \frac{1 - rC''/2C'^2}{1 + 2r^2st + rC''/2C'^2}\frac{d((KL-1)/K^2L)}{ds}\right\}$$

$$= \frac{r(C'C''' - 2C''^2)(2 + 2r^2st)}{2C'^3(1 + 2r^2st + rC''/2C'^2)^3}\frac{KL-1}{K^2L} < 0$$

for m such that $1 - rC''/2C'^2 = 0$. In other words, if there exists an interior solution m such that $dV_i/dm = 0$, then it is uniquely defined by (2) and is a local maximum. $m^* < \infty$ comes form the fact that as m approaches infinity, s approaches zero and $r/2C'(s)$ approaches infinity, which make it necessary that $rC''/2C'^2$ is not bounded above (and therefore exceeds one). This characterizes Case (1). Case (2) is a corner solution where $dV_i/dm < 0$ and $m = 0$.

Proof of Corollary 2: The result is proved only for h. The proof for t is similar. Suppose that the equilibrium is interior. The equilibrium conditions are $K = r/2C'$ and $rC''/2C'^2 = 1$. It is clear that $ds^*/dh = 0$ by the second condition. Together with the first condition this implies that $dK^*/dh = 0$ which in turn implies $dm^*/dh = -1$.

In a corner solution $dm^*/dh = 0$, and the equilibrium conditions are $K = r/2C'$, and $K = h + s + r^2s^2t$. Totally differentiating the two conditions and rearranging yields

$$\frac{ds^*}{dh} = -1/\left(1 + 2r^2st + r_iC_i''/2C_i'^2\right) < 0$$

and

$$\frac{dK^*}{dh} = \frac{r_iC_i''}{2C_i'^2}\Bigg/\left(1 + 2r^2st + \frac{riC_i''}{2C_i'^2}\right) > 0.$$

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