

PROFITS, VARIABILITY OF PROFITS AND FIRM SIZE : THE EVIDENCE FROM GREEK INDUSTRIAL FIRMS

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The study investigates empirically whether there exists a relationship between (a) profitability and firm size and (b) variability of profitability and size in the Greek manufacturing sector.

The investigation is carried out separately for four manufacturing sectors (food, textiles, chemicals, and rubber and plastics) and is based on annual observations on profits and size for 229 firms over the period 1971-1978.

To test for the existence of the above relations analyses of variance are performed with the data obtained separately for each sector.

The results of the test carried out indicate that firm size does not affect either profitability or its variability in Greek manufacturing.

The present study investigates empirically whether there exists a relationship between (a) profitability and firm size and (b) variability of profitability and size in the Greek manufacturing sector.

This investigation is considered useful not only because of the implications that the existence of those relationships has for the theory of growth of firms¹ but also for practical reasons and in particular the correct formulation of government policy towards small firms², especially in a developing economy.

Profitability is expected on theoretical grounds to vary between firms of different sizes if there exist economies scale. These could be either of a technical nature at plant level³ or other economies such as those related to managerial activity market research, or the avoidance of risk via diversification. Baumol⁴ has argued that «increased money capital will not only increase the total profits of the firm, but because it puts the firm in a higher echelon of imperfectly competing capital

1. Singh A. and G. Whittington, «Growth, Profitability and Valuation». Cambridge University Press, 1968.

2. Johnson P. «Policies Towards Small Firms. Time for Caution». Lloyds Rank Review, July 1978.

3. Hadli J. and D. Whitcomb, «Economies of Scale of Industrial Plants», Journal of Political Economy, Vol. 75, 1977.

4. Baumol, W.J., «Business Behavior, Value and Growth» Macmillan, New York 1959.

groups, it may very well also increase its earnings per dollar of investment».

Differences in the variability of profits between firms of different size could be attributed to the effects of diversification. Large firms tend to be more diversified and are therefore in a better position to offset losses from one activity against profits from another. Thus, they are expected to enjoy a relatively more stable stream of profits through time¹.

Statistical Unit in the Investigation

The statistical unit in the present investigation is that of the manufacturing firm rather than of the manufacturing plant. Thus, in examining the effects of size on profitability we are looking not only for the existence of technical economies at plant level but for other economies as well which are related to other functions within the firm apart from production.

The analysis is carried out separately for different industrial sectors. This is deemed necessary so as to eliminate the problem of different degrees of competition that firms in different sectors have to face. Furthermore, demand conditions are bound to be more similar for firms operating within the same sector. Also, the errors that result when making comparisons between companies which follow different accounting conventions, especially those concerning the valuation of assets and the treatment of depreciation allowances for tax purposes, are likely to be smaller when the firms belong to the same sector.

Sources and Nature of the Data Used

The present analysis is based on information concerning four separate manufacturing sectors out of a total of twenty into which manufacturing companies are classified according to the classical two digit system. The sectors examined are those of food, textiles, chemicals, rubber and plastics. The analysis is confined to those sectors only for the usual reasons associated with minimising research costs. However, the sample of those sectors has been selected randomly from the total population which means that the results obtained from the analysis per-

1. Alexander S. «The Effect of Size of Manufacturing Corporations on the Distribution of the Rate of Return». Review of Economics and Statistics, Vol. 31, 1949.

formed here can reasonably be used in making inferences about the whole of the industrial sector.

The data used consist of annual observations for the eight years 1971 to 1978 on net profits and total assets for individual companies belonging to the above sectors.

The period is considered to be long enough so as to offer a sufficient number of observations on profits and their variability, but short enough in terms of having a relative homogeneity in the data.

The source of these observations has been the Register of Industrial Firms kept by the Federation of Greek Industries, which in cooperation with the Institute of Economic and Industrial Research in Athens compiles and classifies the balance sheets and the profit and loss accounts of all industrial enterprises operating under the legal form of *société anonymes* and limited liability and employing capital over drs. 500 thousand.

The above Register excludes enterprises operating under various forms of personal companies. However, limited liability companies as opposed to the *société anonymes* are very similar to the other types of personal company in terms of their size profile, the rules governing their operation and their tax treatment. Hence, the exclusion of other forms of personal companies is not expected to produce any biases in the results.

