

MULTI-DIMENSIONAL ASPECTS OF
MARKET STRUCTURE AND
MARKET PERFORMANCE

by

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"Economics is only an observational and interpretative science which implies that in questions like ours the room for difference of opinion can be narrowed but not reduced to zero.

J. A. Schumpeter - Capitalism, Socialism and Democracy. P. 107

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

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I INTRODUCTION

Since the writing's of Mason (6) and later of Bain (1, 2, 3), there has been much work conducted on hypotheses concerning the relationships that exist between the structure of a market and the conduct and performance of participants within that market. It is the link between market structure and market performance that is usually subjected to empirical tests, the treatment of conduct being omitted.* The theoretical basis of the structure-performance relationship is well discussed in the literature (3, 4, 6, 8) and our major concern here will be to critically examine the empirical analysis of these relationships. We shall proceed firstly as others have done, and then go on to propose an alternative, and it will be suggested, a more appropriate strategy.

* Bain offers some justification of this omission.

See (3) p.p. 303, 431.

II REGRESSION ANALYSIS

(i) The Variables, the Sample, the Sources

The following variables have been chosen to represent market structure and market performance, and are typical of those chosen by other writers.

Market Structure

Concentration Ratio	C
Economies of Scale	E
Absolute Capital Requirements	K
Advertising/Sales Ratio	AS
Growth of Industry Demand	D

Market Performance

Profit Rate	P
Growth Rate	G
Research and Development Expds	R
Advertising Expenditures	A

All variables are measured at 1963 unless otherwise stated below, and the following sample of U.K. manufacturing industries, listed here with their S.I.C. numbers, was chosen, primarily on the basis of the ability to obtain compatible data.

III	211-240	Food, Drink and Tobacco
IV	261-277	Chemical and Allied Industries
V	311-322	Metal Manufacture
VI	331-352	Engineering
VI	361-369	Electrical Engineering
VII	370	Shipbuilding and Marine Engineering
VIII	381-389	Vehicles
IX	391-399	Metal Goods
X	411-421	Textiles

XI	431-433	Leather Goods
XII	441-450	Clothing and Footwear
XIII	461-460	Bricks, Pottery, Glass and Cement
XIV	471-479	Timber and Furniture
XV	481-489	Paper, Printing and Publishing
XVI	491-490	Other Manufacturing Industries

Sources

The three main sources of data were

- (1) Annual Abstract of Statistics - H.M.S.O.
- (2) Company Assets, Income and Finance - B.O.T.
- (3) Statistical Review of Press and T.V. Advertising -
The Legion Publishing Company

These last two perhaps need further comment. "Company

Assets, Income and Finance" is a classification of Companies which in 1960*

- a) had assets of £0.5m or more or income of £50,000 or more
- b) Whose shares were quoted on a U.K. Stock Exchange
- c) Are mainly engaged in U.K. manufacturing, distribution, construction, transport, property and certain other services.

For each firm is given several statistics concerning its assets and income and a code classifying it according to the S.I.C. industrial classification, though in so far as a firm has several activities, such a classification may not be an accurate reflection of the firm's participation and influence within the economy as a whole. Summary tables are given of the distribution of assets and income according to the S.I.C. classification. It

* An appendix lists those companies which in 1963 satisfied the conditions (a) (b) (c) but which did not do so in 1960

is thus possible to derive from this publication several of the measures required and the exact way in which this was done is discussed below with relevance to each variable in turn.

The "Statistical Review of Press and T.V. Advertising" is a classification of advertising expenditures in the Press and on T.V. in various "markets" broken down by firm. It was possible roughly to aggregate these markets into our broader industry groupings and hence gain a measure of industry advertising expenditures.

The following symbols relate to the publications above:

(1) AAS (2) CAIF (3) SRPTA

and will be used below to identify the exact sources of the data.

The Variables

a) Concentration Ratio

This is taken to represent the level of actual competition within the industry. The precise variable taken is the percentage of total industry output produced by the four largest firms in each industry (CAIF).

