

Firm Size and the Division of Labor *

In 1951 George Stigler wrote in his deservedly famous article:¹

“Broadly viewed, Smith’s theorem suggests that vertical disintegration is the typical development in growing industries, vertical integration in declining industries. The significance of the theorem can therefore be tested by an appeal to the facts of vertical integration”.

Looking at the evidence of the period from the end of the sixties to the present day, it seems that events have developed quite differently from the way predicted by Adam Smith as long ago as 1776 in *The Wealth of Nations* and by Stigler many years later.

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The recent publication of Italy’s 1981 Industrial Census has highlighted a phenomenon of which there had already been some signs for a number of years — the fact that manufacturing firms in every sector are reducing their size. This phenomenon has been noted and amply documented by, among others, G. Zanetti² and it is therefore unnecessary here to do more than present a self explanatory table which gives the most important details (Table 1).

* I wish to thank numerous friends and colleagues for the time they gave to reading and discussing this article. In particular, I am grateful to A. Brero for his help on several empirical points and to F. Momigliano, M. Salvati, P. Sylos Labini and S. Mariotti, who gave me the idea for a radical change to the approach adopted in an early version of this paper. Naturally, I remain entirely responsible for the content. The paper was prepared in connection with a research project that is under way in Turin with the support of the Ministry of Education (contribution in the academic year 1981-82, 40%).

¹ G. STIGLER, “The Division of Labour is Limited by the Extent of the Market”, *Journal of Political Economy*, LIX, June 1951, pp. 185-193. The title of the article is also the title of chapter 3, Book 1 of *The Wealth of Nations*.

² Cf. G. ZANETTI, “Struttura industriale ed efficienza del sistema economico italiano: linee evolutive e aspetti programmatici”, *Economia Italiana*, No. 2, 1983.

TABLE 1

AVERAGE SIZE OF ESTABLISHMENTS IN MANUFACTURING
ITALY: 1961, 1971, 1981 (1971 = 100)

	Basic metals	Non-metal minerals	Chemicals	Engineering	Food & Drinks	Textiles	Garments & Shoes	Lumber prod.	Paper	Rubber
1961	158	112	84	87	82	123	73	98	214	89
1971	100	100	100	100	100	100	100	100	100	100
1981	84	93	77	35	89	73	150	99	79	69

Source: ISTAT, *Censimento dell'Industria e del Commercio* (1961, 1971, 1981).

TABLE 2

AVERAGE SIZE OF ESTABLISHMENTS IN MANUFACTURING
U.S.A.: 1967 AND 1977 (1967 = 100)

Sectors	Usa	New York	Pennsylvania	Massachusetts	Michigan	Alabama	Georgia	Texas	California
Textiles	93	95	99	111	59	83	63	54	117
Chemicals	101	104	103	123	96	103	103	114	109
Basic metals	84	79	80	63	87	62	168	73	77
Rubber	89	87	73	59	81	74	—	93	84
Auto	82	67	73	72	90	58	57	49	72
Engineering	88	91	82	93	81	87	87	128	108
Instruments	84	103	79	79	60	158	94	—	94
Electronics	50	52	62	43	51	—	—	—	64

Source: Census of Manufacturing 1967 and 1977.

The reduction in the average size of firms is not limited to Italy.³ For the sake of comparison, Table 2 shows the average size of establishments in some important manufacturing industries in the U.S.A. between 1967 and 1977. Data are given for the older industrialised states of the north-east and north-center (New York, Pennsylvania, Massachusetts and Michigan), certain southern and south-western states (Alabama, Georgia and Texas), where industry has been booming for at least the last ten years, and California. For each sector the average size in 1967 has been put at 100 and the corresponding index calculated for 1977. Even in the United States, there has been a noticeable reduction in the size of establishments in every sector except chemicals.

In other countries of the European Community (West Germany, the United Kingdom and Denmark, though possibly not France) the same tendency has been observed in sample data for the years 1975 to 1978.⁴ A period of three years is obviously too short to draw valid conclusions about a long-run trend, but more recent census data are not yet available to confirm this evidence.⁵

The reduction in the average size of firms may occur for one of two reasons: a) the appearance of a large number of small new firms, and b) the reduction in the average number of employees in existing firms of all sizes.

In the case of Italy, the census data indicate that both factors have contributed. Similar conclusions have been drawn for the other European countries.⁶ (Unfortunately the US Census data made available to the author did not allow the observation of changes within size-groups.)

