CHAPTER VII
Firm's size and Profitability

In both economic theory and empirical studies variables like the firm's size and product differentiation have been conceived as barriers to entry. A firm's size defined and measured by its assets is thought to be more meaningful and purposeful when it is defined and measured by other variables like the amount of employment and labour-capital ratio etc. since the former definition is in conformity with the concept of barrier to entry. Total asset being a good approximation of owned and borrowed money capital, it is associated with the difficulty of financing large lump of assets that limit entry to certain fields. Secondly, it is the size of the total lump of capital that determines opportunities available to the firm which are denied to other potential entrants in the absence of the lump of capital required. In short, this sort of definition of a firm's size possesses the characteristics of the capital requirement barrier to entry about which Bain has expressed uncertainty. Stigler has shown skepticism but Hall and Weiss have been optimistic. The difference in opinion has been, however, based on findings emanating from different methods adopted for study.

Both the firm's size and the degree of product differentiation being conceived as barriers to entry it is not at all a prudent venture to try to find out a relationship.

1. J. S. Bain: Barriers to new competition
2. G. Stigler: Capital and rates of returns in manufacturing industries, 1963
whenever be its nature, between a firm's size and the degree of product differentiation since this is not meaningful in economic terms. After all we can not assume one of the two as a dependent or an independent variable while the other is independent or dependent variable at the same time and therefore, bears a functional relationship with the other i.e., we can not say either

\[ a = f(L) \] or

\[ L = g(a) \]

where \( a \) denotes firm's size and \( L \) means the degree of product differentiation. Then how do we succeed in relating these two variables? We propose here to relate the degree of product differentiation first to profitability and then to relate profitability to the firm's size since in economic theory profitability has been assumed as a function of product differentiation and a firm's size as defined by us can again be supposed to bear a functional relationship with profitability.

A generalised hypothesis supported by different empirical studies states: Entry barriers bear a positive and direct relationship with profitability. This generalisation, in fact, remains imprecise since without having a prior

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demarcation in the set of variables preventing entry logical and factual characteristics of deduction from this study are imprecisely for the following reasons: The relative effect of different types of entry barriers in different stages of economic growth in a country upon the profitability of the 'headstart' would be different from the viewpoint of degree as well as significance; second, all types of entry barriers are not of the same origin — some of them are created autonomously as factors generated from the process of growth of the industry and some are the product of deliberate policy openly or tacitly followed by the 'head start'. Barriers belonging to the former category may be called natural or legal barriers and the latter may be called dependent barriers to entry. Both the firm's size and product differentiation are considered to be dependent barriers to entry. On the same grounds, it is meaningless to assume one as a function of another.

5. J.K. Galbraith specifically points out the 'theory of the head start'. It means the earlier established and larger firms have a head start over younger and small firms that gives them certain advantages enabling them to maintain their position and to grow at the expense of the younger firms and of firms not yet established. J.K. Galbraith, American Capitalism: Countervailing power and state (Boston Houghton Mifflin 2nd ed 1956)
Though both the variables belong to the category of dependent variables yet each refers to a different segment of the activities of a firm. The 'size' is exclusively related to the production sector whereas product differentiation is basically a variable functionally related to the selling sector. An increase in a firm's size will be associated normally with an increase in either quality or quantity of products or both but an increase in product differentiation brings about usually a change in the artificial quality of the products. A firm's size does not in itself lead to an improvement in the artificial quality of the product or products. Secondly, a change in a firm's size may bring about a change in profitability but a change in profitability can hardly be thought to be a variable which is used for bringing about a change in the degree of product differentiation of a firm. Invoking the much controversial profit maximisation policy normally followed by a rational firm one can comfortably assume that product differentiation adopted by a firm has a goal apart from retaining its existing market share and this goal is usually to make profit. About the nature of the relationship between product differentiation and profitability we shall discuss in detail in chapter VIII.

A firm's size apart from its paid up capital depends also on its reserves which entirely depends on the size of profit and bonus etc. Accordingly, it is neither illogical
nor practically unsound to assume that there is a functional relationship between profitability and the size of a firm.

