PUBLIC DISCLOSURE RULES, PRIVATE INFORMATION-PRODUCTION DECISIONS AND CAPITAL MARKET EQUILIBRIUM

by

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1. Introduction

The effects of prevailing and proposed disclosure rules on capital market equilibrium have been assessed in many ways.[1/] One favorite involves testing for changes in assessed distributions of future values of or rates of return on securities, primarily common stocks. This is the approach used by, for example, Gonedes, Dopuch, and Penman [1976], Benston [1973], Friend and Herman [1964], and Stigler [1964]. Given an explicit or implicit characterization of market equilibrium in terms of probability distributions of securities' future values, this approach essentially assumes that the effects (if any) of changes in disclosure rules will be reflected in investors' assessed values for these distributions' parameters. (Estimates based upon observed security prices are used as proxies for investors' assessments.) In some studies, the parameters' values and investors' inferential behavior are pictured as changing in specific ways if the disclosure rules of interest have their intended effect (as seen by the studies' authors). For example, Friend and Herman [1964] make the following argument about the "full disclosure" aspects of the Securities Act of 1933:

> With full disclosure we would expect less drastic shifts in estimates of expected profitability of a given [security] issue as a result of the greater initial level of economic information (and, presumably, the reduction in the possibility of surprises from this source), a greater scope for scientific investment analysis, a diminished reliance on and use of rumor, and a reduction in the scale of manipulative practices (p. 391; fn. 18).

This argument leads Friend and Herman to expect a reduction in the variances of returns on securities if the 1933 Act's disclosure requirements "were effective" (p. 391).

The above perspective seems to reflect an important implicit assumption commonly made in both academic and nonacademic works in this area. Specifically, it is assumed that a disclosure rule leading to the production of informative signals necessarily alters the nature (e.g., reliability) of the types of signals currently available to investors or the number of different types of signals that are available to investors if it is an "effective" rule.[2/] Thus, if the available empirical results for a given rule are inconsistent with such alterations, the disclosure rule is inferred to be "ineffective," in the sense that it leads to the production of ineffective or noninformative signals insofar as assessing distributions of securities' future values is concerned. (In some studies--such as Benston [1973] and Friend and Herman [1964]--only alterations of a specific type are deemed to be consistent with a rule's being effective.) The same kind of perspective appears to characterize the current debates over alternative disclosure rules for municipalities and for banks and the recently adopted rules for disclosures about "replacement cost" data.[3/]

Overlooked by this perspective are the characteristics of information-production decisions made by market agents on personal account--via individual actions or private forms of collusion (e.g., information-production activities carried out by firms for subscribers or by trade associations for members). If there are any substitution or complementarity relationships among the signals produced on private account and the signals covered by disclosure rules, then the "effectiveness" of the rules cannot, in general, be assessed independently of private information-production activities. Thus, empirical evidence allegedly dealing with the effects of new disclosure rules will, in general, actually reflect both (1) the direct (or "own") effects of the rules on produced information and (2) the effects of any changes in information-production activities pursued on private account and induced by the rules' enactment. Moreover, even if there are no substitution or complementarity relationships, such evidence will, in general, still encompass aspects of decisions made on private account. It will do so because of any induced wealth effects of public information production decisions. These wealth effects may occur for either of three reasons: (1) the effects on equilibrium prices of the informational implications of signals produced as a result of public information-production decisions (i.e., disclosure rules), (2) the effects associated with the incidence of the direct costs of public information-production decisions, and (3) the wealth effects associated with the public information-production decisions' effects on the costs of private information-production decisions. As far as any individual investor is concerned, all of these effects are essentially the same as those induced by changes in firms' other production-investment decisions (i.e., those not dealing directly with information-production activities imposed upon firms via public information-production decisions). The informational implications of the newly produced signals have effects on investors' distributional assessments that are analogous to those of newly produced outputs. The costs imposed upon firms as a result of public information-production decisions are analogous to the costs of producing goods and services. And the external effects of public information-production decisions on the costs of private information-production decisions are analogous to externalities with respect to firms' decisions to produce goods and services and households' private production decisions. (See Ghez and Becker [1975] for a development of the household production function perspective.)

Given the second and third effects mentioned above, it is clear that public information-production decisions can have wealth effects even if the signals produced as a result of those decisions reflect no information beyond that reflected in previously or contemporaneously produced signals. These two possible effects turn on the fact that real resources are, in general, used up in the production of information called for by public information-production decisions. This raises issues of cost incidence and external effects. (Enforcing the rules associated with these decisions is also costly. We include enforcement costs in "production costs.")

The major objective of this paper is to explore some aspects of the relationship between disclosure rules--or, more generally, public information-production decisions--and private information-production decisions. For the most part, we focus on the behavior of an individual agent. Thus, our exploration is one of partial equilibrium analysis. Some important aspects of general equilibrium are, however, discussed.

Our main interest is in the sorts of disclosure rules imposed upon firms by the Securities and Exchange Commission (SEC) and the Financial Accounting Standards Board (FASB). But our remarks and results are really not restricted to these rules. They are equally applicable to the public disclosure rules adopted by, for example, the Food and Drug Administration, the Environmental Protection Agency, and the Federal Trade Commission. Indeed, the rules adopted by these other agencies may be viewed by the SEC and the FASB as substitutes for or complements of the rules adopted by the SEC and the FASB. Thus, these other agencies' actions may be taken into account by the SEC and the FASB when the latter make their own information-production decisions. The other agencies may behave in a similar fashion vis-a-vis the SEC's and FASB's rules.

Finally, note that the sorts of empirical studies considered above are among those to which the FASB and SEC seem to be giving more serious attention in conjunction with their rulemaking activities; see, e.g., the 1977 Report to the SEC by the Advisory Committee on Corporate Disclosure (e.g., Vol. 1, Ch. 22), the testimony presented before the SEC by Collins and Dent [1978], and the analyses presented in FASB [May, 1978]. Thus, the explorations given here seem to be both important and timely.

This paper is organized as follows. The setting of the problem investigated is identified in Section 2. Important notation and assumptions are given in Section 3. Details on the characterization of information-production that is used throughout are given in Section 4; the opportunities for and costs of information-production are specified in that Section. Section 5 provides formal statements of (1) an investor's consumption/investment problem conditional on his information-production decision and (2) an investor's information-production problem. The implied optimality conditions and demand function for privately produced signals are given in Section 6. Section 7 uses various aspects of this demand function in an exploration of the effects of public information-production decisions. For the most part, our exploration is one of partial equilibrium analysis. Remarks on general equilibrium issues and areas for further work appear in Section 8. Section 9 contains a summary.

2. Problem Setting

For simplicity, attention is restricted to a single-period setting, extending from the beginning of period t (or "at time t") to the beginning of period t + 1 (or "at time t + 1"). The essential aspects of our analysis can be extended to a multiperiod setting along the lines suggested by, e.g., Gonedes and Dopuch [1974].

Each market agent is assumed to behave as if he faces two related problems: (1) making an optimal consumption/portfolio decision and (2) making an optimal information-production decision. Initially, we assume that private-sector information-production activities are conducted by individual agents. We then consider private forms of collusion, e.g., information-production via "firms."

Information-production activities lead to the production of signals. These signals serve as conditioning arguments in agents' assessed probability distributions of returns on securities. The timing assumptions pertinent to all of this are as follows. Agents come to the market at the beginning of period t with resources (e.g., labor services, financial assets, etc.) to be allocated to consumption expenditures, portfolio holdings, and information-production at time t. Information-production decisions are made before any consumption/portfolio decisions are made. Of course, any agent may choose to allocate nothing to information-production, and thus choose to use only information initially available to him when he came to the market and any newly produced information available via public information-production decisions made at time t. Public information-production decisions are those imposed upon the private sector by regulatory bodies, such as the SEC, the FASB, and the various stock exchanges.

The outlays for private and public information-production activities are made at the beginning of period t. After these outlays are made, the results (i.e., produced signals) become available. Then consumption/portfolio decisions are made. Whatever amount of an investor's wealth is not allocated to information-production is fully utilized in making his optimal consumption/portfolio decisions. The assessed probability distributions of securities' future values used by an investor in making these decisions are conditional upon the available results of both the investor's private information-production decisions and the public information-production decisions made at time t. The results of public information-production decisions are, for purposes of this paper, defined to include whatever signals are made available to all agents as a result of public disclosure rules in effect at time t (and thus adopted at or before time t). All public information-production decisions are assumed to be known when individuals make their own (private) information-production decisions. At time t + 1 the current period's realized values of securities are known.

Each investor is assumed to behave as if he is a price-taker in the capital market and all other markets too. Thus, when making his decisions at time t with respect to both information-production and consumption/portfolio allocations, all prevailing prices--viewed as the currently proposed equilibrium prices announced by a Walrasian auctioneer--are taken as givens by each individual. The information-production setting adopted here is, therefore, similar to the one often used in works on information and product quality, such as the recent paper by Kihlstrom [1974]. This similarity is not coincidental. As far as fundamental economic issues are concerned, an individual's producing information about uncertain attributes of a product or service--such as appliances, automobiles, medical services, or legal services--is obviously analogous to his producing information about the uncertain attributes of the property rights encompassed by firms' securities. The distribution functions of those rights' future payoffs are among those attributes.