Undoubtedly, we are dealing with a very widespread development, affecting the industrial structure of almost all the western industrialised countries and reversing the tendency which, although affecting countries in different ways, was observable everywhere until the end of the sixties. It is not surprising that after a decade of prolonged stagnation of the world economy there should have been a reduction in employment in manufacturing industry. One would not, however, necessarily

³ The 1981 Industrial Census provides data on individual establishments and not on firms. The difference is significant but certainly not sufficient to distort the interpretation of the phenomenon (in 1981 for example the average number of establishments was 1.06 per enterprise).

⁴ For observations on the period 1975-78 see D. BAROIN and P. FRACHEBOUD, *La contribution des P.M.E. à l'emploi en Europe*, Centre de Recherche Travail et Société, Université des Paris IX Dauphine, 1982.

⁵ Measuring the size of a firm in terms of the number of employees is obviously not ideal, but there is no convenient alternative when dealing with international comparisons.

⁶ Cf. D. BAROIN and P. FRACHEBOUD, *op. cit.*, 1982.

expect the average size of firms to have fallen — it would seem more likely that the recession would have hit the smaller marginal firms first, eliminating them from the market and leaving the larger firms untouched. As this has not occurred, we must look for an alternative and more general explanation.

The attempt to find an acceptable general explanation is not without pitfalls. National differences must be kept in the background, together with any interpretations based on institutional aspects. Nonetheless, the scale of the phenomenon justifies the effort.

The line of argument I intend to follow here is simple enough. My hypothesis is that the observed reduction in the average size of firms is caused by two concurrent factors:

(1) the increased rigidity of the overall cost structure of business firms (for which labor rigidity is an important, but not the only explanation);

(2) the increased uncertainty in both factor and product markets, which makes more flexible organisational structures desirable.

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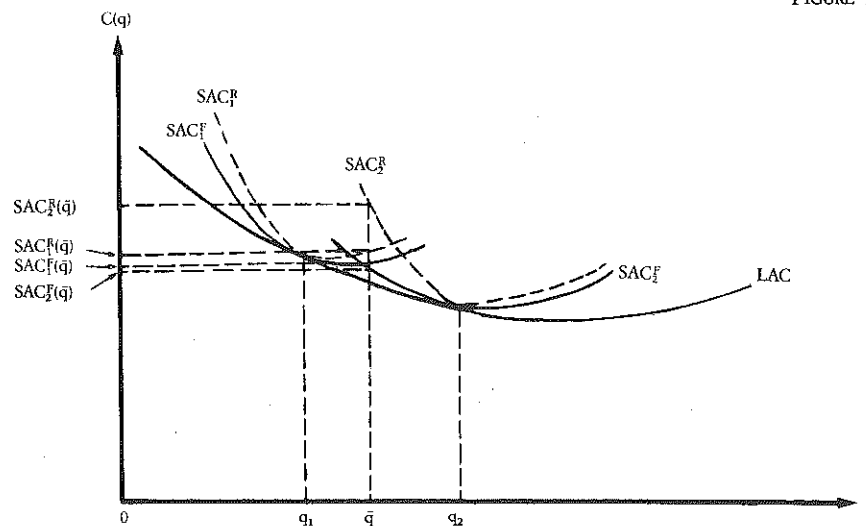
Until the beginning of the seventies world demand was growing at a steady rate. When the first oil-crisis occurred and the price of raw materials rose, conditions began to change very rapidly. Firms were faced with a situation in which markets were no longer expanding as fast as before and were sometimes actually shrinking. It therefore became necessary to find new strategies in order to keep market share in the increasingly aggressive climate, characterised by far greater uncertainty in both product and factor markets. The general climate also deteriorated rapidly in the labour market. The attempts to reduce job losses were often in vain, the unions became increasingly bitter and union-management relations became more rigid in virtually all the western industrialised countries.

Labour, traditionally a “variable factor”, has become gradually less “variable”.⁷ If we represent this graphically, at each level of production the short-run average cost curve takes on a more pronounced asymmetric U-shape. Due to the increasing “fixity” of labor costs, the slope of

⁷ See also W.OI's remarkable anticipation of this change in his “Labor as a Quasi-Rigid Factor”, *Journal of Political Economy*, 1961.

the curve to the left of the optimum production level becomes steeper than to the right, where in fact it may actually stay unchanged, as with flexible labour (Figure 1).

