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Chapter Author: Tibor Scitovsky

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ECONOMIC THEORY AND THE MEASUREMENT OF CONCENTRATION

TIBOR SCITOVSKY
STANFORD UNIVERSITY

ECONOMIC theory might contribute in two possible ways to the development of a satisfactory measure or set of measures of concentration. The theory of price and general competitive strategy under conditions of oligopoly might provide guidance for choosing the measure that best distinguishes industries according to differences in their methods of competition. While I am not too familiar with this branch of economic theory, I doubt if it could be of much use at the present stage of its development, when—under the impact of Von Neumann's and Morgenstern's work on the general theory of strategy—it is in a state of ferment. Furthermore, I am not at all convinced that our main purpose in measuring concentration is (or should be) to distinguish among industries or economies according to their methods of price setting and competition. The public are concerned about industrial concentration, because they are concerned about its economic and political effects. The economist should, therefore, analyze at least the economic effects and assess their importance. Accordingly, measures of concentration should be evolved with a view to their usefulness in accomplishing this task. This criterion is very different from the criterion mentioned above, since the methods of price setting and competition brought about by concentration are neither the only nor necessarily the most important effects of concentration. Hence, the second possible contribution of economic theory is to make hypotheses as to the various effects of concentration. By so doing, it will indicate the various uses to which measures of concentration will be put and thus help to develop the most satisfactory measure.

I shall concentrate on this latter relation, and try to give a detailed statement of the various effects that the theorist would expect concentration to have. Also, I shall use this opportunity to make a few criticisms of some of the existing measures of concentration.

The discussion of the effects of concentration will have the useful by-product of providing an appraisal of some of the alternative measures of oligopoly power. Let us remember that measures of concentration, whether they try to measure the concentration of ownership, profits, or market policies within an industry, are only one

among many possible indexes of oligopoly power. Another set of indexes aims at measuring oligopoly power by its effects. In this category belong the indexes developed by Lerner, Bain, Morgan, Papandreou, to mention only a few. I propose to deal with some of these at least in passing.

In discussions of the effects of industrial concentration, it is customary to distinguish between the distributive effects and the effects on the efficiency of economic organization; but each of these can be broken down yet further. In the case of the distributive effects of concentration, it is desirable to distinguish the effect of concentration on income distribution from its effect on the distribution of social and political power. In the case of the efficiency effects, the effects of concentration on resource allocation are usually stressed. Here we must distinguish the effects on resource and output allocation among different firms and industries from the effects on the way in which each individual firm combines its different productive resources. Furthermore, concentration may also influence the firm's internal administrative and engineering efficiency, and may affect technological progress. These six effects can be called the direct effects of concentration. Through its influence on income distribution, general efficiency (and hence labor productivity), and technological progress, concentration may also influence the level of employment; but since this is an indirect effect, wrought through the direct effects mentioned above, it will not be discussed further.

1. *Effect on Income Distribution*

INDUSTRIAL concentration has been attacked chiefly because of its effect on income distribution. Some attack it on equalitarian grounds, because concentration is generally believed to enhance the inequality of income distribution. Others feel that it is inequitable for anyone to receive a higher income than is necessary to call forth the supply of his type of services in the socially desirable quantities. In general, many resent the fact that in a world of monopolies and countermonopolies inequalities of income arise that have no economic justification or explanation but are caused by disparities in bargaining power. Furthermore, income distribution is not a matter of equity alone. Since it is one of the determinants of specialization and of the flow of primary resources into different uses, one can argue that income distribution is also a matter of efficiency—an efficient income distribution being defined as one that would bring about an efficient allocation of resources.

Industrial concentration may affect income distribution in a variety of ways. Concentration influences the profit margins and prices charged in product markets as well as the prices paid for resources in factor markets; and it can also affect income distribution by making it more expensive and generally more difficult for newcomers to enter the industry.

Statistical measures of the effects of concentration on income distribution have not yet been developed. An index, however, is provided by Bain's index of profit rates. In fact, it has been claimed that Bain's index measures not only this single effect of concentration but is a suitable index of concentration or oligopoly power itself. The aim of all concentration, it might be argued, is monopoly profit; and therefore the best way of measuring concentration is to measure the extent to which it achieves this aim. This argument would be valid if it were found that the other effects of oligopoly power were exerted through the same factors that influence profits and in a similar way.