3. Important Notation and Assumptions

Some important notation used throughout this paper is defined below. All definitions pertain to one capital market agent, unless otherwise indicated. For convenience each firm is assumed to issue only one type of security (e.g., "common stock").

N = The number of firms whose securities are traded. It is not essential for $N < \infty$ to be held fixed.

n_{jt} = The number of the jth firm's securities purchased at time t after the results of the time t information-production decisions are available.

$\underline{n}_t \equiv (n_{1t}, n_{2t}, \ldots, n_{Nt})$.

n^0_{jt} = The number of the jth firm's securities held before any time t decisions are made, i.e., the endowment holdings.

c_t = The time t consumption expenditure.

w_t = Total wealth at the beginning of period t, before outlays for private information-production are made.

η_i = The ith agent's private information-production decision variable (explained below).

η_A = The public information-production decision variable (explained below).

$\underline{\eta} \equiv (\eta_i, \eta_A)$, a vector decision variable.

$\underline{\theta}_{\eta}$ = A vector signal produced via the information-production activities indexed by the vector $\underline{\eta} = (\eta_i, \eta_A)$. The components of this vector consist of the signals associated with private information-production activities and those associated with public information production activities.

π_{jt} = The price of the jth firm's security at time t, conditional on all of its production-investment activities as of time t.

$\underline{\pi}_t \equiv (\pi_{1t}, \pi_{2t}, \ldots, \pi_{Nt})$.

$F(\underline{\pi}_{t+1}|\underline{\theta}_{\eta},\underline{\eta})$ = The joint distribution function of firms' securities' prices at time $t + 1$ assessed conditionally (at time t) on the signal, $\underline{\theta}_{\eta}$ resulting from the information-production decision $\underline{\eta}$.

$C(\eta_i|\eta_A)$ = The private cost of the information-production decision, η_i, conditional on η_A.

$u(c_t, c_{t+1})$ = the agent's utility function for consumption expenditures at times t and $t + 1$. (In a single period setting, $c_{t+1} = w_{t+1}$ under the assumptions given below.)

Throughout, tilde (˜) is used to denote a random variable.

The single period utility function, $u(c_t, c_{t+1})$, is assumed to be nondecreasing and strictly concave in c_t and c_{t+1}. The cost function, $C(\eta_i|\eta_A)$, is assumed to be nondecreasing and strictly convex in the decision variable η_i, which is discussed in Section 4. Continuity of the second derivatives of both functions is also assumed. Note that $C(\eta_i|\eta_A)$ pertains to the costs borne by an individual as a result of his own (private) information-production activities, given the public information-production activities adopted (or re-adopted) at time t. Not included in the value of $C(\eta_i|\eta_A)$, for a given value of $\underline{\eta}$, are any explicit costs directly imposed on this individual as a result of the time t public information-production decisions. More on this later. The prevailing prices of factors of production constitute an implicit conditioning argument of this cost function.

4. Characterization of Information-Production

4.1 Production Opportunities

The available opportunities for information-production will be characterized in terms of the sufficiency conditions developed by Blackwell [1951, 1953]; see, also, Marshak and Radner [1972; Ch. 2]. This approach provides a convenient means of ordering alternative feasible information-production decisions, indexed by the values of $\underline{\eta} = (\eta_i, \eta_A)$, in terms of the "amount" of information corresponding to each decision. Using this approach to order alternative information-production possibilities is analogous to using quantities of goods or services to order alternative consumption bundles or output vectors under the usual nonsatiation assumption.

Let $\tilde{\theta}_{\underline{\eta}}$ be the information random vector corresponding to the information-production decision $\underline{\eta} = (\eta_i, \eta_A)$. The components of this vector pertain to attributes of the economy that are relevant to assessing the joint distribution of securities' future values. The specific attributes represented in $\tilde{\underline{\theta}}_{\underline{\eta}}$ depend on the existing technology for information production and whatever asset pricing model characterizes investors' choice behavior. For some values of $\underline{\eta}$, the distribution function of $\tilde{\underline{\theta}}_{\underline{\eta}}$ may imply a constant value for, say, the k^{th} of the coordinates of $\tilde{\underline{\theta}}_{\underline{\eta}}$ for all values of the other coordinates. In this case, the underlying information production decision never alters available information on the k^{th} attribute of the economy. Producing no information beyond that already available--and thus incurring no information-production costs at time t--is assumed to be feasible. We denote this decision by the value $\underline{\eta} = (0, 0)$.

For each value of $\underline{\eta}$, the signal ultimately available is the realized value of $\underline{\tilde{\theta}}_{\eta}$--which is known at time t. Each signal induces a conditional joint distribution, $F(\underline{\pi}_{t+1}|\underline{\theta}_{\eta}, \underline{\eta})$, of securities' future values, $\underline{\tilde{\pi}}_{t+1}$. Thus, alternative information-production decisions involve, in effect, decisions to incur costs for the purpose of re-assessing the distribution function of $\underline{\tilde{\pi}}_{t+1}$.

It is assumed that the index $\underline{\eta}$ is defined so that for a given value of η_A, say, $\bar{\eta}_A$, $\eta_i' > \eta_i''$ implies that the information random vector $\underline{\tilde{\theta}}_{\eta'}$ is "sufficient" for the information random vector $\underline{\tilde{\theta}}_{\eta''}$, where $\underline{\eta}' = (\eta_i', \bar{\eta}_A)$ and $\underline{\eta}'' = (\eta_i'', \bar{\eta}_A)$, in the sense implied by the results in Blackwell [1951, 1953]. Loosely speaking, $\underline{\tilde{\theta}}_{\eta'}$ is sufficient for $\underline{\tilde{\theta}}_{\eta''}$ when, conditional on the true state of the economy and on an observation on $\underline{\tilde{\theta}}_{\eta'}$, the distribution function of $\underline{\tilde{\theta}}_{\eta''}$ is independent of the underlying state of the economy. It only depends on the given value of $\underline{\tilde{\theta}}_{\eta'}$. In short, once we observe a value of $\underline{\tilde{\theta}}_{\eta'}$, we can learn nothing more about the given state of the economy from any observation on $\underline{\tilde{\theta}}_{\eta''}$. In this sense, $\underline{\eta}'$ is "more informative" than $\underline{\eta}''$. Technical details on this characterization are available from Blackwell [1951, 1953] and Marshak and Radner [1972; pp. 64-67].

Each component of $\underline{\eta}$ is assumed to be a continuous decision variable. As indicated, the first component, η_i, indexes the i^{th} investor's private information-production decision. The second component, η_A, indexes the public information-production decision. The value of the first component is, of course, the only potentially distinguishing feature of $\underline{\eta}$ for different investors. Each investor is assumed to behave as if η_A is exogenously given when each makes his optimizing private information-production decision. And our definition of sufficiency is conditional on this value.

The ordering of information systems with respect to the index η_A is assumed to be in terms of the aggregate cost of producing the signals called for by η_A conditional on all private decisions. This aggregate cost is assumed to be increasing in η_A. This does not imply, however, that they are increasing for each firm. If, for example, the additional signals associated with η_A are already being produced by a given firm, then that firm can satisfy the new public information-production decision without incurring additional information-production costs.

4.2 Production Costs and Related Issues

The function $C(\eta_i|\eta_A)$ gives an individual investor's total explicit costs of private information-production activities, conditional on the contemporaneous public information-production activities.[4/] But these are not the only costs ultimately imposed on each individual. Public information-production activities may also impose costs on a given individual. And, in general, they necessarily impose some costs on the collection of all market participants.

Public information-production decisions may impose costs on a given agent in at least two ways. First, if these decisions are financed by taxes, then the required tax payments of an individual are costs to him of η_A. Alternatively, these decisions may be financed by expenditures of the firms upon which the public information-production decisions (or "disclosure rules") are imposed. In this case, the implied decreases in the equilibrium values of these firms (due to the outflows of real resources induced by these decisions) represent costs imposed upon the holders of the firms' shares, at least in a first-round analysis. Taken by itself, any such cost leads, in a first analysis, to a reduction in the initial wealth of any agent holding the securities of affected firms when the public information-production decision is made.[5/]

Of course, the identity of the ultimate bearers of these costs depends upon incidence issues similar to those entering into an analysis of the ultimate bearers of taxes. If, for example, public information-production decisions are financed via expenditures by affected firms, then those firms' cost functions are altered. Other things equal, this implies changes in the equilibrium prices of the firms' outputs. Thus, in the end, the consumers of these outputs bear some of the costs of public information-production decisions (and, correspondingly, the holders of the affected firms' securities bear less of the costs than they would otherwise bear). The holders of the affected firms' securities would have to assess the implications of these possibilities just as they would have to assess the implications of a change in any other determinant of a firm's cost function.

For some firms, public information-production decisions will not be entirely cost-imposing decisions even when these decisions are financed by expenditures imposed on firms. Such decisions may also shift the demand functions faced by some firms, such as the firms that can produce the services used in the production of signals called for by public information-production decisions. Firms that provide data processing and external accounting services are obvious examples. Indeed, under some conditions (e.g., sufficiently high fixed costs) the public decision may shift a market demand function by enough to establish a viable market for some outputs whose production was previously not profitable--and thus it may induce the formation of firms (or divisions of firms) that specialize in the production of signals called for by public information-production decisions or in the provision of "educational programs" and consulting services pertinent to the production of such signals.[7/] In addition, they may impose "quality standards" or other restrictions on firms that provide some outputs (such as the auditing services related to the SEC's reporting requirements). Such restrictions may affect both demand functions and supply functions. In any event, both supply function and demand function influences are among the factors that securityholders are assumed to consider (along with other attributes of firms' production-investment decisions) when assessing distribution functions of firms' future values.