FIGURE 1



The consequence is fairly obvious. With flexible labor, let SAC_1^F and SAC_2^F be two short-run AC curves tangent to LAC at q_1 and q_2 . Suppose there are technological indivisibilities such that there is no other SAC^F between SAC_1^F and SAC_2^F . If the firm wants to produce \bar{q} , it will operate on SAC_2^F as $SAC_2^F(\bar{q}) < SAC_1^F(\bar{q})$. With semi-rigid labor the relevant curves become SAC_1^R and SAC_2^R . If desired output stays at \bar{q} , the firm will now reduce capacity and operate on the right-hand side of SAC_1^R since $SAC_1^R(\bar{q}) < SAC_2^R(\bar{q})$.

The reduction in capacity is therefore a direct consequence of the downward rigidity of labor costs. The increased rigidity of labor, however, has not occurred alone. Uncertainty has increased in both product and factor markets, making it more difficult for firms to plan in the short-term. Frequent adjustments have become more and more necessary and this too requires a high degree of flexibility.

In a world of monopolistic competition and open economies, like the one we live in, the room for maneuver on price available to each firm is limited and usually linked to the possibility of product diversification. I shall therefore limit the analysis here to the question of quantity adjustments.

For both new and existing firms it has become increasingly important to choose an organisational structure which will guarantee ample margins of *ex-post* flexibility. I shall therefore concentrate on the new forms of organisation which are emerging in answer to the need for flexibility.⁸

* * *

One interpretation of the reduction in the average size of establishments is the decentralisation of manufacturing industry — a process which was much discussed in Italy in the seventies. The underlying idea of many Italian studies was that the decentralization of the manufacture of labor-intensive items not amenable to assembly-line production, the move towards craft shops, small-scale manufacturing units and the more extensive utilization of work-at-home were all ways of recovering full labor flexibility in a decade characterized by a progressive tightening of the labour market.

This idea can be set in the framework of the business firm put forward by G. Stigler:

“it is better to view the firm as engaging in a series of distinct operations: purchasing and storing materials; transforming materials into semi-finished products and into finished products; storing and selling the outputs; extending credit to buyers, etc. That is, we partition the firm not among the markets in which it buys inputs but among the functions or processes which constitute the scope of its activity”.

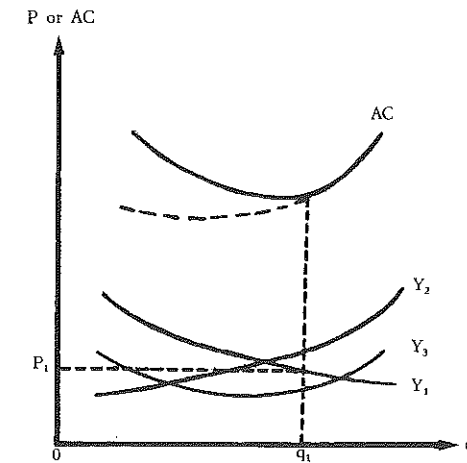
Each function, which can be considered independently of all the others, has an average cost function which varies according to the rate of output.

Some functions will have a rising average cost curve, others a U shaped curve, and others a falling curve. We reproduce here the diagram proposed by Stigler to represent this situation. Y_1 , Y_2 and Y_3 are three “functions” of the firm needed to carry out the productive process. The total average cost for the firm is therefore given by the vertical sum of all the individual cost functions (Figure 2).

Why then does the firm not abandon function Y_1 , which is subject to increasing returns, and allow another firm to specialise in its production

⁸ Interestingly, when higher flexibility and frequent quantity adjustments become necessary, even inventory management may fail to be an efficient buffer against market uncertainty if carrying costs are rising rapidly.

FIGURE 2



to take full advantage of increasing returns and purchase it as a semi-finished good at price P_1 ?

As long as the firm produces less than q_1 there is a clear advantage in doing this — measured by the lowering of the total cost curve AC shown with the dotted line. Stigler maintained, however, that the demand for function Y_1 may be too low to justify a new firm specialising in its production. As he said “... the demand for market information may be too small to support a trade journal”. If the industry expands, however, the demand for Y_1 may become sufficient to justify the setting up of a new specialised firm. This firm will initially enjoy a monopoly situation but will be faced with an elastic demand and, in practice, cannot make the firms which abandoned function Y_1 pay more for the product than the average cost which they would incur if they carried out the production themselves.

One of the implications of this model is that the phenomenon of vertical disintegration, and therefore greater division of labor, is a characteristic of expanding firms. Function Y_1 will be abandoned by single firms only when there is sufficient demand for Y_1 in the whole industry to justify specialised production. For the same and opposite reason one would expect a tendency towards vertical integration in declining industries.

