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MEANS OF REDUCING COMPETITIVE COSTS

July 1986

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## Abstract

There have recently been studies which have shown that corporate managers may have incentives to release private information. A common thread through these studies is that the release of private information may also entail costs by providing competitors with valuable information. However, as is shown here, the release of private information may in many cases reduce, rather than enhance, competitive pressures, by lowering competitors' expected output and thereby increasing the expected price of industry output. The reduction in competition alone, then, may be an additional motivation for disclosing private information. An implication of this is that a firm with private information may be willing to join an industry trade association even if it expects to gain little, if any, new information from the association. It also implies that such a firm will not necessarily oppose the mandatory release of additional proprietary information in its financial statements, such as line of business data or earnings forecasts.



## INTRODUCTION

A dominant firm in an industry is often better situated than its competitors to collect proprietary information about future industry conditions. If it does have such information, its competitive position may be affected if it chooses to publicly release it. Analyzing the competitive effects of such a disclosure is the focus of this paper. These effects merit consideration because, as recent research has shown, there may be incentives for corporate managers to disclose private information. Such incentives may arise if the manager's firm is selling new securities and information disclosure would cause the value of the firm to rise (Bhattacharya and Ritter (1983) and Verrecchia (1983)). Or, they may result from the manager's desire to signal to the market his ability to collect timely information about the firm (Trueman (1986)). Alternatively, they may arise if the release would deter potential investors from collecting their own costly information (Diamond (1985)).

A common thread through these models is that the release of private information may also entail costs by providing competitors with valuable information. However, as is shown in this paper, the release of private information may in many cases reduce, rather than enhance, competitive pressures. The reduction in competition alone, then, may be an additional motivation for disclosing private information.

The setting of this paper is similar to that of Novshek and Sonnenschein (1982), Clarke (1983), and Kirby (1985). In their models oligopolistic competitors initially receive private, unbiased, signals of industry demand; the effects of information sharing on firm profits are then analyzed. However, in contrast to their models, here the information of one firm, the dominant firm in the industry, is superior to that of all of its competitors in that it



is a sufficient statistic for their private signals. The dominant firm therefore cannot learn anything new from information sharing in this setting and will only release its information if the disclosure reduces the level of competition. The analysis also differs from previous work in that more general firm production functions are considered and, more importantly, the possibility that the competitors may be able to collect additional, costly, information on their own about industry conditions is allowed.

The dominant firm's decision as to whether or not to release its information is based on the disclosure's effect on the expected output of the firm's competitors. It is shown that in certain settings the disclosure is beneficial to the dominant firm in that it reduces the competitors' expected output and thereby increases both the expected price of industry output and the dominant firm's expected profits. Furthermore, the disclosure benefits the competitors. By giving competitors better information about industry demand the disclosure allows them to make a more informed choice of production level, increasing their profits. It also obviates the need for the competitors to collect their own additional costly information about product demand. Consumers, however, are hurt by the disclosure. They face a smaller expected supply and a higher expected price for the product.

This analysis provides additional predictions for firm behavior. The first is that a dominant firm in an industry might be willing to participate in an industry trade association, where private information about industry conditions is shared, even if the dominant firm expects to gain little, if any, new information from the association. Second, it illustrates that a dominant firm will not necessarily oppose some rulings which mandate the release of additional proprietary information in its financial statements,

such as line of business data or earnings forecasts. Further, since any information disclosed will only be fully used by its competitors if it is believed to be truthfully revealed, the dominant firm will be motivated to have its disclosure audited, thus providing an additional demand for auditing services.

The plan of this work is as follows. In section I the economic setting is described. This is followed in section II by an analysis of the conditions under which a dominant firm in an industry will find it profitable to release proprietary information. In section III is a discussion of possible extensions to the analysis and in section IV are a summary and conclusions.

## I. ECONOMIC SETTING

Consider an industry made up of a dominant firm and one smaller firm, both of whom act as risk neutral agents in a one period world.<sup>1</sup> At the beginning of the period each firm sets an input level,  $q_d$  for the dominant firm and  $q_c$  for the competitor. This produces output for sale at the end of the period of  $f_d(q_d)$  for the dominant firm and  $f_c(q_c)$  for the competitor. The market price of the product produced,  $p$ , is assumed to be a decreasing linear function of the total level of output and to be given by:

$$p = x - y(f_d(q_d) + f_c(q_c)) \quad (1)$$

At the beginning of the period the value of the parameter  $y$  is known to both firms; however, the value of the parameter  $x$  is known with certainty only