For convenience, all public information-production decisions are assumed to be financed by expenditures made by the affected firms. Also, it is assumed that securityholders take account of the resource inflow and outflow implications of these decisions, due to the latter's effects on demand or supply functions. The net real resource implications of η_A are determinants of the changes in an investor's wealth corresponding to whatever value of η_A is ultimately adopted and imposed upon firms whose securities he holds. In short, insofar as the implications for investors' initial wealths are concerned, a net real resource flow induced by the selection of η_A is assumed to be treated in the same way as are the net real resource flows induced by firms' other operating activities.

As indicated earlier, changes in public information-production decisions may also have informational implications that lead to changes in securities' current equilibrium prices (see Sec. 1). The latter changes also lead to changes in investors' initial wealths, as would changes induced by revisions in the characteristics of firms' other operating activities.

5. Problem Formalities

5.1 The Post- and Pre-Signal Conditional Consumption/Investment Problems

For a given produced signal, $\tilde{\underline{\theta}}_{\underline{\eta}} = \underline{\theta}_{\underline{\eta}}$, conditional on the information-production decision $\underline{\eta}$, the investor's choice problem is to select c_t and $\underline{n}_t$ so as to maximize expected utility:

$$\max_{(c_t, \underline{n}_t)} U[c_t, \underline{n}_t | \underline{z}] = \max_{(c_t, \underline{n}_t)} \int_{-\infty}^{\infty} u(c_t, c_{t+1}) dF(\underline{\pi}_{t+1} | \underline{\theta}_{\underline{\eta}}, \underline{\eta})$$

subject to $\quad K(c_t, \underline{n}_t | \underline{z}) = w_t - c_t - C(\eta_i | \eta_A) - \sum_j \pi_{jt} n_{jt} = 0$

where

$$c_{t+1} = \sum_j \pi_{jt+1} n_{jt} + y_{t+1} = w_{t+1} ,$$

$$w_t = \sum_j \pi_{jt} n^0_{jt} + y_t ,$$

$$\underline{z} = (w_t, \underline{\pi}_t, \underline{\theta}_{\underline{\eta}}, \underline{\eta}) ,$$

and y_t and y_{t+1} are the investor's income receipts at times t and $t + 1$, respectively. Both income receipts are assumed to be known at time t.

The optimal solution for this problem is denoted by $c^*_t(\underline{z})$ and $\underline{n}^*_t(\underline{z})$.

Conditional on $\underline{\eta}$ and before any produced signal (or value of $\tilde{\underline{\theta}}_{\underline{\eta}}$) is available, the investor's conditional expected utility is given by

$$V(\hat{\underline{z}}) = E_{\tilde{\underline{\theta}}_{\underline{\eta}}} [U(c^*_t(\tilde{\underline{z}}), \underline{n}^*_t(\tilde{\underline{z}}) | \tilde{\underline{z}})]$$

where $\underline{\tilde{z}} \equiv (w_t, \underline{\pi}_t, \underline{\tilde{\theta}}_\eta, \underline{\eta})$, $\underline{\hat{z}} \equiv (\bar{w}_t, \underline{\pi}_t, \underline{\eta})$, and $\bar{w}_t = w_t - C(\eta_i|\eta_A)$.

For a fixed value of $C(\eta_i|\eta_A)$, it is known that $V(\underline{\hat{z}})$ is an increasing function of η_i, which is an index of sufficiency. This is implied by the results given in Blackwell [1953]. See also Marshak and Miyasawa [1968; Theorem 6.3]. When changes in the value of the strictly convex cost function, $C(\eta_i|\eta_A)$, are recognized, this result may not hold. Thus, in general, optimizing with respect to η_i need not lead to selecting maximal sufficiency on private account.

From our assumption about the strict concavity of the utility function $u(c_t, c_{t+1})$, it follows that maximum expected utility--given by the post-signal optimization problem--is a concave function of $\bar{w}_t$. Thus, $V(\underline{\hat{z}})$ is a concave function of $\bar{w}_t$.

We shall assume that $V(\underline{\hat{z}})$ is a twice differentiable function of $\underline{\hat{z}}$ and that $V(\underline{\hat{z}})$ is a strictly concave function of η_i, with a maximum at some positive finite value of $\underline{\eta}$.

5.2 The Information-Production Problem

At the beginning of period t, the agent's private information-production problem is as follows:

$$\underset{\eta_i}{\underline{\max}}\ V(w_t - C(\eta_i|\eta_A),\ \underline{\eta}, \underline{\pi}_t)$$

$$\underline{\text{subject to}} \quad C(\eta_i|\eta_A) \leq w_t \ .$$

The quantity $w_t - C(\eta_i|\eta_A)$ is the amount available for making consumption/investment decisions after paying for the resources used by information-production activities pursued on private account.

6. Optimality Conditions

6.1 First Order Condition

The first order optimality condition for the information-production problem is:

$$V_i' - V_w' C_i' = 0$$

where $V_i' \equiv \partial V/\partial \eta_i$, $V_w' \equiv \partial V/\partial w_t = V_{\bar{w}}'$, and $C_i' \equiv \partial C(\eta_i|\eta_A)/\partial \eta_i$. The first term in this condition reflects the effect of $d\eta_i$ on $V(\hat{\underline{z}})$ holding the costs of information production constant. Thus, this first term reflects the effects of any changes in the investor's assessed joint distribution of securities' future values, conditional on given costs of private production of signals and conditional on the public information-production decision in effect at time t. Since an increase in η_i corresponds to a "more informative" set of information-production activities, $V_i' > 0$; see Section 4. By assumption, $C_i' > 0$. The assumed concavity of the single period utility function implies $V_w' > 0$ for the set of feasible information-production decisions, as defined in Section 5.

The first-order condition implicitly defines the optimal value of η_i as a function of η_A, one of the exogenous parameters of the investor's private information-production problem. Since $V(\hat{\underline{z}})$ is at least twice continuously differentiable in η_A, the value of η_i that satisfies the first and second order optimality conditions is a continuously differentiable function of η_A; see Taylor [1955; pp. 241 ff.]

6.2 Second Order Condition

For later use we note that the second order optimality condition is:

$$D \equiv V''_{ii} + C'_i V''_{ww} C'_i - V'_w C''_{ii} - 2V''_{wi} C'_i < 0$$

where V''_{ii} and C''_{ii} are the second partial derivatives of $V(\cdot)$ and $C(\cdot|\cdot)$, respectively, with respect to η_i; V''_{ww} is the second partial derivative of $V(\cdot)$ with respect to w_t; and V''_{wi} is the partial derivative of V'_w with respect to η_i.

6.3 Reaction Function

The first order optimality condition must be satisfied for every value of η_A. This requirement leads to a function, $\eta_i^*(\eta_A)$, giving the optimal value of η_i^* for each value of η_A. The Implicit Function Theorem (see, e.g., Taylor [1955; pp. 241 ff.]) can be exploited in order to solve for this function of η_A.

The relevant mechanics are given in the Appendix. For immediate purposes we simply note that application of the Implicit Function Theorem leads to the formal result:

$$\frac{d\eta_i^*}{d\eta_A} = -\frac{1}{D}\frac{\partial}{\partial \eta_A}\left(\frac{\partial V}{\partial \eta_i}\right) + \frac{1}{D}\frac{\partial}{\partial w_t}\left(\frac{\partial V}{\partial \eta_i}\right)\left[C'_A - \frac{dw_t}{d\eta_A}\right]$$

$$= \text{Substitution Effects} + \text{Wealth Effects},$$

where $-(d\bar{w}_t/d\eta_A) = C'_A - (dw_t/d\eta_A)$, from the definition of $\bar{w}_t$.

The first term in the above expression captures the substitution effect of $d\eta_A$ on the use of private information-production possibilities in the production of expected utility. The second term captures the wealth effect of $d\eta_A$ on the demand for privately produced signals. As indicated earlier (see Sections 1 and 4.2), this wealth effect may be due to informational implications, induced shifts in firms' demand or supply functions, or the external effects of public information-production decisions on the privately-borne costs of private information-production activities.

In order to assess the implications of $d\eta_A$ for $d\eta_i^*$, the partial derivatives of $\partial V/\partial \eta_i$ with respect to η_A and w_t must be "signed." Consistent with what usually occurs in demand theory, this is not accomplished by the implications of the assumptions made about the utility function $U(\cdot)$ or the cost function $C(\cdot)$. The discussion in the next section will consider several alternative sets of conditions about these partial derivatives as well as other determinants of the effects of $d\eta_A$ on $d\eta_i^*$.

