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SOME NOTES ON THE THEORETICAL SPECIFICATION  
OF STRUCTURE PERFORMANCE RELATIONSHIPS

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This paper is circulated for discussion purposes only and its contents should be considered preliminary.

The estimation of market structure-performance relationships has been a major activity within the field of industrial economics for some time and yet such relationships are poorly founded in theory. This paper attempts to derive a specification of the structure-performance relationship from a theoretical analysis of oligopoly, emphasizing particularly aspects of the relationship which appear to have suffered significantly from misspecification in the main body of existing empirical work. No attempt will be made to provide complete coverage of variables where adequate formulations are widely used. The paper will be limited to essentially static measures of performance and to a single-equation context. Although recognizing that the structure-performance relation is only one equation embedded within a set of equations in which performance, behaviour and structure are determined, we may, perhaps realistically, view such a system as recursive. Thus there may indeed be feedbacks in this system but they occur with substantial lags which may allow us to pull out the equation in question for separate treatment. In any event this is what this paper will do.

#### Performance and Measured Performance

We turn first to the appropriate definition of static performance. Obviously although we are measuring a positive relationship our objectives are couched in welfare terms. Of central interest is the link between product market power and static efficiency and thus the focus of our attention should be the divergence of price from marginal cost, which will normally be approximated by the ratio of profits to sales revenue.\* However we should also recognize that firms may only be cost

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\*  $\frac{p - mc}{p} = \frac{pX - mcX}{pX} = \frac{\Pi}{R}$  in the case of constant cost industries. This may of course be an invalid assumption, particularly if we are picking up positions of short-run equilibrium.

minimizers in a restricted sense. In managerially controlled firms, the general case in contemporary industrial society, behaviour may be consistent with one of the necessary conditions for profit maximisation, namely that marginal revenue is equated with marginal cost, in order to maximize the pool of profits which are then to be divided between management and stockholders/. (see Williamson {1964}) In a situation where management has substantial discretion reported profits may show a considerable deviation from maximum profits. This deviation may be related to market structural variables and will thus tend to bias the estimated relation between structure and measured performance, and at the limit will render the link insignificant. In this situation the analysis would point toward a strategy of decomposing profits into its various elements, relating them to structure, and subsequently reassembling the evidence. In this context the welfare implications are not of course unambiguous. Where costs are minimized we could derive measures of dead-weight loss due to monopoly. Where income transfers in favour of management have been made then the loss of consumer or producer surplus will be dependent on changes in marginal cost, unless we are willing to specify different marginal utilities of money for different income recipients (see Parish and Ng {1972}). Otherwise it is simply a transfer from stockholders to managers with no consequences for efficiency. Of course one might argue that in the long-run all this discretionary expenditure by management will enter the determination of marginal cost, then marginal cost will be too high and profit-maximizing pricing behaviour will ensure increased dead-weight loss.

We can of course draw quite different theoretical conclusions about market structure and costs, namely the scale-economies arguments which have been rife in Europe for a long time. In this case it is possible to explain any relationship between profits and concentration as simply

reflecting scale economies.\* However this is difficult to reconcile with the existence of a greater degree of market power as concentration increases.

It might also be argued that market power is unrelated to concentration since divergences of price from marginal cost are only sustainable where barriers to entry exist. This proposition will be examined later in some detail but we can say now that the existence of a barrier does not imply the divergence of price from marginal cost. This depends on the inter-firm behaviour of the existing group and most theories of oligopoly suggest an important role for the number of agents in the market.

The Importance of Static Efficiency

A word in support of attempts to measure the static efficiency implications of market power should perhaps be added. There has been a tendency in recent years to suggest that the existence of monopoly or oligopoly does not imply any significant departures from the welfare optimum in a static sense and that in a dynamic sense its existence may indeed be beneficial. While not wishing to go into the links between technical progress and market structure in this paper it is necessary to assert the belief that the estimates of static efficiency loss incident to monopoly have been wildly understated and that more importantly these estimates have become part of the conventional wisdom. Harberger's original estimates were significant underestimates for two basic reasons, (Harberger, {1954}). First he failed to recognize that in the formula for welfare loss,  $\frac{1}{2} dp \cdot dX$ , one cannot calculate  $dp$  from data on the ratio of profits to revenue,  $(\frac{\Pi}{R})$ , and subsequently estimate  $dX$  by independently assuming

