CHAPTER IV.

FIRM SIZE AND EXPORTS: THE EMPIRICAL ANALYSIS.

As it is obvious from the analytical framework of the previous Chapter, the inter-relationships and causality of the arguments regarding market power, scale economies, technological factors and production efficiencies etc., with respect to firm level exports is through the firm size variable. The relationships of these various factors, that determine export behaviour of firms, with respect to firm size variable is hypothesized in terms of their direct and indirect implications. For example, the issue of domestic market power is taken to be captured by the size variable itself, in its relative terms under the market structure characterized. Under the existing domestic market conditions, how the larger firms attain higher domestic market power is argued out in terms of their higher access to imported inputs, brand names, to specific factor markets and in terms of their diversification behaviour etc. Although these factors might have their own implications on exports in general, but here it is through the firm size variable. For example, in the previous Chapter, it has been established that larger firms generally have higher access to imported inputs. Under the given observation, the causality that could be
established between firm level exports and imported inputs will have implications on the causality between firm size and exports. To illustrate this, if one argues that higher firm level imports results in higher exports, this would mean that larger firms which have higher access to imports should export more than the smaller firms. In the following exercise the direct relationship between firm size export behaviour will be established and later the indirect effects will be analyzed.

At this juncture, it is important to take into notice that the empirical observations and predictabilities of the theoretical arguments presented in the previous Chapters is subject to approximations and implicitness in specifications. This need arises due to the complexity of the existing phenomenon and inherent drawbacks of the (abstract) numbers in capturing and measuring the relevant variables which are supposed to represent the existing phenomenon. Not only due to the above possibilities but also due to data limitations, some of the variables that are taken may be only proxy representatives of some of the relevant factors.

The classification of firms by size and characterization of their distinct export behaviour, under the specified conditions, could imply large degree of non-linearities in the causalities between the variables. This becomes germane, especially when large and small firms are taken in one
sample. This is because, as argued in the previous Chapter, the export behaviour of large and small firms is not only distinct but also governed by the determinants in differential fashion. As a result, the relationships need not be monotonic.

IV.I. The DATA.

The firm level data that is used in the following exercises is classified into two broad groups.

1) Firm level cross section series data at the aggregate classification of the engineering industry.

2) Firm level cross section series data at the disaggregate level of three sub-group of engineering industries.

1) The cross section series data at the aggregate level of the industry is collected for 100 firms for the periods of 1982/83, 83/84, 85/86, based on the company balance sheets from the Confederation of the Engineering Industries (C.E.I). As shown in Table 6, the sample consists of mostly medium and large firms.

2) Basic firm level data for 32 firms belonging to Steel Tubes and Pipes industry and 20 firms belonging to the Diesel Engines and parts industry was collected for 1982/83 from the Directory of Members of the Association of Indian Engineering Industries (A.I.E.I). In the sample of Steel tubes and pipes industry the sales turnover of firms range from a minimum of Rs. 15 lakhs to a maximum of Rs 171.73 lakhs and in the Diesel engines sample it ranges from Rs.10.6 to Rs.792.79 lakhs.
<table>
<thead>
<tr>
<th>Table : 6</th>
<th>Characteristics of Firm Size Measures of the Sample data (1 &amp; 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The Aggregate Industry Sample (1) 1985/86</td>
</tr>
<tr>
<td></td>
<td>Rs, Lakhs</td>
</tr>
<tr>
<td>1. Total sales</td>
<td></td>
</tr>
<tr>
<td>a. Minimum value</td>
<td>4332</td>
</tr>
<tr>
<td>b. Maximum value</td>
<td>452961</td>
</tr>
<tr>
<td>c. Coefficient of variance</td>
<td>222</td>
</tr>
<tr>
<td>d. Standard deviation</td>
<td>11.47</td>
</tr>
<tr>
<td>2. Total capital employed</td>
<td></td>
</tr>
<tr>
<td>a. Minimum value</td>
<td>919</td>
</tr>
<tr>
<td>b. Maximum value</td>
<td>965502</td>
</tr>
<tr>
<td>c. Coefficient of variance</td>
<td>328</td>
</tr>
<tr>
<td>d. Standard deviation</td>
<td>77.6</td>
</tr>
<tr>
<td>3. Value Added</td>
<td></td>
</tr>
<tr>
<td>a. Minimum Value</td>
<td>991</td>
</tr>
<tr>
<td>b. Maximum Value</td>
<td>223996</td>
</tr>
<tr>
<td>c. Coefficient of variance</td>
<td>226</td>
</tr>
<tr>
<td>d. Standard deviation</td>
<td>24.9</td>
</tr>
<tr>
<td>N = 100</td>
<td>N = 76</td>
</tr>
</tbody>
</table>

* c and d are the parameters of the normalised measures.
One of the problems with the Diesel engines sample is that several firms, especially the large firms, are diversified into producing a wide range of products. The firm level data is not decomposed for different products produced by a firm. In case of the Steel tubes and pipes industry sample, the firms appeared to be specializing in steel tubes and pipes only (Black and Galvanized).

Comprehensive firm level data for 115 firms belonging to Hand, small and cutting tools industry was collected for 1983/84 both from secondary and primary sources. For the reasons of completeness of data only 76 firms is used in the econometric exercises.

As shown in Table 6 the size distribution in the sample ranges from very small to very large firms.

Out of the 76 firms, data for 30 firms was collected from secondary sources based on the company balance sheets and the rest of the firm's data, especially for the small and medium, is based on firm level field interviews. Majority of small firms in the sample, about 35, are located in Delhi, Ludhiana, Julunder, and Patiala.

In the sample of 76 firms, 10 firms are indirect exporters. Their exports are taken into account.

In Hand, small and cutting tools industry firms, generally, are diversified into producing wide range of products, but mostly within the broad range of the tools industry. A few of the large firms in the sample are diversified into producing products other than the
ones that belong to the industry classification. The other important characteristic of the industry that should be taken into notice is that the industry can be classified into two sub-groups; the cutting tools and the small tools. The cutting tools industry produces sophisticated tools like carbide tipped and pneumatic tools. The hand and small tools industry produces low technology products like spanners, hand hammers, hacksaw blades, knives, reamers, pliers, vices, axes, shovels, bandsaws, wrenches and chisels etc.

A few of the products in the hand tools industry, like hand hammers, chisels and spanners are reserved for the small scale sector. As discussed in Chapter III, the reservation policies may result in the violation of the basic assumption of the analysis that a firm is set up to cater to the domestic market first and has option to sell both in the domestic and foreign markets. If some of the large firms in the industry have become highly export oriented because they were not allowed to grow in the domestic market due to the reservation policies, it would mean the elimination of domestic demand pulls on exports. Secondly the small firms in the industry would not face much competition from the large firms. In order to reduce the possibility of this bias in the econometric exercises, the firms in the sample, which are suspected to be influenced by the institutional factor are removed from the sample.
IV.II. The Measurement Of The Variables.

