CONCENTRATION, SIZE AND PERFORMANCE OF EUROPEAN FIRMS*

by

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I. INTRODUCTION

The empirical work on market structure, conduct and performance in the U.S. has been surveyed by Weiss (1971). To our knowledge no survey of similar work in Europe is available to date, possibly because all studies in the area are recent while scholars are few. This is an attempt to fill the gap with no pretention to covering the entire field. In fact, we want to focus on concentration.

Concentration has for long been considered as the key variable to use, for reasons which are mainly theoretical, although empirical work is emphasizing more and more the importance of other variables (such as product differentiation and barriers to entry). Concentration apparently continues to take a central position in the American Literature, as evidenced by the availability of a time series of complete sets of data on concentration ratios for various levels of aggregation.

It seems fair to say that European scholars have tended to put more emphasis on the analysis of market conduct, perhaps because Europe was and still is the "Mecca" of cartels and collusive behavior. Typical for this approach is the work by the late Houssiaux (1958) who has pointed out the ability of firms to improve as well as to exploit existing oligopolistic situations. Indeed, there is a reluctance of many European to consider market structure as a datum. The interaction between structure and conduct or conduct and performance is often thought to be a more interesting topic than the analysis of the traditional structure - conduct -

performance sequence, although formal analysis is still very much in an infant stage. Some theoretical work on the impact of the firm's strategy on its environment, using optimal control techniques, has been done by the first author[1] : corporate power is viewed as an asset in which investment for attaining a desired environment can take place. This approach may lead to promising results, as can be seen from the survey by Jacquemin and Thisse (1972). However, econometricians do not seem to have discovered this field as yet, although it provides a natural domain on which to try out estimation techniques for simultaneous equations. Hence, because of its emphasis on econometric studies, while market conduct and collusive behavior are difficult to measure empirically[2] , we feel that this paper cannot but give a biased view of what European economists have been doing, the more so as we shall not cover the growing literature on case studies of particular industries (See e.g., Phlips (1962a), Prodi (1966), Wunden (1969), Herbert (1970) and Buyse (1970) on cement, nitrogen fertilizers, photographic materials, clay, textiles, electrical equipment and automobiles).

The reluctance to focus on concentration data (which do not even officially exist for the Common Market as a whole) might also be related to the widespread feeling that it is difficult to define the relevant market in an operational way in a European context. We shall not dwell here on the eternal problems raised by product differentiation,[3] but rather insist on the problems raised by the geographical extension of the market. Many people wonder to what extent a national concentration ratio is capable of measuring anything like market power in countries like Belgium or the

Netherlands or even their largest neighbors. These countries are typically small, export oriented and above all open to foreign competition, in sharp contrast to the U.S. which has what looks to us as an enormous internal market, with international trade playing a very marginal role. Conversely, now that the Common Market is in operation, one wonders to what extent it may be considered as one single market, from the point of view of the measurement of market structure.

We think that, as a rule, it does make sense to consider the national markets as the relevant markets, even with the E.E.C. in operation. The removal of trade barriers is not a sufficient condition for the existence of one integrated market, and the increase of trade inside the Community as such is not a sufficient indicator of the creation of effective competition inside Europe. Indeed, oligopolistic market structures (typical for most manufacturing industries) and a long history of collusive behavior allow for market segmentation (into areas generally coincident with national boundaries) with the help of a series of techniques such as : market agreements, agreements that make markets "transparent", basing-point systems (which are enforced by the Coal and Steel Community), exclusive dealing arrangements and other selling practices. As these practices were extremely widespread after World War II and still are[4], it is much too soon to consider Europe as one single market. For the interpretation of the available statistical material (which refers mostly to the sixties), it seems appropriate therefore to consider the national markets as relevant, and to compute structural indicators such as concentration ratios, firm size distributions, etc., on a national basis. Sections 2 and 3 will be devoted to international comparisons of structural data derived from national data.

Once we are this far, we cannot escape the next non-cynical question which is to ask : To what extent is the relevant market still relevant, given present-day developments. On the product differentiation front, the waive of conglomerate mergers makes it difficult to stick to the traditional rule[5] according to which one should look at the firm's components separately in their respective relevant markets. On the other hand, Houssiaux emphasized (as early as 1958) that the sum total of market powers exerted by a firm in different sectors may be smaller than the power it has in the economy as a whole, so that one should really study its position in a national or international framework, across the industries in which it sells. Needless to say, the same can be said with respect to multinationals. That is why Section 4 devoted to studies of market performance based on industry data, is followed by a discussion of results based on data for the largest individual firms in Europe.

