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The Misuse of Accounting Rates of Return: Comment

By STEPHEN MARTIN*

> It is better to light one candle than curse the darkness.
> *Motto of the Christopher Society*

In a recent paper (1983), Franklin Fisher and John McGowan argue that the large empirical literature that purports to examine the relationship between market concentration and profitability in fact does not do so, and that such exercises with accounting measures of profitability are meaningless.

These conclusions are based on the following series of propositions:

1) empirical investigations of the relationship between concentration and profitability "uniformly" measure profitability as a rate of return on assets or stockholders' equity;

2) the discount rate that makes the present value of an income stream equal to the expenditure that generates the income stream is the only measure of profitability which is "correct" for economic analysis;

3) (as shown by a series of examples) accounting measures of the rate of return on assets are very poor proxies for this "correct" rate of return.

I wish to make the following points: (a) proposition 1) is inaccurate as a description of the literature that investigates the relationship between concentration and profitability; (b) proposition 2), that what Fisher and McGowan label "the economic rate of return" is the only correct measure of profitability for economic analysis, is unconvincing, since a quite different measure of profitability emerges from familiar formal models of firm behavior; (c) the Fisher-McGowan examples illustrate a property of accounting measures of assets that is well known to students of industrial organization. I will discuss each of these points in turn.

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I. Empirical Studies of Profit and Concentration

Fisher and McGowan indicate:

> The large volume of research investigating the profits-concentration relationship uniformly relies on accounting rates of return, such as the ratio of reported profits to total assets or to stockholders' equity as the measure of profitability to be related to concentration. [p. 82]

As a description of the literature reporting studies of the relationship between concentration and profitability, this is simply incorrect. A large number of studies, possibly a majority, measure profitability as a rate of return on sales. This includes all studies that use the well-known "price-cost margin" computed from Census of Manufactures data (see my 1979 article, p. 474). Many of these studies are discussed in the literature surveys that are cited by Fisher and McGowan (Leonard Weiss, 1974; F. M. Scherer, 1980). Weiss (p. 199) suggests that such a measure is superior to other measures of profitability; so does Scherer (p. 269), who describes the rate of return on stockholders' equity and the rate of return on capital as "second-best" in comparison with the rate of return on sales.

II. Measuring Profitability for Economic Analysis

Fisher and McGowan state:

> The economic rate of return on an investment is... that discount rate that equates the present value of its expected net revenue stream to its initial outlay. ...it is clear that it is the economic rate of return that is equalized within an industry in long-run industry competitive equilibrium and (after adjustment for risk) equalized everywhere

> in a competitive economy in long-run equilibrium. It is an economic rate of return (after risk adjustment) above the cost of capital that promotes expansion under competition and is produced by output restriction under monopoly. *Thus, the economic rate of return is the only correct measure of the profit rate for purposes of economic analysis.*
>
> [p. 82, emphasis added]

The conclusion that what Fisher and McGowan call the economic rate of return is the only correct measure of the profit rate for purposes of economic analysis is thus based on an appeal to the economic theory of the behavior of the profit-maximizing firm. It is, however, well known that another measure of profitability arises naturally in formal models of profit-maximizing firm behavior: the Lerner index of monopoly power, the price-marginal cost margin.

Many studies of the relation between concentration and profitability have used models of the price-cost margin.[1] It manifests itself not only in models of output determination under conditions of market power, but also in models of various sorts of conduct (such as advertising or research and development).[2]

It is doubtful whether any measure of profitability can be unambiguously identified as "correct," to the exclusion of all others, for purposes of economic analysis. Fisher and McGowan's discussion of what they call "the economic rate of return" does not establish that measures of profitability based on the Lerner index are inappropriate for economic analysis.

At this point it is convenient to formally derive a version of the Lerner index. Consider a firm that combines the services $L(t)$ of labor and $K(t)$ of capital according to a continuous, twice differentiable production function $Q = F(L, K)$.[3] Output is sold at a price given by a continuous, twice differentiable inverse demand function $p(Q)$.[4] The services of labor are hired in a competitive labor market at wage $w(t)$. Capital is purchased at price $p^k(t)$. Capital stock depreciates at rate $\delta(t)$,[5] so that investment at time t is

$$I(t) = \dot{K}(t) + \delta(t)K(t), \tag{1}$$

where the dot indicates the time derivative.

The firm acts to maximize the present discounted value of net cash flow,

$$\pi = \int_{t=0}^{\infty} e^{-rt}\{\, p[F(L(t), K(t))]\, F(L(t), K(t)) - w(t)L(t) - p^k(t)I(t)\} \, dt. \tag{2}$$

First-order necessary conditions for profit maximization follow by substituting (1) into (2) and applying Euler's equation from the calculus of variations. They are

$$Qp'(Q)F_L(L, K) + p(Q)F_L(L, K) = w \tag{3}$$

$$Qp'(Q)F_K(L, K) + p(Q)F_K(L, K) = (r + \delta)p^k - \dot{p}^k = \lambda p^k \tag{4}$$

where

$$\lambda = (r + \delta) - (\dot{p}^k / p^k) \tag{5}$$

is the shadow rental of the quantity of capital

[1] For example, Joe Bain (1956, pp. 7; 190–91); Norman Collins and Lee Preston (1970, p. 10); Stephen Rhoades and Joe Cleaver (1973, p. 91); Keith Cowling and Michael Waterson (1976); see also S. J. Liebowitz (1982, p. 231, fn. 1).