A. Firm Size Measure.

Some of the quantitative measures of firm size that are generally used are:

i) total sales turnover.¹

ii) labour employed.²

iii) net assets.³

iv) total capital employed and

v) value-added. (See Table 7).

Each of these measures have particular limitations and also may represent a facet of firm size which is, perhaps, multi-dimensional in nature. The following are some of the limitations of each of the measures. Degree of capacity utilization has implications on the measure based on total sales turnover. In times of lower capacity utilization sales turnover would underestimate a firm's size. Varying degrees of factor intensities, under a given technology of an industry, across firms has implications on the size measures based on labour employed, net assets, and total capital employed. A highly capital intensive firm could be underestimated by the measure of labour employed and vice versa. Varying levels of working and fixed capital employed by firms depending on the degree of vertical

¹ Lall (1981).
³ Panchamuckhi (1978).
### Table - 7

**Matrix of correlation coefficients**

**The Size Measures**

The Aggregate Industry Sample 1985/86:

<table>
<thead>
<tr>
<th></th>
<th>Total sales</th>
<th>Value-added</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value-added</td>
<td>0.97</td>
<td></td>
</tr>
<tr>
<td>Total capital employed</td>
<td>0.93</td>
<td>0.88</td>
</tr>
</tbody>
</table>

The Disaggregate Industry sample: 1983/84

<table>
<thead>
<tr>
<th></th>
<th>Total Sales</th>
<th>Value-added</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value-added</td>
<td>0.78</td>
<td></td>
</tr>
<tr>
<td>Total capital employed</td>
<td>0.97</td>
<td>0.79</td>
</tr>
</tbody>
</table>
integration or disintegration has implications on the size measures of value-added and net assets. A highly vertically disintegrated firm, which is involved mostly in assembling components would employ higher working capital and show low value-added. In such case, the size measures of value-added and net assets would underestimate the size of a firm.

Given the limitations of each of the measures, for reasons of reliability, three alternative measures of firm size are used in the econometric exercises. The measures are total sales, total capital employed and value-added. In the later exercises, among the three measures, alternative measures are used in different equations to avoid the possibilities of statistical biases and variables entering both sides of the equations.

In the sample of firms of aggregate level of the engineering industry, the firms at the aggregate classification of the industry as a whole are taken in one sample for the estimations at the aggregate level. Although it is questionable to use any firm size measure to compare firms across different industries, the aggregate level exercises are done mostly to derive consistent generalizations to be derived from the disaggregate level.

Apart from the three measures, firm level domestic market shares is also taken to capture one of the firm size facets that is firm level domestic market power, in relative terms. Generally a
imperfect market structure or concentration of market power are measured at industry level in terms of top few firms market shares and Herifindal indices. Theoretically, firm level market power can be taken in terms of positive deviation of a firm's price from marginal and average costs. This is based on the assumption that in perfectly competitive market structure firms make normal profits with prices equaling average and marginal costs. This is very difficult to measure empirically given the limitations in the availability of firm level data. Therefore, the domestic market shares are taken to be a proxy to capture firm level market power.

B. Firm Level Exports. (E)

Firm level exports are taken in f.o.b. (free on board) values. As discussed in Chapter III, many small firms undertake exports indirectly through marketing houses and other large firms. The value of indirect exports of those small firms in the sample which undertake indirect exports are taken into account.

C. Export Propensity. (E/S).

As defined in Chapter III, conceptually, firm level export propensity is taken in terms of a firm's degree of orientation towards export versus domestic market or in other words a firm's 'propensity' to export. This can be measured as follows:

\[ S = \text{total sales turnover of a firm, in value terms} \]

\[ \text{Herifindal Index} = \frac{a \cdot n + 1}{n} \]

\[ a = \text{the variance of distribution of market shares. } n = \text{the number of firms in the industry.} \]
E = exports of a firm, in value terms.
DS = (S - E), domestic sales of a firm.
E = (S - DS)
(E/S) = 1 - (DS / S).

C. Firm Level (Financial) Efficiency: The aggregate industry sample.

Comparative analysis of production efficiency differences across firms is applicable only to the samples of firms within an industry operating under uniform technological conditions. In the aggregate industry level exercises, a simple (and rough) measure of firm level financial efficiency in terms of extent of costs spent for a unit of value-added realized, is used. Comparative analysis of firms belonging to different industries within the broad classification of the engineering industry is justifiable to some extent, strictly on the basis of the assumption of profit maximization. This would mean that whatever activity a firm does, a firm aims at equating marginal costs to marginal revenue (under the assumption of perfect competition). The measures based on the approach can be applied to multi-product firms under the assumption that a multi-product firm equates marginal costs of producing different products in search of maximizing profits. But cost inefficiency of firms may be a result of

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5 Klein (1965). pp 83-139. This measure is similar to the measure of scale economies of Christensen and Green (1976), which will be discussed in the next chapter.
differentiable production inefficiencies like technical and allocative efficiencies. The production efficiency measures will be derived for the disaggregate industry sample in the following Chapter. The present measure should serve to have maximum possible completeness in the specification of equations and also towards deriving possible generalizations by comparing the results at the aggregate and disaggregate levels.

One of the possible drawbacks of this measure, or any other measure which takes value-added as output is that it is influenced by the degree of vertical disintegration of a firm. A highly vertically disintegrated firm (which might be almost like a marketing house), which does not involve in much of its own production, (but may have large sales turnover) may show low level of efficiency. Since none of the firms in the data samples used have high levels of vertical disintegration and the samples do not show significant dispersion in the degree of vertical integration (see Table I), the measure should not cause any significant level of the above mentioned drawback.

The other drawback of the measure is the assumption of perfectly competitive product and factor markets. If firms are realizing different prices for output and pay differential factor prices, it will reflect in the level of the financial efficiency of firms.  

6 This is because value-added can be expressed as follows:

\[ P = \text{price of output.} \]
\[ Q = \text{quantity of output.} \]
\[ R = \text{raw materials in value terms.} \]
D. The Measures of Inputs.

i) Labour.