II. FIRM SIZES AND CONCENTRATION

It is of some interest to ask what is the comparative level of concentration in different European countries. More specifically, one would like to know in which countries concentration is larger.

For lack of comparable census data based on production or shipments,[6] computations of firm concentration ratios have to rely on size distributions in terms of employment.[7] These refer to the year 1962 for which the first and unique Common Market industrial census[8] is available. It is only in its 1973 "Second Report on Competition Policy" that the E.E.C. Commission published time series of firm concentration ratios for a limited number of industries, using employment and shipments data. In the well-known comparative study by Bain (1966) and a more recent book by H. de Jong (1971), efforts are made to compare data from very different sources.

What are the findings ?

Looking first at the data from the 1962 Common Market census,[9] we can say that industrial structure is very homogenous in Europe - as is the case between U.S. and Great Britain according to Pashigian (1968). An industry that is more concentrated in one country is also more concentrated on the average in another country. Sectors with many firms in one country also tend to have many firms in other countries. Similar results are to be found in Pryor (1972).

However, the size of firms, per industry, displays marked differences. Correlations between countries are markedly smaller [Horowitz, (1970), Table 86] and distributions are very different as can be seen[10] from Table I :

Table I : *Distributions of the Ratio (*100) of the Average Size of the Four largest Firms in one Country to the Average Size of the Four Largest Firms in Belgium, per Three-digit Industry.*

Nation	Number of Industries	Median	Quartiles
France	88	274	178-599
Italy	89	236	131-467
Netherlands	87	119	61-231

Given these differences in size, it would be surprising if the overall concentration levels were not very different. France (and probably Germany) has the largest firms, while Belgium has the smallest. One therefore expects France to appear as the most concentrated and Belgium as the least concentrated.

On a first look, this doesn't seem to be the case. A direct comparison of national concentration ratios suggests that the larger countries are less concentrated than the smaller ones :

Table II : *Distributions of the Ratio (*100) of the Concentrated Ratio (Four Largest Firms) in one Country to the Corresponding Belgian Ratio, per Thre-digit Industry.*

Nation	Number of Industries	Median	Quartiles
Netherlands	93	100	58-146
Italy	93	64	43- 94
France	93	50	33-106

Using absolute entropy measures, Horowitz (1970) also finds that the larger countries display a larger entropy and therefore a smaller concentration level.

It should be clear, though, that a correction should be made for the geographical size of the countries involved. As the number of firms (N) is a good proxy for market size, this correction can be obtained by dividing absolute entropy by log N (i.e., the largest possible entropy, given the number of firms in an industry).[11] The resulting "relative" entropy indicates the extent to which entropy diverges from its maximum, given the size of the market (N). A smaller relative entropy indicates a relatively larger concentration.

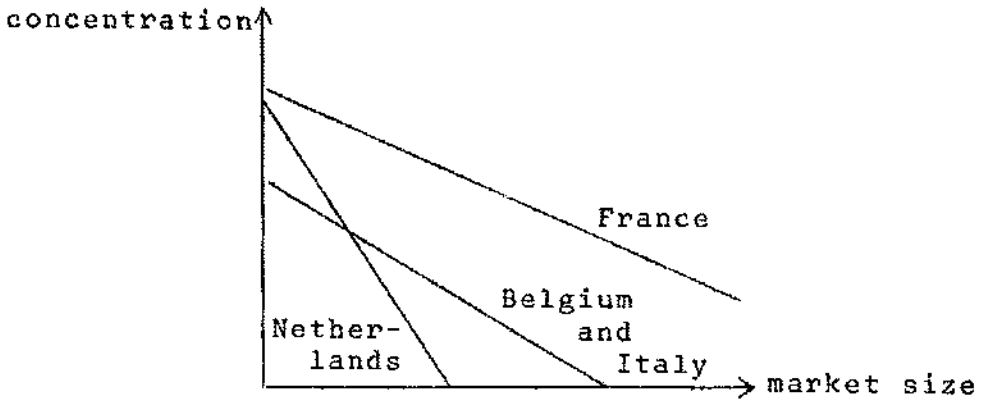
Table III : *Average (Absolute and Relative) Entropy for 21 Two-digit Industries in Manufacturing Industry*

Nation	Absolute Entropy	Relative Entropy
Italy	10.4182	0.7667
France	9.6718	0.7300
Germany	9.4443	0.7271
Netherlands	7.7763	0.7395
Belgium	7.5681	0.7267
Luxembourg	4.3666	0.7301

Table III shows that the average relative entropy behaves very differently. There are no great differences between countries, generally speaking (although we should mention that Horowitz finds striking differences in a number of particular industries).