2. *Effect on Distribution of Power*

THE next effect of industrial concentration I want to deal with is its effect on the distribution of social and political power. I shall consider this effect separately, partly because the distribution of social and political power is important quite aside from the effects it may have on income distribution, partly because concentration may affect income distribution and the distribution of social power in different ways, and partly also because value judgments may be different with respect to the two distributions.

It is sometimes argued, for example, that the increased concentration of business and of organized labor on the two sides of the labor market have just about offset each other as far as their effect on income distribution is concerned. If this is so, we would nevertheless regard the advent of collective bargaining on a nationwide scale as of the utmost political, social, and economic importance. Again, in our present-day society, when the power of the state is great and increasing, the individual's protection against abuses of this power might well lie in the social power of organized economic and other groups; and in this connection—as well as in many other connections—the political scientist might well be interested not only in the degree of concentration but also in how concentration is distributed among different social groups and economic interests.

3. *Effect on Resource Allocation*

THE next two effects of concentration have to do with resource allocation. Under pure competition, each firm would combine its resources in the best (socially most desirable) proportions and produce an output that stands in the correct (socially most desirable) relation to the output of all other firms and industries, because perfectly competitive prices reflect relative scarcities and demands correctly, and because each firm, guided by these prices, would aim at maximum profits.

Neither of these conditions is likely to be fulfilled under oligopoly.[1] When oligopolists sell at prices above marginal cost and oligopsonists buy at prices below marginal value, relative prices become unreliable as indexes of relative scarcities and relative demands; and the producers, whose policies are guided by market prices, may make socially undesirable decisions. In particular, too little will be produced and too few resources utilized in industries with high margins;[2] and too much will be produced and too many resources utilized in industries with low margins.

This is the chief effect of concentration on allocation; but it should be noted that it is the result of market imperfection in general rather than of concentration alone, which is only one of the many manifestations (or causes) of market imperfection. Furthermore, misallocation of resources is caused, not by the size of profit margins, but by the fact that they differ sharply among industries—though the best practical way of narrowing this difference might nevertheless be to lower the average profit margin.

To express the importance of this effect of concentration or of market imperfection we would want, ideally, a measure of society's loss chargeable to misallocation of resources. But we have hardly begun to take the first step toward laying the conceptual foundations on which statistical estimates of such social loss might be based.[3] In the interim, the best we can do is to use the margin between price and marginal cost as an index of this loss—or rather, some parameter of the frequency distribution of this margin. This is Lerner's well-known index of the degree of monopoly. A general

[1] The condition of profit maximization is discussed in section 5 below.

[2] Unless otherwise stated, the terms "margin" and "profit margin" refer throughout this paper to the margin between price and marginal cost, or between marginal value and price.

[3] See the work of Gerard Debreu in several Cowles Commission "Discussion Papers" privately circulated.

appraisal of this index will be given later, but I shall discuss some of the specific objections to it here.

One objection to Lerner's index of monopoly power is that its practical application presents formidable problems, because firms do not use marginal cost as an operational concept. The second objection is that Lerner's index shows the degree of monopoly power only in the product market and ignores the possibility of the firm's oligopsony power in factor markets.[4]

Both these difficulties, however, can easily be resolved in certain cases. In firms whose output varies in proportion with the input of variable factors (i.e. where the variable factors have fixed production coefficients) the margin between price and average variable cost (an operational concept!) can be used as an index of market imperfection both in the market where the firm sells and in the markets where it buys. In such firms, average variable cost and marginal cost would coincide if it were not for imperfect competition in factor markets; and the difference between average variable and marginal costs measures the weighted average degree of market imperfection faced by the firm in the factor markets. By adding this difference to the difference between marginal cost and price, which measures market imperfection in the product market, we obtain the margin between average variable cost and price as a measure of market imperfection in both product and factor markets. Dean's cost studies suggest that the special condition under which this amended form of Lerner's index could be used occurs in many industries.