The connection between the level of vertical integration and the size of the firm is straightforward. Other conditions being equal, the decision to transfer any of the firm’s functions to a specialised outside firm must

result in a reduction in the work-force of the original firm — the more labor intensive the function transferred, the greater the loss of jobs.

Today, Stigler's theory of vertical integration may find support in the micro-electronics industry, but it seems at odds with shrinking firm size in almost every other sector of manufacturing industry. In particular, it seems to be in conflict with the hypotheses put forward here to explain the reduction in average firm size.

That the division of labor has historically occurred when markets were growing is an unequivocal fact, and up to this point there can be no arguing with Stigler's interpretation. The conflict arises when we observe that in conditions of: (i) markets shrinking after a long period of expansion; (ii) increasing uncertainty, and therefore unpredictability of the outcome of decisions, resorting to vertical disintegration helps to reintroduce margins of flexibility within the firm.

* * *

Many technological advances in the last twenty years have had the effect of making an increasing number of functions of the firm more and more specialised. Take, for example, most "business services", such as publicity and design, legal and fiscal services, software preparation, market research and auditing, or even the manufacturing of certain parts and components and maintenance operations. When these functions are labor intensive and require increasingly specialised skills and equipment, they are frequently characterized by high fixed or semi-fixed costs. In some cases the "fixity" depends on the fact that a function must be carried out by a group of specialists who cannot be employed in other functions, in others these costs depend on the need for equipment which can only be used for the specific function for which it was designed.

Some of these functions can be separated from the main productive process without affecting its efficiency. The degree of integration achieved by firms, at least until the mid-sixties, suggests that the level of activity of such functions, integrated over the years, should have approximately reached the MES (minimum efficient size). When output is lower than q^* , the average cost of the function will rise rapidly for the firm as it would for any activity involving a fixed cost (Figure 3).

It then follows that in periods of slow growth and uncertainty of demand, i.e. when demand falls short of q^* , firms are exposed to the risk of finding their fixed, specialised structures severely underutilised.

In these circumstances the incentive to resolve the "make or buy" option by delegating the supply of business services or intermediate goods to outside firms is strong. From the point of view of the cost functions this means moving from a "MAKE" to a "BUY" type configuration (Figure 4). For values of $q < q^*$ the average cost associated with the BUY option rises less rapidly than with the MAKE option.

FIGURE 3

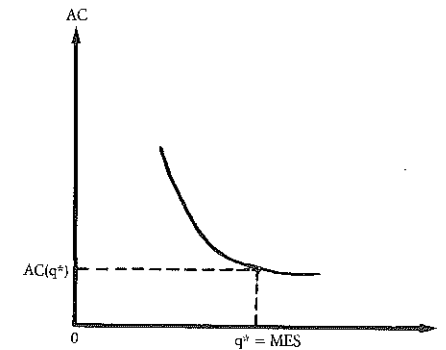
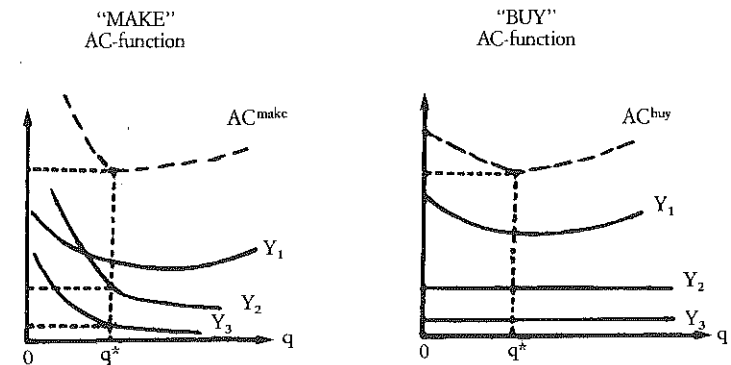


FIGURE 4



Y_1 = the main "productive" function in the strict sense (not decentralizable);
 Y_2 = a decentralizable function;
 Y_3 = another decentralizable function.

In conclusion, the conditions which prompted large-scale vertical integration in the past may have become less relevant today. The slowing of the growth rate in world markets and the resulting general climate of uncertainty require a greater capacity for rapid upward and downward adjustments.