We doubt that Table III gives the true picture. The correction for market size seems insufficient for at least two reasons. First, the computations are limited to two-digit industries, in which the number of firms does not represent "true" market size. On the other hand, unweighted averages per country can hardly be considered as representative. We would rather look at three-digit industries, for which more plausible results are available. A cross-section regression (per country) of the concentration ratio on total employment (E) and average firm size ($\bar{F}$), all in logs, eliminates differences in market size (as $N = E/\bar{F}$). The

intercept then gives an estimate of the average level of concentration per country to the extent that the slopes are homogeneous.[12] The regression results can be represented graphically as follows :



The french industry turns out to be systematically more concentrated than the dutch, the belgian and the italian. The Netherlands have a particular shape : this country has industries that are relatively both more and less concentrated, probably because of the presence of a number of large multinationals, as is confirmed by de Jong (1971, pg. 127).

The conclusion that France comes first should not be too surprising. France is at the top because of the well-known "closed" character of its economy,[13] linked with a longstanding tradition of official support of cartelization in all its forms. When cartels are well-organized and protected by the authorities, industrial concentration can

develop quietly without improving efficiency.[14] Needless to say, a thorough historical analysis would be needed to verify this alleged complementarity of cartelization and concentration. Such an analysis has still to be carried out, but the few descriptive case studies available[15] tend to support the idea.

The results reported so far summarize the situation in the early sixties. What can be said about the evolution since then ? The E.E.C.'s Second Report on Competition Policy gives, as said, the only time series information available. This information is scanty.

First, the Report gives the number of "international operations" (participations, common subsidiaries and simple subsidiaries) and a partition into those in which E.E.C.-firms only took part and the other ones.[16]

Table IV : *International Operations in the E.E.C.*

	Participations		Common Subsidiaries		Simple Subsidiaries	
Year	Number	Between EEC-firms only (%)	Number	Between EEC-firms only (%)	Number	Between EEC-firms only (%)
1966	254	33	315	34	781	35
1970	327	35	345	34	1199	39
1971	368	39	382	35	1408	42

As Table IV indicates, the number of international operations seems to be increasing steadily. The number of

operations in which firms belonging to non-member countries take part is markedly larger than the number of operations between E.E.C. firms only, but its relative importance tends to decrease.

Table V gives an idea of the location of these operations. Given its very small geographical size, Belgium seems to be by far the favorite place to put up a subsidiary or to take a participation, while the interest in France is steadily increasing.

Table V : *Location of international operations (%)*

Year	Germany	France	Italy	Netherlands	Belgium	Luxembourg
1966	22	19	13	16	24	6
1970	24	22	12	13	22	7
1971	22	24	11	12	24	7

American firms are involved most often but their relative importance is declining rather sharply, as can be seen from Table VI.

Table VI : *Nationality of firms involved (%)*

Year	EEC	USA	GB	Switzerland	Scandinavia	Japan	Other
1966	58	21	9	5	3	-	4
1970	56	18	10	7	3	1	5
1971	55	17	10	7	4	2	5

NICE Classification	Year	Germany		France		Italy		Belgium	
		Employ-ment	Shipments	Employ-ment	Shipments	Employ-ment	Shipments	Employ-ment	Shipment
232 Wool	1962	-	-	20	-	23	22	26	30
	1966	15	13	21	-	19	21	31	33
	1969	18	15	20	-	17	18	32	34
233 Cotton	1962	-	-	13	-	11	13	19	18
	1966	17	19	14	-	11	13	25	21
	1969	23	17	15	-	14	15	28	32
237 Hosiery	1962	-	-	11	-	4	7	9	10
	1966	16	21	13	-	3	6	9	10
	1969	17	20	14	-	3	6	11	13
385.1 Bicycles	1962	46	45	62	-	72	70	-	-
	1966	55	54	63	-	65	63	-	-
	1969	66	63	63	-	66	65	-	-
Motorcycles	1962	94	99						
	1966	99	99						
	1969	98	98						
271 Paper and Board	1962	23	30	20	-	20	25	-	-
	1966	23	34	19	-	22	24	-	-
	1969	26	40	20	-	22	23	-	-
272 Paper and Board products	1962	18	20	7	-	6	12	-	-
	1966	18	24	6	-	5	9	-	-
	1969	20	28	8	-	5	8	-	-
313.1 Pharmaceutical products	1962	-	-	-	-	24	26	34	34
	1966	-	-	-	-	22	25	47	47
	1969	-	-	-	-	28	32	43	43