Suffice it to note here that the usual assumption implicit in much empirical and theoretical work on public disclosure rule changes is likely to hold only by coincidence. Specifically $d\eta_i^*/d\eta_A \neq 0$, in general. In short, changes in public information-production decisions will lead, in general, to changes in private information-production decisions. The net effect of both types of change on both the nature and "amount" of produced information available to investors may, therefore, be quite different from what is inferred by fixating on only the public information-production (e.g., disclosure rule) decision(s). Similarly, the net effect on capital market equilibrium may be quite different. This is particularly important for studies such as those referenced in Section 1--with respect to interpreting empirical results and designing tests of hypotheses.

The importance of induced private actions in an assessment of regulatory provisions' effects arises, of course, in other areas too. For example, the ultimate effects of "safety legislation" (e.g., required installation of seat belts in automobiles) and of public expenditures on the protection of property rights (e.g., governmental expenditures on police protection) depend on individuals' decisions made on private account (e.g., voluntary efforts to drive safely and voluntary expenditures on private police forces). That is, the ultimate effects of such regulatory provisions depend on the provisions' direct (nominal) effects on the allocation of resources and on the effects of induced private actions on the allocation of resources. These sorts of complications have received considerable attention in the economics literature; see, e.g., Peltzman [1975] and Bartel [1974] for illustrative analyses. What is surprising is that public information-production decisions of the sort pertaining to external accounting have not been analyzed along the same lines.

7. Some Effects of Changes in Public Information-Production Decisions

7.1 Preliminary Remarks

At the outset, we assume $V''_{iw} > 0$; i.e., we assume that private information-production activities are "normal" factors in the production of expected utility. Similarly, $V''_{wA} > 0$ is assumed. In effect, this means acceptance of Wicksell's Law vis-à-vis the factors η and w_t insofar as producing expected utility is concerned; see Rader [1972; p. 99].

Neither one of these assumptions about second derivatives seems unreasonable. The productive characteristics of information systems used to produce signals for probability assessments do not depend upon the amount of wealth that will be allocated conditionally on the probability assessments. But the amount of wealth does define the scale of activities with respect to which an information system can be exploited. And it seems reasonable to expect the information system to be more productive in the production of expected utility when it can be exploited on a larger scale, given the costs of the system. This is the condition given by the assumptions $V''_{iw} > 0$ and $V''_{Aw} > 0$.

A seemingly useful analogue for this condition is the case of a pure Samuelsonian public good--for which there are no "congestion" effects--and an increase in the size of the clientele given access to the public good. In this (admittedly extreme) case, every member of the clientele benefits from the public good, independently of the size of the clientele. If all members of the clientele are identical, in terms of tastes, endowments, etc., then one can represent the changes in aggregate "benefits" as being proportional to the changes in group size.

Similarly, since a unit of wealth is identical to any other unit and since the productivity of a produced signal in the assessment of probability distributions is the same for every unit of wealth--given our price-taker assumption--the "benefits" of an information system can be represented as increasing in the number of units of wealth. In our above discussion, these "benefits" are represented by the productivity $(V'_i$ or $V'_A)$ of information in the production of expected utility.

The way that private (public) information-production decisions affect the marginal productivity of public (private) information-production is reflected in the sign of V''_{iA}--which equals V''_{Ai} because of the continuity properties of $V(\cdot)$. If $V''_{iA} > 0$, then these factors of production are used in conjunction with each other rather than as substitutes, for given costs and wealth.[6] At the outset, $V''_{iA} > 0$ is assumed.

7.2 No Cost Effect

Consider the simple case wherein changes in the public information-production decision have no effect on the cost function for private information-production. That is, $C'_A = 0$. In this case:

$$\frac{d\eta^*_i}{d\eta_A} = \left(\frac{V''_{wA}C'_i - V''_{iA}}{D}\right) - \left(\frac{V''_{iw} - V''_{ww}C'_i}{D}\right)\frac{dw_t}{d\eta_A} \quad .$$

$$= \begin{pmatrix}\text{Substitution}\\ \text{Effect}\end{pmatrix} - \begin{pmatrix}\text{Wealth}\\ \text{Effect Coefficient}\end{pmatrix}\begin{pmatrix}\text{Change in}\\ \text{Wealth}\end{pmatrix} .$$

The nonwealth (i.e., the substitution) effect of $d\eta_A$ on $d\eta^*_i$ is ambiguous; it depends on the magnitudes of the elasticities of the marginal productivities of private information-production and of wealth, with respect to public information-production. This differs from the "usual" case in demand theory, wherein the substitution term is unambiguously negative. If $d\eta_A$ has a greater effect on the marginal productivity of wealth, $d\eta_A > 0$ will--holding $\bar{w}_t$ constant--lead to $d\eta_i^* < 0$, since $D < 0$ according to the second order optimality conditions and since $\bar{w}_t$ constant implies w_t constant when $C_A' = 0$. This implies, of course, that empirical assessments of the effects of disclosure law changes will, other things constant, lead to underestimates of their "own" effects on agents' inferences--unless such assessments are based on adequate controls for the induced changes in η_i^*.

This kind of case can arise when public information-production decisions do, in fact, lead to improved consequences of allocating a given amount of wealth to present consumption and portfolio formation--as reflected in the increased marginal productivity of wealth--by permitting improved (e.g., more precise) inferences about securities' joint distribution of returns without affecting the costs of feasible private information-production decisions (i.e., $C_A' = 0$). This may arise when, e.g., the disclosure rule changes pertain to signals whose implications can only be crudely ("less precisely") assessed via feasible private decisions and whose implications are demanded for use in conjunction with the implications of privately produced signals. Changes in disclosure rules pertaining to "illegal" corporate payoffs, the components of banks' portfolios, municipal securities, leases, lines of business and the details of management/auditor conflicts may fall into this category.

Suppose constancy of $\bar{w}_t$ and, thus, $dw_t/d\eta_A = 0$, does not hold for for every agent. The impact of $dw_t/d\eta_A$ on η_i^* depends on the marginal productivities of η_i and w_t. Since $V_{ww}'' < 0$ (because $U(\cdot)$ is strictly concave) and since $C_i' > 0$, $D < 0$, and $V_{iw}'' > 0$, the multiplier of

$dw_t/d\eta_A$ in the above expression is strictly negative--increasingly so the larger is the effect of w_t on the marginal productivities of η_i and w_t (evaluated at η_i^*). In short, the effect of $d\eta_A$ will, other things equal, depend on the distribution of wealth across agents with different preferences and different values of η_i^*. Moreover, since the values of these marginal productivities for a given agent depend upon the informational implications of $\underline{\eta}$ as seen by that agent, the ultimate aggregate effects of $d\eta_A$ also depend on the nature and heterogeneity of investors' probability assessments. This variety of determinants of the effect of $d\eta_A$ has, to my knowledge, not been recognized in any of the available empirical assessments of disclosure laws, including those that purport to be based on explicit theoretically sound models of resource allocation. To date, these assessments appear to have been based on the implicit assumption that the marginal productivities of private information-production decisions and wealth are unaffected by public information-production decisions or that the latter decisions affect neither the use of real resources nor probability assessments (and thus $dw_t/d\eta_A = 0$ for all agents). Since many of these studies refer to resource allocation and the "information content" of public disclosure rules (see, e.g., Benston [1973], Collins [1975; Section 12], and Gonedes, Dopuch, and Penman [1976], among others), the implicit assumption that $dw_t/d\eta_A = 0$ for all agents is, to say the least, perplexing. Indeed, since these studies purport to provide results from tests for "information content," the implicit assumption that $dw_t/d\eta_A = 0$ for every agent seems entirely unwarranted--unless the aggregate effects of changes in w_t are assumed to "net out" to no effect.

Of course, the ultimate value of $dw_t/d\eta_A$ for any given holder of some firm's securities will depend, in part, on: (1) the way in which the public information-production decision is financed (see Section 4.2) and on (2) the extent and nature of any "cost shifting" that may occur. The latter determinant raises the same kinds of issues that arise regarding tax shifting; see, e.g., Hyman [1973; Ch. 8] for a discussion of the latter. A third determinant is the nature of the firm's accounting system. For example, for some firms the immediate costs (to the firms) of disclosure rules pertaining to, say, "line of business" data may be low (relative to other firms' costs) because these data are already incorporated into the firm's internal accounting system. Or they may amount to zero, as in the case of a "single line" firm. Quite trivially, whether a firm has to bear any information-production costs under a given disclosure rule depends upon whether it has anything to disclose (in accordance with the rule). In general, the costs of complying with disclosure rules will differ across firms because of the differential scale of their operations or because of the differential mix of their activities. Each of these factors can induce systematic differences in the values of $dw_t/d\eta_A$ (and thus $d\eta_i^*/d\eta_A$) for the agents holding different firms' securities. These potential systematic differences among values of $d\eta_i^*/d\eta_A$ across agents are in addition to the differences ascribed to differences among utility functions, probability assessments, and wealth endowments (see above).

7.3 No Cost Effect ($C_A' = 0$) and the Two-Parameter Asset Pricing Model

An interesting special case arises when the Sharpe/Lintner version of the two-parameter asset pricing model adequately characterizes capital market equilibrium.[7/] In equilibrium, this version implies that each agent holds a portfolio consisting of the market portfolio and lending or borrowing at a "risk-free" (i.e., zero variance) rate. Also note that this version is not, in general, inconsistent with probability assessments that differ across investors. This depends on the nature of the differences; see, e.g., Gonedes [1976] and Lintner [1969] for pertinent analyses. Thus, invoking this version in a discussion of information-production activities that may differ across investors involves no inherent theoretical flaw.

