Proof that in an efficient market, event studies can provide no systematic guidance for revision of accounting standards and disclosure policy for the purpose of maximizing shareholder wealth*

SHYAM SUNDER *Carnegie Mellon University*

Abstract. A systematic revision of accounting standards and disclosure policy on the basis of evidence obtained from event studies conducted in an efficient stock market is shown to be an ineffective means of maximizing shareholder wealth.

Résumé. Une révision systématique des normes de comptabilité et des conventions relatives à la présentation de l'information à partir de l'information recueillie à la suite d'études d'événements menées dans un marché boursier efficient se révèle inefficace lorsqu'il s'agit de maximiser la richesse des actionnaires.

Introduction

The idea that price in competitive markets is adjusted speedily to incorporate the information available to the market participants forms the basis of a large body of accounting research. Opportunities for riskless arbitrage cannot persist in equilibrium.[1] Application of this idea to matters of accounting policy created much excitement among accounting researchers in the 1970s. Accounting researchers had been frustrated by the inconclusive theoretical debates of the fifties and the sixties about which external criteria (e.g., verifiability, reliability, etc.) might be appropriate in selecting accounting standards. Deep divisions within the Accounting Principles Board, and professional rejection of *Accounting Research Study No. 1 and No. 3* by Moonitz (1961) and by Sprouse and Moonitz (1962) respectively, exacerbated the dissatisfaction researchers felt with what came to be known as "*a priori*" research. When the Benston (1967) and Ball and Brown (1968) studies documented a linkage between accounting data and stock prices, accounting researchers seemed to seize this chance to define and promote a

1 See Fama (1970) for empirical and Plott and Sunder (1982, 1988) for experimental evidence.

criterion for the evaluation of accounting policies. This criterion was not only impersonal but also had the apparent advantage of being grounded in financial economic theory.

Early assessments of the value of stock market data for evaluation of accounting policy were optimistic. Gonedes (1972, p. 12) stated:

observations of the market reactions of recipients of accounting outputs should govern evaluations of the actual information content of accounting numbers produced via ... alternative ... procedures.

Beaver and Dukes (1972, p. 321) were even more explicit:

the method which produces earnings numbers having the highest association with security prices is the most consistent with the information that results in an efficient determination of security prices ... [and] it is the method that ought to be reported.

Beaver and Dukes (1972) qualified their results with respect to the consideration of costs of accounting. May and Sundem (1973) supported the basic idea but added some further qualifications with respect to information which may not be available to the market under the extant accounting policy.

However, within a few years, the same authors led the way in pointing out that the shareholders of the firms are not the only party involved in accounting and that the problem of assessing the desirability of accounting standards extends well beyond the scope of what can be accomplished through analysis of stock prices (see Cyert and Ijiri (1974), Gonedes and Dopuch (1974) and Beaver and Demski (1974)).

Given the welfare theoretic analysis of these papers, few have been willing to argue, after 1975, that the desirability of accounting policy from the point of view of the *society as a whole* could be assessed on the basis of stock prices. However, the idea that the desirability of accounting policy from the point of view of the *shareholders* can be so assessed has not been challenged and it persists in the literature. The controversy on methods of accounting for oil and gas exploration costs led the Financial Accounting Standards Board and the Securities and Exchange Commission to sponsor the Dyckman and Smith (1979) and Haworth, Mathews and Tuck (1978) studies respectively. It is difficult to say what, if any, effect such studies have had on the behavior of these regulatory bodies. Furthermore, Gonedes and Dopuch (1974) maintained that the *effects* of accounting regulations on stock prices *can* be assessed via capital market efficiency.

In this paper I address the question of whether it is possible to increase the welfare of security holders by systematically adjusting accounting policy in accordance with the stock market response to such policy. This paper is not concerned with the general problem of what objectives regulatory bodies should or do have[2] and what means they should or do employ to achieve these objectives. As with any public policy problem, a multiplicity of objectives is likely to

2 See Dopuch and Sunder (1980) on the subject.

be sought through a variety of means. This paper is focused on one objective (i.e., the welfare of security holders) and the difficulty of attaining this objective through one means – policy revisions based on security market event studies. It does not rule out the possibility that event studies may help attain other objectives. If event studies are valuable in attaining other policy objectives, it should be possible to construct an argument or produce evidence in support of such a proposition. Propositions cannot be assumed to be correct by default. Obviously, policy makers use many means other than event studies to seek their objectives. This paper does not deal with those problems.