Table V : *Concentration ratios (4 largest firms) in selected industries and countries in 1962, 1966 and 1970.*

It is difficult, if not impossible, to say anything about the impact of these operations on firm concentration. All comparable information is to be found in Table VII, taken from the Commission's Second Report. If anything, it is representative of the state of affairs as far as structural time series are concerned, and informative mainly through the number of blanks in it. It seems reasonable to argue that, even if the recent waive of mergers and take-overs has affected industrial concentration,[17] the relative position of the E.E.C. countries has not changed, so that analyses based on the 1962 census are still relevant.

III. PLANT SIZES AND CONCENTRATION

Data on plant size and plant concentration are somewhat easier to obtain and a larger number of studies are available.[18]

Scherer's 1973 paper is a good starting point for the analysis of plant sizes. It focuses on the average size of those plants which, when all plants are arrayed in descending size order, account for the top 50 percent of an industry's cumulative employment or output, and is based on twelve industries in six nations. Using United States plant sizes as a benchmark, he ends up with the following comparisons pertaining to the years 1963-1967 :

Table VIII : *Comparison of Average Plant Size Tendencies, letting the Index for each most closely Comparable United States Industry = 100*

Nation	Range of Indices	Median	No. of Indices
United States	100-100	100	12
Canada	12-117	51	12
United Kingdom	21-340	92	12
Sweden	10-209	40	12
France	11-131	77	12
West Germany	24-246	91	11

There is near parity of plant sizes among the United States, the United Kingdom and Germany ; while in Canada and Sweden the tendency is toward plants of considerably smaller employment, France lying in between.

Smaller nations have smaller plants, as is confirmed by Table IX, which compares countries inside the E.E.C., using the 1962 Common Market census.[19]

Table IX : *Distributions of the Ratio (100) of the Average Size of the Four Largest Plants in one Country to the Average Size of the Four Largest Plants in Belgium, per Three-digit Industry*

Nation	No. of Industries	Median	Quartiles
France	88	274	178-559
Italy	89	236	131-467
Netherlands	87	119	61-231

To explain these differences, Scherer first computes estimates of minimum optimal production scales. These turn out to be uniform from nation to nation. He then sets up and tests a model, which shows i.e. that a) average plant sizes will be smaller, the smaller is the market in relation to the minimum optimal production scale and the slower the rate of market growth is ; b) plant sizes are expected to be larger, the higher seller concentration is, i.e., when an oligopolist's share of the available market demand increment is large.

With uniform minimum optimal scales, there results strongly suggest that increased seller's concentration is a prerequisite, in small nations, for efficiency, i.e., to allow firms to attain minimum optimal scale.

In our opinion, this conclusion should not be extrapolated to all countries, as Scherer tends to do when he suggest that his results "might be interpreted as support for the conventional European wisdom that concentration is necessary for efficiency", and "could inject further complexity and doubt into the formulation and execution of Anti-trust Policy". Even inside the Common Market, concentration may have been necessary for efficiency only in smallest countries, such as the Benelux countries. The findings of Nioche (1969), according to which the percentage of plants with less than 50 employees is the smallest in Belgium and the Netherlands and the largest in France and Italy, points in this direction. It should also be noted that firm and plant concentration are practically equal in the Benelux countries, while the former is markedly larger than the latter in Italy and especially in France.[20] A confirmation is given by the following international comparison of the "degrees of divergence" between firm and plant-concentration [Morvan (1972) p.292)] measured in terms of the work-force employed.

Table IX bis : *International Comparison of Degrees of Divergence**

Ratio of firms and plants concentration	France	Italy	Netherlands	Belgium	Luxembourg
$N^x = 4$	1,80	1,46	1,17	1,11	1,00
$N^x = 8$	1,56	1,34	1,13	1,06	1,00
$N^x = 20$	1,35	1,20	1,09	1,02	1,00
$N^x = 50$	1,20	1,12	1,04	1,01	1,00

* N^x = number of largest firms and plants.