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\* It is difficult to see how a significant inter-industry relationship could be so interpreted since there need be no close relationship between size of firm and concentration across industries.

some value for the price elasticity of demand ( $\eta_p$ ) - he actually assumed  $\eta_p$  to be unity for all industries. On the contrary, theories of monopoly or oligopoly behaviour would suggest that  $dp$  is determined by the price elasticity of demand. Harberger's observation of generally low values of  $dp$  is consistent with high values of the elasticity and thus much bigger estimates of welfare loss than Harberger generated. The other basic reason for understatement follows from Harberger's assumption that the competitive profit rate is the average profit rate. Thus if the distribution of profit rates is not skewed the calculations will show no excess profit and therefore no welfare loss. Kamerschen {1966} corrected for the first problem, assuming monopoly equilibrium, and his results suggest that the biases induced by Harberger's methods are very considerable. Thus we feel that static efficiency loss can be important and thus it is relevant to enquire into its origins.

#### Concentration and Static Efficiency

Most empirical studies have tested an hypothesis of a direct relationship between concentration and profitability without being very clear about the appropriate measure of concentration or about the appropriate form of the relationship. An exception to this general observation is provided by the work of Stigler {1964}, where costs of policing a collusive arrangement are found to be inversely related to the Herfindahl measure of concentration (H). \* As a consequence of his theory Stigler then uses such a measure of concentration in an examination of profit rates and compares the results with those when using the 4-firm concentration ratio. The Herfindahl turns out

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\*  $H = \sum_i s_i^2$  where  $s_i$  is the market share of the  $i^{\text{th}}$  firm. Thus H

has a lower bound of zero (competition) and an upper bound of unity (monopoly).

somewhat better, but there are some unresolved questions. First, little is said about the form of the relationship between  $H$  and the degree of collusion and second, given the degree of collusion there is no unique relation with the profit rate. The degree of collusion is one component of product market power and product market power in turn determines the departure of price from marginal cost. Thus if we can assume constant costs, the performance variable should be the profit-revenue ratio  $\left(\frac{\Pi}{R}\right)$  and not rate of return on assets  $\left(\frac{\Pi}{K}\right)^*$ , but, in addition, the prize from collusive activities depends also on the behaviour of consumers and potential entrants. In the first case, that is in the short-run,  $(p - mc)/p$  will be inversely related to  $\eta_p$ , the market price-elasticity of demand. In the long-run the extent that this can be maintained will be determined by the supply function for new entrants. Both these points raise questions for the inter-industry analysis of structure - performance relationships. In both cases conditions can vary a great deal from industry to industry. My own assessment would be that little has been done on the question of the inter-industry variation in the elasticity of demand. In response to the problem some investigators have restricted their samples to consumer goods industries but this seems like an extremely minimal response and would perhaps have been more appropriate if the split had been made into durable and non-durable goods. But obviously at a level of aggregation which is meaningful market elasticities of demand can be quite different. However, some analysts have expressed doubts about the relevance of such an observation (see, e.g., Worcester, {1964} and Williamson, {1969}). They have argued that the degree of monopoly has nothing to do with  $\eta_p$ , rather it is determined by the supply function for entrants, that is that the height of barriers to entry affects the cost function of entrants and therefore determines the position and shape of the supply function. In the short-run this

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\* Competitive equilibrium requires  $\Pi = 0$  and thus  $\Pi/R$  and  $\Pi/K$  will be equated, but, with some degree of product market power these alternative measures will diverge unless the  $K/R$  ratio is constant across industries.



obviously will not be true. Dynamic models of optimal pricing prescribe a price trajectory decaying over time from the monopoly level (determined by  $\eta_p$ ), and approaching some asymptote defined by the conditions of entry into the market, (see, e.g., Gaskins, {1971}/) and Jacquemin {1972}). Since we do not normally observe long-run equilibrium situations, differences in  $\eta_p$  can be important. However, even in the long-run  $\eta_p$  will still have a role because the difference between pre-entry and post-entry price will be inversely related to  $\eta_p$  (Modigliani, {1958}). Thus with inelastic demand not only can price diverge from marginal cost in the short-run but this can also persist in the long-run. We are therefore left with a rather uneasy basis for inter-industry analysis where, as will usually be the case, we do not have the information to quantify price-elasticities at the level of disaggregation that our analysis demands.