[2] Richard Schmalensee (1972, pp. 20–43); Douglas Needham (1975); John Cubbin (1981).

[3] For references to the extensive literature on aggregation, see Robert Solow (1956) or Fisher (1969). The standard neoclassical model is worth investigating, not as an exact description of reality but as a useful approximation to reality. For a specific discussion of aggregation and empirical studies of industrial organization, see my paper with David Ravenscraft (1982).

[4] The firm may be a pure monopolist or a producer in a monopolistically competitive industry. The demand function and the production function may be made to depend on time without altering the nature of the results.

[5] As δ is allowed to vary over time, this is not a "Santa Claus" case (Fisher and McGowan, p. 92). It is possible to endogenize the rate of depreciation (as a function of the intensity of use of capital) without altering the nature of the results.

that may be purchased for a dollar (and functional dependence on time has been suppressed for compactness).

Equations (3) and (4) may be rewritten

$$(6) \qquad (p - w/F_L)/p = 1/\varepsilon_{Qp}$$

$$(7) \qquad (p - \lambda p^k/F_K)/p = 1/\varepsilon_{Qp}$$

where ε_{Qp} is the price elasticity of demand. Of course, equations (6) and (7) are just two different ways of writing the Lerner formula, since marginal cost is

$$(8) \qquad MC = w/F_L = \lambda p^k/F_K.$$

Equations (6) and (7) thus imply

$$(9) \qquad (p - MC)/p = 1/\varepsilon_{Qp}$$

and the Lerner index of monopoly power, the price-marginal cost margin, has emerged from a formal, dynamic, intertemporal model of profit-maximizing firm behavior.

It is important to note that the optimal conditions for factor employment at time t (equations (6) and (7)) and the equivalent Lerner index depend only on values that are known at time t, a property that Kenneth Arrow terms "myopia:

> ...[P]erhaps the most striking feature of the optimal policy is its independence of future movements of the profit function. This function, it must be remembered, incorporates all knowledge of market conditions both for the selling of the product and for the purchasing of inputs; it also incorporates all aspects of technology other than depreciation of equipment. In particular, the future shifting of technological knowledge plays no role in present investment decisions.
>
> The myopic property of the optimal capital policy implies a considerable economy of information needs in the firm's decision making process, perfectly comparable to the use of the price system for decentralization.
>
> Until very recently the myopic property was largely unremarked in the literature. Indeed, the usual formulation, for example, Keynes's use of the marginal efficiency of capital,... requires comparison of the present value of all future returns for a given investment with the investment cost. This procedure is not unambiguous... its most significant defect is to concentrate attention on the choice between undertaking an investment and not undertaking it at all, whereas the myopic rule is based on comparison between undertaking the investment now and postponing it for a short period.
>
> [1964, pp 27–28]

When factor markets work—when the price system allows decentralization in factor markets—the myopic property similarly allows a considerable economy of information in the assessment of profitability, by use of measures based on the Lerner index rather than present value calculations.

Such measures of profitability will be suitable for samples of firms or industries that employ relatively nonspecific, tradable capital assets (such as wholesale or retail trade; see my forthcoming article and Bruce Marion et al., 1979).[6] Such measures of profitability will be appropriate for samples drawn from populations that employ specialized, imperfectly tradable capital assets, if the degree of specificity of assets is roughly constant over the sample (Blake Imel et al., 1972). Such measures of profitability will be appropriate for broad cross-section samples if one controls for variations across the sample in the nature of markets for capital assets (and it can be argued that conventional measures of absolute capital requirements and entry conditions do this, in an imperfect way).

The myopic property of the Lerner index also reflects the fundamental differences between the conventional neoclassical view of the production process, that underlies the model presented here, and the view of the production process that is implicit in the Fisher-McGowan examples. The firm is

[6]Alternatively, one may say that sunk costs should be small and fixed assets traded in markets which work well; see William Baumol et al. (1982, pp. 280–82 and fn. 2).

modeled here as an ongoing concern, acquiring fixed and variable factors to produce output that is marketed on a continuing basis; decisions are made by evaluating the consequences of marginal changes. The examples presented by Fisher and McGowan involve what might be called "oilfield production": as asset is acquired, a project is undertaken, the project yields a time stream of returns, the asset is used up, the project is ended.[7] Ongoing firms in the Fisher-McGowan examples are simply collections of such assets, that are not traded once a project commences.

III. The Lerner Index and Accounting Measurements

Fisher and McGowan cannot establish that what they call the economic rate of return is the unique correct measure of profitability for purposes of economic analysis. They simply fail to discuss the large portion of the empirical literature relating concentration to measures of profitability based on the Lerner index. Their conclusions concerning the literature that relates concentration and profitability are thus not established by their arguments.