IV. EFFECTS OF INDUSTRIAL CONCENTRATION

We now turn to the relationship between industrial concentration and market performance [see Phlips, et alii (1971)], and first take up the administrative inflation hypothesis.

According to one version of the hypothesis, more concentrated industries use their monopolistic power during upswings of the business cycle to increase selling prices more than would be justified by increase in demand and costs. An analysis of belgian, dutch and french wholesale prices over the period 1958-1965 shows very clearly that this was not the case. A covariance analysis reveals an impressive homogeneity as to a) the absence of any relationship between price increases and concentration ratios, and b) an increase in prices with unit wage costs and unit materials costs.

However, this doesn't preclude the possibility that oligopolistic industries may contribute indirectly to inflation by granting wage increases more easily, given their ability to pass increases in unit labor costs on to price. According to authors such as H.N. Ross (1973), this is the "true" version of the administrative inflation hypothesis. To test it empirically, one may wish to analyze a period of "stagflation", i.e., stagnation with rising prices, as currently observed in Europe. A first test[21] seems to provide some empirical support, even though the period under investigation (1958-1964) was a period of expansion with rising prices.

All this is compatible with the positive profit-concentration relationship American studies tend to turn up with. Surprisingly enough, no such relationship could be verified with the European data at hand.

Even if we were to ignore the problem of measuring "true" profits, a series of additional difficulties creep up when one has to analyze different countries : the critical figure above which profits may be considered as being "large" differs from country to country, as a result of differences in accounting practices ; the same is true with respect to concentration, as there is a bias due to market size ; the use of averages over different years (to eliminate the business cycle) is dangerous, if only because business cycles are not perfectly synchronized.

After a series of adjustments, the results are still largely negative. For Belgium, the relationship is all but positive. All that can be said is that the average level of profits is higher in high barrier industries, and that profits display a greater stability in concentrated industries with high barriers to entry. One single positive relationship was found for Italy, but only in recession years : over the period 1959-1965, nothing significant could be worked out. These results are in keeping with the conclusions reached by Guerci (1970) for the years 1964-1968.

Are we to conclude that increased concentration promotes efficiency, not monopoly, in countries as small as those under investigation ? Maybe, but we should warn the reader that alternative explanations are available. In many industries, a large part of the profits are made on foreign

markets under more competitive conditions ; the aggregation of large and small firms in some of the data may bias the results ; the accounting practices of European "holdings" may average out the difference we are after. Finally, there may be a similarity bias which a single-equation approach ignores.

Fortunately, the results are much more robust when we look at the production side, possibly because the statistical material is more homogeneous. Whether they extract higher profits or not, concentrated industries do pay higher wages in all countries under study (Belgium, France and Italy). As data on wages in different countries are based on the same industry classification, it becomes possible to apply Zellner's model for "seemingly unrelated regression", and to estimate the coefficients simultaneously for different countries, allowing for contemporaneous correlation (between countries). Each country is then treated as a micro-unit, and the Common Market as the macro-unit. One can test for aggregation bias.

The test gives negative results, in the sense that there is an aggregation bias. The micro relations are different. The Zellner model moreover gives results that are markedly different from single-equation ordinary least squares. A *ceteris paribus* increase in the concentration ratio by 50 points (from 10 to 60) leads to an increase of the hourly wage ratio of 11 % in Belgium, 20 % in France and 36 % in Italy. In absolute figures, this corresponds to increases of the hourly wage rate of $0.014 in Belgium, $0.025 in France and $0.029 in Italy (at the official 1963 exchange rate) whenever the concentration ratio goes up by 10 points.

The positive wage-concentration relationship is compatible with the assumption of an indirect contribution to inflation, and with a positive profit-concentration relationship. But it may also reflect higher qualification of the labor force . (To test this, more detailed data on schooling, age, etc., would be needed.) At first sight, one is tempted to conclude that workers get their share of a larger profit. Horowitz (1971 a, p. 177) concludes in the same way, after estimating a fairly aggregate (two-digit) simultaneous model, in which wages, shipments, investments and entropy appear as endogenous variables. We quote :

"Thus, implicit in the analysis and the results are the conclusions that, although the underlying causes may not be perfectly clear, labor does not generally find the less concentrated industries to be as lucrative as the more highly concentrated industries, and that industry sales and investment per firm tend to be less, the lesser is the level of concentration. It might also be argued, albeit very cautiously, that (1) the observation with respect to sales reflects a greater attraction for 'shifting the demand curve upward' as the degree of market power increases, or a greater ability to extract higher prices for the same quantities when market power increases ; and (2) the observation with respect to investment reflects a greater profit potential as the degree of concentration increases. All results are compatible with the hypothesis that increased concentration leads to increased profits. Nevertheless, compatibility and causality are not one and the same."

