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DISCRETIONARY DISCLOSURE*

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This paper shows how the existence of disclosure-related costs offers an explanation for why a manager exercises discretion in disclosing information even though traders have rational expectations about his motivation to withhold unfavorable reports. In effect, disclosure-related costs introduce noise by extending the range of possible interpretations of withheld information to include news which is actually favorable. Therefore, traders are unable to interpret withheld information as unambiguously 'bad news' and thereby discount the value of the firm to the point that the manager is better served to disclose what he knows.

1. Introduction

This paper analyzes a model in which a manager of a risky asset exercises discretion in the disclosure of information in the presnce of traders who have rational expectations about his motivation. The information is a signal which reveals the true liquidating value of the risky asset perturbed by some noise. The manager decides to either release or withhold this signal on the basis of the information's effect on the asset's market price. He exercises discretion by choosing the point, or the degree of the information quality, above which he discloses what he observes, and below which he withholds his information. I refer to this point as a threshold level of disclosure. Traders are aware of the existence, but not the content, of the information possessed by the manager. Therefore, a manager's choice of a threshold level of disclosure has to be determined in conjunction with trader's expectations. This is because the manager's decision to withhold information depends upon how traders interpret its absence, and traders' conjecture about the content of the withheld information depends upon the manager's motivation for withholding it: thus, the manager's threshold level of disclosure and traders' expectations have to be determined simultaneously since they are not

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separate problems. The salient feature of my model is the existence of an equilibrium threshold level of disclosure such that traders' conjecture about the content of withheld information is fulfilled by a manager's motivation to withhold the information. As a description of this phenomenon, the usefulness of my model is that it reconciles the extant theory in the economic literature with empirical observations in the accounting literature.

The idea that the possessor of superior information or insight will signal what he knows either directly or through his actions to achieve some economic benefit has been studied by a number of economists in a variety of institutional settings. For example Spence (1973), in a seminal study, suggests that more talented workers will attempt to signal this fact to potential employers by acquiring more education. Recently, Grossman (1981) and Milgrom (1981, see especially pp. 387–390) considered whether the possessor of superior information about product quality can influence a buyer by selectively disclosing what he knows; see also Leland (1981). In their analyses, Grossman–Milgrom conclude that the possessor of information about a product or asset (e.g., a salesperson, manager, seller, etc.) would be obligated to follow a policy of full disclosure. The intuition underlying this result is that when a salesperson, say, withholds information, buyers' suspicions about the quality of the product are so great that they discount its quality to the point that the salesperson is always better served to disclose what he knows. In effect, the threshold level of disclosure collapses to the least favorable possible information the salesperson can possess; this forces the salesperson to always reveal what he knows. While the results of the Grossman–Milgrom analyses are not in dispute, empirical work has suggested that managers do exercise discretion in the disclosure of information.

Because of the difficulty of verifying whether information which is withheld and never disclosed is either 'good' or 'bad' news (to say nothing of the problem of determining whether withheld information exists in the first place), empirical work typically assesses whether a manager exercises discretion in the *delay* in reporting mandated accounting statistics, such as accounting earnings, on the basis of that information's content. For example, 'good news' has come to be known in the accounting literature [see, e.g., Ball–Brown (1968)] as a positive difference between the actual earnings reported and the market's expectation of earnings, and, similarly, 'bad news' as a negative difference. Dyer–McHugh (1975) find a negative but insignificant relation between accounting rate of return data and reporting delays using Australian data. Givoly–Palmon (1982) find that the delay of 'bad news' is robust to alternative definitions of timeliness and models of expected earnings. Patell–Wolfson (1982), in a study of intra-day returns, find that 'good news' tends to be reported prior to the close of trading, whereas 'bad news' tends to be released after the close of trading. Chambers–Penman

(1983) conclude that missing an expected report date is a signal of forthcoming 'bad news' which is reflected in security price on the date of expected release. This is not to suggest that the empirical evidence is beyond dispute. Watts (1978) finds no significant evidence in the cross-sectional distribution of quarterly lags to support the deliberate delay hypothesis. Kross–Schroeder (1983), despite the fact that they find that the timing of an information release has a significant impact on returns, confine their analysis to an eight-day interval surrounding the announcement date, as opposed to the expected date of announcement. Aside from problems which arise from testing the discretionary delay hypothesis, the simple institutional fact that 'bad news' creates delays in auditing and preparing accounting data may confound the evidence.