Suppose that the public information-production decision corresponding to $d\eta_A$ applies to all issuers of securities, though not necessarily in a uniform way. In this scenario all agents bear some fraction of the aggregate public information-production costs attributable to $d\eta_A$, no matter how this aggregate is supposed to be allocated across firms and no matter what kind of cost-shifting occurs amongst firms. The only factor that might affect the costs ultimately borne by a given agent is the fraction of his portfolio invested in the risky component of every agent's optimal portfolio, viz., the market portfolio. If, for example, the costs borne by issuers of risky securities exceed those borne by issuers of the "risk-free" asset, then holders of increasingly risky portfolios (corresponding to larger investments in the market portfolio) bear a larger fraction of the costs. Thus, if the riskiness of an agent's optimal portfolio is an increasing function of his wealth, then--in equilibrium--the "rich pay more" towards financing public information-production decisions.

Of course, the informational implications of $d\eta_A$ may be greater for risky securities than they are for the riskless asset. Thus, even though the "rich" may contribute more towards cost coverage, they may end up being better off in terms of the ultimate value of $dw_t/d\eta_A$ or, more importantly, in terms of maximum expected utility based on their optimal consumption/portfolio decisions. In other words, they may get more in exchange for their greater contribution towards financing public information-production decisions.

7.4 No Cost Effects; Substitute Signals

When privately and publicly produced signals are, conditional on $\eta_i^*(\eta_A)$ and η_A, substitutes (i.e., $V''_{iA} < 0$), then the leading term of the expression for $d\eta_i^*/d\eta_A$ always reinforces the wealth effect when $dw_t/d\eta_A \leq 0$, in contrast to the case of complements $(V''_{iA} > 0)$. Increases in η_A always lead to decreases in η_i^*. This is the kind of situation one expects when, for example, the produced signals corresponding to $d\eta_A$ have implications identical to signals produced on private account. In this case, empirical results on the effects of $d\eta_A$ may lead one to infer "no effects"--and thus lead one to conclude that $d\eta_A$ leads to the production of "useless" signals--even though those signals are, in fact, informative. In other words, the change in public information-production decisions does lead, in this situation, to the production of signals that alter probability assessments. It is the case, however, that substitutes for those signals were already being produced. Thus, the change in η_A need not, by itself, have any direct effect on the signals ultimately used by investors in pricing out securities. (See fn. no. 2.)

Of course, the change in η_A does affect matters through its effects on w_t for each investor. In the case of perfect substitutes, there are no new informational implications, by definition. Thus, the effects of a change in η_A on w_t will turn on shifts in, for example, firms' cost functions and demand functions.

Suppose, for example, that adequate substitutes (e.g., approximations) for "replacement cost data" are produced on private account. Then, new rules requiring public disclosures of these signals may have few (if any) effects even if those signals are informative. But upon recognizing why no effects are detected, one could hardly argue that the produced signals corresponding to the disclosure rule change reflect no information pertinent to assessing securities' joint distribution of returns.[8/] Given the spate of replacement-cost approximation procedures made available by and to analysts, consulting firms, and academics, this scenario does not seem "farfetched."[9/] Indeed, the "replacement cost data" provided by firms in accordance with new disclosure rules may be just as much "approximations" as the data produced by investors on private account. Thus, this particular type of disclosure rule may be consistent with a case of virtually "perfect" substitutes. The SEC's recent rule on this issue and firms' recent disclosures in accordance with this rule are not obviously inconsistent with this scenario; see Securities and Exchange Commission [March 23, 1976], Arthur Andersen & Co. [1977], and Arthur Young & Co. [1977].

7.5 Cost Effects ($C'_A \neq 0$): Substitute Signals ($V''_{iA} < 0$)

Recall the general expression for $d\eta^*_i/d\eta_A$ (from Section 6.3):

$$\frac{d\eta^*_i}{d\eta_A} = \frac{1}{D}(V''_{wA}C'_i + V'_wC''_{iA} - V''_{iA}) + \frac{1}{D}(V''_{iw} - V''_{ww}C'_i)\left(C'_A - \frac{dw_t}{d\eta_A}\right) .$$

Clearly, the difficulties of accurately assessing the effects of $d\eta_A$ are increased when the new public information-production decisions alter the cost function for private information-production decisions. There are many routes towards this end. Consider, for example, the case of "segment" or "line of business" disclosure rules. And suppose that the substitution relationship, $V''_{iA} < 0$, holds.

It is usually argued that a public disclosure rule requiring the production of line-of-business signals (pertaining to, e.g., sales, income, etc.) will reduce some analysts' information-production costs and perhaps eliminate the costs incurred by others, such as the costs of purchasing line of business signals. These are two of the outcomes emphasized in, for example, a recent SEC Staff Report on segment reporting rules:

> . . . [it] has been the experience of the Staff in interviews to date that security analysts need more detailed segment data, and that many spend a disproportionate amount of their time in trying to relate company line-of-business information, reported pursuant to current SEC requirements, to aggregate economic data relating to unit shipments by product classification. Such data is published by the Commerce Department by Standard Industrial Classification (SIC) Code, which is published to seven levels of detail and by industry trade associations on a periodic basis. The reason for this emphasis by security analysts is that in order to evaluate the growth potential of a company, it is of paramount importance for them to know the share of the market which that company's major products and services possess and the trend of this market share. It is also important for them to know the profitability of each of these products. It is apparent to the Staff that professional investors need this information in much greater detail than is currently provided under current SEC rules and that in order to obtain it they currently use various informal means to elicit estimates of contributions to revenues and profit for classes of products, which can then be related to aggregate economic data. Because analysts normally sell this information to institutional investors, they are not all anxious to have the SEC require registrants to disclose this information, because their customers might then be able to obtain this information directly from registrants and hence not require their services. Nevertheless, the fact remains that no meaningful analysis of a diversified company can be made without adequate segmentation of its products and services into homogeneous groups which can be related to aggregate economic data. The Staff believes that if this information is in fact so important to such an analysis, it should be provided by corporations in the most useful form to all investors. (Securities and Exchange Commission [October 8, 1976; p. 10].)

Presumably, adherents to the above argument would expect, for given η_i^*, that $C_A' < 0$ and $C_{iA}'' \leq 0$--both for the analysts devoting a "disproportionate amount of their time" to their use of some signals (in pursuit of line-of-business implications) and for those who will no longer have to pay for some signals currently being produced by analysts. But precisely what these presumptions imply about the effects of $d\eta_A$ on private information-production activities and, therefore, on the signals ultimately available to capital market agents is not clear.

The first term in the expression for $d\eta_i^*/d\eta_A$ is of indeterminate sign even if $C_A' < 0$ and $C_{iA}'' \leq 0$ for all agents--whether the publicly produced signals increase or decrease the marginal productivity of private information-production activities (as reflected by V_{iA}''). In general, the effects of the segment reporting rules underlying $d\eta_A > 0$ will--holding net wealth, $\bar{w}_t$, constant--depend upon the effects of $d\eta_A$ on both marginal costs and marginal productivities (of w_t and η_i). And the marginal productivity effects depend upon the nature of investors' preference functions, their wealth endowments, their probability assessments, and their current values of η_i^*. But even a determinate substitution effect would not permit precise estimates of the effects of the signals produced as a result of the public segment reporting rules. There is also a wealth effect.

Consider a case wherein the available substitutes are such that the changed public information-production decisions $(d\eta_A)$ have no informational implications not already induced by private information-production decisions. And suppose that $d\eta_A$ leads to no shifts in the demand functions faced by firms. In this case, $dw_t/d\eta_A < 0$, for at least some investors, because of the increased costs of public information-production decisions.

If, for a given agent, the absolute value of the predicted reduction $(C_A' < 0)$ in his total private costs of private information-production exceeds the absolute value of that agent's share of the total aggregate costs imposed upon firms as a result of the public information-production decision--as reflected in the value of $dw_t/d\eta_A$ for that agent--then there is a positive wealth effect on η_i^*. Consequently, empirical results on the information content of the signals induced by $d\eta_A > 0$ will be contaminated by the positive influence of wealth on private information-production activities--even though this wealth effect is irrelevant to an assessment of those signals' information content. Since the wealth effect is positive (i.e., $d\bar{w}_t/d\eta_A > 0$), this contamination will, by itself, lead to overestimates of information content. That is, as a result of this force alone, some of the additional information (or the less severe reduction of information) available to investors should be ascribed to expanded private information-production decisions, not the change in public information-production decisions.