As for the differences among countries, we suspect these could have been reduced if we had been able to introduce a variable measuring geographical concentration. The more concentrated industries are probably located in high wage regions, especially in larger countries such as France and Italy. Furthermore, these countries have smaller concentration ratios on the average : their domain of variation being smaller, regression slopes may be biased upward.

More concentrated industries do pay higher wages. Do they invest more in research and development ? The answer is yes, at least as far as technologically progressive sectors are concerned. On partitioning a sample of 301 belgian firms into a chemical sector (U.N.31), an electronics sector (U.N.37), a moderately progressive sector and the rest, each group being allowed to have its own slope, we find :

$$RI_4 = \underset{(0.16)}{0.64} + \underset{(0.15)}{0.25}\ C + \underset{(37)}{0.16}\ C + \underset{(31)}{0.024}\ C + \underset{(\text{mod.pr.})}{\quad}\ - \underset{(0.045)}{0.006}\ C \quad (\text{non pr.})$$
$$(0.04) \quad (0.039)$$

$$\bar{R}^2 = 0.19 \qquad F - \text{ratio} = 5.36,$$

where RI_4 measures research intensity in the four largest firms (per mill) in 71 three-digit industries, C is the four-firms concentration ratio, and standard errors are given between brackets.

Studies of the possible impact of concentration on other variables, such as advertising and growth, do not seem to be available.[22]

V. SIZE OF FIRMS AND MARKET PERFORMANCE

This section is devoted to an analysis of the largest European firms in the context of the E.E.C. A brief description of their relative importance is followed by an evaluation of their performances, without emphasizing the particular industries they are operating in, for reasons given in the introductory section.

Table X gives an idea of the evolution, in the United Kingdom, of the share of the top 100 quoted companies in the total net assets of manufacturing industry,[23] while Table XI describes the share of the top 50 E.E.C. companies (in manufacturing and extractive industry in gross domestic

Table X : *United Kingdom*

Group	1948	1957	1968	Percentage growth rate 1948-1968
Top 4	10.2%	11.4%	14.7%	6.5%
Top 12	17.8%	20.6%	26.2%	6.6%
Top 50	35.0%	39.9%	50.8%	6.6%
Top 100	46.5%	50.7%	63.7%	6.2%

product[24] (at market prices). "Global" concentration in the hands of a small number of big firms seem to be rapidly increasing, especially in the period between 1957 and 1968 with its impressive waive of take-over bids.[25]

Table XI : *E.E.C.*

Group	1960	1965	1968
Top 4	5.8%	6.8%	8.1%
Top 8	10.4%	11.8%	14.6%
Top 20	20.9%	22.5%	29.0%
Top 50	35.1%	35.1%	45.7%

What about the relative size of the largest firms, in the United Kingdom and on the Continent ? The few studies at hand show that the dispersion, as measured by the Herfindahl index or the entropy coefficient, decreased on the Continent since the creation of the Common Market, and remained stable in the U.K. At the same time, the dispersion between the British group and the continental group increased. One can infer a faster growth of the continental firms.

Inside the Common Market, the share of each country in the top 100 firms is getting equalized, so that the dispersion is decreasing. These findings are summarized in the following Table[26] :

Table XII : *Relative Entropy of the Top 100 Firms in the U.K. and the E.E.C.*

Year	Total Entropy	Between Groups	Inside EEC	Inside U.K.
1962	0.8916	0.9658	0.8541	0.9083
1963	0.8935	0.9495	0.8631	0.9070
1964	0.8964	0.9363	0.8693	0.9097
1965	0.8978	0.9420	0.8695	0.9132
1966	0.8991	0.9132	0.8767	0.9097
1967	0.9037	0.9282	0.8826	0.9119
1968	0.9025	0.9378	0.8829	0.9015
1969	0.9077	0.9275	0.8936	0.9042
1970	0.9091	0.9190	0.8927	0.9097
1971	0.9117	0.8765	0.9044	0.9013

Market performance has been analyzed in terms of indicators similar to those referred to above : profits, growth rates, R & D.