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<sup>1</sup>The effect of increasing the number of competitors is discussed in section III.

to the dominant firm. The competitor is assumed to have diffuse prior beliefs for  $x$ . At the beginning of the period, however, it observes an imperfect private signal, denoted here by  $\bar{x}_{12}$ , which is related to  $x$  in the following manner:

$$\bar{x}_{12} = x + \bar{\epsilon}_1 + \bar{\epsilon}_2 \quad (2)$$

where  $E(\bar{\epsilon}_1) = E(\bar{\epsilon}_2) = 0$  and  $E(\bar{\epsilon}_1 \bar{\epsilon}_2) = 0$ . That is, the competitor sees  $x$  perturbed by two sources of noise. The distributions of  $\bar{\epsilon}_1$  and  $\bar{\epsilon}_2$  are further assumed to be symmetric and independent of the value of  $x$ .<sup>2</sup> Note that since  $x_{12}$  is a private signal, the dominant firm does not learn the values of  $\epsilon_1$  and  $\epsilon_2$ .<sup>3</sup>

The competitor, however, may have the opportunity to observe the value of  $x$  exactly before making its production decision by paying an amount  $k > 0$  to purchase such information. Alternatively, the dominant firm might decide to directly reveal the value of  $x$  at the beginning of the period, or might release some statement, such as an earnings forecast, which would eliminate some, but not all, of the uncertainty over  $x$ .<sup>4</sup> Specifically, it is assumed here that such an imperfect signal would eliminate the uncertainty over  $\epsilon_2$  so that the competitor learns the value of  $x$  perturbed only by  $\epsilon_1$ . This information is then equivalent to the competitor observing a private signal,

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<sup>2</sup>For most of the results of this analysis the assumption of a symmetric distribution can be dropped without any effect.

<sup>3</sup>Implications of relaxing this assumption are discussed in section III.

<sup>4</sup>It is assumed here that the dominant firm is motivated not to misrepresent its information so that any information released is disclosed truthfully.

denoted here by  $x_1$ , where:

$$\bar{x}_1 = x + \bar{\epsilon}_1 \quad (3)$$

It is assumed that if the dominant firm does not release any information, the competitor will collect its own information if it has the opportunity to do so.

In setting its input level at the beginning of the period the competitor acts to maximize its expected profits taking into account the relation given in (1). However, the input level of the dominant firm is assumed to be fixed in the relevant range of possible market prices. This assumption, although made to simplify the analysis, does not affect the nature of the results to be presented below on the effects of information disclosure.<sup>5</sup> The competitor's decision problem is then to:

$$\max_{q_c} [\bar{x} - y(f_d(q_d) + f_c(q_c))] f_c(q_c) - q_c \quad (4)$$

where  $\bar{x}$  is the expected value of  $x$  as calculated by the competitor given its information. If the dominant firm releases the value of  $x$  exactly, or if the competitor collects its own perfect information,  $\bar{x}$  will equal  $x$ . Otherwise  $\bar{x}$  will equal  $x_1$  if the dominant firm releases an imperfect signal, or will equal  $x_{12}$  if the dominant firm does not disclose any information.<sup>6</sup> In the analysis

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<sup>5</sup>The reason for this is that if disclosure is profitable for the dominant firm when it does not have the flexibility to adjust its input level, it will certainly be profitable when it does have this flexibility.

<sup>6</sup>This will strictly be true only if the act of information disclosure (or non-disclosure) itself does not reveal any additional information. As will be seen below such will be the case here.

below the optimal input and output levels for the given  $\bar{x}$  will be denoted by  $q_c^*(\bar{x})$  and  $f_c^*(q_c^*(\bar{x}))$  respectively. (For notational simplicity, the dependence of  $f_d$  on  $q_d$ ,  $f_c^*$  on  $q_c^*$ , and  $f_c$  on  $q_c$  will be suppressed below where it will not cause confusion.)

Note that unless the competitor obtains perfect information on  $x$ ,  $\bar{x}$  and  $f_c^*(\bar{x})$  will be random variables from the viewpoint of the dominant firm. For the subsequent analysis let  $E_{12}$  ( $E_1$ ) denote the expected value of  $f_c^*(\bar{x})$  given that the signal  $x_{12}$  ( $x_1$ ) is to be observed by the competitor and  $E_0$  the expected value of  $f_c^*(\bar{x})$  given that the competitor is to observe  $x$  exactly.