The objections to the use of a concentration ratio for this purpose are many and well discussed in the literature (3,5). Briefly, the concentration ratio is a continuous statistic whilst significantly different types of competition may not exist arrayed along a continuum, that is, that the concentration ratio tends to suggest that there is but a gradual change from say 90% to 100% concentration whereas in practice such a change may involve a movement from say a three firm oligopoly to a complete monopoly and such a change would have repercussions on the market which the magnitude of the change in the concentration ratio would not suggest. On the other hand, a change in the concentration ratio of the same magnitude at some other point on the scale, say 45% to

55% may be of no practical significance whereas the concentration ratio suggests a change. Further, the concentration ratio is unable to differentiate between competition as typified by oligopoly as against price leadership, and neither does it attach any significance to the number and size distribution of those firms which do not enter into its calculation. Lastly, the concentration ratio measures numbers, not "competition".

b) Economies of Scale

The method of measurement here is borrowed from Comanor and Wilson (4), though we have had to use firms as the basic element as opposed to plants, which Comanor and Wilson use. We hence take the average firm size among the largest firms accounting for 50% of total industry output, relative to total industry output. This is in effect an estimate of the minimum efficient scale of firm relative to total output. (CAIF).

c) Absolute Capital Requirements

This is once again taken from Comanor and Wilson and is the average industry output at the estimated minimum efficient scale weighted by the ratio of total industry assets to total industry sales. (CAIF).

d) Advertising/Sales Ratio

The importance of advertising expenditures as a means of differentiating the product has been well documented by Bain and others. We here take total industry advertising expenditures (SRPTA) relative to industry sales (CAIF)* to represent the degree of product differentiation in an industry. In so far as

* In this way we eliminate the variance of advertising expenditures associated with scale of output as opposed to that associated with product differentiation.

the basis for differentiation depends on the nature of the product and the identity of the buyer, then this variable may be inadequate for this task. For example a producer goods industry may rely more on direct representation and less on advertising than a consumer goods industry, either because it is difficult to advertise say a blast furnace, or because buyers are so few in number that direct selling techniques are employed.

e) Growth of Industry Demand

This is taken as the growth of industry output. These concepts are of course only synonymous if industry prices are constant or if demand for the industry's product is completely inelastic. In so far as we possess no data for industry demand we have had to use industry output as the relevant measure.

The Relationship

$$Y = ae^{gt}$$

where Y represents industry output

t represents time

a and g are parameters

was fitted by least-squares regression to data (AAS) for the period 1960-66 for each industry, whence the estimate of g is the measure of the rate of growth of industry demand.

f) Profit Rate

This is the ratio of overall industry profits before tax (AAS) to total industry assets (CAIF) expressed as a percentage. In order to counteract the possibility of having selected an unrepresentative year, an average of such calculations for 1962, 1963 and 1964 was taken as the relevant measure.

g) Growth Rate

This is the proportionate rate of growth of industry

assets between 1960 and 1963 expressed as an annual percentage, namely

$$\frac{A_{1963} - A_{1960}}{(A_{1963} + A_{1960})/2} \cdot \frac{100}{3}$$

(CAIF)

h) Research and Development Expenditures

This was taken as the total of such expenditures, excluding those sums provided by Government sources, (AAS) divided by the number of firms (CAIF) for each industry, and taken as an average of such calculations for 1960-66 again to avoid the possibility of having selected an unrepresentative year.

i) Advertising Expenditures

Taken as the total expenditure on Press and T.V. advertising (SRPTA) per firm for each industry.

The actual data used is presented as Appendix 2.

(ii) The Function

The usual approach to this type of work is to relate the performance variable* to the set of structural variables by Ordinary Least-Squares Regression Analysis. We shall first do this with each of our performance variables in turn. Most of the functions specified in other work are of a logarithmic form though some contain both linear and log-linear measures. Comanor and Wilson (4) use a function (in terms of our notation)**

* Most studies usually have only one dependant variable-typically profit rates.