According to Baumol (1959, p.34), a positive profit-size relationship is to be expected, on the assumption that larger firms can benefit from reaching a higher echelon in the imperfect capital market. This argument can be generalized to all factor markets : firms may want to grow through the acquisition of other firms, in order to gain control of scarce factors such as qualified management, greater liquidity or licenses. To some extent, the idea has been confirmed by empirical evidence for the U.S., such as in Hall and Weiss (1967) and Gupta (1969), although with some qualifications (see [Marcus (1962)])

European studies, on the contrary, are much less conclusive, as emphasized by de Jong (1971, p.156). Singh and Wittington (1968), for example, analysing 450 british quoted companies, find no relationship between profit and size. For their sample of the top 100 European firms, Jacquemin and Cardon (1973) derive a negative relationship.

It should be said, however, that the variance of profit rates among firms decline substantially as one goes from small to large corporations. This result has been obtained by studies focusing on a cross-section comparison of profit variability among size classes [Sherman (1968)], as well as by analysis of the variability of profit rates over time for firms of various sizes [Samuels and Smyth (1968) for the U.K., Jacquemin and Cardon (1973) for the E.E.C.] The main explanation is the greater diversification in the larger firm which produces and sells more products, more varieties of any given product and operates a greater number of plants in a greater number of geographically segmented markets. "The large firm, then, may be viewed as an aggregate of n small firms, each of them 1/n its size. The variance of the profit rates for the large firms should then be approximately $1/\sqrt{n}$ of the variance of the profit rates of firms 1/n as large." [Caves (1970), p.287, Alexander (1949), Dyckman and Steckler (1965)]. There is also no clear relationship between sizes and growth rates. Generally, for a large sample of firms, the growth rate seems to be relatively independent of size, if one looks at frequency distributions of average growth rates as in Singh and Whittington (1968) for the U.K. or Fizaine for France. The growth-size relationship appears to be a stochastic one, and one has to refer to

the Pareto, Yule or lognormal distributions. Several tests of Gibrat's law are available [Didier (1969), Morand (1962)]

However, for more recent periods and for smaller samples made of the very large firms, there are indications that changes in size are not a random proportion of initial size [J.M. Samuels and A.D. Chester in K. Cowling (ed.) (1972)] For the largest European firms, Jacquemin and Cardon (1973) derive the following regression results :

$$\underline{g} = \underset{}{69} - \underset{(2.9)}{4.5} \log S + \underset{(3.8)}{1.6} P - \underset{(3.0)}{7.5} N + \underset{(1.0)}{4.0} D_1 + \underset{(0.3)}{1.7} D_2 + \underset{(0.02)}{0.09} D_3$$

$$- \underset{(0.2)}{0.8} D_4 + \underset{(2.2)}{10.3} D_5 - \underset{(0.7)}{3.9} D_6 + \underset{(1.9)}{7.8} D_7 + \underset{(2.2)}{10.0} D_8$$

$$R^2 = 0.4 \qquad n = 79$$

where $\underline{g}$ is the growth rate of shipments between 1962 and 1970, S denotes firm size, P stands for the profit rate, N indicates a firm of british nationality and D is a dummy for industry. The figures between brackets are $\underline{t}$ - ratios. Clearly, firm size and british nationality have a negative impact on growth, while the profit rate and the progressive character of the industry (5, 7 and 8) act positively.

We finally turn to another stand-by in the field : research and development. W.J. Adams (1970) has made a comparative study of the U.S. and France, and concludes that neither absolute nor relative dimension affect R & D : "bigness is not a prerequisite for progressiveness". Using employment data, one of the authors arrived at a similar

though slightly qualified conclusion, as far as Belgium is concerned.[27] Research personnel evidently increases with firm size, but at a rate that differs greatly from industry to industry. The interesting question is whether research efforts increase more than proportionally with size, as emphasized by the Schumpeterian school. The answer is yes and no. Yes, up to a certain size, which lies around 7,000 employees ; no, above. This means that most belgian industries are still in a phase of "oncreasing returns".

Two recent studies, by Binamé and Jacquemin (1973) and Defay (1973), make use of sales and expenditure data, which should be more appropriate to the analysis of R & D budgets. These data relate to 157 belgian firms, accounting for about 70 % of all research efforts.