The analysis performed here covers a sample of 229 individual firms in total. This number has been obtained by taking from the Register of the F.G.I. all firms belonging to the above four industrial sectors in 1971 except those that failed to continue their operations in the period 1971-1978 or those for which data were not available in anyone of those years.

It is assumed here that the events which led to the exclusion of firms from the present sample are not systematically related to their size and hence that this exclusion does not introduce any bias into the analysis. This assumption implies that bankruptcies during the period examined were not related to size. It should also be noted that the population in the Register of the F.G.I. consisted in 1971 of 1123 companies in total. Thus the sample used here represented approximately 20% of that population.

The classification of the companies included in the sample into «large» and «small» ones has been done according to their opening size in 1971. Size is measured in terms of total assets owned. The dividing line between large and small is the size of 50 million in total assets.

The following table presents the number of companies examined in each industrial sector and size group:

TABLE 1
Classification of Companies Into Sectors and Into Size Groups

Total Assets Sector	Over 50 million Drachmas	Less than 50 million Drachmas	Total
Food	43	23	66
Textiles	63	27	90
Chemicals	13	16	51
Rubber and Plastics	35	9	22
Total	154	73	229

The size variable used here follows the definition used by Baumol¹ as «the amount of owned and borrowed money capital». Of course total assets is one of many alternative measures of firm size, such as employment and turnover, each with its advantages and disadvantages in terms of representing accurately a multidimensional concept. Fortunately, it has been found empirically in many countries² including Greece³ that there is a close correlation between these alternative measures.

The use of the criterion of 50 million drs. in total assets for the classification of companies into large and small although arbitrary is considered reasonable given the size distribution of Greek manufacturing firms⁴.

The measure of profitability used here is the ratio of pre-tax net profits to total assets. It should be stressed that this ratio should be taken in practice as an approximate indicator of the performance of the firms examined, because of the well known difficulties concerning the accuracy of the published profit data.

The comparisons between firms using the above ratio are affected

1. Baumol W.J. «Business Behavior, Value and Growth» op. cit.

2. Bates J., «Alternative Measures of the Size of Firms», in P.E. Hart «Studies in Profit, Business Saving and Investment in the United Kingdom, 1920-1962», 1965, Ch. 8.

3. Tzoannos J. «The Effects of the Legal Form and Size on the Financial Structure of Greek Manufacturing Firms», in Greek, Spoudae, 1, 1980.

4. See Federation of Greek Industries «Greek Manufacturing Industry in 1978», Athens 1979, Table V-2.

by the existing difference in the treatment of depreciation allowances for tax purposes. For many firms as a result of the system of investment incentives the amortisation charges in certain years are much higher than the true depreciation of fixed assets while for others they are lower. We believe that, by averaging the profitability ratios for each individual firms over the years examined, the influence of these differences upon the results will be minimal.

It will be noted also that it has been decided to deduct interest charges from the profit figure to be used. This deduction makes the results of the analysis sensitive to the differences in gearing between firms. On the other hand, if interest charges had not been deducted, the analysis would have been affected by the differences in the degree of capital intensity. Labour intensive firms would, *ceteris paribus*, have shown a lower degree of profitability in comparison to the capital intensive ones.

It will be noted also that we are using pre-tax rather than after tax profits. This is due to the fact that the interest in the present analysis lies with the degree of efficiency involved in the use of resources employed by the firms examined rather than with how profits are distributed. Furthermore, the use of after tax data would have accentuated the aforementioned problems related to the use of depreciation allowances.

Since we are primarily interested on how effectively firms utilise the resources employed by them, total assets is the scale variable used in the denominator of the profitability ratio.

Methodology Used

The analysis of the above data performed here takes the form of testing the two null hypotheses, (a) that average profitability is the same in the two size groups and (b) that average variability in profitability is the same in the two size groups, by one-way analysis of variance, separately for each industrial sector. Thus, eight tests are performed in total.