Two cases will be of interest here. One is where  $f_c^*(\bar{x})$  is a convex function of  $\bar{x}$  and the other is where it is a concave function. An example of  $f_c^*(\bar{x})$  convex is where  $f_c = aq_c^b$  with  $1/2 < b < 1$  while an example of  $f_c^*(\bar{x})$  concave is where  $b < 1/2$ . To see this note that, given this production function, the first order condition for optimal input  $q_c^*(\bar{x})$ , can be written as:<sup>7</sup>

$$\bar{x}abq_c^{*b-1} - yf_dabq_c^{*b-1} - 2ya^2bq_c^{*2b-1} - 1 = 0 \quad (5)$$

Totally differentiating with respect to  $q_c^*$  and  $\bar{x}$  gives:

$$\frac{dq_c^*}{d\bar{x}} = \frac{-q_c^*}{\bar{x}(b-1) - yf_d(b-1) - 2ya(2b-1)q_c^{*b}} \quad (6)$$

and:

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<sup>7</sup>For this demonstration the dependence of  $q_c^*$  and  $f_c^*$  on  $\bar{x}$  is suppressed.

$$\frac{d^2 q_c^*}{d\bar{x}^2} = \frac{\bar{x}(b-1)bq_c^* - yf_d(b-1)bq_c^*}{(\bar{x}(b-1) - yf_d(b-1) - 2ya(2b-1)q_c^{*b})^3} \quad (7)$$

Also:

$$\frac{df_c^*}{d\bar{x}} = abq_c^{*b-1} \frac{dq_c^*}{d\bar{x}} \quad (8)$$

and:

$$\frac{d^2 f_c^*}{d\bar{x}^2} = ab(b-1)q_c^{*b-2} \left( \frac{dq_c^*}{d\bar{x}} \right)^2 + abq_c^{*b-1} \frac{d^2 q_c^*}{d\bar{x}^2} \quad (9)$$

Substituting (6) and (7) into (9) gives:

$$\frac{d^2 f_c^*}{d\bar{x}^2} = \frac{ab(b-1)(2b-1)q_c^{*b+1}(\bar{x} - yf_d - 2yaq_c^{*b})}{(\bar{x}(b-1) - yf_d(b-1) - 2ya(2b-1)q_c^{*b})^3} \quad (10)$$

The denominator of (10) is negative given that the second order condition is satisfied while, given the first order condition, the numerator is negative if  $1/2 < b < 1$  and positive if  $b < 1/2$ . Then,  $f_c^*$  is convex in  $\bar{x}$  for  $1/2 < b < 1$  and concave for  $b < 1/2$ .

## II. THE EFFECT OF INFORMATION DISCLOSURE ON THE PROFITS OF THE DOMINANT FIRM

At the beginning of the period the dominant firm must decide on its disclosure policy regarding its private information,  $x$ . The set of possible disclosures, denoted by  $D$ , is given by  $D = (\Phi, x_1, x)$  where  $\Phi$  represents no disclosure and  $x_1$  is as defined previously. With the firm's expected profits,

$E(\pi)$ , given by:

$$E(\pi) = E[[x - y(f_d(q_d) + f_c^*(\bar{x}))]f_d(q_d) - q_d] \quad (11)$$

and given that the dominant firm's input level is assumed fixed, information disclosure affects firm profits through its effect on the expected output of the competitor,  $E[f_c^*(\bar{x})]$ . (For the case where the competitor does not learn  $x$  exactly this expected value is calculated by the dominant firm given its knowledge of  $x$  and the distributions of  $\bar{\epsilon}_1$  and  $\bar{\epsilon}_2$ .) Information disclosure will increase the dominant firm's profits if it reduces the expected output of the competitor, and thereby increases the output's expected selling price in the market.

#### A. $f_c^*(\bar{x})$ CONVEX

In order to analyze the effect of information disclosure on the dominant firm's profits in the case where  $f_c^*(\bar{x})$  is convex in  $\bar{x}$  the following lemma is useful:

Lemma 1: If  $f_c^*(\bar{x})$  is convex in  $\bar{x}$ , then  $E_{12} > E_1 > E_0$ . The reverse obtains if  $f_c^*(\bar{x})$  is concave in  $\bar{x}$ .

Proof: The proof follows immediately from Theorem 2 in Rothschild-Stiglitz (1970) by noting that  $x_1$  is equal to  $x$  perturbed by a mean zero random variable and that  $x_{12}$  is equal to  $x_1$  perturbed by another mean zero random variable, independent of the first.

Q.E.D.