With regard to the empirical work, two points need emphasizing. First, although my analysis ostensibly concerns the withholding of information, and not its delay, in section 5 of this paper I suggest an interpretation of my results which explains delays in the context of the withholding of information. Second, an alternative to my explanation for why a manager delays the reporting of 'bad news' is that he hopes that during the interim some 'good news' will occur to offset what he has to say.[1] The disadvantage of this explanation is that it ignores the fact that rational expectations traders will correctly infer 'bad news' as soon as it becomes apparent that the information is being withheld.

My model reconciles the empirical evidence with existing economic theory in the following way. In the model proposed here, the manager may either disclose or withhold information, which is a signal about the true liquidating value of the asset he manages. However, if he reports what he observes, the value of the asset is reduced by some cost, which I interpret as the cost associated with disclosing information. Typically, one thinks of the disclosure-related cost as solely the cost of preparing and disseminating information for traders' inspection. I prefer to regard this cost more broadly so as to also include the cost associated with disclosing information which may be proprietary in nature, and therefore potentially damaging: to emphasize this, henceforth I refer to the disclosure-related cost as a proprietary cost. In my model, I assume the proprietary cost is constant, independent of what signal the manager discloses. It seems apparent that there would be a proprietary cost associated with releasing information which is unfavorable to a firm (e.g., a bank would be tempted to ask for repayment of its loan). However, the release of a variety of accounting statistics about a firm (e.g., sales, net

[1]This idea is courtesy of Maureen McNichols. She tells the story of the knave who, when condemned to die by the King, contrives to convince the King that if allowed a year's time, he will teach the King's horse to talk in return for his life. The King grants this temporary reprieve, but as the knave is being led off, his friends ask in astonishment how he could possibly make such a bold claim. At this the knave responds: 'Within a year anything could happen: the King could die, the horse could die, or the horse could even learn to talk!'

income, costs of operation, etc.) may be useful to competitors, shareholders, or employees in a way which is harmful to a firm's prospects even if (or perhaps because) the information is favorable. One recent example of this is the response of the UAW (United Auto Workers) for fewer labor concessions in the face of an announcement by Chrysler Corporation's chairman that that firm's fortunes had improved. Other examples might include the reluctance of managers in certain highly competitive industries, such as personal computers or airlines, or certain politically sensitive industries, such as the oil industry or foreign automobile importers, to disclose favorable accounting data.

The existence of a proprietary cost has the following significance. If a proprietary cost exists and information is withheld, traders are unsure whether it was withheld because: (i) the information represents 'bad news', or (ii) the information represents 'good news', but not sufficiently good news to warrant incurring the proprietary cost. In effect, a proprietary cost introduces noise into the model by extending the range of possible interpretations of withheld information to include news which is actually favorable. Traders' inability to interpret withheld information as unambiguously 'bad news' is sufficient to support a threshold level of disclosure whereby for certain observations a manager is motivated to withhold information. In addition to establishing the existence of an equilibrium threshold level of disclosure, the critical nature of the proprietary cost is further demonstrated by showing that my analysis is consistent with that of Grossman–Milgrom as the proprietary cost goes to zero: that is, in the absence of a proprietary cost, a manager follows a policy of full disclosure.

It could be argued (and probably is suggested by the examples of a proprietary cost cited above) that the proprietary cost should be a function of the information observed by the manager. For example, 'average news' would have a low proprietary cost *vis à vis* more 'dramatic news', corresponding to a signal in the tail of its distribution. Although this analysis is limited to the case of a constant proprietary cost, I show through an example how the logic extends to the more general case. While the idea is robust, it appears unlikely that the existence of a threshold level of disclosure can be assured in the absence of imposing some (perhaps strong) regularity conditions on the functional relation between a proprietary cost and signals.

The intuition employed above to explain the existence of a threshold level of disclosure suggests that as the (constant-level) proprietary cost increases, so does the threshold level. This is because as the proprietary cost increases, the range of possible favorable interpretations of withheld information increases, thereby allowing the manager greater discretion. This proposition is formally demonstrated as a corollary to my main result.

This corollary has an interesting empirical implication in that it suggests that the greater the proprietary cost associated with the disclosure of information, the less negatively traders react to the withholding of information. This is because the threshold level of disclosure rises as the proprietary cost increases, and traders discount the withholding of information less heavily as the threshold rises. Therefore, if different levels of proprietary costs could be distinguished, a higher versus lower level would suggest a lessened versus heightened negative reaction to the withholding of information.

A brief outline of this paper is as follows. In section 2 I describe my model of discretionary disclosure, and in section 3 I define a discretionary disclosure equilibrium to the problem of a manager exercising discretion in the presence of traders with rational expectations about his motivation. In section 4 I show the existence of an equilibrium threshold level of disclosure; some comparative statistics concerning this threshold are also presented here. Concluding remarks are offered in the final section.