** C and AS are zero-one dummy variables in the Comanor and Wilson case i.e. "high" or "low" values.

described by

$$P = \alpha_0 + \alpha_1 AS + \alpha_2 \log K + \alpha_3 \log E + \alpha_4 \log D + \alpha_5 C + u$$

and this was arrived at mainly by examination of the zero-order correlations between the dependant variable and each independant one. However, we shall adopt a strictly logarithmic function throughout except in respect to the variable D which we shall assume exponentially related to the performance variables. This is because this variable plays a dual role within the structure-performance relationship, affecting not only the substance of the relationship, but also the absolute levels of the performance variables. One role arises in that penetration costs as paid by new entrants may reasonably be lower when the rate of growth of demand for the particular market's product is high, whilst another role is that changes in demand growth will directly affect profit rates, advertising expenditures and the like. Further, it is because of this latter role that no intercept term is allowed in the function, all non-zero values of the performance variables being related, in the absence of market power, to demand conditions. Our function is hence of the form

$$\log X = \beta_0 \log C + \beta_1 \log E + \beta_2 \log K + \beta_3 \log AS + \beta_4 D + \epsilon$$

where X is a particular performance variable and ϵ a random error term.

Since there is obviously some simultaneity in the relationship between advertising expenditures and product differentiation, then in the case of the former as performance variable, the term $\beta_3 \log AS$ was omitted from the relationship, that is, we simply examined the affect of the other elements of market structure on advertising expenditures. Failing this

the specification of a simultaneous equation system would have been necessary in order to avoid the possibility of simultaneous equation bias.

(iii) The Results

The results are given below in Table One. Figures in parantheses are t-values.

Concentration is statistically significant* in all the relationships, and the results would suggest that industries with low levels of actual competition tend to have higher profit rates than do firms in a more competitive environment, a result in accord with that obtained by Bain (3) and Comanor and Wilson (4). Such industries also display higher growth rates, rather interestingly they have lower levels of research and development expenditures and, somewhat surprisingly, they have lower advertising expenditures, than the competitive firm.

* Statistical significance throughout this paper refers to significance at a 95% confidence level.

Table One: Regression Results

Dependant Variable	log C	log E	log K	log AS	D	R ²	F
log P	0.709 (8.493)	-0.287 (-2.5961)	-0.167 (-2.318)	0.076 (1.245)	0.084 (2.683)	0.989	258.615
log G	0.731 (7.942)	-0.330 (-2.025)	-0.132 (-1.515)	-0.052 (-0.616)	-0.014 (-0.334)	0.974	107.875
log R	-1.087 (-4.141)	0.044 (0.095)	0.459 (1.854)	0.212 (0.874)	10.057 (-0.497)	0.878	14.339
log A	-1.338 (-3.873)	0.777 (-1.188)	0.414 (-1.194)	-	0.011 (0.065)	0.857	21.763

Straight-forward application of O.L.S. to the profit equation indicated the presence of heteroskedasticity and experimentation revealed that this could be removed, and an increase in the explained sum of squares sustained by re-evaluation of the relationship weighting by the square-root of total industry sales. (CAIF)

The variables reflecting barriers to entry, namely economies of scale, absolute capital requirements and product differentiation are statistically significant. In total, the signs of the coefficients on the variables reflecting barriers to entry would tend to support the hypothesis that a firm sees its main threat as being external. Hence, higher entry barriers bring lower profits, suggesting the firm is more lax in its pursuit of profit as against other ends or indeed that it is less efficient than would otherwise be the case. High entry barriers similarly increase the security from take-over under this hypothesis and hence remove the stimulus to grow for security reasons. Behind these entry barriers firms also feel more willing to undertake more research expenditures and this may be evidence of the other elements of managerial utility pursued at the expense of profits, as suggested by the negative relationship between barriers to entry and profits.

The rate of growth of industry demand is significant only in its relationship to profits having the positive effect expected. The negative relationships of demand growth to growth of assets and to R and D are surprising, the former in the light of Marris's theory (7) which predicts that the rate of growth of corporate assets will in fact equal the rate of growth of company sales in the equilibrium position, and the latter in the light of Schmookler's theory (9) which predicts a positive relationship between demand growth and R and D.