Thus we can write

(1) \[ \alpha = f(L) \]
(2) \[ \gamma' = g(L) \]

where \( \alpha \) denotes the firm's size, means profitability and \( L \) stands for the degree of product differentiation. A relationship between \( \alpha \) and \( L \) is sought to be established through and so we write

(3) \[ \alpha = f[g(L)] \]

Differentiating \( \alpha \) with respect to \( L \) using chain rule we get

\[ \frac{d\alpha}{dL} = \frac{d\alpha}{d\gamma} \cdot \frac{d\gamma}{dL} \]

The composite function \( \alpha \) expressed in (3) now can be used in our investigation into the mechanism of an established firm's working and we can conduct an empirical experiment on the hypothesis that a firm's size bears a positive relation with profitability expressing more precisely

\[ \frac{d\alpha}{dt} / \frac{d\gamma}{dt} > 0 \]

In our study the data on expenditure on selling effort and sales have been used to measure the degree of product differentiation

6. In the analytical framework of this study we have defined profit as net profit calculated as profit after tax. The amount of net profit, i.e., after tax profit depends on the tax rate. A firm usually declares dividends and bonus on the basis of net profit earned by it during a particular period. Bonus taken as a deferred dividend of a particular year is declared on the basis of net profit minus reserve.
Profitability has been measured by the ratio of net profit to sales and the size of a firm by the ratio of assets in successive periods to the assets of a particular period (initial period). We have introduced a one-period lag between the data relating to product differentiation and data on profitability and a one period lag between the data on profitability and the data measuring the firm's size on the basis of the assumptions that

(a) expenditure measured in selling effort of this period influences the sales and profit respectively of the next period,
(b) this period's profit is added to the next period's reserve and
(c) there is no lag between sales and profit since in the profit and loss account of a firm this period's profit is calculated on the sales of the same period.

As we are interested in finding the relative change in a firm's size from a particular time point, we are therefore, justified in using the ratio $A_t/A_0$ where $A_0$ denotes the amount of assets held by a firm during a specific period of time which can be used as base period and $A_t$ denotes the amount of assets held by a firm in a succeeding period of time. This ratio is

7. Hall, M., L.W. Weiss have studied the relationship and the result of the study is available in their article 'Firm size and profitability', Review of Economics and Statistics XLIX 1967.
used to measure the change in the size of a firm overtime. Moreover, we have assumed for our empirical investigation of the composite function α expressed in (3) that these three variables α, γ and Δ are linearly related as suggested by the scatter diagram.

Corresponding to the aforesaid assumptions we have three linear equations

(i) \( TR_t = \alpha + w_{2t-1} \)

(ii) \( \Pi_t = \beta + w_{2t-1} \)

(iii) \( F_t = a + \Pi_{t-1} \) where \( TR_t \) means sales revenue of period \( t \), \( \Pi_t \) denotes \( t \) period's net profit and \( F_t \) means absolute size of a firm in period \( t \), \( w_{2t-1} \) denotes expenditure on selling effort in previous period and \( \alpha, \beta \) and \( a \) are constants i.e. parameters which contribute to the variables \( TR, \Pi \) and \( F \) respectively, because a part of total sales revenue is in reality independent of the influence of expenditure incurred in selling effort; similarly, apart from selling effort other factors are also responsible for profit; for instance, goodwill, reputation and the established allegiance of the existing buyers etc. quite obviously are factors responsible for normal sales a part of which constitutes profit of the firm; similarly, the size of a firm depends not entirely upon profit realised by the firm concerned, because variables like borrowed money capital by selling debenture also contributes to the size of a firm.
Our study relates to ten established firms of ten industries and we have tried to estimate the relationship between (a) the size of a firm and profitability i.e. \( \alpha \) and \( \gamma' \) where \( \alpha = A_t/A_0 \) and \( \gamma' = \Pi/TR \) on the one hand and (b) profitability and the degree of product differentiation i.e. \( \gamma' \) and \( L \) on the other by their respective regression co-efficients. Two equations for each firm have been estimated by using the method of least squares. We have used two regression equations

\[
\alpha = a + b\gamma' \quad \text{and} \quad \gamma' = a + bL
\]

in conformity with the composite function (3).

Further, the sample size selected being very small we have subjected the co-efficient 'b' in each regression equation to the 't' test and also estimated its standard error. Since \( \sigma^2 \) is unknown we have used the normal deviate

\[
s_{y,x}^2 = \frac{\left[ \Sigma Y^2 - \left( \frac{\Sigma Y}{n} \right)^2 \right] - b^2 \left[ \Sigma X^2 - \left( \frac{\Sigma X}{n} \right)^2 \right]}{n-2}
\]

and the test statistic

\[
t = \frac{(b - \beta)\sqrt{\frac{1}{n}(X - X)^2}}{s_{y,x}}
\]

to test the relevant hypothesis at 5% level of significance.