To all of this we should add the adverse demand-function shifts that the SEC's staff seems to be predicting for some firms and analysts, namely, those that now sell line-of-business signals. If no economic rents (due, for example, to economies of scale) were being earned in this activity before the change in η_A, then the predicted demand-function shifts do not induce decreases in any agent's wealth, w_t, in a first-round (partial equilibrium) analysis. That is, if all factors of production used in this activity only received competitive returns before the change, then the change in η_A leads to no reduction in wealths--conditional on the prevailing prices of factors of production. But the change does, of course, induce a movement of resources into other pursuits. And this may, as a result of general equilibrium adjustments, lead to changes in relative prices and, therefore, wealth redistributions. Thus, the ultimate (general equilibrium) effects may involve decreases in the wealths of some agents as a result of the predicted demand-function shifts. This force, by itself, constitutes a force for a reduction in the value of η_i--induced by the increase in η_A--and thus a reduction in the information available to investors. This reduction should be ascribed to a reduction in the scale of private information-production activities, induced by wealth changes. By itself, it is not relevant to an assessment of the information content of new signals resulting from $d\eta_A > 0$. Moreover, this component of the total wealth effect for any agent further complicates the social choice issues surrounding line-of-business disclosure rules.[10/]

7.6 Remarks on Cost and Wealth Effects

The importance of $dw_t/d\eta_A$ and C_A will, of course, depend upon the relative importance of an agent's holdings of the securities issued by firms affected by public information-production decisions and upon the institutions used for producing information on private account. Given the distribution of relative ownership interests in the "typical" firm falling within the jurisdiction of, say, the SEC or the FASB and given the likely magnitudes of the costs imposed upon firms by public information-production decisions, the costs imposed upon a "representative" investor (through the term $d\bar{w}_t/d\eta_A$) seem likely to be small. Indeed, if satisfying the demands of a public information-production decision involves using signals that will be produced anyway (for, say, internal use by firms' managements), the additional costs imposed on firms may be negligible. Consider, for example, the cost implications of the Federal Trade Commission's Line-of-Business reporting program, for which cost estimates have been widely reported. (Some recent estimates are recorded in Weidenbaum [1977; p. 147].)

DuPont estimated that its compliance with the FTC's proposed 1974 reporting form would induce a one-time ("set-up") cost of \$1.2 to \$1.8 millions and recurring costs of "several hundred thousand dollars."[11/] Thus, before taxes, the set-up costs might range from about \$0.025 to \$0.0375 per outstanding share of common stock as of the end of 1974. For a security whose price was, at that time, around \$100 per share, the corresponding after-tax numbers are hardly likely to be catastrophic. And if the total recurring costs are really "a few hundred thousand," one is hard pressed to foresee earth-shattering after-tax effects. Moreover, since the results of the information-production changes underlying these cost estimates may have been used for internal purposes anyway, the estimates may overstate both the set-up and recurring costs that should be ascribed to the FTC's disclosure rule.

Next, consider the changes in $C(\eta_i^*|\eta_A)$ induced by changes in η_A. If the framework developed by, e.g., Gonedes [1975] is used, then one expects collusion with respect to the private production of signals, as a result of direct bargaining or indirect (implicit) bargaining via, say, financial intermediaries (e.g., mutual funds) and other institutions (e.g., organizations that supply economic analyses to "subscribers").12/ For such production activities, $C(\eta_i^*|\eta_A)$ pertains to a given agent's share of the total production cost. Consequently, if colluding investors are sufficiently numerous, the ultimate impact of $d\eta_A$ on $C(\eta_i^*|\eta_A)$ for any one agent may be quite small.

If the above sorts of conditions do hold--at least as decent approximations--then the effects of $d\eta_A$ on $d\eta_i^*$ will be dominated by the wealth effects due to the informational implications of $d\eta_A$ and by the effects of $d\eta_A$ on the marginal productivity of privately produced signals, as reflected by V''_{iA}. If, in accordance with Wicksell's Law of Production, publicly and privately produced signals are normal factors of production, then $V''_{iA} > 0$. By itself, this would contribute towards an overstatement of the "own-effects" of publicly produced signals, because some of the effects of expanded information production on private account will appear--in the types of studies described in Sec. 1--to be effects of the changed public information-production decisions. A force contributing towards understatement would exist if publicly and privately produced signals are substitutes $(V''_{iA} < 0$. Moreover, the effects of both of these sources can be either mitigated or aggravated by the wealth effects induced by the informational implications of changes in public information-production decisions.

7.7 Cost Effects and Financing the Production of Public Goods[13/]

The preceding section points to a similarity between $C(\eta_i|\eta_A)$ and w_t insofar as the joint effects of sharing arrangements and changes in η_A are concerned. There are also some noteworthy differences. In general, the impact of $d\eta_A$ on the costs of private information-production affects all market agents whether or not they now hold the securities of firms affected by $d\eta_A$. In terms of first-round effects (i.e., ignoring cost shifting, etc.), the impact of $d\eta_A$ on w_t is only pertinent to those who now hold the securities of the affected firms. Moreover, the effect of $d\eta_A$ on w_t increases with the size of one's holdings of the securities issued by any of the latter firms. There is no such automatic relationship between the implications of $d\eta_A$ for $C(\eta_i|\eta_A)$ and the sizes of an agent's holdings of firms' securities.

Imposing the costs associated with $d\eta_A$ on the affected firms--and thus on its security holders--can be viewed as a means of financing the production of a public good so that those <u>presumed</u> to benefit most from the public good contribute more towards its production, by experiencing a larger cost-effect on w_t. <u>Presumptive attainment</u> of this end is accomplished by tying these contributions to the sizes of one's holdings of securities issued by firms. This assumes that the extent to which one benefits from signals produced by or about a firm varies directly with the size of one's holdings of that firm's securities. To some extent, this tying-in scheme illustrates the approach discussed by Bradford and Hildebrandt [1976] regarding the financing of public goods' production. The crux of their approach involves exploiting the appearance of levels of public goods in demand functions for private goods. Inferences about the values that agents place on changes in the levels of public goods are made by observing the effects of such changes on demands for private goods. In our analysis, the variable corresponding to their concept of a public good is η_A, which appears in our demand function for privately produced signals. See the expression for $d\eta_i^*/d\eta_A$ given in Sec. 6.3.

This approach towards allocating the costs of public information-production activities can be defended along lines similar to those often used in defense of proportional property taxes (applied to market values) when the latter are used to finance local government expenditures on "collective consumption" goods (for example, police protection, education, fire-fighting, etc.). It is often argued--by those favoring a "benefits approach"--that those with more wealth in the form of property gain more from such local government expenditures, especially if they are sufficiently mobile to "vote with their feet." Thus, the tax burden that they bear, it is argued, should vary directly with the value of their property. The same sort of argument can be made about bearing the costs of public information-production activities financed via expenditures by firms.

Even if some nonsecurity holders benefit from publicly produced signals about a firm, one can develop various arguments justifying the above tying-in scheme. For example, one might argue that attempting to collect fees from all agents who benefit from such disclosures (induced by the value of η_A) may involve assessment and collection costs that are simply too great to be justified on grounds of optimal (or even improved) resource allocation. In short, such an attempt may lead to an outcome that is less efficient than the one based on collections from only current security holders. Of course, collecting from the latter does not imply that they ultimately bear all of the costs. That depends on "cost shifting" (and, thus, general equilibrium) issues.

Moreover, all groups of "current security holders" provide and receive some of the cross subsidies implied by this arrangement. Just as the current nonsecurity holders of, say, firm j can receive and use the publicly produced signals induced by $d\eta_A$ without any direct payment (via $dw_t/d\eta_A$), the current security holders of firm j can receive and use the publicly produced signals about other firms whose securities they do not hold. On balance, changes in public information-productions decisions may induce no systematic or important wealth redistributions.

7.8 Cost Effects and Economic Rents

The costs imposed on firms as a result of public information-production decisions affect firms' equilibrium values as does any other operating outlay having the same stochastic properties. In general, these cost impositions can affect both the marginal and the total costs of firms' operations, depending upon the nature of their operations and the details of the public information-production decisions.[14] In this regard, the effects of some of these decisions may be discriminatory.

Suppose, for example, that all firms engaged in a particular type of activity (or "line of business") face the same prices of outputs and inputs, behave as price-takers, and have access to the same production technology. Given free entry and exit, no firm in this setting earns economic rents. But if public information-production decisions affect the cost functions of these firms in a nonuniform way (across firms), then otherwise identical firms (ignoring scale differences) will end up facing different cost functions. In short, the costs induced by those public decisions may alter the terms on which firms compete. An example of this phenomenon is provided by what the SEC's Advisory Committee on Corporate Disclosure called the "Small Company Problem." In its 1977 report to the SEC, this committee notes the following (Vol. 1, p. 511):

> It has been argued that the indiscriminate application of governmental regulatory, disclosure, tax, and other policies, including SEC registration and periodic reporting requirements, imposes a relatively greater compliance burden on small companies than on large ones. Some have contended further that the net effect of these policies is to endanger the continued existence of smaller companies and to inhibit the formation of new enterprises.

On the basis of some survey results, the committee itself inferred that the costs of complying with the disclosure requirements of the 1934 Securities and Exchange Act are relatively greater for small companies than for large ones (Vol. 1, pp. 512-513). Similar concerns about the "small company problem" seem to have been part of the motivation for the FASB's recently issued Statement No. 21 (see, in particular, paragraph number 5).[15/]

Thus, in general, the cost effects of public information-production decisions may work to the advantage of particular firms--and thus particular groups of security holders--by providing them with sources of economic rent in the guise of relatively more favorable cost functions. This may be one of the reasons for which some firms favor some proposed disclosure rules while other firms engaged in the same types of activities oppose the rules--even though the proposals will affect all firms' costs in the same direction and even though they all agree on the information content of the signals corresponding to the proposed rules.[16/] Moreover, to the extent that different groups of security holders are differentially affected, it points to a force that will, other things equal, cause security holders' private information-production decisions to be affected in a discriminatory way as a result of the windfall gain/loss effects that will be reflected in the term $dw_t/d\eta_A$. This further complicates empirical assessments of the effects of public information-production decisions on the produced signals ultimately available for investors' assessments of return distributions.