With regard to the question of barriers to entry the difficulties of measurement may not be so enormous, although they are still substantial, and valiant attempts have been made in this direction (Bain, {1956}). However it is again questionable whether inter-industry analysis is appropriate. In a sense the problem is similar to the controversy over intra- or inter-firm production functions. This time we are concerned with the barriers production function and we can expect that its characteristics will show substantial variation across industries. Thus, for example, we cannot easily assume that differences in levels of advertising across a wide array of industries correspond to similar rankings in barriers induced by advertising.\* In some industries the marginal productivity of advertising may rapidly fall off with the level of advertising but the barrier effect may be as great as for some other industry where a higher level of advertising is optimal. The point being that marginal conditions determine the optimal level of advertising but intra-marginal conditions determine the height of the barrier created.

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\* This question will be pursued further in the following section.

The arguments about price-elasticity of demand and barriers outlined above would at the least dictate a cautious approach to inter-industry analysis and, if we were to take them seriously, would require us to focus rather more sharply on the estimation of the components of product market power within relatively homogeneous industries. We can do this in two ways -either we can use the traditional source of Census of Production material across a wide array of industries, but this time shifting the focus of the analysis to changes in performance over time, or we can restrict ourselves to a sector or broadly defined industry and examine product-market power as reflected in the performance of individual firms.

At this point it is necessary to be more precise about the theoretical link between concentration and price-cost margins, and given that oligopoly is ubiquitous, either in a national, regional or local market context, we need a theory of firm behaviour which takes account of interdependence among firms in decision-making. It could be argued that the only satisfactory approach to oligopoly is one in which the objectives of the firm imply its reaction to interdependence (Stigler, {1968}). Thus if we assume the firm to maximize profits then this implies that the firm explores the costs and benefits associated with collusive behaviour. If we regard the monopoly outcome as an upper bound then we could define Stigler equilibrium as (Stigler, {1964}) :

$$\frac{p - mc}{p} = \frac{f(H)}{\eta_p}, \quad (1)$$

where  $f(H)$  is a measure of the effectiveness of collusion,  $0 \leq f(H) \leq 1$ . However, we cannot be too specific about  $f(H)$ , although we do know that it is conditional on buyer concentration and the probability of repeat purchasing, which are unlikely to remain constant across industries. Even if we were

able to measure these variables we still do not have a precise specification of the way in which they enter the determination of price-cost margins. Rather than attempt a direct test of such a theory, which would of necessity have to be rather crude, it may be useful to test a rather simpler model of oligopoly behaviour which gives a more precise indication of the predicted relation between concentration and price-cost margins and which may in turn provide some insight as to the effectiveness of collusion.

Assume an industry with  $N$  firms producing a homogeneous product, each firm independently trying to maximize profits and possessing identical cost functions. Equilibrium in the industry is achieved when

$$\frac{p - mc}{p} = \frac{1 + \lambda}{N \eta_p} \quad (2)$$

$$\text{where } 1 + \lambda = \frac{dX}{dX_i} = 1 + \frac{\sum_{j \neq i} X_j}{dX_i}$$

Thus  $\lambda$  captures the expectations of any firm in the industry concerning the response by rivals to its own output decisions, assuming these expectations are the same for each firm in the industry. It could of course be viewed as including expectations about the behaviour of potential entrants as well as actual rivals. If we now relax the assumption of identical cost functions then market equilibrium can be written as

$$\frac{p - mc}{p} = \frac{H}{\eta_p} (1 + \lambda) \quad (3) *$$

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\* In the case of a differentiated product the situation is obviously more complicated but the results suggest that the average price-cost margin for the industry would be greater, an outcome which is intuitively appealing (see Cowling and Waterson, {1974}).