2. A description of the market

In this section, I describe a model of a market in which a manager exercises discretion over the disclosure of information to traders. The market consists of two principal actors, the manager of a risky asset and traders, whose expectations determine a price for the risky asset. In the market, four discrete events or time periods unfold. *First*, the manager is endowed with some signal concerning the true liquidating value of the risky asset. The existence of this information, but not its content, is common knowledge among traders. *Second*, the manager decides whether to disclose the signal he receives on the basis of the information's effect on the price of the risky asset. *Third*, traders form expectations which determine a price for the asset on the basis of either the manager's information (if he discloses it) or his motivation (if he withholds it). *Finally*, the risky asset is liquidated and traders holding shares of the asset consume its liquidated value. At any time before the liquidation of the risky asset, traders may exchange their endowments or holdings of this particular risky asset with any other unspecified assets in the market. To avoid problems with inside information [see e.g., Leftwich–Verrecchia (1983)], I preclude the possibility of a manager trading shares of the asset regardless of whether he releases or withholds the information. However, no explicit attention is paid to trading *per se* because the form of the price of the risky asset in question is exogenously specified below.

The liquidating value of the risky asset is unknown until the final period and is represented by a random variable $\tilde{u}$ whose realization is denoted by u. Traders' prior beliefs about $\tilde{u}$ are that it has a normal distribution with mean y_0 and precision (i.e., the inverse of variance) h_0. The manager's signal, or endowment of information, is represented by a random variable $\tilde{y}$ which communicates the true liquidating value $\tilde{u}$ perturbed by some noise $\tilde{\varepsilon}$,

$$\tilde{y}=\tilde{u}+\tilde{\varepsilon}.$$

The random variable $\tilde{\varepsilon}$ has a normal distribution with mean zero and precision s.

Let Ω represent the set of information commonly known to all traders. I assume that the market price for the risky asset, on the basis of Ω, is given by the real-valued function $P(\Omega)$, such that

$$P(\Omega)=\frac{\mathrm{E}[\tilde{u}|\Omega]-\beta(\mathrm{var}[\tilde{u}|\Omega])}{1+r_{\mathrm{F}}},$$

where $\mathrm{E}[\tilde{u}|\Omega]$ is the expected value of $\tilde{u}$ conditional on Ω, $\mathrm{var}[\tilde{u}|\Omega]$ is the variance of $\tilde{u}$ conditional on Ω, β is a continuous, non-negative, and non-decreasing function of its argument, and r_{F} is the risk-free rate of interest. In effect, the price of the risky asset is equal to traders' expectations of the expected liquidating value of $\tilde{u}$, reduced by the uncertainty associated with those expectations by subtracting out some amount which is a (non-negative and non-decreasing) function of the conditional variance of $\tilde{u}$, and adjusted for the risk-free rate of interest. Although the form of the price function is exogenously specified, it is reasonably general. For example, traders with risk-neutral preferences would imply a function $\beta(x)=0$ for all x, and traders with constant risk-tolerance preferences would imply $\beta(x)=\beta x$ for all x, where β is some positive constant. Although I believe that many of the claims made below can be generalized beyond this particular specification for price, the form I suggest results in a facile analysis and appears to capture salient features of an equilibrium market price. Finally, without loss of generality, I assume $r_{\mathrm{F}}=0$ to simplify the notation.

I assume that the manager's objective function is to maximize the price of the risky asset. Although this may be the way managers actually behave, and most laymen would probably regard this assumption as imminently reasonable, it is important to emphasize its wholly exogenous character in this analysis. There is no explicit link made here between the price of the risky asset and managerial compensation. Therefore, no economic justification is offered for why a manager behaves in this fashion: this assumption of price-maximization is a *deus ex machina*.[2] The issue remains important, however. In an extension of this paper, I hope to explore how, possibly, the maximization of the price of the risky asset evolves endogenously from a manager's contractual relation with shareholders.

[2]The Grossman–Milgrom analyses avoid this conceptual problem by dealing with an individual (e.g., a seller) who owns, as opposed to merely manages, the asset. It is difficult to suggest a parallel to this in my scenario, unless one restricts the discussion to situations in which the asset is wholly owned by the manager or additional shares of the risky asset are to be issued.