The labour input in production, in measuring labour intensity of production and estimating production functions, is generally taken either in terms of total number of people employed or total wage bill. If the skill component of labour is not decomposed, both the measures may not be able to give a comparable picture of the extent of the labour input across firms. This is especially true in the context of large degree of labour market segmentation and diversity in the types of labour employed by different size group of firms. The drawback is more prominent in the measure of total number of people employed. In skill intensive production processes the number of people employed would be lower than in the unskilled labour intensive production processes. Similarly, in case of wage bill, skilled labour and professional people are paid a lot higher wages than unskilled and family labour employed. So, in such a case, a high wage bill of a firm could be due to high skill intensity of its production process. In the following exercises, mostly salaries and wage bill is used as the labour input. As discussed in Chapter III small firms generally face the non-unionized labour markets and employ semi and unskilled labour at very low wages. Due to these reasons the results that are derived

\[ \text{Value-added} = PQ - R = wL + rK. \]

\( r \) is price of capital, \( w \) is wage and \( K \) and \( L \) are capital and labour.
with wages as the labour input have to be interpreted accordingly.

E. Capital

Measurement of capital employed by a firm in a given year (the present value) requires detailed data on the value of fixed capital, the rate of depreciation, age and the expected life span of the machinery. In most of the studies, generally a straight line depreciation method is used with an assumed life span of the machinery. Most of these estimates are subject to several limitations because firms in an industry employ machinery of different vintage at different levels of depreciation. Due to data limitations, in the present exercises total capital employed minus depreciation is used as a measure of capital. Total capital employed refers to total investment made by a firm since its establishment. Depreciation figures reported by firms are generally influenced by tax considerations. In order to check for consistency, alternatively both total capital employed inclusive and exclusive of depreciation are used.

Therefore capital is taken in historical costs. Although this measure of capital may not be an accurate measure, since the exercises are at cross section series of firms, the measure should capture the extent of capital employed by firms, in relative terms in a given sample. This is justifiable especially in capturing relative capital intensity of firms in given samples.

7 Page (1984)
F. Imported Inputs and Technology.

Firm level imports of raw materials, components and spares consumed (inclusive of import duties) is taken to represent the variables of firm level imports as such and the extent of firm level imported technology. This measure does not include capital goods imported by firms. This measure is taken to be a proxy to the extent of imported technologies of firms under the argument that firms which employ higher import intensive technologies are more dependent on imported inputs and components.

G. Firm level Diversification.

Number of products produced by a firm captures only a facet of firm level diversification behaviour, i.e. firm level multi-product diversification. This measure does not capture a firm's multi-plant diversification, in its full extent. This is because, as argued in Chapter III, firms could diversify into multi-plants within the same products and also that large houses diversify into multi-firms due to the existing industrial policies.

The Notations of the Variables.

\[ E = \text{exports.} \]
\[ S = \text{total sales turnover.} \]
\[ DS = (S - E), \text{domestic sales.} \]
\[ (E/S) = \text{export propensity or} \]
\[ = \text{export orientation, } (1 - (DS/S)) \]
\[ Z = \text{firm size.} \]
\[ ZS = \text{sales as size measure.} \]
\[ ZK = \text{total capital employed as size measure.} \]
\[ ZV = \text{value-added as size measure.} \]
\[ V = \text{value-added.} \]
\[ = \text{production - (raw materials + power and fuel).} \]
\[ D = \text{depreciation} \]
\[ LS = \text{salaries and wages as labour.} \]
\[ LN = \text{number of people employed as labour.} \]
\[ M = \text{managerial remuneration.} \]
\[ TK = \text{total capital employed.} \]
\[ K = \left( TK - D \right) \text{and also TK itself as capital measures.} \]
\[ IM = \text{imported raw materials, components, stores and spares consumed.} \]
\[ NP = \text{number of products produced by a firm.} \]
\[ DSR = \text{domestic market shares.} \]
\[ X = \frac{LS + D + M}{V}, \text{ firm level financial inefficiency.} \]
\[ N = \text{number of firms in the sample.} \]
\[ DP = \text{dummy variable for the public sector firms.} \]
\[ '0', \text{for the public sector and '1' for the private sector firms.} \]
\[ DV = \text{dummy variable for overseas investment by the Indian firms. '1' for a firm with overseas joint ventures and '0' otherwise.} \]
\[ (LS/V) = \text{labour intensity.} \]
\[ (K/V) = \text{capital intensity.} \]
\[ (IM/S) = \text{import intensity, (imports divided by production).} \]
One of the possibly major drawbacks of the econometric exercises with ordinary least squares estimations for the present type of cross section exercise, where the samples consist of very large and small firms is the presence of heteroskedasticity. This, in turn, causes the parameters estimated to be inefficient. In the cases of the estimations, where heteroskedasticity is found to be strong, proper modification of specification of equations or normalization of variables is done in order to reduce heteroskedasticity.

IV.III. The Specification of the Equations.

And The Results.

IV.III.I. The Specification. Equations I and II.

The equations I and II capture the direct relationship between firm size and exports on the basis of domestic market structure arguments.

IV.III.I.A. The Equation One.

\[ E = a + b_1 Z + b_2 Z^2 + b_3 (DP) + i \]

\[ b_1 \geq 0 \quad b_2 \geq 0 \quad b_3 > 0 \]

A priori, based on the arguments, as put forward in Chapter II and III, regarding the price discriminating monopoly behaviour of large firms and the scale economy advantages due to access to large domestic markets, one can expect a positive relation between exports and firm size. But, however, the relationship need not be monotonic and there might be critical turning points where the relationship changes. Secondly it is proportionate (to firm size) exports that would be more important than absolute exports.
If \( b1 \) and \( b2 \) are positive or \( b1 < 0 \) and \( b2 > 0 \), larger firms not only export more but proportionately more. On the other hand, if the domestic monopoly power becomes a dominant factor resulting in higher monopoly prices and profits, under a given production capacity, to the larger firms, it could reduce their incentive to export. Apart from this, as argued in Chapter III, higher domestic market power, could make large firms x-inefficient and a result in their production processes deviated from the country's comparative advantage. As a result, it reduces their ability to export. In such a case, the expected signs of the parameters would be: \( b1 < 0, b2 < 0 \), or \( b1 > 0, b2 < 0 \). This would mean larger firms would export proportionately less than small and medium firms. Similar arguments are applied to the expected signs of the parameter \( b1 \) in the equation I. ii where export propensity is used as the dependent variable.

The sign of the parameter \( b3 \) with reference to the public sector firms dummy variable, may be expected to be positive. Although all firms in the industry have the import substitution bias under the existing policy regime, the import substitution bias in the public sector firms is expected to be stronger. This is because the public investment, based on non-profit motive, was based on fostering import substitution in many other sectors. Due to this reason, the public sector firms in general are expected to play less prominent role in exports although certain specific
public sector firms like Bharat Heavy Electrical ltd and Hindustan Machine Tools ltd etc do undertake exports to considerable extent.