Thus we have a result which is qualitatively similar to the Stigler theory of collusion, but which is slightly more precise. Note that the Cournot model, implying that  $\lambda = 0$ , puts a lower bound on the distribution of possible outcomes. The upper bound is set by monopoly equilibrium which implies  $H(1 + \lambda) \leq 1$ . However (3) does not provide a formulation which is easily capable of being tested,\* but having in mind that some insight into collusive behaviour is desirable, it is possible to compare equilibria at different points in time. We are then required to make the much less heroic assumption that the price-elasticity of demand remains constant over time within a specific industry. Taking ratios over time we then have

$$\left(\frac{p - mc}{p}\right)_t \bigg/ \left(\frac{p - mc}{p}\right)_{t-1} = \frac{H_{t-\theta}(1 + \lambda_{t-\theta})}{H_{t-\theta-1}(1 + \lambda_{t-\theta-1})} ; \theta \geq 0$$

(4)

If we assume  $\lambda_{t-\theta} = \lambda_{t-\theta-1}$  then we are left with an equation consistent with Cournot equilibrium.

$$\left(\frac{p - mc}{p}\right)_t \bigg/ \left(\frac{p - mc}{p}\right)_{t-1} = \frac{H_{t-\theta}}{H_{t-\theta-1}} \quad (5)$$

Thus the simplistic Cournot hypothesis is consistent with a linear, homogeneous relation between ratios of price-cost margins and ratios of the Herfindahl index of concentration with the expected value of the slope coefficient being

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\* Of course this has not deterred many researchers from estimating an inter-industry relationship between some measure of concentration and performance in the absence of  $\eta_p$ . It has been argued earlier that such an omission is serious.

unity. This relationship is also consistent with any other value of the conjectural variations term, provided that it is constant over time, and, more specifically, that it does not vary as  $H$  varies. However as the market becomes more concentrated we would expect that the conjectural variations term would get bigger, that is firms would become increasingly aware of their interdependence. This then is the link with models of collusion, an increasing value of  $\lambda$  is consistent with an increasing degree of collusion as  $H$  increases. Thus whereas the Cournot model predicts a slope coefficient of unity the collusion model must predict a slope coefficient greater than unity for equation (5). The equation for estimation would be

$$\left(\frac{p - mc}{p}\right)_t / \left(\frac{p - mc}{p}\right)_{t-1} = \beta \left(\frac{H_{t-\theta}}{H_{t-\theta-1}}\right) + \mu \quad (6)$$

Cournot prediction :  $\hat{\beta} = 1$

Collusion prediction :  $\hat{\beta} > 1$

We would expect considerable lags in such a relationship, for example Singh, {1972}, has suggested, on the basis of his observations of takeovers in U.K. industry, that the effect of a change in structure on profits is not fully realized until a five-year period has elapsed. Such lags help to resolve the problem posed by Mancke in a recent article {1974}. In simulation experiments he has found it possible to generate a positive association between profits and concentration (specifically market share) while assuming no monopoly power and no economies of size. Success, and therefore profits, is purely a stochastic event; growth follows from profits and thus profits appear to be associated with size and market share. Thus the usual tests of monopoly power, measuring contemporaneous structure-performance relationships, are not

unambiguous. However the relationship between current changes in performance and past changes in structure is free of this problem of interpretation. This adds strength to our other arguments in favour of shifting the focus toward changes in performance.

The relationship between concentration and price-cost margins is usually taken to refer to product market power (in the context of perfectly competitive conditions on the buyers' side and, in the factor markets, perfectly competitive conditions among sellers of inputs. Such assumptions are patently dubious. It may be reasonable to differentiate between consumer and producer goods in this regard but with the growth of powerful distributors this may no longer be so relevant since we are generally measuring price-cost margins at the wholesale rather than the retail level. Stigler's model of collusion suggests the relevance of buyer concentration in promoting an effective collusion, (1964). Cournot's work also provides a theoretical basis for handling bilateral oligopoly problems, (Cournot, {1838}). Waterson's current work in this area turns up with precise specifications of the relationship between price-cost margins and buyer concentration which, on the basis of Cournot assumptions, turn out in a rather simple way, requiring Herfindahl measures of the appropriate buyer distributions. A weighted average buyer concentration measure can be used, with input-output coefficients providing weights. Countervailing power from the viewpoint of sellers of inputs to the industry in question is rather different. The relevant market may not be the same, and this may be seen as the general case since generally the inputs will not be specific to the product in question. Also, market power in the hands of input sellers, although influencing cost and therefore the price of the particular product, will not have any influence on  $(p - mc) / p$  which is determined solely by conditions in the product market.\*