For testing the first hypothesis, we estimate first the average profitability ratio over the period 1971-1978 for each individual firm in the sample. Then, separately for each sector, the observations on average profitability are classified into the two groups according to size, separately for each industrial sector, and an analysis of variance test is then performed. For testing the second hypothesis we estimate first

TABLE 2

Analysis of Variance of Average Profitability for the Food Sector

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Between Size Groups	1.8095	1	1.8095
Within Size Groups	1794.1187	64	28.0331
Total	1995.9282	65	27.6296

F = 0.0654 Critical $F_{1,64}$ at 5% = 3.99

Average Profitability Small Firms = 3.33%, Large Firms = 3.62%

TABLE 3

Analysis of Variance of Average Profitability for the Textiles Sector

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Between Size Groups	10.4413	1	10.4413
Within Size Groups	2620.7956	88	29.7817
Total	2631.2369	89	29.5644

F = 0.35059 Critical $F_{1,88}$ at 5% = 3.96

Average Profitability : Small Firms = 5.48%, Large Firms = 4.63%

TABLE 4

Analysis of Variances of Average Profitability for the Chemicals Sector

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Between Size Groups	0.9084	1	0.9084
Within Size Groups	1080.0534	49	24.0827
Total	1180.9618	50	23.6192

F = 0.0377 Critical $F_{1,49}$ at 5% = 4.03

Average Profitability : Small Firms = 5.87, Large Firms = 6.01

the coefficient of variation of profitability for the period 1971-78 for each firm. Then, the observations obtained are classified into the two size groups and an analysis variance test is performed.

TABLE 5

Analysis of Variance of Average Profitability for the Rubber and Plastics Sector

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Between Size Groups	22.43005	1	22.43005
Within Size Groups	1188.8874	20	59.44437
Total	1211.31745	21	57.68178

$F = 0.3773$ Critical $F_{1,20}$ at $5\% = 4.35$

Average Profitability: Small Firms = 11.82, Large Firms = 5.33.

The Results Obtained

The results obtained from the analysis of variance performed on the average profitability data are presented on tables 2-5 respectively for the food, textiles, chemicals, and rubber and plastics sectors. On the same tables the average profitability figures for all the firms in each size group are also presented.

In two sectors (textiles, rubber and plastics), average profitability appears to have been higher in the small firms group, while in the other two (food, chemicals) it appears to have been higher in the large firms group.

The results, however, from the analysis of variance indicate that the differences in average profitability between small and large firms in all the sectors examined are not significantly different from zero at the usual levels of significance. Thus, it appears that size has no effect on profitability in all the sectors examined.

It should be pointed out that, in order to check whether the above results are not due to the particular dividing line used here to classify firms into large and small ones, a scatter diagram of average profitability against size was constructed for each industrial sector. In all the sectors examined no clear pattern relating profitability to size was revealed, by these diagrams. Furthermore, no particular size group was found to have a distinctly different level of profitability to the others.

Thus, a different dividing line to the one used here, would not have produced any different results.

The fact the above results have been found to hold in all the sectors examined combined with the fact that these sectors have been selected randomly, make it reasonable to infer that for the whole of the Greek manufacturing industry no significant relationship exists between size and profitability.

One possible explanation why size does not appear to affect profitability could be that over the range of firm sizes to be found in the Greek manufacturing sector costs remain constant. Some support for this explanation can be derived from the fact that most firms that are treated as large by our criteria would be treated as small according to the criteria used in advanced industrialised economies. E.g. the Bolton Committee¹ in Britain defined as small firms those employing less than 200 people².

Another explanation, not necessarily incompatible with the previous one, could be that within each sector there is considerable product differentiation, which enables high cost small firms to sell to markets prepared to accept higher prices. It should in fact be born in mind that the industrial sectors, as defined, consist of companies whose products are directed to a variety of different markets with only very loose links between them.

On the other hand, this constancy of cost over different firm sizes implied by the results may be due to a genuine lack of economies of scale at firm level either because of a lack of technical economies at plant level³ or other economies, such as those related to management and multiplant operations⁴, rather than the the small range of sizes in the sample in comparison to those existing in other economies. In fact the empirical evidence from other countries lends little support to the existence of a systematic positive relationship between size and profitability^{5,6}.

1. Committee of Inquiry on Small Firms, Chairman J.E. Bolton, «Report», Cmnd 4811 H.M.S.O. London 1971.

2. See also Hassid J. «Greek Industry and the E.E.C.», Institute of Economic and Industrial Research, Athens 1980 Vol. 1, Ch. 3.

3. Haldi J. and D. Whitcomb, «Economies of Scale in Industrial Plants», op. cit.

4. Scherer F.M., A. Beckenstein, E. Kaufer, R.D. Murphy, «The Economics of Multiplant Operations», Harvard University Press, 1975.

5. Singh A. and G. Whittington, «Growth, Profitability and Valuation», op. cit.

6. Marcus M., «Profitability and Size of Firm», Review of Economics and Statistics, Vol. 51, 1969.

This explanation gains some support from the evidence obtained in the study by Nikolaou¹ on inter-size efficiency differentials in Greek manufacturing. That study which was based on a census of manufacturing establishments (rather than firms) for 1969, found larger establishments to be less efficient than smaller ones. Size was measured by the number of persons employed.