I.ii. \( (E/S) = a + b_1 (Z) + b_2 (DP) + i \)

As analytically formulated in Chapter III.1, the relationship between \( (E/S) \) and firm size is a behavioral one. The sign of \( 'b_1' \) depends upon the domestic market structural conditions and their implications on large and small firms export behaviour. Under a fixed production capacity, if large firms are complacent to exploit their downward sloping domestic demand curve (to reap super normal profits) and small firms which face expansion barriers in the domestic market and are in a position to produce at the world market price, small firms export propensity, \( (E/S) \) will be higher. In such a case, the sign of \( 'b_1' \) in the above equation can be expected to be negative. 8

IV.III.1.B. The Equation Two.

II.i. \( E = a + b_1 (DSR) + b_2 (DSR)^2 + b_3 (X) + b_4 (IM/S) + b_5 (DV) + b_6 (NP) \)

\( b_1 ; b_2 \geq 0 , b_3 < 0 , b_4 \geq 0 , b_5 \geq 0 , b_6 \geq 0 \)

II.ii. \( (E/S) = a + b_1 (DSR) + b_2 (X) + b_3 (IM/S) + b_4 (DV) + b_5 (NP) \)

\( b_1 \geq 0 \)

The arguments for the expected signs of the parameters \( 'b_1' \) and \( 'b_2' \) in II.i and \( 'b_1' \) in II.ii

8 It is necessary to remind, here, the definition of \( (E/S) \) done before, which is \( (E/S) = 1 - (DS/S) \). Therefore, conceptually, it refers to degree of export orientation (or propensity to export). Conceptually it does not mean exports, normalized by firm size, although one of the firm size measures, total sales, comes in the denominator.
with respect to the variable of domestic market shares are similar to the ones made in equation I.1 and I.ii
with regard to the respective parameters.

On standard theoretical lines, the sign of the coefficient \( b3 \) with respect to \( X \), the inefficiency index, can be expected to be negative, i.e., firm level efficiency is a necessary condition for exports. In this respect the causality between \( E, (E/S) \) and \( X \) can be other way round if there are significant dynamic economies (like learning by doing) in export activity. Due to the pressures of more competitive (than domestic market) world markets, feedback from overseas exposure etc export oriented firms can become more efficient producers over a period of time compared to non-exporters. But, here, the causality is taken on standard theoretical lines.

On the other hand \( b2 \) II.ii may turn out to be positive. Due to large degree of market imperfections and institutional factors like export subsidies etc firm level relative efficiency may not be a necessary condition for export orientation. As argued, in the previous Chapter, size of a firm has implications on it's relative efficiency and in turn on exports. The relationship between firm level efficiency and exports need not be monotonic across all size groups, because of different levels of domestic market pressures on different size group firms. This aspect will be brought out more specifically in the equation III.
On a priori grounds, the sign of the parameter \( \beta_4 \) with respect to \( (\text{IM/S}) \), the import intensity variable could be either way. If the variable \( (\text{IM/S}) \) works as a proxy to the extent of imported technology of a firm, it might facilitate the import intensive firms to operate on the latest vintage technology and produce high quality products and facilitate exports. Further, (on the basis of Ethier's argument), if there are significant external economies at international level embodied in the imported inputs and intermediates, they should facilitate higher export possibilities to an import intensive firm. It has been established in Chapter II, that it is larger firms which have higher access to imported inputs and technology. So the above positive benefits of imports should make larger firms to export more. But the relationship could be negative on the following grounds. If higher access to imports reduce costs to firms (consequently the prices) and if supply elasticity is less than domestic demand elasticity, it could result in higher domestic sales or profits and lower exports.

On the other hand, as argued in chapter III, given the nature of domestic demand where there is higher preference to the products with higher import content and brand names, higher access to imports to firms might increase it's relative domestic market profitability and reduce their incentive to export. Secondly, if imported technology and it's adaptation process results in the deviation of a import intensive (large) firm's production process from
the country's comparative advantage, it could result in reduction in it's ability to export.

The implication of firm size in the overseas investment variable is that it is firms within the large size group, which can undertake overseas investment. The estimated coefficient of 'b5' in equation II.i (and 'b4' in equation II.ii) could be positive if firms with overseas investment are exporting more than the others through vertical integration with their overseas subsidiaries and because their higher exposure to the world markets. On the other hand, it could be negative if these firms are substituting exports for overseas investment.

The implication of firm size in the multi-product variable (NP), in capturing multi-product diversification may not be a clear cut one. This is because, as discussed in Chapter II, both large and small firms involve in multi-product diversification due to various reasons. By taking the variable on it's own, the coefficients, 'b6' in II.i and 'b6' in II.ii can be expected to be negative if large extent of multi-product diversification reduce economies of specialization in production and exports. On the contrary it can turn out to be positive, if there are economies of scope and marketing and consequent increase in export possibilities.
IV.III.II. The Results: The Equations I and II.

IV.III.II.a. The Results for The Aggregate Industry.

The Sample I.

Tables 8A, 8B, 9A, 9B, and 10A and 10B show the results obtained for the equation I for the aggregate industry sample with total sales turnover, total capital employed and value-added as firm size measures, respectively. Although the results that are presented for the sample I are for the year of 1985/86, similar exercises were done for periods of 1982/83 and 1983/84. The results obtained are largely similar for all the periods.  

The consistent and statistically significant positive and negative signs of the estimated coefficients of 'b1' and 'b2' of the quadratic terms with respect to the three of the size measures support the alternative hypothesis put forward in the specifications. The results indicate that there is a critical firm size above which absolute exports decline as size increases. Major implication of the respected signs of the parameters is that the proportionate increase in exports decline as firm size increases and becomes negative after the critical size level. As shown in Tables 8B, 9B, and 10B, the sign of the estimated parameters in the equation with export propensity variable (E/S) as the dependent variable (Equation I.i.i) are negative in the three of the cases (of different

9 See Patibandla(1988b).
Table 8A: Equation 1.1

The Aggregate Industry Sample 1985/86
Total sales as a Measure of Firm Size

\[ E, \ln E = a + b_1 (ZS) + b_2 (ZS)^2 + b_3 (DP) + i \]