The conclusion logically follows from applying the basic idea that in economic equilibrium the arbitrage opportunities cannot persist. When systematically applied, the strategy of revising accounting policy on the basis of observed stock price reaction to policy gets built into the investor expectations in such a way that stock prices no longer form a useful basis for policy. It does not matter whether the systematic strategy is deterministic or stochastic. The strategy can succeed only if it is a surprise to the investors; when systematically employed, it cannot come as a surprise to them.

Value of event studies to accounting regulations

Consider an accounting regulatory action A, e.g., a new standard issued by the FASB, which results in a net change of x dollars in the present value of cash flows available to the holders of each share of stock of the firm. The regulator does not know the value of x and seeks to utilize the information that the stock market participants might have in order to find and implement accounting standards that would maximize the shareholders' wealth;[3] i.e. standards for which $x \geq 0$. With this objective, the following procedure is publicly announced and implemented:

1 An accounting standard is announced.
2 Stock markets price reaction, p, is observed.
3 Accounting standard is modified using observation p.

Regulatory strategy, $M(p)$, is a function of p. $M(p)$ is defined as the probability of reversing the original action A if the observed change in stock price is p.

The stock market is assumed to be efficient in the sense of being unbiased. Given the observed price effect, p, the implied distribution of the present value of cash flow effect x is given by probability density function $\phi(x|p)$. Unbiasedness means that the expectation of x under this probability density is equal to p.

Randomness in the conditional distribution of cash flow x arises as a property of the market mechanism. In a perfect market mechanism x and p would be deterministically related to each other. Since no opportunities for arbitrage can

3 If the assumed purpose of such revision were changed, say, to minimize the stock price, the conclusions of the paper would be unchanged.

persist in equilibrium, conditional distribution $\phi(x|p)$ must be such that the expectation of x is equal to p.[4]

$$\int_{-\infty}^{\infty} x\phi(x|p)\,dx = p.\tag{1}$$

First suppose that the investors act nonstrategically in the sense that they ignore the possibility that action A might be reversed by the regulatory body on the basis of observed price effect. Let p_1 be the market price effect observed under such behavior. Observation p_1 implies, and is implied by, the following probability density function of cash flows:

$$\phi(x|p = p_1).\tag{2}$$

Arbitrage condition (1) requires that

$$p_1 = \int_{-\infty}^{\infty} x\phi(x|p = p_1)\,dx.$$

If a regulatory body applies strategy $M(p)$ to the observed price p_1, original action A will be rewarded with probability $M(p_1)$ (resulting in $x = 0$) and retained with probability $\{1 - M(p_1)\}$. Let p_2 be the equilibrium price effect observed under the assumption that the market takes into account not only the effect of action A but also the possibility of policy reversal on the basis of observation p_1. Now p_2 must be such that it implies, and is implied by, the following distribution of cash flows:

Mass function $\text{Prob}(x = 0) = M(p_1)$ plus

density function $\{1 - M(p_1)\}\phi(x|p = p_1).$

Again the arbitrage condition requires that the expected value of cash flow x be equal to the change in price, p_2:

$$p_2 = E(x) = 0 \cdot M(p_1) + \int_{-\infty}^{\infty} x\{1 - M(p_1)\}\phi(x|p = p_1)\,dx$$

$$= \{1 - M(p_1)\} \int_{-\infty}^{\infty} x \cdot \phi(x|p = p_1)\,dx.\tag{3}$$

If price p_2 is observed, then strategy $M(p)$ is applied to this price instead of to p_1, and therefore the observed price must be p_3 given by:

$$p_3 = \{1 - M(p_2)\} \int_{-\infty}^{\infty} x \cdot \phi(x|p = p_2)\,dx.\tag{4}$$

4 For ease of notation, assume that either the investors are risk neutral or that the risk associated with random valuation errors in the market is diversifiable. More generally, price will be equal to the expected utility of x without affecting the results of this paper.