(iv) Comments on the Methodology

Many of these relationships are rather weak and the only consistently important variable is concentration, and this

yields a surprising result in the case of the advertising equation. The difficulty with this type of analysis is the multiplicity of the relationships that exist between the performance variables, as has been discussed above. For example, we are restricting the causality to run from advertising as a structural variable to profits as a performance variable. Now we can go in two directions from this point. First we may say that advertising expenditures are clearly a performance variable as well as a structural one in that they are a symptom of a particular market structure as well as a propagator of the same, and that similarly, profit rates may, in so far as they act as an inducement to entry, also be a structural characteristic. Second, irrespective of whether advertising expenditures or profits are structural or performance characteristics, they are inseparably bound in so far as advertising expenditures may enhance profitability and that high profit may provide the finance necessary to further the level of advertising expenditure. Similarly arguments on causality arise in the case of demand growth and research and development expenditures as they also do with demand growth and advertising expenditures. Indeed, we are in reality dealing with a multiplicity of extremely intricate interrelationships the like of which cannot be catered for by the single equation, uni-directional, rigidly specified relationships we have used up to now. This means that it is impossible to separate the relationship between any pair of a structural and a performance variable from the complex framework from which it derives unless full account is taken of all such relationships in the form of a complete system.

One way is to specify a complete simultaneous equation

system. This too has disadvantages however in that it still involves imposing strict patterns of relationship as opposed to the fluidity of interdependence which the theory suggests. Further it means actually recognising, structuring and specifying every possible relationship that might exist, and lastly, it involves problems of econometric investigation in that one is typically left with the conclusion that most variables would be endogenous to such a system and hence identification of most of the structural relationships impossible.

An alternative approach is to allow a greater degree of freedom among the variables to react with each other, and as it were to estimate some "net" possibly even "equilibrium" relationship between market structure and market performance. Indeed, what we really want to do is to relate market structure to market performance and our problems so far are concerned with the multi-dimensional aspects of these two concepts. We shall now go on to suggest that most of such problems can be overcome by the use of that statistical technique known as Canonical Correlation.

III CANONICAL ANALYSIS

(i) The Technique - an introduction

Canonical Correlation is a technique used widely in other social sciences, particularly in Psychology, but rarely in Economics*. One particular form of Canonical Analysis is well known in Economics however, namely Regression Analysis. Now in Regression Analysis we have a set of "independant" variables which we believe have some causal effect upon a single "dependant" variable. The general idea is then to choose a weight for each component of the set of independant variables such that the correlation between the dependant variable and the variable obtained by post-multiplying the matrix of independant variables by the vector of weights (commonly called the predicted value of the dependant variable), is maximised.**

Now in the case in point we have a set of independant variables representing market structure. Our dependant variable is market performance, but we have no single measure to represent this but only a set of variables. Now Canonical Correlation is rather like Regression Analysis except that it allows us a set of dependant variables, and hence we are selecting two sets of weights, one for the independant variables and the other for the dependant variables, such a selection being restricted to that which produces the largest possible correlation

* G. Tintner - Econometrics - gives examples of some uses in Economics.

** Usually looked at as minimising the sum of squares of the residual variable obtained by subtracting the predicted value of the dependant variable from the dependant variable itself. The two are of course essentially the same thing.

between the two weighted sets. In short, Canonical Correlation is performing a regression between two sets of variables*, or rather, in the case of Regression Analysis, we are performing a Canonical Correlation in which one set has only one member, for it is clear that Regression is but a special case of Canonical Correlation. This latter point can be made clearer in the mathematics of the technique.

(ii) Mathematics of the Technique

A short mathematical expose of Canonical Correlation will now be given along lines familiar to those acquainted with Regression Analysis-

* Almost the title of Hotelling's pioneering work in this fields - see H. Hotelling - "Relations between Two Sets of Variates" - Biometrika 28.

Consider the system

$$Ya - Xb = u \quad (1)$$

where Y is an (n x p) matrix of fixed variables

X is an (n x q) matrix of fixed variables

a is a (p x 1) vector of constants

b is a (q x 1) vector of constants

u is an (n x 1) vector of a random variable

and let

$$E(u) = 0$$

$$E(u'u) = \sigma^2 I$$

$$E(u'_t, u_{t-1}) = 0$$

$$E(X'u) = E(Y'u) = 0$$

$p \leq q$ (if this is not the case then X becomes Y and

Y becomes X

and add only for convenience that X and Y are in standardised form. This is exactly the same system which we start with in Regression Analysis except that here we have Y as a matrix as opposed to an (n x 1) vector.