<table>
<thead>
<tr>
<th>I.1</th>
<th>a</th>
<th>b_1</th>
<th>b_2</th>
<th>b_3</th>
<th>R^2</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.1.a</td>
<td>-383</td>
<td>80.5</td>
<td>-0.74</td>
<td>586</td>
<td>0.23</td>
<td>9.9</td>
</tr>
<tr>
<td></td>
<td>(5.09)</td>
<td>(4.6)</td>
<td>(3.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.1.b</td>
<td>ln E 0.76</td>
<td>0.27</td>
<td>-0.002</td>
<td>1.75</td>
<td>0.05</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>(2.28)</td>
<td>(1.90)</td>
<td>(1.30)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 100

I.1.a The critical turning point = Rs. 235227 lakhs
I.1.b The critical turning point = Rs. 243458 lakhs

The figures in the brackets are 't' values:

* Significant at 0.025 level.
** Significant at 0.05 level.
*** Significant at 0.10 level.
Table 9A: Equation 1.1
The Aggregate Industry Sample 1985/86
Total Capital Employed as a Measure of Firm Size

1.1. $E, \ln E = a + b_1 (ZK) + b_2 (ZK)^2 + b_3 (DP) + i$

<table>
<thead>
<tr>
<th></th>
<th>$a$</th>
<th>$b_1$</th>
<th>$b_2$</th>
<th>$b_3$</th>
<th>$R^2$</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E$</td>
<td>-575</td>
<td>16.74</td>
<td>-0.021</td>
<td>864</td>
<td>0.20</td>
<td>8.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.61)*</td>
<td>(4.5)*</td>
<td>(4.12)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\ln E$</td>
<td>0.72</td>
<td>0.04</td>
<td>-0.00051</td>
<td>2.23</td>
<td>0.03</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.55)**</td>
<td>(1.45)**</td>
<td>(1.40)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N=100

1.1.a The critical turning point = Rs. 364843 lakhs
1.1.b The critical turning point = Rs. 367600 lakhs

The figures in the brackets are 't' values:

* Significant at 0.025 level.
** Significant at 0.05 level.
*** Significant at 0.10 level.
The Aggregate Industry Sample 1984/86
Value Added as a Measure of Firm Size

\[ \ln E = a + b_1 (ZV) + b_2 (ZV)^2 + b_3 (DP) \]

### Table 10A - Equation 1.1

<table>
<thead>
<tr>
<th></th>
<th>( a )</th>
<th>( b_1 )</th>
<th>( b_2 )</th>
<th>( b_3 )</th>
<th>( R^2 )</th>
<th>( F )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( E )</td>
<td>-230</td>
<td>31.6</td>
<td>-0.135</td>
<td>467</td>
<td>0.20</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>(4.5)*</td>
<td>(4.0)*</td>
<td>(2.6)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \ln E )</td>
<td>0.96</td>
<td>0.13</td>
<td>-0.00055</td>
<td>1.47</td>
<td>0.07</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>(2.61)*</td>
<td>(2.26)*</td>
<td>(1.74)*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( n = 100 \)

1.1.a The critical turning point = Rs. 115947 lakhs
1.1.b The critical turning point = Rs. 116938 lakhs

The figures in the brackets are 't' values:

* Significant at 0.025 level
** Significant at 0.05 level
*** Significant at 0.10 level.
firm size measures), but they are not statistically significant.10

As discussed before, in an exercise of the present type, based on the cross-section series, heteroskedasticity is a natural outcome which could result in inefficient estimates (but not biased). Heteroskedasticity of errors is tested by segregating the sample into four groups and testing the significance of the variance of the residuals. The variance of the residuals are for the groups quite different from each other, as shown below.

Heteroskedasticity of Errors.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of observations</th>
<th>Variance of the residuals.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
<td>0.00045</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>0.0011</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>0.0016</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>0.010</td>
</tr>
</tbody>
</table>

Graph 5 shows the plot of squared estimated residuals against firm size. There is a systematic relationship between the residuals and the explanatory variable (ZS), which indicates the presence of heteroskedasticity. Apart from this, Park's (1966) test is done to give further proof for the presence of heteroskedasticity.

The correlation coefficient between the squared estimated residuals and the explanatory variable (ZS) is (-0.199), significant at 0.01 level.

10 If one fits a linear curve to a non-linear relationship, $R^{**}$ will turn out to be low. In the present case, if there are different clusters of size groups of firms in explaining exports, $R^{**2}$ will turn out to be low.
Squared Residuals

The Estimated Equation I was developed with the Aggregate Industry Sample of Errors. Heteroskedasticity of Errors was not significant.
Squared residuals = - 6.9 - 0.42 (ZS) 

\( R^2 = 0.09 \quad F = 4.0 \)

Figures in the brackets are `t' values.

* Significant at 0.01 level.

On the basis of Park's test, the statistical significance of the above estimated parameter indicates the presence of heteroskedasticity.

In order to reduce heteroskedasticity, the equation is re-estimated by normalizing both sides by the independent variable, (ZS), firm size.

\( \frac{E/S}{ZS} = a \left( \frac{1}{ZS} \right) + b \)

The results of the above equation, as shown in section `B' of Tables 8B, 9B, and 10B have turned out to be statistically more significant. The respective signs of the estimated parameters support the hypothesis that export propensity declines as firm size increases.

In general, the results support the hypothesis that domestic market power could be the major factor in explaining firm level export behaviour under the assumption that larger is a firm higher is it's domestic market power and higher the domestic market power lower would be the export orientation.

The estimated coefficients of `b3' with respect to the public sector firms dummy variable is positive and statistically significant at large. The result supports the hypothesis that the public sector firms, established with the primary objective of import
Table 8B. Equation 1.ii

\[ (E/S) = a + b_1 (ZS) + b_2 (DP) + i \]

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b_1</th>
<th>b_2</th>
<th>R^2</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>(E/S)</td>
<td>0.611</td>
<td>-0.0003</td>
<td>0.029</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.59)</td>
<td>(1.7)**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.</td>
<td>(E/S)</td>
<td>0.066</td>
<td>-0.01</td>
<td>0.003</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.6)*</td>
<td>(3.0)*</td>
<td>(0.26)</td>
<td></td>
</tr>
</tbody>
</table>

N = 100

The figures in the brackets are 't' values.

* Significant at 0.025 level.

** Significant at 0.05 level.

B. Shows the results for equation 1.ii, corrected for heteroskedasticity.
Table 9B. Equation 1.

\[ \bar{y} (E/S) = a + b_1 (ZK) + b_2 (DP) + i \]

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>( b_1 )</th>
<th>( b_2 )</th>
<th>( R^2 )</th>
<th>( F )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>( (E/S) )</td>
<td>0.009</td>
<td>-0.00002</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B.</td>
<td>( \frac{(E/S)}{ZK} )</td>
<td>0.019</td>
<td>-3.66</td>
<td>0.99</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N= 100

Figures in the brackets are 't' values

* Significant at 0.025 level.