The first study uses a cubic regression of R & D expenditures on sales to discover that the linear part is the only significant one, for total industry as well as for particular industries. The second study introduces a production function, to find that investments in R & D have a much larger impact on value added (v) than investments in fixed capital (K) :

$$V = 0.139\ L + 0.101\ K + 0.645\ (R\&D) + 20.8$$

Furthermore, on analyzing the impcat of firm size on research efforts, Defay shows that research personnel grows less than proportionally with total personnel.

VI. CONCLUSIONS

Putting together the pieces of a puzzle (for which many pieces are still missing), the following picture emerges. Large countries tend to have large firms, large plants and small concentration ratios. In very small countries, concentration seems to be a prerequisite for efficiency.

Empirical evidence does not support the assumption of a positive profit-concentration relationship nor does it support (one version of) the administrative inflation hypothesis. On the other hand, concentration does lead to higher wages and greater research efforts (in progressive industries), so that one wonders how these results are to be reconciled. More refined thinking and possibly more sophisticated econometric techniques may be needed to determine how these relationships have to be testes in countries as small and "open" to international trade as the countries under review.

As far as "big business" is concerned, there is a striking tendency towards increased "global" concentration. But no evidence of increasing profits, faster growth or more intensive research efforts could be found to support the myth of big business. The main consequence of a larger size is to reduce the variability of profit rates, hence the firm's exposure to risk.

F O O T N O T E S

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[1]Jacquemin (1972).

[2]Empirical work on collusion is not impossible, though, as is exemplified by A. Phillips' recent paper on price fixing in British industry.

[3]On these, see Phlips (1963 and 1964 b).

[4]See E.E.C. Commission, 1973, and the recent European Sugar Industry Case.

[5]e.g. Adelman (1964, p.203 and 206) and Kumps (1974).

[6]For France, concentration ratios in terms of sales (see Loup (1969)) and employment (see Morvan (1972)) are available. However, the french industrial classification is not comparable with those of the other E.E.C. countries. Concentration ratios based on production are also available for a selected number of particular products (see Houssiaux (1968-69)), but these are far from covering the entire manufacturing industry. Further data are to be found in Van Meerhaeghe (1963) for Belgium, Evely and Little (1960), Armstrong and Silberston (1965), George (1967), Hart (1970) and Sawyer (1971), for Great Britain, Kilger and Karl in Arndt (1971) for Germany. For further details and other countries, see Marfels (1972).

[7]As in Horowitz (1970) and Phlips (1971).

[8]Resultats définitifs de l'enquête industrielle de 1963, *Etudes et enquêtes statistiques*, E.E.C., Brussels, 1969/2.

[9]Tables I and II are taken from Phlips (1971), Chapter 6.

[10]Germany could not be included because too many data on the largest firms were crossed out from the census data as the result of a strict application of the rules of statistical secret.

[11]Absolute entropy H is defined as $H = \sum_i q_i \log_2 q_i$, where q_i is the market share of firm i in an industry. The larger

is H, the smaller is concentration. For a monopoly H = 0, H is maximal when all q_i are equal and reduces to log N, for a given number of firms in the industry. Relative entropy G is computed as $G = H/\log_2 N$, where N is the number of firms in the industry considered.

[12]For more details, see Phlips (1971, p.153-160).

[13]de Jong (1971, p.112-125).

[14]This point will be further discussed in Section 3.

[15]See Phlips (1962 a).

[16]These numbers are based on a continuing analysis of the financial press.

[17]One may have doubts about this. See Ijiri and Simon (1971) and Didier and Malinvaud (1969).

[18]Nioche (1969), Horowitz (1970), Phlips (1971), Morvan (1972), Scherer (1973) and the forthcoming book by Scherer et al, (1974).

[19]Table VIII is taken from Phlips (1971), Chapter 6.

[20]See Phlips (1971), Chapter 6, Tables 6.8 and 6.11.

[21]Phlips (1973).

[22]An important research project on advertising, competition and market conduct in oligopoly by Lambin (1972) should be mentioned here.

[23]Taken from Whittington (1972). According to the FTC's *Economic Report on Corporate Mergers* (1969), the top 100 U.S. firms accounted for 49.3% of net assets in 1968.

[24]Taken from Jacquemin and Cardon de Lichtbuer (1973).

[25]See Utton (1971).

[26]Jacquemin (1970), Jacquemin and Kumps (1971) and Jacquemin and Cardon (1973).

[27]Phlips (1969 or 1971).

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