3. A description of a discretionary disclosure equilibrium

In this section I define a discretionary disclosure equilibrium. When the manager observes the realization of $\tilde{y}=y$, which is his endowment of information, he may disclose it or withhold this signal from traders, but he does not misreport what he observes. The latter is a reasonable assumption in the presence of mechanisms whereby traders can verify any of the manager's claims *post facto*.[3] In addition, if the manager discloses the information (but not if he withholds it from the market) the expected, or mean, liquidating value of the risky asset is reduced by some constant level c, which represents the proprietary cost of disclosure. The nature and rationale for the proprietary cost has already been discussed in the introduction, and therefore suffice it to say here that c is assumed to be positive. Later, I discuss proprietary costs which depend on the realization $\tilde{y}=y$.

Because of the proprietary cost, when a manager discloses what he observes the price of the risky asset adjusts to

$$P(\tilde{y}=y)=\mathrm{E}[(\tilde{u}-c)\,|\,\tilde{y}=y]-\beta(\mathrm{var}[\tilde{u}\,|\,\tilde{y}=y]). \tag{1}$$

When a manager withholds information, traders make an inference on the basis of its absence. Suppose that traders imagine that when a manager withholds information this implies that the realization $\tilde{y}=y$ is below some point x on the real line. This, in turn, implies that the price of the risky asset is

$$P(\tilde{y}=y\leqq x)=\mathrm{E}[\tilde{u}\,|\,\tilde{y}=y\leqq x]-\beta(\mathrm{var}[\tilde{u}\,|\,\tilde{y}=y\leqq x]). \tag{2}$$

Notice, in particular, the absence of any costs when the information is withheld.

The point x is referred to as a threshold level of disclosure: specifically, a threshold level of disclosure is a point $x\in \boldsymbol{R}$ such that a manager withholds $\tilde{y}=y$ whenever $y\leqq x$, and discloses it otherwise. Therefore, a discretionary disclosure equilibrium is defined as a threshold level of disclosure $\hat{x}\in \boldsymbol{R}$ which simultaneously satisfies the following two conditions:

1. A manager's choice of $\hat{x}$ maximizes the price of the risky asset for each observation $\tilde{y}=y$.

2. When a manager withholds information, traders conjecture that the observation $\tilde{y}=y$ made by the manager has the property that $y\leqq \hat{x}$.

Condition 1 requires that a manager selects a threshold level of disclosure

[3] This is also assumed in the Grossman–Milgrom discussions. Leland (1981) inteprets this assumption as a large penalty for lying.

which maximizes the price of the risky asset in response to how traders interpret the release or withholding of information. Condition 2 is a rational expectations requirement. It asserts that traders' conjectures are consistent with a manager's motives to withhold information.

4. The existence of a discretionary disclosure equilibrium

In this section, I establish the existence of a discretionary disclosure equilibrium whenever the proprietary cost is positive. Before doing so, some preliminary results are useful: in particular, expressions for $P(\tilde{y}=y)$ and $P(\tilde{y}\leqq x)$ are determined.

Lemma 1.

$$P(\tilde{y}=y)=y_0-c+\frac{s}{h_0+s}(y-y_0)-\beta\left(\frac{1}{h_0+s}\right). \tag{3}$$

Proof. This follows from well-known results concerning the conditional distribution of a normally distributed random variable; see, e.g., Mood–Graybill (1963, pp. 207–215). Q.E.D.

Lemma 2.

$$P(\tilde{y}=y\leqq x)=y_0-\frac{h_0^{-1}g(x)}{G(x)}-\beta(k(x)), \tag{4}$$

where

$$g(x)=\frac{1}{\sqrt{2\pi}}\sqrt{\frac{sh_0}{h_0+s}}\exp\left(-\frac{1}{2}\frac{sh_0}{h_0+s}[x-y_0]^2\right),$$

$$G(x)=\int_{-\infty}^{x} g(t)\,\mathrm{d}t,$$

$$k(x)=h_0^{-1}-\frac{s}{h_0+s}(x-y_0)\frac{h_0^{-1}g(x)}{G(x)}-\left\{\frac{h_0^{-1}g(x)}{G(x)}\right\}^2.$$

Proof. This follows from well-known results concerning the distribution of a normally distributed random variable; see, e.g., Johnson–Kotz (1972, pp. 112–113). Q.E.D.