** Significant at 0.05 level.
### Table 10B: Equation 1.ii

1.ii \( (E/S) = a + b_1 (ZV) + b_2 (DP) + i \)

<table>
<thead>
<tr>
<th></th>
<th>( a )</th>
<th>( b_1 )</th>
<th>( b_2 )</th>
<th>( R^2 )</th>
<th>( F )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>(E/S)</td>
<td>0.011</td>
<td>-0.00015</td>
<td>0.029</td>
<td>0.045</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.64)</td>
<td></td>
<td>(1.71)**</td>
</tr>
</tbody>
</table>

\[ (E/S) = a (ZV) + b_1 + b_2 (DP) + i \]

<table>
<thead>
<tr>
<th></th>
<th>( a )</th>
<th>( b_1 )</th>
<th>( b_2 )</th>
<th>( R^2 )</th>
<th>( F )</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.</td>
<td>( \frac{(E/S)}{ZV} )</td>
<td>0.045</td>
<td>-0.006</td>
<td>0.007</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(3.37)*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ \frac{(E/S)}{ZV} = a (ZV) + b_1 + b_2 (DP) + i \]

\( N = 100 \)

The figures in the brackets are 't' values.

* Significant 0.025 level.

** Significant at 0.05 level.
substitution, are relatively inward oriented compared to the private sector.

The results estimated for equation II for the aggregate industry sample are shown in Tables II A and II B. The results for II i are statistically significant at large. In II i the estimated coefficients for 'b1 and b2' with respect to the domestic market shares variable are similar to the ones with the firm size variable in equation I, estimated and are subject to similar interpretations. The parameter estimated for 'b3' with respect to (X), firm level relative inefficiency is of negative sign and statistically significant only in case of the semi-log estimations. The result support the hypothesis, to a large extent, that firm level relative efficiency is a necessary condition to exports. As discussed earlier, the causality between (X) and (E) could be other way round if there are significant dynamic economies in exports, which can possibly observed in the following Chapter. As discussed in the specifications, the relationship between (X) and (E) could be operative through firm size variable. This is observed in the following equation III.

The coefficient estimated for 'b4' with respect to firm level imports is negative but not statistically significant. This could be due to multi-colinearity between (DSR) and (IM/S) in the estimation. As established in Chapter III (see Table 2), there is systematic positive relation between firm size (here
Table 11 A: Equation II.4

The Aggregate Industry: Sample 1985/86

II.1. \[ E = a + b_1(DSR) + b_2(DSR)^2 + b_3(X) + b_4(IM) + b_5(DJ) + i \]

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b_1</th>
<th>b_2</th>
<th>b_3</th>
<th>b_4</th>
<th>b_5</th>
<th>R^2</th>
<th>F</th>
<th>Multiple correlation coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b_1</td>
<td>1996</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1936</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b_2</td>
<td>-160348</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b_3</td>
<td>-511</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-511</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b_4</td>
<td>-69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b_5</td>
<td>0.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R^2</td>
<td>0.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>3.09</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple correlation coefficient</td>
<td>0.37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

II.1.a E 265 1996 -160348 -73 -511 -69 0.14 3.09 0.37
(3.7)* (3.6)* (0.55) (0.81) (0.36)

II.1.b In E 3.7 115 -542 -1.99 -5.57 1.34 0.11 2.34 0.33
(1.96)* (1.75)** (2.15)* (1.26) (1.015)

The figures in the brackets are 't' values

N = 100

* Significant 0.025 level.
** Significant at 0.05 level.
OSR) and firm level imports, with larger firms having higher access to imports. Furthermore, there could be two countervailing influences operating on the relationship between (E) and (IM/S). The institutional factors like the import replenishment policies, which give access to imports to firms for undertaking exports impose a positive relation between exports and imports. On the other hand, increased access to imports, as hypothesized, might increase domestic market power and reduce propensity to export, (which is, to some extent, confirmed by the negative sign of 'b4' estimated, despite the positive relation imposed by the import replenishment policies). 11

The underlying assumption for the overseas investment dummy variable is that only relatively larger firms are capable of undertaking foreign investment. The variable differentiates the exports of firms within the large size group. The estimated parameter for 'b5' of the dummy variable is of positive sign but not statistically significant. The statistical insignificance could be due to the reason that there are only 12 firms with overseas investment within the sample of 100 firms. The weak positive sign indicates that

11 The following results show the estimated relationship between domestic sales and imports.

\[ \text{logDS} = 8.9 + 0.079 \text{ log(IM)} \]

(3.0)* \[ R^2 = 0.08 \quad F = 9.5 \]

\[ \text{logDS} = 9.2 + 0.00007 \text{ (IM)} \]

(8.3)* \[ R^2 = 0.41 \quad F = 6.9 \]

*. Figures in the brackets are 't' values; significant at 0.01. It is obvious from the above results, firm level imports are explaining domestic sales far more significantly than exports.
firms with overseas investment might be exporting more than the other firms due to their vertical integration with overseas subsidiaries and also due to higher exposure to the world markets.

Table II.B shows the results for the equation II.ii, with export propensity as the dependent variable. Due to heteroskedasticity problems, as before, the results are insignificant. The results of the equation, normalized by the (DSR) variable (in order to correct for heteroskedasticity), as shown in section 'B' of Table II B, are significant to a large extent. The respective signs of the estimated coefficients support the above observations that export propensity declines as firm size increases.

IV.III.II.B. The Results for The Industries at the Disaggregate level. The Sample II.

Tables 12A, 12B, 13A, 13B, and 14A, 14B show the results estimated for equation I with the disaggregate industry sample of Hand, small and cutting tools industry. The size distribution in this sample is far larger than in the sample I; consisting of very large and small firms (see Table 6). The results are quite similar to the results estimated at the aggregate industry level. But, in addition, the equation estimated (for I.ii) with export propensity (E/S) as the dependent variable, without normalization also, is statistically significant (with significant 't' and F values), with negative signs with respect to firm size variable.