However, their examples do illustrate an important property of accounting data, one that has implications for the use of the Lerner index. I show this by specializing equation (9) and obtaining an expression for the Lerner index that can be related to empirical studies employing rates of return on sales as measures of profitability.

Suppose the production function exhibits constant returns to scale; as noted by William Baumol et al. (p. 33), this is the leading empirical case. Under constant returns to scale, marginal cost and average cost are the same. Formally, from (8),

$$(10)\quad wL + \lambda p^k K = MC(LF_L + KF_K) = MC(Q),$$

so that

$$(11)\quad MC = (wL + \lambda p^k K)/Q = AC,$$

and the Lerner index (9) may be rewritten as

$$(12)\quad (pQ - wL)/pQ = 1/\varepsilon_{Qp} + \lambda p^k K/pQ.$$

Without loss of generality, L may be interpreted at this point as a vector of variable factors, with w a conformable vector of factor prices. The left-hand side of (12) is then the margin of revenue over the cost of variable inputs, as a fraction of revenue (or equivalently the margin of price over average variable cost, as a fraction of price). This clearly corresponds to the widely used "price-cost margin" computed from Census of Manufactures data,[8] and to profit rates on sales computed from other sources.

Most simply, it may then be argued that the price elasticity of demand for the product of a single firm will be a function of industry characteristics (including but not limited to market concentration and entry conditions); more formal approaches are possible (for example, Keith Cowling and Michael Waterson). Aggregation to the industry level raises the well-known industry boundary problem—the classification of firms or divisions of firms into industries—but equation (12) clearly provides a framework that encompasses many empirical studies of profitability at the firm and industry level. Such studies should, of course, control for differences between average and marginal cost; conventional measures of minimum efficient scale and the cost disadvantage of smaller firms serve this role. It is generally

[7]As noted by Fisher and McGowan (p. 84, fn. 9), it is not the wearing out of assets that is critical. I use the term "oilfield production" with reference to Richard Mancke (1974), who runs simulations based on assumptions similar to those of the Fisher-McGowan examples.

[8]For specific discussions of the price-cost margin as computed from Census of Manufactures data, see Weiss (p. 199) or Scherer (pp. 271–72). Liebowitz criticizes the census price-cost margin by comparison with Internal Revenue Service data. Scherer identifies two major problems with IRS data: the assignment of entire firms to a single industry (p. 270) and the impact of accounting rules that are followed for tax purposes only (p. 272). Liebowitz corrects for the first problem (pp. 238–39, fn. 22); he recognizes the second (p. 238, fn. 21) and assumes it can be ignored. There is no reason to think that this is the case; his results can be interpreted as confirming the suitability of census data.

recognized that a capital-sales ratio should be included as an explanatory variable when profitability is measured as a rate of return on sales, and (12) provides a formal rationale for this.

The force of the Fisher-McGowan examples, applied to (12), is that accounting measures of the value of the capital stock are likely to be poor measures of the economic value of such assets, so that the capital-sales ratio, the second right-hand side term in (12), will be subject to serious measurement error.

It should first be noted that although the Fisher-McGowan examples make this point with great clarity, it is not new. It is discussed by Scherer (pp. 272–73); it is discussed by Weiss (pp. 196–97); it is discussed and specifically addressed by studies which employ stock market measures of asset value (James Bothwell and Theodore Keeler, 1976; Timothy Sullivan, 1977; Stavros Thomadakis, 1977).[9]

Somewhat more generally, the Fisher-McGowan examples suggest that since accounting measures of the value of capital are likely to be flawed, accounting techniques should themselves be the subject of analysis. As noted by Nicholas Gonedes and Nicholas Dopuch (1979, p. 407),[10] this is only possible where data sets include information on the nature of the accounting conventions used to record asset values. The only major cross-section data set that includes this information is the Federal Trade Commission's Line of Business data set. Two studies that examine the robustness of results of concentration-profitability studies to the use of alternative accounting conventions and alternative definitions of capital stock find that such results are robust.[11]

[9]As noted by Thomadakis (p. 181, fn. 1), this measurement error is a serious problem only if systematically related to market structure.

[10]Gonedes and Dopuch are critical of studies that criticize accounting measures of income with reference to "true" or "ideal" concepts of income (pp. 384–85). They assert that the fundamental problem of accounting measurement arises in the context of incomplete or imperfect markets (p. 392, fn. 10).

[11]William Long (1981); my 1981 manuscript. The Long paper employs what Gonedes and Dopuch call a recomputation technique. The Fisher-McGowan paper is an example of what Gonedes and Dopuch call the simulation approach. As Gonedes and Dopuch note, "Neither approach dominates another in terms of insights provided" (p. 400).

IV. Conclusion

The price-average cost margin or rate of return on sales is a measure of profitability which may be used for economic analysis. Fisher and McGowan have demonstrated the well-known point that accounting measures of capital intensity are likely to be inaccurate. This should be, and has been, considered in carrying out empirical studies of the concentration-profitability relationship. The literature that relates concentration to rates of return on sales constitutes a well formulated body of empirical economic research, and examination of absolute or relative price-cost margins to draw conclusions about market power can be expected to yield accurate information about structure-conduct-performance relationships.

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