Additional complications arise for firms engaged in different types of activities (e.g., firms in different industries), even after allowing for risk differences, etc. Here, there may be differential effects because of the demand-function shifts induced by changes in public information-production decisions. For example, the SEC's recently adopted rules on replacement cost disclosures seem to have been a major factor inducing entry into the business of providing basic data, computer software, "educational" programs, and consulting services pertaining to the production and interpretation of accounting numbers defined in terms of "replacement costs." The FASB's Statement No. 8 on "foreign currency translations" seems to have had similar effects in the area of "foreign currency management" (e.g., currency hedging). In general, these shifts may affect firms in a nonuniform way. And they may lead to some windfall gains and losses for some groups of securityholders. These differential effects on securityholders contribute, in turn, to nonuniformities in the effects on securityholders' private information-production decisions.

8. General Equilibrium Issues and Further Work

The preceding section points to a variety of changes that can be induced by changes in public information-production decisions and that can complicate theoretical or empirical work dealing with the effects of changes in these decisions. For the most part, attention was restricted to the actions of an individual agent behaving as a price-taker in all markets. From the view of general equilibrium, a variety of additional changes may be associated with changes in public information-production decisions. These additional changes may be due, for example, to (1) the effects on financial assets' prices of the informational implications of the possible signals associated directly with $d\eta_A \neq 0$ and those associated with changes in η_i^* induced by $d\eta_A \neq 0$, (2) the reallocations of real resources due to these implications, and (3) the effects of $d\eta_A$ on firms' cost and demand functions, conditional on their production-investment and financing decisions These are among the possible factors that can lead to changes in relative prices and, therefore, changes in agents' wealths and agents' optimal private information-production decisions. Thus, for example, from a global perspective, the immediate cost effects of $d\eta_A \neq 0$ on an agent's wealth (as reflected in the term $d\bar{w}_t/d\eta_A$ and evaluated at given prices) is but one part of the total change that might be induced by $d\eta_A$--even when $\bar{w}_t$ is not affected by any informational implications or demand function shifts induced by $d\eta_A \neq 0$. In the end, the incidence of the costs induced by $d\eta_A \neq 0$ may differ greatly from what might be inferred by considering only the immediate costs and only the agents or firms making the explicit payments implied by these costs.

Also note that no formal attention was given to the possible endogeneity of some changes in public information-production decisions. Our specification of investors' demands for privately produced signals assumes that the public information-production decision variable is treated as fixed when agents solve for their optimal decisions. It seems likely that some agents view the public decision variable as something to be influenced rather than to be taken as fixed. Various interest groups do, after all, lobby for or against proposed disclosure rules and changes in those rules. Indeed, the two major bodies dealing with external accounting--the SEC and the FASB--initiate public hearings at critical stages of their decision-making processes. Less public forums (e.g., informal communications at professional meetings) provide additional opportunities for interest groups to attempt to influence the details of public information-production decisions. In short, from a global perspective, η_A may be regarded as a decision variable by some agents (acting on personal account or as a member of a colluding group). The burgeoning literature on the economic aspects of regulation seems to be especially relevant here.[17] (Note, however, that much of that literature is also at the level of partial equilibrium analysis.)

These limitations of our partial equilibrium analysis are, of course, no different from those of much existing theory on, e.g., asset pricing. There, a variety of decisions are held fixed; they include: personal consumption decisions, occupational choices and the split of available time between employment and leisure, investments in human capital, etc.[18] Ultimately, the extent to which the simplified models actually used have descriptive validity is what counts, there and insofar as assessing the aggregate implications of $d\eta_A \neq 0$ is concerned. The fact that the models are based upon a partial equilibrium perspective is, taken by itself, not the sole criterion for evaluating the models' usefulness. In any event, general equilibrium analyses of the issues raised here constitute a broad area for further work.

A variety of other (less global) areas for future work are also identified by our investigation. We pointed to several reasons for expecting assessments of public information-production decisions' effects to be frustrated by induced changes in agents' demands for privately produced signals. Designing experiments that incorporate adequate controls for these induced changes is another obvious area for future work--one that seems particularly important for conducting the types of studies referenced in Section 1.[19]

The characteristics of demand functions for privately produced signals were exploited by our investigation. The role of public information-production decisions in the specification of these demand functions was of special importance. Specifically, much of our discussion turned on the influence of these decisions on: (1) marginal productivities of wealth and private information-production activities in the "production" of expected utility and on (2) cost functions for private information-production activities. Also emphasized was the role of collusive arrangements in determining the costs borne by a given agent regarding private information-production activities. This is an aspect of the general issue of selecting institutional arrangements and organizing factors of production for information-production activities.[20] In addition, some aspects (e.g., cross-subsidization) of alternative means of financing public information-production decisions entered into our analysis of the possible effects of these decisions. Clearly, each of these determinants of the interactions between private and public information-production decisions constitutes a subject for future work--work that involves departing from the lines of attack usually found in both theoretical and empirical studies of disclosure rules, information-production, and capital market equilibrium.

9. Summary

The bulk of the available work on information-production, disclosure rules, and capital market equilibrium overlooks the characteristics of information-production decisions made by agents on personal account (via individual actions or private forms of collusion). If, for example, optimizing behavior by agents leads to substitution or complement relationships among the informative signals produced via private and public information-production decisions (e.g., disclosure rules), then the "effectiveness" of disclosure rules cannot, in general, be assessed independently of the details of decisions made on personal account. The dependence between decisions made on private account and disclosure rules' effects is also due to wealth effects. Thus, empirical evidence allegedly dealing with the effects of new disclosure rules will, in general, reflect the joint effects of these rules and any induced changes in private information-production activities.

This paper explored some basic aspects of the relationship between public and private information-production decisions. By focusing on demand functions for privately produced informative signals, we were able to identify settings wherein the assessed effects of disclosure rules will tend to be upward biased and settings wherein the assessed effects of disclosure rules will be downward biased. For some settings, the direction of the bias appears indeterminate, conditional on our assumptions.

The wealth effects of disclosure rules depend, in part, on the technology for information-production on private account, on the means of financing public information-production decisions, on the institutional arrangements (e.g., private forms of collusion) available for private information-production activities, on the informational implications of newly produced signals, and on the characteristics of firms' decisions. We observed that wealth effects can either reinforce or mitigate the biases induced by substitute/complement relationships, depending upon the details of the setting under examination.[23/]

On balance, it appears that some implicit assumptions of available work on disclosure rules' effects are likely to hold only by coincidence. Whether the inadequacies of these assumptions (taken literally) are sufficient to damage their descriptive validity (relative to alternatives) cannot, of course, be assessed via the results of this paper. And, in the end, their relative descriptive-validity is what counts. Our explorations do, on the other hand, point to a variety of new areas for both theoretical and empirical work on information-production, disclosure rules, and capital market equilibrium. Results from such work should provide insights on basic issues with which available work does not deal--because, in general, it fails to recognize some key relationships between public and private information-production decisions.

APPENDIX

Reaction Function Derivation

Let $f(\eta, \bar{w}_t) \equiv V_i' - V_w'C_i' = 0$, where $\bar{w}_t = w_t - C(\eta_i|\eta_A)$. The total differential of $f(\cdot)$ is given by:

$$df = \frac{\partial f}{\partial \eta_i} d\eta_i + \frac{\partial f}{\partial \bar{w}_t}\frac{\partial \bar{w}_t}{\partial \eta_i} d\eta_i + \frac{\partial f}{\partial \eta_A} d\eta_A + \frac{\partial f}{\partial \bar{w}_t}\frac{\partial \bar{w}_t}{\partial \eta_A} d\eta_A + \frac{\partial f}{\partial \bar{w}_t} d\bar{w}_t$$

$$= \left(\frac{\partial f}{\partial \eta_i} + \frac{\partial f}{\partial \bar{w}_t}\frac{\partial \bar{w}_t}{\partial \eta_i}\right) d\eta_i + \left(\frac{\partial f}{\partial \eta_A} + \frac{\partial f}{\partial \bar{w}_t}\frac{\partial \bar{w}_t}{\partial \eta_A}\right) d\eta_A + \frac{\partial f}{\partial \bar{w}_t} d\bar{w}_t = 0 \ .$$

The term hitting $d\eta_i$ is D, as defined in Section 6.2. The term hitting $d\eta_A$ is given by:

$$D^* \equiv \left(\frac{\partial f}{\partial \eta_A} + \frac{\partial f}{\partial \bar{w}_t}\frac{\partial \bar{w}_t}{\partial \eta_A}\right) = V''_{iA} - V''_{iw}C'_A - [C_i'(-V''_{ww}C'_A + V''_{wA}) + V_w'C''_{iA}] \ .$$

The term hitting $d\bar{w}_t$ is given by:

$$D^{\#} \equiv \frac{\partial f}{\partial \bar{w}_t} = V''_{iw} - C_i'V''_{ww} \ .$$

Collecting terms and solving for $d\eta_i^*/d\eta_A$ leads to:

$$\frac{d\eta_i^*}{d\eta_A} = -\left(\frac{D^*}{D}\right) - \left(\frac{D^{\#}}{D}\right)\frac{d\bar{w}_t}{d\eta_A}$$

$$= -\frac{V''_{iA}}{D} - \left(\frac{-V''_{iw}C'_A - C_i'V''_{wA} + C_i'V''_{ww}C''_A - V_w'C''_{iA}}{D}\right)$$

$$-\left(\frac{V''_{iw} - V''_{ww}C_i'}{D}\right)\frac{d\bar{w}_t}{d\eta_A}$$

$$= -\left(\frac{V''_{iA}}{D}\right) + \left(\frac{V''_{wA}C_i'}{D}\right) + \left(\frac{V_w'C''_{iA}}{D}\right)$$

$$+\left(\frac{V''_{iw} - V''_{ww}C_i'}{D}\right)\left(C_A' - \frac{dw_t}{d\eta_A}\right)$$

$$= - \frac{1}{D} \frac{\partial}{\partial \eta_A} \left(\frac{\partial V}{\partial \eta_i} \right) + \frac{1}{D} \frac{\partial}{\partial wt} \left(\frac{\partial V}{\partial \eta_i} \right) \left[C'_A - \frac{dw_t}{d\eta_A} \right] ,$$

which is the result given in Sec. 6.3.