Table 24 sets out the regression equations firmwise and Table 25 shows the result of t test together with standard error in estimating the value of regression co-efficient.
<table>
<thead>
<tr>
<th>Established firms in industries</th>
<th>Regression equations</th>
</tr>
</thead>
</table>
| 1. Tea                          | $\alpha' = 1.7875 - 0.557Y'$  
|                                 | $\gamma' = 0.9716 - 0.26657Y$ |
| 2. Biscuits                     | $\alpha' = 2.294 - 21.28Y'$  
|                                 | $\gamma' = 0.0034 + 1.4213Y$ |
| 3. Rubber goods                 | $\alpha' = -5.996 - 369.60Y'$  
|                                 | $\gamma' = 0.01546 + 6.909Y$ |
| 4. Cigarettes                   | $\alpha' = 0.67 - 4.5334Y'$  
|                                 | $\gamma' = 0.03855 - 1.3232Y$ |
| 5. Bicycles                     | $\alpha' = 1.13 - 0.4805Y'$  
|                                 | $\gamma' = 0.04114 + 1.515Y$ |
| 6. Automobile                   | $\alpha' = 2.59 - 10.5Y'$  
|                                 | $\gamma' = 0.0813 - 4.909Y$ |
| 7. Cosmetics                    | $\alpha' = 1.47 + 1.0649Y'$  
|                                 | $\gamma' = 0.264 + 1.43Y$ |
| 8. Electric goods               | $\alpha' = 0.0422 + 35.893Y'$  
|                                 | $\gamma' = 0.0513 + 0.3611Y$ |
| 9. Cotton textiles              | $\alpha' = 1.7215 + 2.693Y'$  
|                                 | $\gamma' = 0.0119 + 4.356Y$ |
| 10. Medicines and Drugs         | $\alpha' = 3.46 - 18.173Y'$  
|                                 | $\gamma' = 0.0465 - 0.1858Y$ |
Corresponding to these estimating equations we have tested the hypothesis

\( H : \) There exists no such relationship in the universe as obtained in the sample between \( \alpha \) and \( \gamma \).

Therefore, \( \beta = 0 \). The hypothesis is rejected if either \( t = t_{\alpha/2,n-2} \) or \( t = t_{\alpha/2,n-2} \) at the level of significance \((\alpha) = 0.05\) standard error of \( 'b' \) is estimated by using the formula

\[
\frac{S_{YX}}{S_{XX}^{1/2}}
\]

We have not tested the \( 'b' \) of the regression equations relating \( \gamma \) and \( \beta \) since we have in this chapter assumed following the 'maintained hypothesis', that product differentiation and profitability are positively related to each other. The relationship assumed between the two would be studied in the Indian context separately in chapter VIII.

As per Table 25 relationship between \( \alpha \) and \( \beta \), i.e. the size of a firm and profitability has been found to be significant in three established firms viz., biscuits, cosmetics and rubber goods producing firms. Secondly, in biscuits and rubber goods producing firms the relationship between \( \alpha \) and \( \beta \) has been found to be negative while in the cosmetic goods producing firm it is found to be positive. Third, relationship between \( \alpha \) and \( \gamma \) is found to be significant in the established firms that belong to the industries having sufficiently high degree of product differentiation; for example, cosmetics - 15.53%, biscuits - 11.877% and rubber goods - 4.249%. Fourth, the relationship
between $\alpha$ and $\gamma$ is found to be significant in the cases of firms that lie in the category of industries experiencing positive value of the slope of the trend fitted to the time series of the ratios measuring the degree of product differentiation. Fifth, as Table 12 has sought to establish, the importance given to selling efforts in the said three industries has been found to be sufficiently high. Apart from these three firms the observed 't' being insignificant in all other cases there is no evidence to believe in the existing evidence that there exists any relationship between $\alpha$ and $\gamma$.

However, we cannot outright reject the possibility of the existence of a relationship, whatever may be the nature, between $\alpha$ and $\gamma$ since expansion of the size of a firm depends on the conditions that (i) the total amount of demand which exists during the period $t$ cannot in any case be fully met by the firm concerned, (ii) industry in which the firm operates should be capable of attracting large investment and (iii) the firm should be in sub-optimal supply condition.

The first condition implies that there are some firms in the market, whose products are substitutes for the marketable goods produced by the established firm. Operation in the marketing sector cannot be substituted for operation in the production sector provided that the following situations prevail:

(a) Production function is homogeneous of degree one while prices/input and output are fixed (b) Sales elasticity with
respect to product differentiation is equal to the sales elasticity with respect to actual quality of the product and (c) Operation of the firm is closer to capacity in both production sector and the marketing sector. Obviously, an uniplant firm in such a situation can never expand its size. If it is a multiplant firm then the situation created by (a) - (c) can be over-ridden during the period when the retaliation lag assumes a value greater than zero since in all plants simultaneous existence of these three conditions, hardly be expected.