Defining one signal as being noisier than another if it is a mean zero perturbation of the latter, Lemma 1 states that for  $f_c^*(\bar{x})$  convex (concave) the expected output of the competitor is higher (lower) the noisier the signal it observes.

Using this result the following is easily shown:

Proposition 1: If (a)  $f_c^*(\bar{x})$  is a convex function of  $\bar{x}$  and (b) the competitor does not have the opportunity to collect perfect information itself, then an equilibrium in which the dominant firm discloses the exact value of  $x$  results in higher profits to it than one in which it either releases imperfect or no information.

Proof: From Lemma 1 the expected output of the competitor increases with the noise of the signal it receives. The dominant firm can then minimize the competitor's expected output and maximize its own profits by providing exact information about  $x$ .

Q.E.D.

The intuition behind the Proposition is straightforward. When the competitor only observes  $x$  with error the signal it receives may be greater than  $x$  (and consequently its estimate of the market price will be too high) or lower than  $x$ . If the firm's output is a convex function of the observed value, the increase in output due to observing a value  $\epsilon$  higher than  $x$  is greater than the decrease in output due to observing a value  $\epsilon$  lower than  $x$ . Consequently, a reduction in the randomness of the error with which  $x$  is



observed induces a reduction in the expected output of the competitor. This in turn raises the expected market price of the product and thereby the dominant firm's expected profits. Information disclosure is therefore valuable to the dominant firm.

B.  $f_c^*(\bar{x})$  CONCAVE

From Lemma 1, if  $f_c^*(\bar{x})$  is concave in  $\bar{x}$ , then the expected output of the competitor is a decreasing function of the noise of the information that the competitor receives about  $x$ . Therefore, in contrast to the previous case considered, if the competitor is not able to collect its own perfect information about  $x$ , the dominant firm should not release any of its private information. The competitor's production decision would then be based solely on the noisy signal  $x_{12}$  and its expected output would be minimized. However, if the competitor does have the ability to collect additional information about  $x$ , it may be in the dominant firm's interest to release an imperfect signal of its own information. The reason for this is that such a disclosure may deter the competitor from collecting its own perfect information and thereby reduce the competitor's expected output. To understand why this is so, it must be shown how the competitor's expected gain from information collection is affected by the nature of the signal initially observed by it. As a prelude to this analysis the following Lemma is useful:

Lemma 2: If the competitor learns the value of  $x$  exactly, its profits will be convex in  $x$ .

Proof: For any  $x$ , the competitor's profits given optimal choice of input,  $\pi^*$ ,

are given by:

$$\pi^* = [x - y(f_d + f_c^*(q_c(x)))]f_c^*(q_c^*(x)) - q_c^*(x) \quad (12)$$

Differentiating with respect to  $x$  gives:

$$\frac{\partial \pi^*}{\partial x} = f_c^*(q_c^*(x)) \quad (13)$$

(remembering that all terms involving  $\frac{dq_c^*(x)}{dx}$  drop out because of the

envelope theorem). Then:

$$\frac{\partial^2 \pi^*}{\partial x^2} = f_c^{*'}(q_c^*(x)) \frac{dq_c^*(x)}{dx} \quad (14)$$

Thus,  $\pi^*$  is convex if  $\frac{dq_c^*(x)}{dx} > 0$ . To verify that  $\frac{dq_c^*(x)}{dx} > 0$  take the first

order condition of profits,  $\pi$ , with respect to  $q_c$ :

$$\frac{\partial \pi}{\partial q_c} = (x - yf_d)f_c'(q_c) - 2yf_c(q_c)f_c'(q_c) - 1 = 0 \quad (15)$$

The  $q_c$  satisfying (15) is the optimal input level,  $q_c^*(x)$ . Totally differentiating (15) with respect to  $x$  and  $q_c^*(x)$  gives:

$$\begin{aligned} f_c^{*'}(q_c^*(x)) + [(x - yf_d)f_c^{*''}(q_c^*(x)) - 2yf_c^{*'}(q_c^*(x)) \\ - 2yf_c^*(q_c^*(x))f_c^{*''}(q_c^*(x))] \frac{dq_c^*(x)}{dx} = 0 \end{aligned} \quad (16)$$

Given that the second order condition is satisfied, so that the term in brackets is negative, and given that output is an increasing function of input,  $\frac{dq_c^*(x)}{dx} > 0$ . Therefore  $\pi^*$  is convex in  $x$ .

Q.E.D.