FOOTNOTES

[1]The rules issued or proposed by the Securities and Exchange Commission (SEC) and the Financial Accounting Standards Board (FASB) are among those receiving substantial attention.

[2]In this regard, it is important to distinguish between two issues: (1) The informativeness (or "effectiveness") of the signals whose production is covered by the disclosure rule--signals for which there may be perfect substitutes already available; and (2) the extent to which a given disclosure rule leads to a change in the number or nature of available informative signals (i.e., those that actually lead to changes in the set of available information). At this point, we are focusing on implicit assumptions that tie conditions (1) and (2) together in empirical work even though the asserted condition for a rule's "effectiveness" appears to be the first one.

[3]See, for example, Coldwell [1975], Securities and Exchange Commission [October 1, 1974], Sommer [1975], and Securities and Exchange Commission [March 23, 1976].

[4]This cost function for agent i may change over time as a result of successive periods' public or private information-production decisions. This possibility--for which we provide no notational recognition--does not affect the main points of our discussion.

[5]Note that this statement deals exclusively with the cost induced by such a decision. Changes in firms' ultimate equilibrium values--established after completion of all private and public information-production activities--due to the information reflected by signals produced at time t are not relevant at this point.

[6] A detailed discussion of substitute/complement relationships amongst signals is given in Gonedes [1976a].

[7] See Fama [1976; Ch. 8] for a review of this and other versions of the two-parameter model.

[8] The crux of fn. 2 is relevant here.

[9] See, e.g., Donaldson, Lufkin, and Jenrette [1976], Largay and Livingstone [1976], and the numerous references given in the latter. Many appraisal companies are actively promoting their services in this area; among them are Stone and Webster Appraisal Corp. and American Appraisal Associates.

[10] Analogous issues arise with respect to other sorts of rules, too. Consider, for example, the SEC's current proposals for reporting by "small business." In this case, the SEC is concerned about the alleged "excessive" costs imposed upon small firms by its information-production decisions. So, it is considering selection of "less stringent" disclosure rules for such firms. But this may lead to the imposition of higher private information-production costs on those analysts who now follow small businesses (i.e., $C_A' > 0$ for these analysts). For these analysts, one might have $d\bar{w}_t/d\eta_A < 0$ even if the "less stringent" disclosure rules lead to the imposition of lower costs on "small firms," and thus favorable cost-function shifts for these firms (which, other things equal, imply $dw_t/d\eta_A > 0$ for one who holds the securities of "small firms").

[11] These estimates are taken from p. 15 of "Federal Trade Commission's Line of Business Program," an attachment to Securities and Exchange Commission [October 8, 1976].

[12]The incentives for collusion arise because of the "public good" attribute of produced information. The specific forms of collusion adopted will depend, in general, on the structure of the market for information; see Gonedes [May 1976]. Additional material pertinent to this issue is provided by Stillson [1974] and Lleland and Pyle [1976]. Note that after individuals (implicitly) collude via intermediaries, the intermediaries may themselves collude. See, e.g., the proposals described by Herman [1977].

[13]The public good attribute of produced signals is discussed by Gonedes and Dopuch [1974] and Gonedes [1975].

[14]In this regard, note that some of these decisions may apply to only those firms in selected industries (e.g., extractive industries, banking, insurance, etc.), some may apply to only "large" firms (as with the recently adopted SEC "replacement cost" disclosure rule), and others may affect only those firms having specified types of transactions (e.g., acquisitions of facilities via leasing). In short, the details of some disclosure rules are such that not all firms are affected in the same way because the firms are pursuing different operating and financing decisions. Differences among firms with respect to their internal accounting systems (e.g., the extent to which disaggregated data are retained) will also lead to differential effects across firms. Finally, note that the major effects of some changes in public information-production decisions may be on firms' fixed costs.

[15]This Statement pertains to "nonpublic enterprises," for which the following definition is given (paragraph no. 13):

> . . . a nonpublic enterprise is an enterprise other than one (a) whose debt or equity securities trade in a public market on a foreign or domestic stock exchange or in the over-the-counter market (including securities quoted only locally or regionally) or (b) that is required to file financial statements with the Securities and Exchange Commission. An enterprise is no longer considered a nonpublic enterprise when its financial statements are issued in preparation for the sale of any class of securities in a public market.

[16] Similar reasoning (perhaps involving both cost-function and demand-function shifts) may also explain, in part, the positions adopted by CPA firms in response to rules proposed by, e.g., the FASB or the SEC--speaking on behalf of themselves or their clients.

This perspective is used by Manne [1974] in what he offers as a possible explanation for some underwriters' support for the disclosure provisions of the Securities Act of 1933. The crux of his suggestion is revealed in the following excerpt (Manne [1974; pp. 34-36]):

> There is some evidence that the securities industry in the period between 1929 and 1933 made a number of private efforts to curtail intensive competition. Various associations of firms were formed, and attempts were made to enforce "canons of ethics" for their members. But, of course, the more these "ethical" firms agreed not to compete or interfere with established relationships between corporations and underwriters, the more firms not abiding by these prohibitions prospered.
>
> Then along came the New Deal, and the man whom Wall Street claimed to hate most offered the first really effective chance to overcome the industry's own depression. . . . The trick, of course, was to find a regulatory device that would add relatively higher costs, because of comparative disadvantages, to those new or less efficient firms that cut prices while still giving the appearance of protecting the public.
>
> If we look, then, for practices that distinguished leading underwriting houses from their "less ethical," more unsavory competitors, a strange fact emerges. One difference in their activities related to the degree and quality of the public disclosure made by these firms about the stocks they underwrote. A prospectus prepared by a leading Wall Street house in 1928 could, with really insignficant differences in financial disclosures, obtain a clearance from the Corporate Finance Division of the SEC today. But many firms flourished, or at least survived, by not marketing such "high-quality" stocks to their customers.
>
> This similarity between the requirements of the Securities Act of 1933 and the operations manuals of leading Wall Street houses of the time may have been coincidental and unintended. But a more likely explanation is that the industry leaders succeeded in channeling Roosevelt's penchant for regulation into a valuable competitive advantage. The ensuing increase in relative costs weakened whatever comparative advantage sharply competing firms previously enjoyed in offering a different quality of service to their customers. Ultimately, shareholders in all companies using underwriters' services must have lost something by this shift away from competitive efficiency.

[17]An overview of this literature is provided by Posner [1974]. A recent paper providing useful insights on the economic aspects of regulation is Peltzman [1976].

[18]The importance of these additional factors depends, in part, on the time horizon underlying one's analysis. Is it likely that these other factors will change in any important way in the length of time specified by this horizon?

[19]Some experiments or quasi-experiments along these lines may involve using micro-data of the sort collected by Welber G. Lewellen [1976] for his ongoing project, "Individual Investor Portfolio Performance." These data pertain to "the investment objectives, decision processes, information sources, and asset holdings" of his sample units; see Lewellen [1976; p. 73].

[20]Various aspects of these issues are considered in: Stillson [1974], Lleland and Pyle [1976], Herman and Safanda [1973], and Gonedes [May 1976].

[21]Some available works on external accounting and capital market equilibrium mention "wealth effects" or "costs." See, e.g., Beaver [1973], [1976] and Horwitz and Kolodny [1977]. But what they have in mind is either unclear or very different from what is discussed here. For example, it is often not clear whether they are dealing with wealth effects that turn on real resource usage (e.g., real resources used in the production of information) conditional on prevailing prices or those that turn on wealth redistributions--in a pure exchange setting--due to changes in relative prices. In other cases, attention seems to be restricted to the wealth redistributions induced by signals' informational implications in a pure exchange setting. In addition, the implications of wealth effects for private information-production activities are never considered. Also when the real resource costs

of public information-production decisions are recognized, their induced effects on private information-production decisions are ignored. For the most part, it is just noted that such public decisions are "costly," which seems somewhat gratuitous. Finally, the relevant "public goods" (or "collective consumption") issues raised by public information-production decisions are rarely given serious (if any) attention.

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