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\* However if we are proxying marginal cost by average cost then factor market characteristics may influence the estimated value of the price-cost margin since these characteristics will partly determine the deviation of marginal cost from average cost.

Without exploring these general problems of countervailing power any further our previous suggestions in favour of restricting the sample to a specific industrial sector or switching the focus to changes in performance may again be helpful. However it might be felt that growth in market power among sellers, due to increases in concentration, may induce a similar process among buyers - certainly the potential benefits from collusion among buyers would be directly related to the success of collusion among sellers. Thus the omission of buyer concentration from any estimated relationship would tend to bias down the parameter estimate associated with the measure of seller concentration.

#### Advertising and Static Efficiency

In long-run equilibrium price will only depart from competitive levels where barriers to the entry of new firms exist. This section will examine the role of advertising as a barrier to entry and also as a competitive weapon within the existing group of firms. The paper emphasizes advertising because it is felt that the main body of existing empirical work dealing with this subject is badly misspecified.

A barrier due to advertising exists because of the brand loyalty among consumers which is induced by the messages received about existing products.\* This effect in aggregate will be related to the level of advertising expenditure, assuming efficient allocation of advertising resources among media. Extra expenditure can allow for more advertising of a given population, aimed at

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\* There may be an associated barrier effect induced by the existence of scale economies to advertising which dominate production scale economies. This will then induce an even greater disparity between pre- and post-entry prices.

increasing the intensity of brand loyalty, or alternatively can allow for greater coverage of consumers. Again efficient allocation will imply equating marginal returns to extra expenditure in these two directions. Thus the immediate focus should be on the volume of advertising messages received. It is reasonable to assume, and there is a substantial body of evidence to support such an assumption (see Cowling, {1972}) that the production of brand-loyalty faces eventually diminishing marginal returns. If we now extend this property to the barrier production function then we expect a concave relation between the level of the barrier and the volume of advertising messages put out :

$$B = B(A)$$

with  $B' > 0$  ;  $B'' < 0$  ; where  $B$  is the barrier facing new firms and  $A$  is advertising messages. However if  $A$  is measured as current input into the barrier production function then obviously no barrier to new firms would result since both new firms and old firms would be on the same footing. It is the dynamic aspect of advertising which is central to the whole question of barriers, and we would expect advertising to have a distributed lag effect on consumer behaviour with the impact decaying gradually over time.\* One simple specification incorporating this property is

$$B = B \sum_{\theta=0}^{\infty} (1 - \lambda)^{\theta} A_{t-\theta} \quad (8)$$

where  $\lambda$  is the depreciation rate ( $0 < \lambda < 1$ ). We have defined an intra-industry barrier production function but we cannot expect its parameters to be the same across an array of product markets with quite different characteristics. For some products brand-loyalty may be easily established at low

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\* There is a lot of evidence available on this property, see for example Cowling, {1972} and Peles, {1971}.



levels of advertising expenditures, with additional expenditures being faced with rapidly diminishing returns. Thus the industry would be in equilibrium at low levels of advertising in contrast with some other industry where brand-loyalty is only gradually acquired but where there is no early onset of rapidly diminishing returns.

Thus we have no expectation that a broad inter-industry cross-section will reveal any systematic relationship between advertising and barriers. Again our analysis would suggest the relevance of restricting our sample of observations to a sector of the economy or examining the effect of changing barriers over time. The first alternative would in general require firm level observations and raises the issue of the other role of advertising as a competitive weapon within an existing group of firms. Whereas advertising may provide a more or less common barrier within which a group of firms can exist in equilibrium with prices above competitive levels, advertising as a competitive weapon can determine the distribution of price-cost margins among these firms.