A third objection to Lerner's index is that it measures market imperfection rather than monopoly or oligopoly power. The margin between price and marginal cost would not be zero even in the complete absence of oligopoly, which is only one of several factors that account for this margin. Accordingly, to measure the effects of oligopoly alone, two further indexes were developed, one by Rothschild and the other (along lines suggested by Triffin and Morgan) by Papandreou.[5]

The second effect of concentration on resource allocation also

[4] Lerner himself, unlike most other advocates of his index, was fully aware of this objection and met it in a way similar to that suggested in the next paragraph.

[5] Cf. K. W. Rothschild, "The Degree of Monopoly," *Economica*, February 1942, pp. 214-239; Theodore Morgan, "A Measure of Monopoly in Selling," *Quarterly Journal of Economics*, May 1946, pp. 461-463; A. G. Papandreou, "Market Structure and Monopoly Power," *American Economic Review*, September 1949, pp. 883-897.

results from the gap between price and marginal cost or marginal value; but it has to do with the proportions in which the individual firm combines its different productive resources. In short, it has to do with the method of production adopted by the firm. The margin between the price and marginal cost of productive resources tends to keep the socially most desirable method of production from being also the cheapest; and owing to the pyramiding of margins at successive stages of production, it might lead to a general bias against the use of capital equipment and other manufactured factors of production. Misallocation of this type must be distinguished from misallocation of the first type, discussed in the previous section, because, unlike the first type, it increases both with the average degree of market imperfection and with its dispersion, and also because vertical integration as well as bilateral concentration in factor markets are likely to restore the correspondence between the social desirability and the money cost of different methods of production.[6]

No attempts have as yet been made to appraise the importance of this type of misallocation and the social loss resulting from it, but the approach used in the case discussed in the last section must also be used here. Lerner's index, however, or any similar index is not applicable, because it cannot show the corrective influence of vertical integration or bilateral concentration.

4. *Effect on Efficiency of the Firm*

CONCENTRATION also affects the firm's internal administrative and engineering efficiency. Since this effect is exerted through the influence of concentration on the entrepreneur's desire to maximize profits, its consideration must be prefaced by a short discussion of profit maximization.

Under pure competition, the profit of the most profitable firm is supposed to be kept at or near zero by the free entry of newcomers. All the less profitable firms therefore are suffering a loss; and it is the whip-hand of this loss that keeps each entrepreneur on his toes and, so to speak, forces him to maximize his profit. By contrast, when restraints on or costs of entry to a monopolistic or oligopolistic market suspend the operation of the competitive forces that would tend to eliminate profits, then the failure to maximize profit

[6] Cf. Lionel W. McKenzie, "Ideal Output and the Interdependence of Firms," *Economic Journal*, December 1951, pp. 785-803. See also my *Welfare and Competition* (Irwin, 1951), pp. 356-363 and 437-438.

may lead merely to lower-than-maximum profits instead of to the punishment of losses. The desire for profit may be strong enough, of course, to render even the threat of low profits enough to call forth the utmost effort to maximize profits; but the widespread criticism of the assumption of profit maximization suggests that there must be many markets in our economy in which the restraint on entry and consequent guarantee of monopoly profits removes or at least greatly weakens the desire to maximize profits.

What is the significance of the oligopolist's failure to maximize profits from the point of view of efficiency? I argued in section 3 that under imperfect competition even profit maximizing behavior would lead to inefficient resource allocation; and this situation may be rendered still worse by the firm's failure to maximize profits.[7] But, and this is more important, failure to maximize profits causes inefficiency also in another sense. It can be shown that profit maximization calls for efficiency in the internal administration and engineering setup of the firm, *whatever the nature and structure of the markets in which the firm operates.* Profit maximization therefore is desirable even if market imperfection interferes with efficient resource allocation; and it may well be one of the most important effects of concentration that by weakening the incentive to maximize profits it also weakens the management's incentive to enforce and maintain the firm's internal efficiency.

The internal inefficiency of the firm may take a variety of forms. On the technical side it may involve offering the consumer an unsatisfactory product, producing a given product with wasteful and old-fashioned methods, or simply not keeping up with technological progress. On the administrative side it may mean plain bad administration, the inadequate coordination of the firm's different activities and plants, or the unnecessary and wasteful expansion of the firm's administrative bureaucracy.