Now it is desired to derive estimates of a and b which minimise (u'u) or, in other words, to maximise the correlation between Ya and Xb.

Now this correlation is evidently

$$R = \frac{\sum_{i=1}^p \sum_{j=1}^q y_i x_j a_i b_j}{\sqrt{\sum_{i=1}^p y_i^2 a_i^2 \sum_{j=1}^q x_j^2 b_j^2}} \quad (2)$$

and the variances of the y's and x's

$$\sum_{i=1}^p y_i^2 a_i^2 = 1$$

$$\sum_{j=1}^q x_j^2 b_j^2 = 1 \quad (3)$$

which we have set equal to unity (i.e. all variables are standardised)

Now maximising (2) subject to conditions (3) can be shown to yield a set of simultaneous equations which in matrix form is represented by

$$\begin{aligned}(X'Y)'b - \lambda(Y'Y)a &= 0 \\ (X'Y) a - \lambda(X'X)b &= 0\end{aligned}\tag{4}$$

where λ is a Lagrange multiplier

or

$$\begin{aligned}(Y'Y)^{-1}(X'Y)'b - \lambda I a &= 0 \quad (i) \\ (X'X)^{-1}(X'Y) a - \lambda I b &= 0 \quad (ii)\end{aligned}\tag{5}$$

whence on substituting 5(ii) into 5(i) we get

$$\{ (Y'Y)^{-1}(X'Y)'(X'X)^{-1}(X'Y) - \lambda^2 I \} a = 0 \tag{6}$$

In the case where $p = 1$ i.e. the case of least-squares regression, one can easily derive the well known solutions

$$\begin{aligned}b &= (X'X)^{-1}(X'Y) \\ \lambda^2 &= (Y'Y)^{-1}(X'Y)'b\end{aligned}$$

In the case where $p > 1$ however, it is necessary to solve (6) for its characteristic roots and vectors. (6) has a non trivial solution iff

$$| (Y'Y)^{-1}(X'Y)'(X'X)^{-1}(X'Y) - \lambda^2 I | = 0$$

whose solution will give p characteristic roots (λ^2 's) and vectors (a 's). Substitution of these into (5) will give p vectors for b . Hence we have p squared canonical correlations with vectors a and b for each. The largest canonical correlation and its associated vectors is the one which maximises the correlation between $Y a$ and $X b$ and hence minimises $(u'u)$.

(iii) The Function and the Results

The specification of the relationships to be subjected to canonical analysis is, like that used in the regression analysis, strictly logarithmic except in respect to the demand growth variable. Two functions were in fact fitted to the data, one which had advertising expenditures in the market performance set but omitted the advertising/sales ratio from the market structure set, and the other being the reverse case, having the advertising/sales ratio in the market structure set but taking the performance set as including but profit rate, growth rate and research and development expenditures. The two functions were

$$a \log P + b \log G + c \log R = \beta_0 \log C + \beta_1 \log E + \beta_2 \log K + \beta_3 \log AS \\ + \beta_4 D + u_1$$

$$a' \log P + b' \log G + c' \log R + d' \log A = \beta'_0 \log C + \beta'_1 \log E + \beta'_2 \log K \\ + \beta'_4 D + u_2$$

where the notation is as before and the data and its sources unchanged. The fitting of these two relationships yielded the results presented below as Table Two.

Table Two: Canonical Correlation Results

	Coefficients (first analysis)	Coefficients (second analysis)
Market Performance		
log P	1.64	1.26
log G	-1.83	-1.69
log R	0.18	0.24
log A	-	-0.34
Market Structure		
log C	-0.16	-0.30
log E	0.01	0.07
log K	0.03	-0.07
log AS	0.30	-
D	0.20	0.14
	0.91	0.89
chi squared	23.07	21.71
degrees of freedom	3	1

The relationship between any pair of a structural and a performance variable can be seen by examining the ratio of the coefficient on the structural variable to that on the performance variable, the interpretation of this magnitude then being the effect on the performance variable of a unit change in the structural characteristic. Hence if the chosen pair have the same sign, be it negative or positive, the relationship between them is positive, whilst if the signs are different, the relationship is an inverse one.