Following this argument, when the market takes into account the application of strategy $M(p_i)$ to observed price p_i, it will result in observed price p_{i+1} given by:

$$p_{i+1} = \{1 - M(p_i)\} \int_{-\infty}^{\infty} x \cdot \phi(x|p = p_i) \, dx. \tag{5}$$

Note that this system, wherein strategy based on observed price has a feedback effect on observed price, will reach equilibrium when:

$$p_{i+1} = p_i = p^0. \tag{6}$$

That is, in equilibrium, we must have:

$$p^0 = \{1 - M(p^0)\} \int_{-\infty}^{\infty} x \cdot \phi(x|p = p^0) \, dx.$$

Since p is an unbiased estimator of x, the value of the integral is p^0:

$$p^0 = \{1 - M(p^0)\} \cdot p^0 \quad \text{or} \quad p^0 \cdot M(p^0) = 0. \tag{7}$$

Equation (7) implies that, no matter what the value of x is, in order for p to be an equilibrium market response to regulatory action A, at least one of the following two conditions must be fulfilled:

$$M(p) = 0 \quad \text{for equilibrium value } p = p^0 \tag{8}$$

$$\text{Equilibrium price change} \quad p^0 = 0. \tag{9}$$

Recall that $M(p)$ is defined as the strategy of reversing action A with probability $M(p)$ if market price effect p is observed. Condition (8) means that any price p is attainable in equilibrium, provided that the observation of p is associated with zero probability of reversing action A. Since in an efficient market, p is equal to the expected value of x, the only way of using p as an unbiased estimator of x is to insure that the reversal action A has no dependence on the observation of p. That is, the observation of price p is irrelevant to the revision of policy.

The regulatory body can use a strategy $M(p)$ which has a positive value and therefore a positive probability of policy reversal for some values of p. However, these values of p (except for $p = 0$) cannot be the equilibrium price reactions of the market. To the extent the theoretical rationale of event studies is based on the idea of economic equilibrium, any systematic reversal of policy based on observation of a nonzero p is not defensible.

Since much has been written about the weaknesses of stock market event studies over the past 15 years,[5] it may be worth pointing out that the value of their results to makers of policy given in this paper have little to do with the

5 See Demski (1973) for an early but still up-to-date critique and Foster (1980) for a recent review of oil and gas-related event studies. Lev and Ohlson (1982) provide a broader review and Sunder (1982) points out the-needle-in-the-haystack problem and the expectations problem in event studies.

internal and external validity and the statistical procedures of these studies. My arguments apply to each security individually and are in no way affected by the sample size of the study. I assume that the market responds efficiently and the conclusion is in no way affected by the magnitude of white noise in the market response. The magnitude and distribution of the real cash flow effects of accounting policy could be varied without altering the result.

Finally, one may be tempted to return to a variety of inefficiencies observed in the market place to justify the usefulness of the event studies for accounting policy. Such recourse would be ironic (because it is the presumed efficiency of the market place that led some to recommend that the policy be based on market reaction) and fruitless (how can we defend policy based on prices obtained from an inefficient market?). It is tempting to draw distinctions among "degrees of efficiency" and to argue that investors cannot be *that* rational. The results of this paper could be reversed by venturing outside the traditional theory of efficient markets and proving that under some precisely defined concept of limited or bounded rationality, observed market prices can provide a basis for improved decisions. Simply asserting that the market is not in equilibrium or that investors cannot see that far, however, is not enough to support the value of market event studies to accounting policy.

Arbitrage conditions

One may also wish to argue that the application of no arbitrage condition in equation (3) is unnecessarily strict. Investors could be assumed to know x individually and therefore attain an equilibrium given by

$$p^0 = x(1 - M(p^0)) \tag{7'}$$

instead of equation (7). They would adjust x downward for the application of regulatory policy $M(p)$ and yield an equilibrium price reaction p^0 which is exactly equal to the expected value of x under the given regulatory policy.