It is to be noted that profit maximization is a sufficient but not a necessary condition of the maintenance of internal efficiency in the firm. Management may be interested in efficiency per se, quite apart from its effect on profits; or, to put it differently, management may be interested in minimizing costs even if it is not anxious to maximize profits. I am rather skeptical, however, about this type of argument; and the experience of this country during World War II with the cost-plus type of contract suggests strongly that the profit

[7] It could conceivably lead also to better allocation, but this does not seem very likely.

motive is still the best if not the only guarantee of efficiency in the firm.

So far as I am aware, no attempts have been made to measure this effect of concentration.

5. *Effect on Rate of Technological Progress*

IN THE last two sections we were concerned with the effect of concentration on efficiency in a static sense and on the firm's inducement to keep step with the progress of its competitors. But concentration also affects the rate of technological progress, even though the importance and the direction of this influence is a matter of controversy. There is agreement only on the fact that basic scientific research has in our day become a very expensive operation, which can be indulged in only by large firms and well-endowed universities. Big business is therefore held to promote basic scientific progress.

Entirely separate from this is the problem of how soon a given state of scientific knowledge or a given rate of scientific progress will be put to industrial use. Here again bigness plays a role, although there are several conflicting factors. To begin with, the large firm has a greater inducement than the small firm to introduce methods of production requiring a high capital investment[8] and whenever improved productive methods happen also to require a heavy investment, it is the large firms that will put them into effect the sooner and the more readily. Secondly, there is the risk factor, which pulls in the opposite direction. It has been argued that an oligopolistic market is more risky than a freely competitive one; and it is also maintained (although on somewhat incomplete evidence) that large firms are more reluctant to engage in risky ventures than are small firms. It would follow from this that investment in innovations that involve a risk would be more readily undertaken by the small firm and in the freely competitive market. Thirdly, newcomers have more of an inducement than established firms to use the most up-to-date methods; whereas the adoption of the best available methods by established firms is governed and often retarded by the rate at which their existing equipment is wearing out. Since the distinction between established firms and newcomers usually coincides with that between large and small firms, this factor also tends to associate faster progress with the small firm. Common observation suggests that the first factor often has the upper hand

[8] For the reasons see p. 111 below.

over the other two but for a definitive answer we must await here too a statistical study.

6. *Conclusions*

WE ARE now ready to draw certain conclusions about the measurement of concentration from this short review of its effects. It appears, to begin with, that a simple distinction can be drawn between measures of concentration on the one hand and all other indexes of monopoly or oligopoly power on the other hand. Monopoly and oligopoly consist of a power relation among the sellers or the buyers in a certain market; and this power relation depends largely on the number and size distribution of the competing sellers or buyers. Measures of concentration try to express the number and size distribution of competitors in terms of a one-parameter index, which could then be regarded as a direct measure of the degree of oligopoly.[9]

By contrast, all other indexes and proposed indexes of oligopoly or monopoly aim at measuring it indirectly by its effects. In view of the tenuous connection between numbers and size distribution on the one hand and the resulting oligopoly situation on the other, there is a great temptation to do this. Unfortunately, however, this procedure raises other, and I suspect worse, difficulties, which are due to the great variety of effects that concentration has. If concentration is to be measured by its results, which effect should be chosen for the role of the measuring rod? The answer would be easy if one effect were more important than all the others, or if all the different effects were closely correlated. However, there is good reason to doubt the latter; and the former is one of the questions we cannot yet answer.

Bain's index of profit rates therefore must be rejected, I think, as a general measure of oligopoly power—at least until statistical investigation has established that the most important influence of concentration is its effect on income distribution, and that the creation of monopoly profit is the main aspect of its redistributive effect. It is true that the size of profits is likely to be correlated with some of the efficiency effects of concentration; but there is at least one, which may well be among the most important, with which it is not correlated. It will be recalled that one result of concentration is the weakening of the competitive pressure under which the firm maximizes profits and maintains its internal efficiency for the sake of maximizing profits. It is obvious that Bain's index is inadequate as

[9] See, however, Fellner's discussion of this paper for a three-parameter index.

a measure of the effect of concentration on the firm's internal administrative and engineering efficiency.