In the present case of equation I.ii of (E/S) also, the tests for heteroskedasticity are conducted. Graph 6
### Table 11 B. Equation II.ii

\[(E/S) = a + b_1 (DSR) + b_2 (X) + b_3 (1M/S) + b_4 (DJ) + i\]

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b_1</th>
<th>b_2</th>
<th>b_3</th>
<th>b_4</th>
<th>R^2</th>
<th>F</th>
<th>Multiple Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>0.03</td>
<td>-0.36</td>
<td>-0.08</td>
<td>0.082</td>
<td>-0.50</td>
<td>0.02</td>
<td>0.69</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>(1.36)</td>
<td>(0.68)</td>
<td>(0.55)</td>
<td>(0.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[(E/S) \text{ DSR} = b_1 \text{ DSR} + b_2 (X)_{\text{DSR}} + b_3 (1M/S) + b_4 (DJ)_{\text{DSR}}\]

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b_1</th>
<th>b_2</th>
<th>b_3</th>
<th>b_4</th>
<th>R^2</th>
<th>F</th>
<th>Multiple Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.</td>
<td>0.01</td>
<td>-16.2</td>
<td>-0.029</td>
<td>0.37</td>
<td>0.000001</td>
<td>0.40</td>
<td>16</td>
<td>0.62</td>
</tr>
<tr>
<td></td>
<td>(3.7)*</td>
<td>(3.1)*</td>
<td>(0.96)</td>
<td>(3.8)*</td>
<td>(0.34)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N ± 100

The figures in the brackets are 't' values

* Statistically significant at 0.025 level.
Table 12A: Equation 1.1

The Disaggregate Industry Sample: 1983/84
Total Sales as a Measure of Firm Size

1.1  \( E, \ln E = a + b_1 (ZS) + b_2 (ZS)^2 + i \)

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b_1</th>
<th>b_2</th>
<th>R^2</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1.a</td>
<td>( -157 )</td>
<td>43.3</td>
<td>-0.7146</td>
<td>0.42</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>(6.19)*</td>
<td>(4.17)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.b</td>
<td>( 3.6 )</td>
<td>0.0006</td>
<td>-0.000003</td>
<td>0.13</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td>2.66*</td>
<td>(1.67)**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( N = 76 \)

1.1.a. The critical turning point = Rs. 942465 thousands
1.1.b The critical turning point = Rs. 960000 thousands

The figures in the brackets are 't' values:
* Significant at 0.025 level
** Significant at 0.05 level
*** Significant at 0.10 level
Table 13A: Equation 1.1

The Disaggregate Industry sample: 1983/84
Total Capital Employed as Measure of Firm Size

I.1 \[ E, \ln E = a + b_1 \text{(ZZ)} + b_2 \text{(ZK)}^2 + i \]

<table>
<thead>
<tr>
<th>I.1.a</th>
<th>( \hat{a} )</th>
<th>( \hat{b}_1 )</th>
<th>( \hat{b}_2 )</th>
<th>( R^2 )</th>
<th>( F )</th>
</tr>
</thead>
<tbody>
<tr>
<td>E = -123</td>
<td>10.5</td>
<td>-0.00075</td>
<td>0.45</td>
<td>29.8</td>
<td></td>
</tr>
<tr>
<td>(4.5)</td>
<td>(2.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.1.b</td>
<td>( \ln E = 3.6 )</td>
<td>0.0028</td>
<td>-0.00000026</td>
<td>0.12</td>
<td>4.9</td>
</tr>
<tr>
<td>(2.28)</td>
<td>(1.35)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 76
1.a. The critical turning point = Rs. 105000 thousands
1.b. The critical turning point = Rs. 807600 thousands

The figures in the brackets are 't' values:
* Significant at 0.025 level
** Significant at 0.05 level
*** Significant at 0.10 level
### Table 14.1: Equation 1.1

The disaggregate Industry sample: 1983/84

Value-Added as a Measure of Firm Size

<table>
<thead>
<tr>
<th>1.1</th>
<th>$E, \ln E = a + b_1(ZV) + b_2(ZV)^2 + i$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$a$</td>
</tr>
<tr>
<td>1.1.a</td>
<td>$E$</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.b</td>
<td>$\ln E$</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$N = 76$

1.1.a The critical turning point = Rs. 352375 thousands

1.1.b The critical turning point = Rs. 410561 thousands

The figures in the brackets are 't' values

* Significant at 0.025 level

** Significant at 0.05 level

*** Significant at 0.10 level.
Graph - 6

Heteroskedasticity of Errors.

Hand, small and cutting Tools Industry sample.

The Estimated Equation I. ii
shows the plot of the squared estimated residuals against firm size variable. There is systematic relationship between the two although it is not as significant as before.

The correlation coefficient between the squared estimated residuals and the explanatory variable is (-0.17), significant at 0.05 level.

Squared residuals = - 3.3 - 0.12 (ZS)

\( R^2 = 0.09 \quad F = 2.34 \)

Figures in the brackets are 't' values.

** Significant at 0.05 level.

The above tests do indicate the presence of heteroskedasticity in the estimation. But, as expected, it is not as significant as in the case of the aggregate industry sample. As before, in order to reduce heteroskedasticity, the equation is re-estimated by normalizing it on the both sides by the explanatory variable. As shown in section B of Tables 128, 138 and 148, the results, after normalization, have turned out to be statistically significant at higher level with improved \( R^2 \) and F values.

The results confirms the negative relation between firm size and revealed export orientation and the interpretations made in case of the results with the aggregate industry sample. As expected the results more robust in the present case of the disaggregate industry sample.

Tables 15 and 16 show the results estimated for equation 1.1 for the samples of Steel tubes and pipes
Table 12 B. Equation 1.1

\[
(E/S) = a + b_1 (ZS) + i
\]

<table>
<thead>
<tr>
<th>A. (E/S)</th>
<th>0.23</th>
<th>-0.00017</th>
<th>0.067</th>
<th>5.32</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2.30)*</td>
</tr>
</tbody>
</table>

\[
\frac{(E/S)}{ZS} = a(\frac{1}{ZS}) + b_1 + i
\]

| B. (E/S) \| ZS | 0.24 | -0.006 | 0.46 | 60 |
|               |      |        |       | (7.7)* (5.6)* |

N = 76

The figures in the brackets are 't' values.

* Significant 0.025 level.
Table 13 B. Equation 1.ii

\[
(E/S) = a + b_1 (ZK) + i
\]

---

A. 

<table>
<thead>
<tr>
<th>(E/S)</th>
<th>a</th>
<th>b_1</th>
<th>R^2</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.24</td>
<td>-0.00005</td>
<td>0.07</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2.35)*</td>
<td></td>
</tr>
</tbody>
</table>

---

\[
\frac{(E/S)}{ZK} = a \left(1 \frac{1}{ZK}\right) + b_1 + i
\]

---

B. 