There are three problems with this argument. First, in systematic applications of event studies, regulatory policy would be a function of p and not of x. Second, and more fundamentally, the assumption that each investor knows x individually is not consistent with the arguments that have been advanced in support of event studies. In an efficient market, price p is supposed to reflect the aggregation of the partial information about x possessed by various individuals. Individuals *do not* have access to the aggregated information about x outside the market process and cannot base their decisions on the knowledge of its value. If each individual investor had access to x prior to participation in the market, it would not be difficult for the regulator to discover it either. Then, why conduct an event study? Finally, there is no empirical or other evidence that the equilibrium defined by (7') is attainable through any known market mechanism in environments where x is individually unknown. To the contrary, Plott and Sunder (1988) provide evidence that aggregation of diverse information through double auction mechanisms cannot be taken for granted in all economic environments.

Rational expectations

The reason the results of this paper are fundamentally different is that they rely on the idea of rational expectations (Muth (1961), Lucas (1972) and Kanodia (1980)) which require that the assumptions of a model should be consistent with its results.[6] If we assume that a policy making body, such as the FASB, would systematically (note, not deterministically) use the results *of* stock market event studies to make policy, it is not reasonable to assume that the stock market will remain oblivious to such use for long. When we consider the effect of such policy use *of* stock prices *on* stock prices, the usefulness of market studies for making policy evaporates.

Note that it does not matter how small the probability of policy revision based on price, $M(p)$, is. As long as it is nonzero, the equilibrium price reaction is driven to zero and therefore price becomes useless to revise policy.

Expected reaction by regulator

The effect of an accounting or other regulation on stock prices depends not only on the cash flows affected by the standard but also on the expected reaction of the regulatory body to the observed stock price change. If the expected reaction is nil, the latter effect will not exist. However, expectation of reaction cannot remain nil unless the regulatory body as a matter of policy refrains from such reaction. If it reacts even once, or uses the observation of stock price reaction as an argument for or against some regulatory action, investors will not entirely rule out the possibility that the subsequent accounting standards may be changed in response to the observed prices. In order to observe the market consequences of its actions properly, the policy making body must abstain from reacting to the stock price changes as a matter of principle.

One may argue that even if the policy making body refrains, as a matter of principle, from ever reacting to stock price changes by altering accounting standards already issued by them, observations of market price reactions may provide useful guidance to action on subsequent standard setting activity on other issues. If the issues are completely unrelated, market reactions to past standards may have little relationship to the consequences of the proposed ones. If they are closely related, an efficient market will incorporate into the price the expected effect of itself on related standards that are expected to be issued unless the agenda of the policy making body itself comes as a surprise to the market place. Efficiency of markets is a two-edged sword: the virtue of anticipating and incorporating information into prices justified the event studies in the first place, it also precludes the results of such studies from a policy process.

Implications and conclusion

The above finding that *observed* stock price changes cannot be used systematically to maximize shareholders' wealth through modification of accounting stan-

6 Also see Brennan and Schwartz (1982) for a derivation of consistent regulatory policy in the context of regulated industries.

dards and disclosure policy does not necessarily mean that stock prices are irrelevant to such policy making in general. Nor does it mean that such policy or standards have no effect on stock prices. From the point of view of the shareholders, it would be desirable to implement accounting standards and disclosure policy that will increase the stock prices. If stock price consequences of specific policy proposals can be estimated with a reasonable degree of accuracy by some indirect means, such estimates may form a useful input into the policy making process. My finding is that if policy depends on observed stock prices which in turn depend on policy, such prices cannot form a basis for policy.

What are the implications of this result for interpretation of the event studies? Interpretation of their results is straightforward if we can safely assume that the stock market at the time saw no possibility of the prices being used as the basis of subsequent reversal of the policies to which it was reacting. If such an assumption cannot be defended, observed price reactions in event studies can form a reliable basis for policy only in the context of an appropriately specified equilibrium model in which the anticipated future events are properly discounted and incorporated into prices. In the absence of such an equilibrium model, no reliable implications for policy can be drawn, no matter how statistically significant the empirical results are.

References

Ball, R.J. and P. Brown, "An Empirical Evaluation of Accounting Income Numbers, *Journal of Accounting Research* (Autumn 1968) pp. 159–178.

Beaver, W.H. and J.S. Demski, "The Nature of Financial Accounting Objectives: A Summary and Synthesis," *Studies on Financial Accounting Objectives: Journal of Accounting Research*, Supplement (1974) pp. 170–184.