Lerner's index must be rejected on similar grounds. This index, unlike Bain's, is aimed primarily at expressing the effects of concentration on efficiency; and it measures not an ultimate but an intermediate effect: the margin between price and marginal (or average variable) cost. But since concentration exerts its economic effects through two channels—margins and obstacles to entry—Lerner's index is also one-sided. It registers the influence of concentration on the allocation of output and resources among different firms and industries and would be acceptable as a general index of concentration only if this were the main effect of concentration. The index fails altogether to register the firm's internal efficiency, which has to do with obstacles to entry; it is an unsatisfactory measure of the distributive effects, which have to do both with margins and with obstacles to entry; and it also fails to show the effect of concentration on technological progress and on the choice of the firm's method of production. Rothschild's and Papandreou's measures, while interesting in some respects (especially Papandreou's), are also based on the firm's profit margin and must therefore be rejected on similar grounds.

7. *Standards of Adequacy*

WE CAN now at long last consider the proper subject of this Conference: measures of concentration in the strict sense of the word. Since these do not aim at measuring the *effects* of concentration, they can hardly be criticized for inadequacy on that score. But the foregoing discussion suggests that their main purpose is and must be to serve as a basis for a systematic statistical appraisal of the effects of concentration. Theory can only provide a list of these effects and indicate their nature. Ahead of us is the major task of verifying the surmises of theory and appraising the importance—absolute and relative—of each effect of concentration. It is clear that for this task a good measure of concentration is required; and it is by the standard of adequacy for this task that measures of concentration must be judged.

One of the problems raised is the choice of the most suitable quantity in terms of which to measure concentration. As far as I am aware, five such quantities have been suggested: employment, sales, value added, value of total assets, and "net capital assets." Theoretical considerations are helpful, I think, in making this choice. We

should expect large firms to use more capital-using and small firms to employ more labor-using methods of production for at least three reasons. One is that the scope for using labor-saving machinery increases with size. The second is that large firms are likely to be in a better bargaining position vis-à-vis the producers of equipment and therefore obtain the latter at more favorable prices than do small firms.[10] The third reason is that the factor limiting the size of small firms is usually their limited access to capital, whereas the size of large firms is limited by various other considerations; and capital theory suggests that this difference in the limit to size encourages higher capital-using methods of production in the large firm.[11] Accordingly, we should expect a measure of concentration based on employment to understate, and one based on total or "net" capital assets to overstate the degree of concentration. This would leave sales and "value added" as the best measures of size; and since "value added" data are not available at present, we should conclude that the volume of sales is the most satisfactory basis for measuring concentration.

The use of sales for this purpose has been criticized, however, on the ground that it would show horizontal concentration but not vertical integration. Indeed, if the same index is to measure both horizontal and vertical integration, then employment, or assets, or—to take care of the problem raised in the previous paragraph—some average of employment and assets, would be a more suitable quantity in terms of which to measure the degree of concentration.

It is not at all certain, however, that it is desirable to express both horizontal and vertical integration with the aid of a single measure of concentration. If our sole concern were the effect of concentration on the distribution of income and of social and political power, a single measure might suffice. But if we are also concerned, as I think we should be, with the effect of concentration on efficiency, more than one measure is needed. For some aspects of efficiency we should expect horizontal and vertical integration to pull in opposite directions. Horizontal concentration can generally be expected to *worsen* efficiency in most respects; but vertical integration is likely to *improve* efficiency at least in the firm's choice of a method of production and in its combination of the different factors of production. This was argued in section 3. It is not my task to suggest a suitable index for measuring the degree of vertical integration; but I do

[10] This is the bilateral concentration referred to in section 3.
[11] Scitovsky, *op. cit.*, Chap. IX, Sec. 4.

think that if the aim of measuring concentration is to help assess its economic effects, horizontal and vertical concentration as well as their measurements should be kept strictly separate.

Another result that emerges from this analysis is the need for a measure of concentration that would show the fields in which and the degree to which concentration on one side of a market is matched by concentration on the other side of the same market. We know that in some though not all respects the effects of concentration are offset by the concentration of "countervailing power"; and it is clearly desirable that measures of concentration should be such as to enable their users to deal with this problem. I am fully aware of the difficulties that arise in this connection, mainly from the fact that the relevant statistics and much of our thinking on these matters are based on classification by industry; whereas the concept of bilateral monopoly or countervailing power refers to the individual market. It is not my task, however, to make concrete suggestions in this paper; and I shall confine myself to a mere statement of the economist's needs.