Now the results from the two functions are essentially the same though the coefficient of $\log K$ changes sign with the inclusion of advertising as a performance variable, the relationship between these two being positive, displaying some conflict as to the affect of changes in barriers to entry on advertising expenditures. It would seem that industries with high levels of concentration, tend, *ceteris paribus*, to have on research and development, higher advertising expenditures higher rates of growth, lower expenditures/ and lower profit rates. Where barriers to entry are high, however, growth rates fall, and research and development expenditures and profit rates rise. The affect of barriers to entry on advertising expenditures seems a little confused with increases in economies of scale and growth of industry demand reducing such expenditures whilst increases in the absolute amount of capital required for entry at minimum efficient scale promoting such expenditures. In the next section we shall carefully compare these results with those obtained from the Regression Analysis in the light of the theoretical discussion earlier.

IV COMPARISON OF THE TWO APPROACHES

Table Three shows the predicted changes in our performance variables in response to certain specified changes in the structural variables. The first figure at each intersection in the table is the prediction obtained from the regression analysis, whilst the second and third figures are the predictions from the two canonically fitted functions.

In many respects the two approaches give similar patterns of causality though the exact magnitudes often differ, for example, take the affect of changes in concentration on growth rates. Take again however the consistency of the predicted affect of changes in concentration on research and development expenditures. The magnitudes are surprisingly close and the strong suggestion is that increases in concentration reduce the level of expenditures on research and development.

In several important areas however the results differ. The Canonical Analysis suggests falls in the level of advertising expenditures as the rate of growth of demand increases over this range, whereas the regression prediction is the reverse. In so far as advertising expenditures are undertaken by established firms in order to secure repeat buying and hence maintain market shares, then an increase in demand over its normal growth path is likely to reduce the magnitude of such expenditures per unit sales unless the increase in demand growth tends in some way to distort the market shares. If the latter were the case, then it is less easy to predict the affect on industry advertising expenditures. The Canonical Analysis further predicts that increases in the rate of growth of demand will increase expenditures on research and development, and this is in agreement

with Schmookler's (9) arguments. The regression analysis predicts the opposite result.

It is the implied effects on profit rates which is the most significant point of disagreement between the two approaches. The regression analysis suggests that increases in concentration stimulate profit rates as do increases in the rate of growth of demand and in product differentiation, whilst increases in economies of scale and absolute capital requirements reduce profit rates. The canonical analysis differs in respect of the effects of changes in concentration and in economies of scale. The results indicate that increases in economies of scale tend on the whole to lead to higher profit rates, and this seems more intuitively plausible than the reverse affect suggested by the regression results. Increases in concentration however produce reductions in profit rates, and a reasonable case could be made here in that in the absence of high entry barriers a firm may be unwilling to earn high profit rates despite its ownership of a certain degree of market power, for fear of attracting new entrants. Rather, such market power may be used as a basis on which to increase the size of the firm, to stimulate demand for its own products, and to build up brand loyalty by increasing its advertising expenditures. Pursuing any of these ends would also tend to increase the height of entry barriers. All these results are suggested by the canonical analysis, but not by the regressions.

The results from the canonical analysis would appear to be more in agreement with the theory usually put forward than do those of the regression analysis, though there are

some surprises. The real question to be asked however is to what extent the results of the canonical analysis can be held to be genuinely superior. We have tried to argue earlier that the regression approach is too "partial" an analysis to cope with the structure-performance concept, it being necessary to consider more than one performance variable at a time. The practicability of establishing a simultaneous equation system has been questioned, and the necessarily rigid chains of causation challenged. The only way to consider the whole set of performance variables at the same time would appear to be by use of Canonical Correlation, and whilst we cannot offer any scientific proof of the superiority of the approach, this virtue alone, taken together with the type of results we have obtained, would suggest that this whole approach may be more fruitful than regression studies, but what is really needed is further experimentation with Canonical Correlation in the market structure-market performance area.

These conclusions must be rather tentative. The sample of industries is small, the level of aggregation high, and the data far from ideal. However, the main purpose has been fulfilled, namely to demonstrate that the analysis of partial relationships in the market structure-market performance approach may be widely inappropriate and that there may be much fruitfulness in the alternative approach of seeking to consider the whole complex of relationships which the structure-performance approach is. So far as making policies which act on market structure in the hope of having some particular affect on market performance, our results would suggest that concern to increase the level of actual competition within a market is unlikely to

have very significant affects on performance in terms of magnitude, and it is rather through such policies as influence product differentiation and the rate of growth of demand for the products of the market that the most effective control can be gained.