Beaver, W.H. and R.E. Dukes, "Interperiod Tax Allocation, Earnings Expectations, and The Behavior of Security Prices," *The Accounting Review* (April 1972) pp. 320–332.

Benston, G.J., "Published Corporate Accounting Data and Stock Prices," *Empirical Research in Accounting: Selected Studies 1967, Journal of Accounting Research*, Supplement (1967) pp. 1–14, 22–54.

Brennan, M.J. and E.S. Schwartz, "Consistent Regulatory Policy under Uncertainty," *The Bell Journal of Economics* (Autumn 1982) pp. 506–521.

Cyert, R.M. and Y. Ijiri, "Problems of Implementing the Trueblood Objectives Report," *Studies on Financial Accounting Objectives: Journal of Accounting Research*, Supplement (1974) pp. 29–42.

Demski, J.S., "Discussion of the Relationship Between Accounting Changes and Stock Prices: Problems of Measurement and Some Empirical Evidence," *Empirical Research in Accounting: Selected Studies 1973, Journal of Accounting Research*, Supplement (1973) pp. 46–54.

Dopuch, N. and S. Sunder, "FASB's Statement on Objectives and Elements of Financial Reporting: A Review," *The Accounting Review* (January 1980) pp. 1–22.

Dyckman, T.R. and A.J. Smith, "Financial Accounting and Reporting by Oil and Gas Producing Companies: A Study of Information Effects," *Journal of Accounting & Economics* (Spring 1979) pp. 45–76.

Fama, E.F., "Efficient Capital Markets: A Review of Theory and Empirical Work," *The Journal of Finance* (May 1970) pp. 383–417.

Foster, G., "Accounting Policy Decisions and Capital Market Research," *Journal of Accounting & Economics* (March 1980) pp. 29–62.

Gonedes, N.J., "Efficient Capital Markets and External Accounting," *The Accounting Review* (January 1972) pp. 11–21.

———— and N. Dopuch, "Capital Market Equilibrium, Information Production, and Selecting Accounting Techniques: Theoretical Framework and Review of Empirical Work," *Studies on Financial Accounting Objectives: Journal of Accounting Research,* Supplement (1974) pp. 48–129.

Haworth, H., J. Mathews and C. Tuck, "Full Cost vs. Successful Efforts: A Study of a Proposed Accounting Change's Competitive Impact," SEC Directorate of Economic and Policy Research (Washington, D.C.: February 1978).

Kanodia, C.S., "Effects of Shareholder Information on Corporate Decisions and Capital Market Equilibrium," *Econometrica* (May 1980) pp. 923–953.

Lev, B. and J.A. Ohlson, "Market Based Empirical Research in Accounting: A Review, Interpretation and Extension," *Studies on Current Research Methodologies in Accounting: A Critical Evaluation, Journal of Accounting Research,* Supplement (1982) pp. 249–322.

Lucas, R.E., Jr., "Expectations and the Neutrality of Money," *Journal of Economic Theory* (April 1972) pp. 103–124.

May, R.G. and G.L. Sundem, "Cost of Information and Security Prices: Price Association Tests for Accounting Policy Decisions," *The Accounting Review* (January 1973) pp. 80–94.

Moonitz, M., *The Basic Postulates of Accounting.* Accounting Research Study No. 1 (New York: American Institute of CPAs, 1961).

Muth, J.F., "Rational Expectations and the Theory of Price Movements," *Econometrica* (February 1961) pp. 315–335.

Plott, C.R. and S. Sunder, "Efficiency of Controlled Security Markets with Insider Information: An Application of Rational Expectation Models," *Journal of Political Economy* (August 1982) pp. 663–698.

———— and ————, "Rational Expectations and Aggregation of Diverse Information in Laboratory Security Markets," *Econometrica* (Forthcoming 1988).

Sprouse, R.T., and M. Moonitz, *A Tentative Set of Broad Accounting Principles for Business Enterprises.* Accounting Research Study No. 3 (New York: American Institute of CPAs, 1962).

Sunder, S., "Research on Accounting and Repeating Policy," in D.L. Jensen (ed.), *Accounting Dissertations: Research Design and Implementation* (Columbus, OH: Ohio State University, 1982) pp. 21–30.