Price-cost margins will differ as the price-elasticity of demand facing each firm differs, and part of this difference can be due to brand-loyalty induced by advertising :

$$\frac{p_i - mc_i}{p_i} = \frac{1}{\eta_{p_i} (A_i/A)} \quad (9)$$

with  $\eta_{p_i} < 0$ .

Equation (9) refers to the  $i^{\text{th}}$  firm and states that the price elasticity facing that firm is inversely related to the share of that firm's advertising. In this sense the situation is different from the advertising induced barrier since in this case advertising's impact can be nullified by the competitive reactions of rivals. It should also be noted that competitive advertising could

be observed where  $\eta'_{p_i} = 0$  or even where  $\eta'_{p_i} > 0$  since advertising could be profitable in a competitive environment simply by raising the quantity sold at any given price, without raising the optimal price via its effect on  $\eta_p$ . The case of  $\eta'_{p_i} > 0$  may be descriptive of retailing where advertising is generally aimed at informing consumers about price and quality and thus making them more responsive to price or quality changes. This of course leads to the prediction that advertising can result in lower price-cost margins, a result demonstrated in some interesting work by Boyer {1974}.

Recently there has been some theoretical questioning of the role of advertising as a barrier to entry. Brozen, {1972} has argued that advertising is no different than any other form of investment and should therefore not be singled out for separate treatment. This view must be incorrect since although the cost functions of new entrants are independent of the investment in plant and equipment of existing firms they are not independent of the stock of advertising capital of existing firms. For any planned rate of sales (as opposed to output) the new firm's expenditure on advertising (or required price level) will be dictated by the brand-loyalty of consumers for the existing firms' products. Schmalensee, {1974} goes further and purports to show that advertising can never result in a barrier facing new entrants unless there are imperfections in the capital market. This position seems to be untenable since the expected stream of earnings from any investment by a new firm is bound to be lower as the advertising levels of existing firms rises, so long as advertising is a capital good. Thus even with perfect capital markets the investment will appear less desirable and therefore the barrier exists.

If we therefore reject these recent attacks we can conclude that advertising is capable of creating barriers and in turn this will lead to

industry deviations of price from marginal cost. Advertising as a competitive weapon can lead to similar results at the firm-level, although this is not unambiguous. The question arises about the appropriate price-cost margin. One could argue that advertising does not enter marginal cost and thus the appropriate margin is defined by the difference between price and marginal production cost. This would be in line with Baran and Sweezy's ideas of necessary expenses (1966). In all cases except where advertising is purely informative this would seem the appropriate measure from a welfare viewpoint. This raises questions about the definition of profits in previous empirical work and will be discussed later.

The last point we should make on advertising is that our analysis provides no basis for the popular use of the advertising-sales ratio ( $A/R$ ) as a barrier variable or as a competitive weapon. Its use becomes more inappropriate the more diverse in size is the cross-section of markets or firms covered. Thus it may be the case that the U.S. automobile industry has a very low advertising-sales ratio (0.6% as reported by Comanor and Wilson, {1967} ), and the U.S. perfume industry has a very high ratio (15.3%, same source), nevertheless this conceals the fact that the U.S. automobile industry is a very large industry and has a large advertising expenditure which may be greater than that of the perfume industry - consumers are receiving more messages about existing models of cars than they are receiving about existing varieties of perfume. The problem is obviously more complicated than this depending on the extent to which the advertiser can isolate the relevant population of consumers via an appropriate selection of media. But where specialist media cannot be isolated, high advertising-sales ratios are quite consistent with low barriers due to advertising since small markets will mean low exposure to advertising.