With this result the following can now be shown:

Lemma 3: The increase in the competitor's expected profits from purchasing exact information about  $x$  is greater the higher the noise of the signal initially observed by the competitor.

Proof: Since profits are a convex function of  $x$ , it follows immediately from Theorem 2 of Rothschild-Stiglitz that the competitor's expected profits, given that perfect information will be collected, are higher the greater the noise of the signal initially observed by the competitor. Its gain from information collection is therefore higher the greater the initial noise.

Q.E.D.

Further:

Lemma 4: The higher the value of the signal initially observed by the competitor the smaller is the increase in its expected profit from purchasing exact information about  $x$ .

Proof: Given any  $\bar{x}$  the expected gain to information collection by the

competitor is given by:

$$\int_{-\infty}^{\infty} [[x - y(f_d + f_c^*(x))]f_c^*(x) - q_c^*(x)]h(x|\bar{x})dx \\ - [[\bar{x} - y(f_d + f_c^*(\bar{x}))]f_c^*(\bar{x}) - q_c^*(\bar{x})] - k \quad (17)$$

where  $h(x|\bar{x})$  is the distribution function for  $x$  given that the competitor has observed a signal equal in value to  $\bar{x}$  and  $k$  is the cost of information collection. In order to prove the Lemma it must be shown that (17) decreases with  $\bar{x}$ . To see this consider a shift in the entire distribution of  $x$  so that  $\bar{x}$  increases by  $\gamma$ . Then the gain given in (17) becomes:

$$\int_{-\infty}^{\infty} [[x + \gamma - y(f_d + f_c^*(x + \gamma))]f_c^*(x + \gamma) - q_c^*(x + \gamma)]h(x|\bar{x})dx \\ - [\bar{x} + \gamma - y(f_d + f_c^*(\bar{x} + \gamma))]f_c^*(\bar{x} + \gamma) - q_c^*(\bar{x} + \gamma) - k \quad (18)$$

Differentiating (18) with respect to  $\gamma$  (and employing the envelope theorem) yields:

$$\int_{-\infty}^{\infty} f_c^*(x + \gamma)h(x|\bar{x})dx - f_c^*(\bar{x} + \gamma) \quad (19)$$

which is negative given the assumption that  $f_c^*(\bar{x})$  is concave. Therefore, the greater the observed  $\bar{x}$  the smaller the gain from collecting information.

Q.E.D.

It follows from Lemmas 3 and 4 that the release of an imperfect signal by the dominant firm affects the competitor's expected gain from information

collection by (1) reducing the noise of the signal initially observed by the competitor and (2) changing the value of the signal initially observed (unless  $x_1 = x_{12}$ ). From Lemma 3 the reduction in noise unambiguously lowers the competitor's expected gain. From Lemma 4 the change in the value of the imperfect signal initially observed by the competitor (from  $x_{12}$  to  $x_1$ ) only reduces the competitor's expected gain if  $x_1 > x_{12}$ . However, if the noise reduction lowers the expected gain sufficiently so that the competitor does not find it profitable to collect its own, perfect, information for any possible value of  $x_1$  revealed, then a policy of partial information disclosure will again be guaranteed to benefit the dominant firm. Since the expected output of the competitor is a decreasing function of the noise of its information (given that  $f_c^*(\bar{x})$  is concave in  $x$ ), having the competitor use only the imperfect signal  $x_1$  rather than collecting and using the exact value of  $x$  will lower its expected output and therefore raise the expected price of the industry output. The following Proposition immediately results:

**Proposition 2:** An equilibrium in which the dominant firm releases an imperfect signal,  $x_1$ , for any  $x$  it observes results in higher expected profits for it than one in which it releases no information if (a)  $f_c^*(\bar{x})$  is a concave function of  $\bar{x}$  and (b) the release deters the competitor from collecting its own perfect information for all possible realized values of  $x_1$ .