Finally, a few words might be said on the problem of finding a one-parameter index with which to express the shape of the distribution of an industry's total sales (or employment, or assets, etc.) among its members. There have been many attempts to solve this problem. To mention just a few: the percentage of an industry's total sales (or employment, etc.) concentrated in a fixed number of its largest firms—this number varying between four and eight; the number of the largest firms—or the percentage of all firms they represent—that among them produce a fixed percentage of the industry's total sales; the Gini index; the attempt, mentioned by Adelman, to fit a simple one-parameter function to a cumulated frequency distribution of size, and to use the parameter of this function as an index of concentration.

It is obvious, I think, that economic theory cannot offer much help in choosing among these and similar alternatives; and the little help it does provide is largely negative. I doubt, for example, if theory can help us choose from among the indexes of the type first mentioned. So far as I know, oligopoly theory does not tell us the maximum number of firms among which competitive behavior will still be oligopolistic. Similarly and for the same reason, we have no principle for choosing the fixed percentage of an industry's sales on which to base an index of the type mentioned second; nor do we have a criterion for choosing between the first and the second type.

As to Gini's index, it must be rejected, I think, because it indicates only the inequality of size distribution and is unaffected by the total number of firms; whereas absolute numbers are clearly relevant to monopoly power. The last-mentioned index, if it can be developed, appeals to me most; but on the basis of its elegance rather than on that of economic considerations. I must admit, however, that I am no specialist on oligopoly theory, which is relevant for choosing among these alternatives; and I should look for the definitive answer to these problems to Stigler or Fellner, who are specialists on the theory of oligopoly.

COMMENT

WILLIAM FELLNER, Yale University

SCITOVSKY's analysis is concerned with how alternative measures of monopoly and of concentration relate to specific economic and social problems. I am in general agreement with his conclusions.

So-called measures of monopoly are essentially different from measures of concentration. Measures of monopoly relate to some property of monopoly, usually conceived of as an *effect* of this market condition. Measures of concentration tell us something about the *likelihood* that monopolistic (oligopolistic) behavior will become observable. All these measures possess significant limitations.

Among the many effects of monopoly, its influence on technological progress is certainly one of the most important and perhaps *the* most important. But no simple statement can be made about this aspect of the problem. It would be hopeless to try to express the influence of monopoly and competition on progress by the sort of measure Lerner has used for a definition of monopoly in terms of its effect on the allocation of resources on static assumptions. The effect on progress presumably does *not* grow monotonically with the "degree of monopoly" in the Lerner sense or in any other independently meaningful sense. It is much more likely that the circumstances most conducive to progress are characterized by some combination of competitive market characteristics with monopolistic ones.

For fuller understanding of the bearing of competition on progress we should know more about the relationship between the research efficiency (inventive efficiency) of the firm and its size. What is even more important, given the research efficiency of the firm we should have specific knowledge of the effect of monopoly and of competition on the quality of foresight and on the strength of the

profit-incentive. For, if all firms *maximized* their profits on *correct* anticipations—including correct anticipations of the future rate of technological progress—then the speed with which given inventions are technologically introduced would be the same under monopoly as under competition.[1] Monopoly and competition influence the rate of progress by their effect on research efficiency, on the quality of foresight, and on the responsiveness of firms to the profit stimulus.

In view of these circumstances, it would be unreasonable to look for a "measure of monopoly" that would directly express the effect of monopoly and of competition on progress; and any measure bypassing this dynamic effect either is subject to the severe limitations of static analysis or is a concentration measure in disguise rather than a measure of monopolistic consequences. In empirical work it seems preferable to experiment with measures of concentration, rather than with measures of monopoly, by examining the question of what behavior is observable in markets characterized by different degrees of concentration.