There are some interesting features of the expression for the price of the risky asset when information is withheld. The expected realization of $\tilde{u}$

conditional upon $\tilde{y}=y\leqq x$ is

$$\mathrm{E}[\tilde{u}\,|\,\tilde{y}=y\leqq x]=y_0-\frac{h_0^{-1}g(x)}{G(x)}.$$

It can be shown that $-h_0^{-1}g(x)/G(x)$ is an increasing function of x, which (using l'Hospital's Rule) approaches minus infinity as x approaches minus infinity, and zero as x approaches plus infinity. Intuitively, this implies that if the threshold is very low (e.g., minus infinity), then the withholding of information is interpreted as 'very bad news' (e.g., $\lim_{x\to-\infty}\mathrm{E}[\tilde{u}\,|\,\tilde{y}=y\leqq x]\to-\infty$). Alternatively, if the threshold is very high (e.g., plus infinity), then the withholding of information provides almost no additional information beyond what was known *a priori* (e.g., $\lim_{x\to\infty}\mathrm{E}[\tilde{u}\,|\,\tilde{y}=y\leqq x]\to y_0$).

The variance of $\tilde{u}$ conditional upon $\tilde{y}=y\leqq x$ is

$$\operatorname{var}[\tilde{u}\,|\,\tilde{y}=y\leqq x]=k(x)=h_0^{-1}-\frac{s}{h_0+y_0}(x-y_0)\frac{h_0^{-1}g(x)}{G(x)}-\left\{\frac{h_0^{-1}g(x)}{G(x)}\right\}^2.$$

It can be shown that $k(x)$ is an increasing function of x which approaches $\{h_0+s\}^{-1}$ as x approaches minus infinity, and h_0^{-1} as x approaches plus infinity. Intuitively, this implies that if the threshold is very low (e.g., minus infinity), then the withholding of information provides nearly as much information as had $\tilde{y}=y$ itself been revealed (e.g., $\lim_{x\to-\infty}\operatorname{var}[\tilde{u}\,|\,\tilde{y}=y\leqq x]\to\{h_0+s\}^{-1}$): that is, the conditional variance of $\tilde{u}$ is approximately equal to the conditional variance when $\tilde{y}=y$ is disclosed by a manager. Alternatively, if the threshold is very high (e.g., plus infinity), then the withholding of information provides almost no additional information beyond what was known *a priori* (e.g., $\lim_{x\to\infty}\operatorname{var}[\tilde{u}\,|\,\tilde{y}=y\leqq x]\to h_0^{-1}$): that is, the conditional variance of $\tilde{u}$ is approximately equal to the variance when there is no additional information. Finally, generalizing this argument, it should be intuitively reasonable that when information is withheld the conditional variance of $\tilde{u}$ increases as the threshold level x increases, since the higher the threshold level the less is learned. These properties of $k(x)$ are summarized in the following lemma.

Lemma 3. The variance of $\tilde{u}$ conditional upon realizations of $\tilde{y}$ below some threshold level x has the following properties:

(i) $1/(h_0+s)\leqq k(x)\leqq h_0^{-1}$,

(ii) $k'(x)>0$,

(iii) $\lim_{x\to-\infty} k(x)\to 1/(h_0+s)$,

(iv) $\lim_{x\to\infty} k(x)\to h_0^{-1}$,

(v) $(\mathrm{d}/\mathrm{d}x)\{h_0^{-1}g(x)/G(x)\}=h_0\{k(x)-h_0^{-1}\}$.

Proof. Properties (i), (iii), (iv), and (v) follow from well-known results concerning the distribution of a normally distributed random variable; see, e.g., Heckman (1979). Property (ii) is proven by Sampford (1953).[4] Q.E.D.

Lemmas 1, 2, and 3 are used to establish the existence of a discretionary disclosure equilibrium. Condition 1 requires that a manager maximizes the price of the risky asset on the basis of his choice of a threshold level of disclosure. This is equivalent to requiring that a manager withhold information whenever

$$P(\tilde{y}=y)\leqq P(\tilde{y}=y\leqq x),$$

or, substituting in the expressions for Lemmas 1 and 2,

$$y_0-c+\frac{s}{h_0+s}(y-y_0)-\beta\left(\frac{1}{h_0+s}\right)\leqq y_0-\frac{h_0^{-1}g(x)}{G(x)}-\beta(k(x)). \tag{6}$$

Rearranging terms, eq. (6) can be expressed as

$$y\leqq y_0+\left[\frac{h_0+s}{s}\right]\left[c-\frac{h_0^{-1}g(x)}{G(x)}+\beta\left(\frac{1}{h_0+s}\right)-\beta(k(x))\right]. \tag{7}$$