Condition (b) of Proposition 2 is important to ensure that information release will be valuable to the dominant firm for all possible values of  $x$ . If condition (b) were not satisfied, then a policy of partial information disclosure for all  $x$  may actually reduce, rather than raise, the dominant

firm's profits. To see this assume that the dominant firm did follow a strategy of releasing an imperfect signal for any value of  $x$  observed. Also assume that condition (b) is not satisfied so that, following from Lemma 4, there would be a critical value of  $x_1$ ,  $x_1^*$  below which the competitor would still collect its own information and above which it would not. Consider now that the dominant firm observes a value of  $x$  less than or equal to  $x_1^*$  and releases an imperfect signal. If the realized  $x_1$  is less than  $x_1^*$  ( $\geq x$ ), the competitor would still collect its own information and its production would be based on the actual value of  $x$ . For any other realization of  $x_1$  (necessarily greater than  $x$ ) the competitor would not collect any additional information but would use the realized value of  $x_1$  to set production. However, this means that the production level set by the competitor would always be greater than or equal to the level which would be set using the actual value of  $x$ . In turn, the expected market price and dominant firm's expected profits would be lower than if the dominant firm revealed no information and the competitor consequently collected its own perfect information. Thus, with condition (b) of the Proposition not satisfied, information release would no longer be uniformly profitable to the dominant firm.

It is easy to show, however, that given the variance of  $\bar{x}_{12}$ , condition (b) of Proposition 2 will be satisfied if the variance of  $\bar{x}_1$  is made small enough. This follows by noting that since the distribution of  $\tilde{\epsilon}_1$  is assumed to be symmetric, an increase in its variance has the same (directional) effect on the expected value of a convex (or concave) function as does a mean zero perturbation of  $\tilde{\epsilon}_1$ . (See Rothschild-Stiglitz for further elaboration.) Then, following from Lemma 3, the increase in the competitor's expected profits from purchasing exact information about  $x$  is smaller the lower the variance of the

signal,  $x_1$ , released by the dominant firm. If the variance of  $\bar{x}_1$  is low enough so that the signal resolves most of the competitor's uncertainty, then, given the cost of information collection, the expected gain to the competitor from its own information collection will become negative for all realized values of  $x_1$ . Condition (b) of the Proposition will be satisfied and a policy of partial information disclosure for all values of  $x$  will be guaranteed to raise the dominant firm's expected profits.

### III. EXTENSIONS OF THE ANALYSIS

Although this analysis has been framed in terms of one competitor, none of the results depend on this assumption; they all continue to hold if there are additional competitors. However, if there are many competitors who are able to share the costs of information collection, it becomes less likely that the dominant firm will be able to deter such collection by the release of a noisy signal. With the per firm cost of information collection reduced given many competitors, the precision of the dominant firm's signal must therefore correspondingly increase if it is to succeed in deterring the competitors' own information collection.

It has also been assumed in this analysis that the dominant firm has no knowledge of the signal initially observed by the competitor; that is, that it does not know the values of  $\epsilon_1$  or  $\epsilon_2$ . If it did, the resulting equilibrium for  $f_c^*(\bar{x})$  concave would change; the dominant firm would always release the exact value of  $x$  (unless the competitor could collect its own perfect information, in which case the dominant firm would be indifferent between releasing  $x$  and releasing nothing). This conclusion comes from the fact that the dominant firm would be motivated to disclose its information exactly whenever it knows that

the competitor is overestimating the market price, in order to get the competitor to lower its output. But this also means, in turn, that if the dominant firm does not release its information, the competitor knows that it is underestimating the price and so will revise upward its estimate. The effect of such a revision process will be to make the dominant firm, in equilibrium, disclose its information no matter what its value.

If, instead, the dominant firm had some, although incomplete, knowledge of the competitor's beliefs, such an extreme equilibrium result need not obtain. The dominant firm would still be motivated to disclose its information exactly if it were sufficiently less favorable than the firm's expectation of the competitor's beliefs. However, if the difference was less pronounced the dominant firm might again have an incentive, in equilibrium, to release only an imprecise signal of its information; the remaining randomness of the competitor's information might be such that its expected output would be lower than if the information were revealed exactly.

#### IV. SUMMARY AND CONCLUSIONS

This analysis has shown that, under certain conditions, a dominant firm's release of information superior to that of its competitor can lower competitive costs by reducing the competitor's expected output. This result therefore provides an additional explanation, not previously advanced, for why a firm would voluntarily release private information. It also implies that a firm may be willing to join a trade association in order to share its information with competitors even if it will not gain any new information from such participation.

The results of this analysis yield several welfare implications. The



expected profits of both the dominant firm and the competitor increase as a result of the information release. The dominant firm benefits from the reduction in the expected output of its competitor because this increases the expected selling price of its product. The competitor's expected profit increases because the competitor observes additional information useful for making its output decision without having to pay for the information. Consumers on the other hand are hurt by this information disclosure since the expected industry output is lower while the expected market price is higher. This latter effect is similar to that which arises under a collusive agreement by firms operating in the same industry and should be recognized by government agencies concerned with regulating the flow of information across firm.

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