Yet the difficulties standing in the way of the concentration-ratio

[1] A well-known proposition maintains that in a competitive industry newcomers enter with a new method (and force old firms to price below old total costs, according to the new method) as soon as new total cost falls short of old total cost, while a monopolist will adopt a new method only if new total cost is lower than old variable cost. This suggests that progress is slower under monopoly. But the proposition obviously implies that the competitive firms have wrong foresight and that they suffer losses. If they had known that new firms would enter with a new method, there would have been fewer firms in the industry, with the result that during the lifetime of the equipment of each firm the total cost would be recovered. During each such period (construction-to-scrapping period) the competitive output would be greater than the monopolistic, but this would merely express the "static difference" between competition and monopoly. The rate of progress (rate of increase of output) *from one such period to the next* would not depend on the character of the market structure if laboratory inventions were made at the identical rate, foresight were correct, and profits were maximized under all market structures. It is true, however, that the length of the construction-to-scrapping period *may* in certain circumstances depend on the market structure. This is probably not a very significant qualification. *The essential proposition here is that with identical laboratory efficiency, perfect foresight, and profit maximization, the difference between the monopolistic and competitive output is merely the familiar difference developed by static equilibrium theory for each successive period.* Aside from some complicating factors, which have no room in a first approximation, there would in these circumstances be no further difference such as would express itself in the growth or the diminution of the "static difference" from one period to the next. Hence there would be no difference in the rate of progress (cf. my discussion of this problem in the *Quarterly Journal of Economics*, "The Influence of Market Structure on Technological Progress," November 1951, pp. 556-577 and "The Test Which Inventions Must Pass: A Correction," May 1952, pp. 297-298).

approach are very considerable, too. One of these is that the approach requires distinguishing groups of firms (industries) from one another, in a fashion which implies a judgment on cross elasticities of demand or of supply. Another difficulty is that some significant consequences of monopoly cannot be measured in a way that permits correlation analysis between concentration ratios and monopolistic consequences. At best we can try to express the concentration characteristics and *some* market results numerically, and add to this a verbal discussion of the relationship between the numerical concentration characteristics and those aspects of market behavior that lend themselves poorly to numerical description.

A concentration ratio in the conventional sense is always a single "property" of an underlying function. The function expresses on the ordinate the cumulated share[2] of an increasing number of firms, with the firms arrayed from the largest to the smallest along the abscissa. For example, the share of the four largest firms is a single property of such a function. Considering that in an analysis of the effects of concentration on market results more than one property of these functions may prove significant, the present practice of basing the measures of concentration on a single property of the underlying function may block fruitful avenues. It seems to me that a somewhat fuller description of the characteristics of these functions could convey a good deal more information, without significant loss of simplicity.

Some convention of the following sort might, for example, prove convenient. Express the share of the largest firm as one number; list the number of the firms with shares exceeding, say, 10 per cent, and make this your second number; express, as your third number, the joint share of the firms with shares exceeding, say, 10 per cent; and add or omit a parenthetical (s) sign at the end of the symbol, depending on whether small firms with individual shares of less than, say, 1 per cent, do or do not jointly account for more than 10 per cent. For example, *20—3—52 (s)* would mean that the largest firm has a share of 20 per cent, that the total number of firms with a share of more than 10 per cent is three, that the joint share of these three firms is 52 per cent, and that very small firms account for more than 10 per cent of the total. A symbol of this sort is not essentially more cumbersome than that which we habitually use for denoting the day of the year, and yet some symbol of this general character

[2] This may be the share in total output or in total employment or in any other significant variable.

may give a reasonably good picture of nearly the entire course of the underlying concentration function. In our illustration we would know that the share of the largest firm is 20 per cent, that the second and the third largest firm have individual shares of between 12 per cent and 20 per cent, and that firms which are very small[3] and which are fairly small[4] in relation to the biggest firm in the group *jointly* account for 48 per cent of the total. We would know also that the joint share of the very small firms is not entirely negligible, but we would not know the distribution as between "fairly small" and "very small" firms. (If this further information were considered essential, a fourth number could be added, in the parenthesis containing the letter *s*, and this number would disclose the joint share of the very small firms.)