However, Condition 2 requires that traders make correct conjectures whenever a manager withholds information. When a manager withholds information, traders infer that the realization $\tilde{y}=y$ is below some threshold level x, i.e.,

$$y\leqq x. \tag{8}$$

Combining eqs. (7) and (8), Conditions 1 and 2 taken together require the existence of a threshold level $\hat{x}\in\boldsymbol{R}$ such that

$$\hat{x}=y_0+\left[\frac{h_0+s}{s}\right]\left[c-\frac{h_0^{-1}g(\hat{x})}{G(\hat{x})}+\beta\left(\frac{1}{h_0+s}\right)-\beta(k(\hat{x}))\right], \tag{9}$$

[4]Property (ii), while intuitively reasonable, turns out to be mathematically subtle. I conjecture that it would only hold for density functions which can be reduced to some exponential form.

since in this event traders' conjecture about a manager's motivation to withhold information is consistent with a manager's decision to do so.

An immediate problem is to establish the existence of a discretionary disclosure equilibrium.

Theorem. There exists a unique discretionary disclosure equilibrium whenever the proprietary cost is positive.

Proof. Rearranging terms, eq. (9) is equivalent to the existence of $\hat{x} \in \boldsymbol{R}$ such that $F(\hat{x}) = c$, where

$$F(x) = \frac{s}{h_0 + s}(x - y_0) + \frac{h_0^{-1} g(x)}{G(x)} + \beta(k(x)) - \beta\left(\frac{1}{h_0 + s}\right).$$

I prove in the appendix that for all $x \in \boldsymbol{R}$

(i) $F(x)$ is non-negative,

(ii) $F(x)$ is increasing,

(iii) $\lim_{x \to -\infty} F(x) \to 0$,

(iv) $\lim_{x \to \infty} F(x) \to \infty$.

Taken together, these four properties logically imply that for any positive proprietary cost c, there exists a unique, finite, real-valued $\hat{x}$ such that $F(\hat{x}) = c$; see fig. 1. Q.E.D.

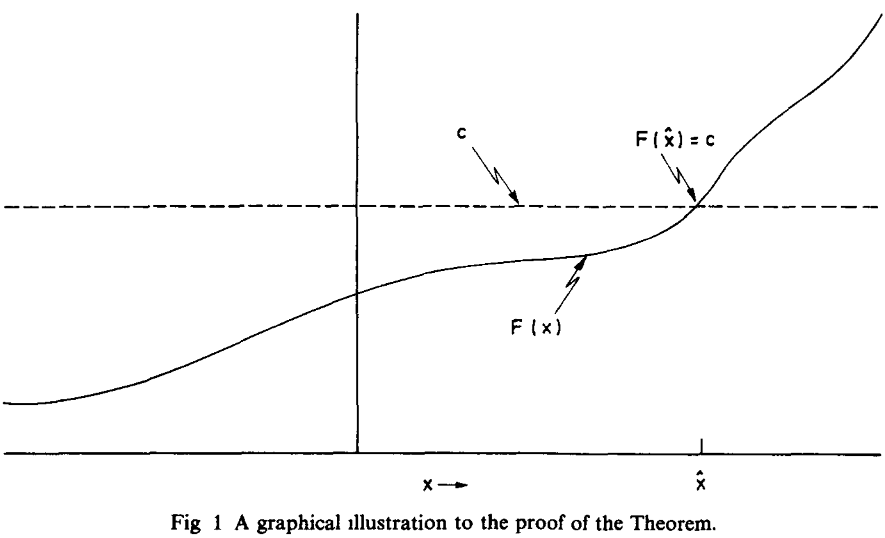

Fig 1 A graphical illustration to the proof of the Theorem.

The nature of this equilibrium is illustrated through a simple numerical example. Let $s=h_0=1$, $\beta(x)=2x$, and $c=0.9276$. Then it is a straightforward exercise to show that for any value y_0, a discretionary disclosure equilibrium exists when $\hat{x}=y_0$, since here $F(y_0)=0.9276$. This particular example is interesting because it demonstrates that the naive notion that a manager only discloses realizations of $\tilde{y}$ which exceed the expected liquidating value of $\tilde{u}$, i.e., y_0, and withholds them otherwise, may actually happen in a rational expectations context.

An intuitive explanation of the Theorem is that when a proprietary cost exists, a manager maximizes the price of a risky asset by disclosing what he observes only when the realization $\tilde{y}=y$ is sufficiently high to overcome the cost associated with its disclosure. Therefore, if the information is withheld, traders are unsure whether it was withheld because: (i) the realization $\tilde{y}=y$ is low, or (ii) the realization is high but not sufficiently high to justify the proprietary cost. Consequently, the withholding of information does not necessarily lead to inferences which are so manifestly negative that a manager always discloses what he observes. In particular, there exists a threshold level where a manager's decision to withhold information is sustained by traders' uncertainty as to whether the correct inference is that the news is 'bad' or 'not quite good enough' to justify disclosure. In the Grossman–Milgrom discussion, traders infer that the news is unambiguously 'bad', which forces the manager to disclose what he observes.