The greater specialisation needed to carry out certain activities has increased their "fixity" and introduced new elements of rigidity in the cost structure. The trade-off between the advantages offered by vertical integration and those of vertical disintegration have probably moved in favour of the latter. Furthermore, in periods of prolonged stagnation, both the product market and the labor market tend to become "buyers' markets". Competition among producers to maintain their market share in the face of continuous attack from potential competitors is an additional element which may favour vertical disintegration in industry.⁹

* * *

Vertical disintegration can also be interpreted in another way. While Stigler emphasizes the coexistence of a number of relatively independent functions within the firm and bases his model of vertical disintegration on precisely this assumption of independence, many advocates of vertical integration place the emphasis on the interdependence of *other* functions which require similar skills, on the technological characteristics of certain processes which permit joint production and hence on the possibility of reducing risks and costs by internalizing these functions through vertical integration. Here too there may be incentives for vertical disintegration. A typical example is provided by the costs of control and coordination. Let us take personnel management which involves negotiations over pay, job organization, job evaluation, internal mobility and so on. In a company with n groups of workers, each group being homogeneous in terms of job assignment, qualifications, skills and pay levels, but markedly differentiated from the other groups, every decision on personnel must be negotiated with all

⁹ A number of observations made by B. BLUESTONE and B. HARRISON in *Capital and Communities: Causes and Consequences of Private Disinvestment* (1980) are particularly interesting in this respect. All the firms in this period followed the strategy of diversifying purchases by splitting orders between a number of suppliers. Many of the company owners interviewed justified the search for "parallel suppliers" on the grounds given above.

the groups in the firm and, before reaching agreement, all groups will tend to consult with each other in order to create common platforms. This means that the cost of each decision depends roughly on the total number of interrelations between the n groups. This number is equal to:

$$\binom{n}{1} + \binom{n}{2} + \binom{n}{3} + \dots + \binom{n}{n} = 2^n - 1$$

Supposing that each interrelation has the same average cost K (which could be given by the number of hours needed for inter-group and intra-group consultation) the total cost of each personnel decision is equal to $K(2^n - 1)$, and increases exponentially with n .

Coordination costs (of which personnel management constitutes one important aspect) will therefore increase more than proportionally with the number of groups to be coordinated. Reduction of coordination costs can be achieved by containing K but it will prove more effective to reduce the number of groups. Vertical disintegration is undoubtedly one way to achieve this end.

It could be argued that control and coordination will be costlier in a highly vertically disintegrated organisation which buys in from outside a large number of services and semi-finished goods. However the coordination required in these cases consists of the rapid transmission and processing of data and information, the costs of which have been drastically reduced by the advent of information technology.

* * *

I have discussed some of the effects of the changing business environment on the organisational structure of firms. I should now like to look briefly at the effects of this change on market strategies. In Europe two interesting developments have occurred in this respect:

a) in the field of consumer goods (which require complex sales organisations and vast publicity campaigns) there is a growing number of large firms who use their sales organisation to commercialize a wide range of products bought externally but retailed under their own brandname alongside a line of lead products produced inside the firm;

b) a parallel development is the increasing number of smaller firms producing exclusively or prevalently for other firms (in the same country or abroad) which deal with the commercialisation of their

products thereby reducing to a minimum the sales organisation needed by the smaller firm.

Both phenomena are occurring on a vast scale and affect almost all traditional consumer sectors, certain household goods (electrical appliances, furniture), consumer electronics with intermediate technological content (radio, television, tape-recorders, calculators, watches, electronic games) and even traditional mechanical sectors (tools, bicycles etc.). In these sectors international competition is fierce and plays almost exclusively on price. Production technologies are well established and there is little difference in unit output costs, especially where the make or buy option can be easily exercised by producers. Consequently, profit margins are gained or lost in function of efficiency and the capacity to penetrate the commercial network. Even a commercial organisation may be viewed as a service structure for the firm, requiring a fixed (or almost fixed) investment and exhibiting decreasing average costs. Hence, a firm which does not have its own brand-name to protect or image to promote may find it profitable to place the commercialisation of its products in the hands of another specialised firm.

These tendencies are not common to all productive sectors however. The situation is rather different among manufacturers of machine tools, heavy equipment and instruments involving high or intermediate technology. Here competitiveness in world markets depends more on non-price competition than on price. Commercialisation and distribution are often entrusted to intermediate specialists (i.e. dealers or representatives) rather than to a larger internal sales department. Market structures are typified by highly differentiated oligopolies in which each producer enjoys a quasi-rent derived from the know-how accumulated over years of experience and learning by doing. Each product occupies a niche in the market and is relatively protected from potential entrants as long as the innovating capacity of the firm allows it to maintain a quality advantage over its potential competitors. Firms operating in this sector are not usually very large. The heaviest fixed costs are not incurred in their sales organisation (generally reduced to a minimum) but in Research and Development, product planning and prototype development.