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Table with multiple columns and rows, containing faint text and numbers. The text is mostly illegible due to low contrast and blurring. The table appears to be a data table with several columns and multiple rows of data.

Table Three: Predictions

	Predicted change in profit rate (percentage points)	Predicted change in growth rate (percentage points)	Predicted change in R & D expenditures (£ for the industry)	Predicted change in Advertising Exps. (£ for the industry)
Change in Concentration Ratio of 1 pp	0.047 -0.0049 -0.0158	0.03 0.004 0.009	-1,930 -1,940 -1,980	-289 - 96
Change in Excess of Scale of 1%	-0.48 0.007 0.09	-3.16 -0.0045 -0.04	1,900 1,950 1,620	4,151 - -1,158
Change in Abs. K. Req'd. of £1m	-0.002 0.0002 -0.0006	-0.0008 -0.0001 0.0004	96 39 -68	97 - 97
Change in A/S Ratio of 1pp*	5.95 1.34 -	-2.42 -2.95 -	31,856 27,995 -	- - -
Change in Demand Growth of 1pp	3.40 5.19 4.734	-0.28 -3.73 -2.33	-55,989 1,089,861 571,477	1,390 - -59,947

* suggests £1.5m increase in industry advertising

APPENDIX 1

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APPENDIX 2

DATA

	Economies of Scale	Absolute K, Req. \$m	AD/Sales %	Growth of Demand %	Sales \$m
Food, Drink and Tobacco	0.3485	126,861	9.43	4.16	4834.30
Chemical & Allied Industries	1.9631	623,770	7.87	4.23	2870.60
Metal Manufacture	0.8335	138,820	0.53	1.81	2086.30
Engineering	0.1389	25,356	1.17	7.89	2944.80
Electrical Engineering	0.5720	82,007	5.78	5.83	1740.50
Shipbuilding and Marine Eng.	1.5603	31,282	1.07	-4.23	414.60
Vehicles	0.8157	102,907	9.36	1.72	2324.40
Metal Goods	1.0831	100,334	3.20	6.47	1449.80
Textiles	1.0132	170,262	1.75	1.47	1974.10
Leather Goods	1.2771	2,564	6.19	-0.76	178.00
Clothing and Footwear	1.3509	43,714	9.43	4.26	888.80
Bricks, Pottery, Glass, Cement	0.3676	36,132	0.54	6.31	735.90
Timber	0.4324	5,340	9.21	1.63	608.60
Paper Printing and Publishing	0.4674	88,101	0.77	5.68	1542.30
Other Manufacturing	1.5914	92,736	0.55	5.60	706.90

DATA

	Profit Rate %	Growth of Assets %	Advertising \$m	R & D \$m	Concentration Ratio	No. of firms
Food, Drink and Tobacco	9.79	6.09	33,979	14,114	31.26	155
Chemical & Allied Industries	9.44	8.86	24,080	56,122	70.30	80
Metal Manufacturers	9.14	15.58	1,015	15,183	38.85	92
Engineering	15.05	9.33	2,314	113,539	16.91	234
Electrical Engineering	12.35	5.42	9,689	26,633	33.56	88
Shipbuilding and Marine Eng.	3.12	6.75	0,188	3,094	57.17	24
Vehicles	15.90	13.43	10,717	33,278	54.80	62
Metal Goods	13.09	7.55	3,285	6,465	53.09	121
Textiles	8.55	6.94	2,743	7,999	51.03	212
Leather Goods	16.28	17.58	0,138	0,518	60.93	12
Clothing and Footwear	11.14	6.19	10,685	3,781	52.74	68
Bricks, Pottery, Glass, Cement	13.40	10.64	0,556	7,483	34.41	92
Timber	19.66	14.77	1,235	1,557	28.48	49
Paper, Printing and Publishing	11.32	8.26	1,117	3,069	41.52	101
Other Manufacturing	14.31	10.39	0,310	3,222	65.90	58