Market Power of the Firm

The existence of product differentiation activities raises the issue of the market power of the firm and the extent to which its performance is a function of its own attributes rather than the behaviour of the group. There is no question of a firm having a degree of market power different from that of its rivals where the product is homogeneous. Any variance in price-cost margins in such a situation would be solely explicable in terms of cost differences and would therefore relate to efficiency rather than market power. In situations of product differentiation we are left with the difficult problem of disentangling efficiency effects from market power effects, at the level of the individual firm. We have already examined one component of the firm's market power, the goodwill produced as a result of a stream of advertising expenditures over time. More generally we can refer to the stock of goodwill induced by the amalgam of marketing strategies over time. This could include quality (including distribution and servicing) and price strategies which have induced consumers to buy from a particular firm and which have effects which persist over time. Having captured a specific share of the market by whatever means that share will tend to be maintained, even at prices higher than rivals', simply because brand-switching implies various costs to the consumer - for example, there are costs involved in gaining information about the price and quality attributes of other brands. Obviously these costs vary from product to product, as of course do the benefits (Stigler, {1961} ). Thus the variance of quality-adjusted price across varieties of a product can be expected to vary inversely with the level of expenditure on the product in question since consumer search will increase with expenditure. This analysis would suggest that market power will increase with market share but that again inter-industry analysis would be inappropriate unless the determinants of consumer search were adequately allowed for.

Variations in firm size need not imply variations in market power but where a concentration measure also enters the relationship then variations in size may pick up market share effects. Thus the interpretation of the coefficient on firm size in such a relationship should be approached with some caution. If positive it could be measuring efficiency and/or market power; if negative it must indicate inefficiency, but the estimate may be biased down. Inefficiency can be due to scale diseconomies or increased managerial discretion due to the increased security from take-over or stockholder intervention provided by size, (Williamson, {1964}).

Before leaving the question of scale it should be noted that as a barrier the effect of scale economies at either plant or firm level is conditional on the elasticity of demand, (Modigliani, {1958}). Since scale variables have been widely used this reinforces the argument advanced earlier in connection with concentration that more attention needs to be paid to the problems posed by the omission of the elasticity variable in inter-industry studies.\*

#### Specification Problems in Existing Empirical Work

In this section we will not be concerned in an exhaustive discussion of the methods and results of previous empirical investigations - a recent survey has done just that (Weiss, {1971}). We will simply be concerned with questions of theoretical specification and the problems of interpretation caused by any departure from the/ theoretical guidelines. We will restrict ourselves to relationships pertaining to static efficiency in the context of a single equation model.

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\* This argument obviously relies on the role of scale economies as a determinant of the margin between pre- and post-entry prices. Any other barrier interpretation of scale must rely on capital market imperfections.

Errors of Omission

Probably the most serious and basic deficiency in existing work is the omission of the price-elasticity of demand from inter-industry studies of profit rates.

Our theoretical analysis suggests no systematic relation between measures of concentration and performance where  $\eta_p$  varies widely so that it is not surprising that we find some results with non-significant or only marginally significant relationships, or poor explanatory power (see survey by Weiss, {1971}, and recent comments by Brozen, {1972} and Philips, {1971}). Other parameters of consumer behaviour, such as the determinants of responsiveness to advertising messages, have also generally been omitted. The problem of these omitted variables, which are generally not easily measurable, may be to some extent circumvented by switching the focus to changes in industry performance. Some recent work by Cowling and Waterson, {1974} has followed this course and reports a significant, positive relationship between changes in concentration and changes in price-cost margins.

Buyer concentration is another variable, theoretically required but generally omitted, which it is possible to measure at reasonable cost. On the basis of our analysis its omission is likely to bias down the coefficient on seller concentration.

Errors of Commission

In this category it is possible to identify three areas where errors have arisen : (1) in the specification of the dependent variable, (2) in the specification of seller concentration and (3) in the specification of the advertising variable. In the case of the dependent variable analysts generally have followed what Bain practised rather than what he preached, (Bain, {1949}) : they have tended to use rate of return on assets or equity  $\left(\frac{\Pi}{K}\right)$  rather than the ratio of profits to sales  $\left(\frac{\Pi}{S}\right)$ . In the constant cost

case the ratio of profits to sales is equivalent to  $(p - mc) / p$ , the performance variable which oligopoly theory suggests is systematically related to market structure. The use of some measure of  $\frac{\Pi}{K}$  would require us to introduce variables explaining imperfections of the capital market, which need not be directly related with product market power, and would also justify the use of a capital-output ratio variable on the right-hand side of the equation. In-so-far as  $\frac{\Pi}{K}$  is closely related to  $\frac{\Pi}{R}$ , which often appears to be the case, then such a misspecification need not be an important source of error. Whether  $\frac{\Pi}{R}$  is a good approximation to  $(p - mc) / p$  is of course a real problem. If we assume that the deviation of average cost from marginal cost is related to capacity utilization, then including variables intended to capture this would appear relevant.