The notion of a *multi-purpose* as opposed to a *uni-purpose* fixed structure, recently developed by W. Baumol and associates, is relevant to our discussion here¹⁰. A multi-purpose "fixity", typified by a sales organization for consumer goods, generates "economies of scope" for

¹⁰ W.J. BAUMOL, J. PANZAR and R.D. WILLIG, *The Theory of Contestable Markets and Industry Structure*, 1982. A fixed multi-purpose structure, unlike a uni-purpose structure

the firm that owns it and the risk of its under-utilization in the face of uncertainty is reasonably low. On the other hand a uni-purpose "fixity" — say a group of machine tools aimed at performing a set of very specific operations and manned by a handful of highly skilled specialists — cannot be utilized other than for the special task for which it has been designed and installed. It follows that a multi-purpose sales organization will seldom be decentralized outside the firm, while a uni-purpose tooling unit is a better candidate for transfer to an independent specialized business that will supply its services on request.

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We should ask ourselves at this point if there are models in the literature capable of explaining the recent observed changes in firm size. Many such models have, in fact, been developed.¹¹ The principal conclusion reached by most of them is that an increase in uncertainty will produce a drop in optimal capacity when firms are risk averse. This result holds if the average cost function is flat. *A fortiori*, it must hold if the average cost is asymmetrically U-shaped with $\left| \frac{d \text{ SAC}}{d q} \right|_{\bar{q}} > \left| \frac{d \text{ SAC}}{d q} \right|_{q^+}$: as discussed above, this feature is often encountered with downward rigidity of labor costs.

As attractive as theoretical formulations of this sort may be, I do not believe that they provide a good interpretation of the recent developments in firm size. The basic problem is to explain not only *why* the average size of firms is falling but also *how*. In other words, we must discover what processes of internal reorganisation firms are adopting to cope with the need for increased flexibility. The reduction in firm size, measured in terms of the number of employees, is a reflection of this need, but it is not in itself sufficient to explain the adaptation strategies of business firms in the face of increasing uncertainty.

This is not surprising. Received theory assumes a world of high information and low transaction costs, where all firms have access to the same technologies and have the same capacity to bid for resources in

generates economies of scope for the firm. This is why there are usually no advantages to be gained from destructuring multi-purpose fixed structures. Uni-purpose structures, on the other hand, are natural candidates for destructuring.

¹¹ For a good example see S.J. NICKELL, *The Investment Decision of Firms*, Cambridge University Press (1978), pp. 75-78.

competitive factor markets. In this hypothetical world, firms in a given industry are all alike, attaining the same optimum size and exhibiting similar organisational structures.¹² In these conditions a reduction in size of the firm would be an unambiguous sign reflecting a smaller optimum size. In the real world, however, information is costly and transaction costs are high, thus the reduction in firm size is an important signal but its full significance is not easy to identify.

Conclusion

It is curious to see that the study of industrial economics, which developed as an independent discipline after the publication of the pioneer work by P. Sylos Labini and J. Bain in the nineteen-fifties on the theory of oligopoly, has always tended to place emphasis on phenomena connected with the growth of the firm, in particular of the large firm. Economies of scale, minimum efficient size, concentration, mergers and vertical integration are all recurrent themes of the theoretical and empirical studies carried out in the name of industrial economics. We are now approaching the end of a decade of stagnation, slower growth and greater uncertainty, yet few traces of this fact are to be found in micro-economic literature.

In this paper I have tried to draw attention to certain new and significant processes which seem to characterize the industrial structure of many western countries. The proposed interpretative framework is far from new. The question is whether, in view of recent experience, Adam Smith's old theorem should not be rephrased as: "the division of labor has been limited by the extent of the market, but at times it may also be enhanced".

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¹² The problem of the optimal size of the firm has recently been studied in a new way by W.A. BAUMOL and associates in the context of contestable markets (see W.A. BAUMOL and D. FISCHER: "Cost-Minimising Number of Firms and Determination of Industry Structure", *Quarterly Journal of Economics*, August 1978. Even in these contributions, however, there are no new proposals for solving the problem of comparison between different organisational structures, even though there are references to evaluation of different industrial structures in terms of social welfare.