For example, the Grossman–Milgrom analysis is equivalent to assuming a proprietary cost of zero (i.e., $c=0$). When $c=0$, an equilibrium requires a threshold level $\hat{x}$ such that $F(\hat{x})=0$. From the above proof, it is clear that $F(x)$ is always non-negative, and approaches zero only as x approaches minus infinity. But a threshold of minus infinity is equivalent to a manager always disclosing what he observes, as any realization of $\tilde{y}$ is above this point: hence, in the absence of a proprietary cost, a manager exercises no discretion. In summary, the existence of a proprietary cost offers a link between the extant theory of Grossman–Milgrom and the suggestion from empirical work that managers do exercise discretion in the disclosure of information.

With regard to proprietary costs which are not constant, but instead depend on the signals observed by the manager, consider the following twist on the previous example. As before, let $s=h_0=1$, and $\beta(x)=2x$. However, in this case, let the proprietary cost be a function of the realization $\tilde{y}=y$, namely, $c(y)=\alpha|y-y_0|+c_0$, where $\alpha=0.25$ and $c_0=1$. A function of this type captures the idea that the proprietary cost has one component which increases with realizations of $\tilde{y}$ which depart (in either direction) from the mean, $\alpha|y-y_0|$, and another component which is independent of the signal itself, c_0. In brief, the more the information departs from what is expected, the greater is the proprietary cost associated with its disclosure. Finally, let

$y_0 = 1$. Using essentially the same logic that I employ in the proof of the Theorem, it can be shown that a (unique) threshold level of disclosure exists at approximately $\hat{x} = 1.57$. This shows that the results of this analysis can be generalized to the case of proprietary costs which depend on the particular signal observed. This generalization is difficult, however, and beyond the scope of this discussion. At a minimum, it appears that for certain proprietary cost functions there may be disjoint regions of disclosure, as opposed to a single threshold (i.e., a single bifurcation of the real line).

The intuition which underlies the proof of the Theorem also seems to suggest that as the (constant-level) proprietary cost increases, so does the threshold level. This is because the greater the proprietary cost, the greater the range of possible interpretations of withheld information. This proposition is formally demonstrated in the following result.

Corollary. The threshold level is an increasing function of the proprietary cost.

Proof. $F(\hat{x}) = c$ is equivalent to

$$\hat{x} = y_0 + \left[\frac{h_0 + s}{s}\right]\left[c - \frac{h_0^{-1} g(\hat{x})}{G(\hat{x})} - \beta(k(\hat{x})) + \beta\left(\frac{1}{h_0 + s}\right)\right]. \tag{10}$$

Differentiating both sides of eq. (10) with respect to c yields

$$\frac{\partial \hat{x}}{\partial c} = \left[\frac{h_0 + s}{s}\right]\left[1 - \{h_0 k(\hat{x}) - 1\}\frac{\partial \hat{x}}{\partial c} - \beta'(.)k'(\hat{x})\frac{\partial \hat{x}}{\partial c}\right].$$

This, in turn, implies

$$\frac{\partial \hat{x}}{\partial c} = \left[h_0\left\{k(\hat{x}) - \frac{1}{h_0 + s}\right\} + \beta'(.)k'(\hat{x})\right]^{-1}.$$

This expression for $\partial \hat{x}/\partial c$ is positive since $k(x) \geqq 1/(h_0 + s)$ and $k'(x) > 0$ for all x, and $\beta'(.) \geqq 0$ by assumption. Q.E.D.

The Corollary provides an interesting empirical interpretation. Suppose that disclosures can be ranked in terms of the proprietary nature of their information. For example, firms in highly competitive industries may regard public disclosures of any kind as potentially costly in the assistance it renders competitors. Firms in less competitive industries may see no costs associated with making public disclosures. The Corollary suggests that the greater the proprietary cost associated with the disclosure of information, the less negatively traders react to the withholding of information. This is because as the threshold level rises, it increases the range of possible favorable observations whose disclosure cannot be justified in view of the cost.