From it follows that a firm whether or not it is a multiplant one can expand its size if it is capable of attracting large investment and is in sub-optimal supply condition. By expanding its size the firm can enjoy the advantages of large scale and is supposed to appropriate excess profit over its rivals until the lag value of retaliation is closer to zero.

The second condition refers to the characteristics of the industry which the sample firm belongs to provided the rate of interest and/or opportunity costs are less than profitability together with the existence of the first condition, the firm can expand its size so long as the capital market is not very imperfect and capital is prepared to move in response to the difference in return.

The third condition refers to the situation in which the established firm while operating optimally in marketing sector is not doing so in production sector. Correspondingly, with the value of retaliation lag close to zero the firm can use its profit to increase its size and realise scale economics if any.
### Table 25

<table>
<thead>
<tr>
<th>Established firms in industries</th>
<th>Estimating equations</th>
<th>Calculated value of t</th>
<th>N-2</th>
<th>Tabulated 5%</th>
<th>S.E. of b</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tea</td>
<td>$\alpha' = 1.7857 - 0.557 \gamma$</td>
<td>0.367</td>
<td>17</td>
<td>2.11</td>
<td>1.309</td>
</tr>
<tr>
<td>2. Biscuits</td>
<td>$\alpha' = 2.294 - 21.26 \gamma$</td>
<td>3.462</td>
<td>13</td>
<td>2.160</td>
<td>6.146</td>
</tr>
<tr>
<td>3. Rubber goods</td>
<td>$\alpha' = -5.996 - 369.60 \gamma$</td>
<td>4.343</td>
<td>9</td>
<td>2.262</td>
<td>85.106</td>
</tr>
<tr>
<td>4. Cigarettes</td>
<td>$\alpha' = 0.67 - 4.533 \gamma$</td>
<td>0.720</td>
<td>13</td>
<td>2.160</td>
<td>6.346</td>
</tr>
<tr>
<td>5. Bicycles</td>
<td>$\alpha' = 1.13 - 0.4805 \gamma$</td>
<td>0.367</td>
<td>11</td>
<td>2.201</td>
<td>1.3765</td>
</tr>
<tr>
<td>6. Automobiles</td>
<td>$\alpha' = 2.59 - 10.5 \gamma$</td>
<td>0.862</td>
<td>13</td>
<td>2.160</td>
<td>12.0089</td>
</tr>
<tr>
<td>7. Cosmetics</td>
<td>$\alpha' = 1.47 + 1.065 \gamma$</td>
<td>3.77</td>
<td>11</td>
<td>2.160</td>
<td>0.2824</td>
</tr>
<tr>
<td>8. Electric goods</td>
<td>$\alpha' = 0.0422 + 35.893 \gamma$</td>
<td>0.750</td>
<td>11</td>
<td>2.160</td>
<td>47.820</td>
</tr>
<tr>
<td>9. Cotton textiles</td>
<td>$\alpha' = 1.7215 + 2.693 \gamma$</td>
<td>0.418</td>
<td>15</td>
<td>2.131</td>
<td>4.55</td>
</tr>
<tr>
<td>10. Medicines and Drugs</td>
<td>$\alpha' = 3.46 - 18.173 \gamma$</td>
<td>0.792</td>
<td>15</td>
<td>2.160</td>
<td>22.935</td>
</tr>
</tbody>
</table>
Now as it is evident in Table-25 we have not found sufficient ground for accepting the 'maintained hypothesis' that the size of a firm is positively related to its profitability. Finding of no significant relationship between $a$ and $b$ as suggested by $t$ test in most of the cases (in the cases of biscuits, rubber goods and cosmetics the relationship found is statistically significant) suggests that (i) the firms have possibly been operating very close to capacity or (ii) the rate of interest and/or opportunity cost of capital are higher than profitability or (iii) they are not at all in sub-optimal supply condition.

Tea, Cigarette, bi-cycle, electrical goods and medicine and drug producing established firms belong to industries in which the scope for further realisation of economies of large scale is extremely limited and therefore, they are unlikely to attract fresh investment i.e. the second condition does not apply to their case. Though automobile and cotton textile belong to the category of large scale industries the first and third condition may not exist in their case. In the cases of biscuits and rubber goods producing established firms, policy of diversification of assets (funds) may perhaps explain the existence of negative relationship between the variables. It requires further research. Even though the second condition exists in automobile and cotton textile industries the rate of interest and/or opportunity cost of capital may be higher than profitability on which further study may have to be done.