Seller concentration has usually been measured as the ratio of the output of the top  $n$  firms to industry output. Our theories suggest the relevance of the Herfindahl measure but this has been little used (see Weiss, {1971}). Where it has been used it has appeared to perform rather better than the concentration ratio (see Stigler, {1964}, Cowling and Waterson, {1974}), but of course the data required to compute the Herfindahl is not readily available. However its computation by government statistical agencies would not only provide analysts with a theoretically more acceptable measure of concentration, but would also reduce problems of disclosure at the same time.

The advertising variable  $(A/R)$  used in previous studies would appear quite inappropriate (see Cowling, Cable, Kelly and McGuinness, {1975}). Nevertheless, this variable has been a popular specification and seems to have helped in the explanation of profit rates or price-cost margins. How can this be explained? Firstly it may be due to a fortunate sampling of industries or firms. Comanor and Wilson's significant coefficient in

weighted regression is conditional on the exclusion of the automobile industry,<sup>\*</sup> and Vernon and Nourse, {1973}, restrict their sample to firms in the top-hundred by size which also have high advertising-sales ratios. Alternatively these results could be picking up an appropriations relationship rather than a barriers relationship.<sup>\*\*</sup> When the advertising variable is correctly specified and the analysis is restricted to a fairly homogeneous sector, advertising appears as both a significant barrier to entry and a significant component of the market power of a specific firm, (Cowling et al., {1975}).

### Policy Implications

There has recently been much doubt expressed about both the significance of the relationship between concentration and profitability and also, if the relationship is significant, about its meaning. On the first point the pendulum seems to have swung in favour of the importance of advertising and against the importance of concentration, see for example Comanor and Wilson, {1967} and Khalilzadeh, {1974}. However since the specification problems raised by these studies are serious the bases for this reassessment seem inadequate.<sup>\*\*\*</sup> With a more satisfactory specification concentration appears significant (Cowling and Waterson, {1974}). We should also note that the general omission of buyer concentration will tend to bias down the measured effect of seller concentration.

If we accept that a relationship exists then the other arguments turn on the survival of the fittest (Demsetz {1973}) - or the luckiest

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\* An industry which happened to have a high profit-rate and the lowest advertising-sales-ratio - and apparently the high profit rate was not explicable in terms of the other variables included in the model.

\*\* There are clear theoretical underpinnings for such a finding, see Cowling et al. {1975}.

\*\*\* This is not to imply that advertising is unimportant. With a more adequate specification advertising again appears as a significant determinant of profitability, see Cowling et al. {1975}.



(Mancke, {1974}). Firms get to positions of power because they are most efficient or by chance, and not by the deliberate acquisition of monopoly power. Whilst accepting that these are possible explanations they are not exclusive so we must turn to the evidence. We would expect efficiency to be more closely related to size rather than concentration, whereas the reverse would be true of market power. However the accumulated evidence for Europe suggests at least that biggest is not best, (Samuels and Smyth, {1968}, Jacquemin and Philips, {1974}). For the U.S. the position is a little more cloudy (Hall and Weiss, {1966}, Soloman, {1974}, Shepherd, {1972}, Gale, {1972}). Hall and Weiss observe a positive and significant firm size effect, but it may be picking up market power effects; Shepherd finds a negative relationship, while Soloman and Gale both observe a significant and positive effect of market share.

In the case of Europe the implications of current research seem unambiguous. Since size does not appear to contribute to efficiency, and concentration can be shown to have a significant impact on price-cost margins, static efficiency will fall with increased concentration. By contrast in the case of the U.S. the results suggest a possible trade-off situation.

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