If we could take it for granted that the underlying concentration function (cumulated distribution) is mathematically always of the same type, we might be able to summarize the essential properties of the entire function by, say, the value of a constant in its equation (or perhaps by the curvature of the function). M. A. Adelman discussed this question, along with other important ones, in his article in the November 1951 issue of the *Review of Economics and Statistics*. However, it seems unlikely to me that the same sort of function would fit reasonably well all or most of the concentration data. This is why I believe that a description of the kind here suggested might be more useful.

Scitovsky gave a constructive and revealing discussion of the relationship between measures of monopoly and measures of concentration on the one hand, and particular research objectives on the other. His discussion strengthens my conviction that measures of concentration, in spite of all their shortcomings, possess the advantage of being less specifically tailored to narrow objectives than are our measures of monopoly. I believe that one of the present shortcomings of measures of concentration would be reduced (perhaps eliminated) if in these measures we could summarize several essential properties of the underlying distribution.

CARL KAYSEN, Harvard University

SCITOVSKY's paper provides a lucid classification of the effects of concentration, and argues that measures registering only one of

[3] Possessing a share of less than 1 per cent.
[4] Possessing a share of less than 10 per cent but more than 1 per cent.

these effects—e.g. measures of profits, or measures of the discrepancy between price and marginal cost—are not good substitutes for direct measures of the number and size distribution of the competing sellers (buyers) in the market. Thus, in his view, the application of economic theory to the problem of measuring concentration supports the continuing attempt to find a good one-parameter summary of the size distribution of the most "appropriate" variable within the limits of the data. Scitovsky thinks this is sales.

This comment endorses a somewhat modified version of Scitovsky's conclusion, but on an entirely different view as to what economic theory shows. The application of price theory to the problem of the measurement of concentration suggests that more sophisticated and precise measures than those provided by any one-parameter summary of the size distribution of firms' sales are not worth the trouble of definition and computation. A simple index of the sort suggested can point to the existence of markets in which the presence and effects of oligopoly deserve detailed study; no more sophisticated measure calculable *without* such detailed study of the particular market can do any more.

This assertion rests on two bases. The first is provided by price theory in general; namely, that the delimitation of the market in which concentration is to be measured typically presents substantial problems and cannot be solved by recourse to Census classifications of industries or commodities. The market has both product and geographic boundaries; in neither product space nor geographic space are these boundaries sharp. To delimit the market in terms of products requires examination of both the chain of potential substitutes at various prices as seen by buyers and the widening circle of potential rival suppliers at various prices as seen by sellers. Similar problems arise in drawing the geographic boundaries of markets for the many commodities for which production is localized and transportation costs are significant. In general, the examination of the power of sellers (or buyers) in any particular market reveals a concentration of interrelated markets with influences of varying degrees of strength on the transactions in the particular commodity or service under examination. The more important of these influences must be included in defining the market relevant to the measure of concentration. Otherwise, an index of concentration would not serve to distinguish monopoly from product specialization.

The second basis of skepticism as to the utility of refined measures of concentration arises from the present state of the theory of oli-

gopoly. This objection is more fundamental than the previous one, and would justify the standpoint of this comment if market boundaries always coincided with Census product definitions. Scitovsky says: "Monopoly and oligopoly consist of the power relation among the sellers or buyers in a certain market; and this power relation depends largely on the number and size distribution of the competing sellers or buyers. Measures of concentration try to express the number and size distribution of competitors in terms of a one-parameter index, which could then be regarded as a direct measure of the degree of oligopoly." The premise of this argument—that the power relation depends chiefly on the number and size distribution of competing sellers—must be denied. Many other features of the market are relevant to this "power relation." At least the following are of equal importance with the number and size distribution of sellers in many market situations: the rate of growth of demand over time, the character and speed of technological change, the degree to which sellers operate in other markets, the extent and nature of product differentiation, and the goals of individual firm policy—e.g. profit maximization vs. security. The failure of oligopoly theory in its present form to assist in the prediction of market behavior, or even to provide a framework for investigating particular markets, springs from its inability to take account of these and similar variables. It seems vain to expect that numbers and size distribution alone will explain market behavior, and therefore equally vain to hope for more from concentration measures than that they should provide a preliminary basis on which resources for further study should be allocated.

This comment is, of course, propaganda: propaganda for more studies of the operation of particular markets, and for elaboration of oligopoly theory to the point where it can begin to explain the results of such studies.