5. Conclusion

This analysis offers a rationale for a manager's discretion in the disclosure of information. A manager's decision to disclose or withhold information depends upon the effect of that decision on the price of a risky asset. However, traders make inferences about a manager's motivation to withhold information, which, in turn, affects his decision. On the one hand, since traders' expectations are rational, a manager must consider the effect of withholding information on their conjecture. On the other hand, since a manager's behavior is rational, traders must assess the effect of their conjecture on his motivation to withhold information. An equilibrium threshold level of disclosure is a point below which a manager's motivation to withhold information is consistent with traders' conjecture as to how to interpret that action.

This result relies on the existence of a cost associated with the disclosure of information. For example, it was shown that the threshold level of disclosure increases as the proprietary cost increases. It also relies on a variety of facile, mathematical assumptions: a constant-level proprietary cost, the asset-pricing formulation, and the multivariate normality assumptions. However, the intuition underlying the withholding of information in the presence of disclosure-related costs (and rational expectations) is sufficiently robust to suggest that these (purely mathematical) assumptions can be relaxed without jeopardizing the result.

A generalization of a constant-level proprietary cost, which is useful for relating this analysis to the discretionary delay of information problem, is to allow the proprietary cost to be a function of time. For example, suppose that information which is current has a substantial proprietary cost associated with it, but as the information becomes more dated the cost dissipates: specifically, the proprietary cost is a continuous, decreasing function of time which approaches zero after some interval has elapsed. Then, as suggested by the Corollary, as the proprietary cost decreases it 'squeezes out' the disclosure of progressively 'worse news' by lowering the threshold level of disclosure, until eventually a manager is obligated to disclose everything as the proprietary cost approaches zero. This would explain the relation found in empirical work between the quality of the news (e.g., 'good' versus 'bad') and the point in time at which it is disclosed; furthermore, it is an explanation which is consistent with traders evidencing rational expectations about the withholding of information.

Whether managers actually exercise discretion remains an empirical proposition. Although the empirical work in this area is not unambiguous, there is at least a suggestion of this practice. The advantage of my model is that it offers one explanation for why this activity may be observed, in addition to illuminating salient features of this activity.

Appendix: Proof of the Theorem

To prove (i), observe that

$$F(x)=\frac{s}{h_0+s}(x-y_0)+\frac{h_0^{-1}g(x)}{G(x)}+\beta(k(x))-\beta\left(\frac{1}{h_0+s}\right), \tag{A.1}$$

$$F(x)=\{h_0^{-1}-k(x)\}\frac{G(x)}{h_0^{-1}g(x)}+\beta(k(x))-\beta\left(\frac{1}{h_0+s}\right). \tag{A.2}$$

Recalling that $1/(h_0+s)\leqq k(x)\leqq h_0^{-1}$ for all x and that β is a non-decreasing function establishes non-negativity. Furthermore,

$$\begin{aligned}F'(x)&=\frac{s}{h_0+s}+h_0\{k(x)-h_0^{-1}\}+\beta'(.)k'(x)\\&=h_0\left\{k(x)-\frac{1}{h_0+s}\right\}+\beta'(.)k'(x).\end{aligned}$$

Recalling that $k(x)\geqq 1/(h_0+s)$ and $k'(x)>0$ for all x and $\beta'(.)\geqq 0$ by assumption proves (ii): $F(x)$ is an increasing function of x. Continuing using eq. (A.2) to represent $F(x)$,

$$\begin{aligned}\lim_{x\to-\infty}F(x)&\to\lim_{x\to-\infty}\{h_0^{-1}-k(x)\}\lim_{x\to-\infty}\frac{G(x)}{h_0^{-1}g(x)}\\&\quad+\beta\left(\lim_{x\to-\infty}k(x)\right)-\beta\left(\frac{1}{h_0+s}\right)\\&\to\left\{\frac{s}{h_0(h_0+s)}\right\}\cdot 0+\beta\left(\frac{1}{h_0+s}\right)-\beta\left(\frac{1}{h_0+s}\right)\to 0;\end{aligned}$$

in addition, using eq. (A.1) to represent $F(x)$,

$$\begin{aligned}\lim_{x\to\infty}F(x)&\to\lim_{x\to\infty}\frac{s}{h_0+s}(x-y_0)+\lim_{x\to\infty}\frac{h_0^{-1}g(x)}{G(x)}\\&\quad+\beta\left(\lim_{x\to\infty}k(x)\right)-\beta\left(\frac{1}{h_0+s}\right)\end{aligned}$$

$$\rightarrow \lim_{x\rightarrow\infty} \frac{s}{h_0+s}(x-y_0)+0+\beta(h_0^{-1})-\beta\left(\frac{1}{h_0+s}\right)\rightarrow\infty.$$

This establishes (iii) and (iv). Q.E.D.

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