Although the present analysis does not cover the same time period, the evidence obtained here taken in conjunction with the above evidence obtained by Nikolaou could possibly be taken to suggest the lack of pecuniary economies related to firm size, such as those suggested by Baumol², which if they existed would have compensated for the absence of technical economies.

The results obtained from the analysis of variance performed on the variability of profitability data are presented on tables 6-9 respectively for the food, textiles, chemicals, and rubber and plastics sector.

It is clear from the values of the F statistic for all sectors that the null hypothesis that there is no difference between large and small firms concerning the variability of their profitability cannot be rejected. Again, in order to check whether the above result is not due to the particular dividing line used the relevant scatter diagrams were constructed and

TABLE 6

Analysis of Variance of Variability of Profitability for the Food Sector

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Between Size Groups	202.645	1	202.6450
Within Size Groups	73593.941	64	1149.9053
Total	73796.586	65	2135.332

$F = 0.1762$ Critical $F_{1,64}$ at 5% = 3.99

1. Nikolaou K., «Inter-size Efficiency Differentials in Greek Manufacturing», Center of Planning and Economic Research, Athens 1980.

2. Baumol, W.J., «Business Behavior, Value, and Growth», op. cit.

TABLE 7

Analysis of Variance of Variability of Profitability for the Textiles Sector

Source of Variation	Sum of Squares	Degrees For Freedom	Mean Square
Between Size Groups	11.4627	1	11.4627
Within Size Groups	819.9594	88	9.3177
Total	831.4221	89	9.3418

F = 1.2302 Critical F_{1,88} at 5% = 3.96

TABLE 8

Analysis of Variance of Variability of Profitability for the Chemicals Sector

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Between Size Groups	52,660.257	1	52660.257
Within Size Groups	1,221,333.4	49	24,925.171
Total	1,273,993	50	25,479.874

F = 2.1127 Critical F_{1,49} at 5% = 4.03

TABLE 9

Analysis of Variance of Variability of Profitability for the Rubber and Plastics Sector

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square
Between Size Groups	7.7887	1	7.7887
Within Size Groups	954.2677	20	954.2627
Total	962.0514	21	962.0514

F = 0.1632 Critical F_{1,20} at 5% = 4.35

examined for the existence of any size group with a variability in profitability different to the others. No such group was found to exist. The alternative hypothesis that larger firms experience, in general, less variability of profitability is based on the idea that they are more diversified than smaller ones and consequently in a better position to offset losses in one activity against profits in another^{1,2}. Thus large firms are expected to show greater inter-temporal stability in their profitability.

The evidence from relevant studies concerning American³ and British^{4,5} firms seems in general to support that alternative hypothesis.

The present results which indicate that the variability of profitability in Greek manufacturing industry is on average the same for large and small firms could be due to large firms here not being much more diversified than small ones. This again might be related to the fact mentioned previously that most of the firms that are treated as large by the standards of the present study and of Greek practice would be treated as small by the standards used in Britain and America.

Summary and Suggestions for Further Research

The evidence from the present investigation suggests that firm size is not a significant factor concerning differences between firms in profitability and its variability through time.

These results could be attributed to the lack of economies of scale, the existence of highly differentiated product markets within each manufacturing sector and a small degree of diversification of activities in comparison, to the state of manufacturing firms in advanced Western economies.

These results have the important implication that in Greek manufacturing profitability is not a constraint on the future growth of firms. Nor is it a positive inducement.

1. Alexander S. «The Effects of Size of Manufacturing Corporations on the Distribution of the Rate of Return», op. cit.

2. Dyckman T.R. and H.O. Stekler, «Firm Size and Variability», Journal of Industrial Economic, 1965.

3. Stekler, H.O., «The Variability of Profitability with Size of Firms, 1947-1958», American Statistical Association Journal, 1964.

4. Samuels J.M. and D.J. Smyth, «Profits, Variability of Profits and Firm Size», Economica, 1968.

5. Singh A. and G. Whittington, «Growth, Profitability and Valuation», op. cit.

It would be interesting to verify this by examining the relationship between growth and profitability, as well as the persistency of profitability through time.

Also, it would be useful to extend the analysis to cover the remaining sectors in Greek manufacturing so as to confirm whether the present findings hold for all of them.