<table>
<thead>
<tr>
<th>(E/S)_ZK</th>
<th>a</th>
<th>b_1</th>
<th>R^2</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.21</td>
<td>-0.004</td>
<td>0.56</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(9.6)*</td>
<td>(6.0)*</td>
</tr>
</tbody>
</table>

---

N = 76

The figures in the brackets are 't' values

* Significant 0.025 level.
<table>
<thead>
<tr>
<th>( \frac{(E/S)}{ZV} )</th>
<th>( a )</th>
<th>( b_1 )</th>
<th>( R^2 )</th>
<th>( F )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. ( \frac{(E/S)}{ZV} )</td>
<td>0.24</td>
<td>-0.00012</td>
<td>0.08</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2.5)*</td>
<td></td>
</tr>
<tr>
<td>B. ( \frac{(E/S)}{ZV} )</td>
<td>0.82</td>
<td>-0.02</td>
<td>0.18</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(3.9)*</td>
<td>(2.9)*</td>
</tr>
</tbody>
</table>

\( N = 76 \)

Figures in the brackets are 't' values

* Significant at 0.025 level.
### TABLE - 15

**Equation - 1.1**

\[
E = a + b_1 (ZS) + b_2 (ZS)^2 + b_3 (NP) + i
\]

\[ZS = \text{Firm level sales (normalised)}
\]

\[1982-83\]

<table>
<thead>
<tr>
<th>(\hat{a})</th>
<th>(\hat{b}_1)</th>
<th>(\hat{b}_2)</th>
<th>(\hat{b}_3)</th>
<th>(R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.(E_T)</td>
<td>48.9</td>
<td>0.55</td>
<td>-0.0002</td>
<td>-12.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.88)</td>
<td>(0.66)</td>
<td>(1.15)</td>
</tr>
<tr>
<td>2.(E_D)</td>
<td>210.4</td>
<td>1.11</td>
<td>-0.000039</td>
<td>-32.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.02)</td>
<td>(0.54)</td>
<td>(0.86)</td>
</tr>
</tbody>
</table>

*Statistically significant at 0.05 level.*

1. **Steel tubes and pipes industry** \(N = 32\)

   a) Minimum value of \(Z\) in the sample = Rs. 15 lakhs.
   
   b) Maximum value of \(Z\) in the sample = Rs. 171,73 lakhs

   c) **Critical turning point of the quadratic curve estimated** = Rs. 206,25 lakhs

2. **Diesel engines and parts industry** \(N = 20\)

   a) Minimum value of \(Z\) in the sample = Rs. 10.6 lakhs
   
   b) Maximum value of \(Z\) in the sample = Rs. 792,79 lakhs

   c) **Critical turning point of quadratic curve estimated** = Rs. 137,500 lakhs.

**Data Source : Director of Members, AIEI**
### TABLE 16

Equation 1

\[ E = a + b_1 (ZK) + b_2 (ZK)^2 + b_3 (NP) + i \]

\( ZK = \text{Firm level capital employed (normalized)} \)

1982-83

<table>
<thead>
<tr>
<th></th>
<th>( \hat{a} )</th>
<th>( \hat{b}_1 )</th>
<th>( \hat{b}_2 )</th>
<th>( \hat{b}_3 )</th>
<th>( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( E_T )</td>
<td>27.6</td>
<td>0.50*</td>
<td>-0.00025</td>
<td>-7.48</td>
<td>0.23</td>
</tr>
<tr>
<td></td>
<td>(2.13)</td>
<td>(1.40)</td>
<td>(0.75)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. ( E_D )</td>
<td>285.5</td>
<td>0.78</td>
<td>-0.000098</td>
<td>-37.2</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>(1.37)</td>
<td>(0.84)</td>
<td>(0.94)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Statistically significant at 0.025.

1. Steel tubes and pipes industry. \( N = 32 \) firms.
   a. Minimum value of \( Z \) in the sample = Rs.3.56 lakhs
   b. Maximum value of \( Z \) in the sample = Rs.54.26 lakhs.
   c. Critical turning point of the quadratic curve estimated = Rs.3616 lakhs.

2. Diesel engines and parts industry = \( N = 20 \) firms.
   a. Minimum value of \( Z \) in the sample = 5.25 lakhs.
   b. Maximum value of \( Z \) in the sample = Rs.254,76 lakhs.
   c. Critical turning point of the quadratic curve estimated = Rs.208,92 lakhs.

Data source: Directory of Members, AIEI.
and Diesel engines and parts industries. Although the parameters estimated for 'b1 and b2' are of positive and negative signs respectively for the two industries, they are marginally statistically significant in case of the semi-log estimations for the Diesel engines industry sample only. In case of Steel tubes and pipes industry, as expected, the results are not significant. This could be because, as discussed in Chapter III.II the export relevance of small firms in the industry is minimal. Small firms in the industry are at a disadvantage to export because of the nature of the product which is bulky and due to high costs involved in the domestic and overseas transport.

Table 17 shows the results estimated for equation II, for the Hand small and cutting tools industry sample. In comparison to the aggregate industry sample, this estimated equation has an additional independent variable, (NP). The results are quite similar to the results obtained for the aggregate industry sample, but are more statistically significant. In addition the equation II.ii, estimated, where export propensity is used as the dependent variable is statistically significant with significant 'F' values and even higher R**2. 12

The estimated coefficient of the import intensity

12 The higher statistical significance at the disaggregate industry sample, shows that heteroskedasticity will tend to be more at the aggregate industry sample, where firms belonging to different engineering industries are put in one sample. In such case, obviously, the external (or residual) effects on the firms exports be more random.
Table 17: Equation II.1

The Disaggregated Industry Samples: 1983/84

\[ E, \ln E = a + b_1 (OSR) + b_2 (OSR)^2 + b_3 (X) + b_4 (\frac{\text{NP}}{S}) + b_5 (\text{NP}) + i \]

<table>
<thead>
<tr>
<th></th>
<th>( a )</th>
<th>( b_1 )</th>
<th>( b_2 )</th>
<th>( b_3 )</th>
<th>( b_4 )</th>
<th>( b_5 )</th>
<th>( R^2 )</th>
<th>( F )</th>
</tr>
</thead>
<tbody>
<tr>
<td>II.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II.1.a E 2.24</td>
<td>5917</td>
<td>-210</td>
<td>-2433.</td>
<td>-3105</td>
<td>-0.96</td>
<td>0.43</td>
<td>10.6</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>(5.3)</td>
<td>(4.5)</td>
<td>(0.5)</td>
<td>(0.25)</td>
<td>(1.48)</td>
<td>**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II.1.b \ln E 4.24</td>
<td>0.91</td>
<td>-0.041</td>
<td>-1.66</td>
<td>-15</td>
<td>-0.25</td>
<td>0.20</td>
<td>3.66</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>(1.81)</td>
<td>(1.8)</td>
<td>(0.44)</td>
<td>(2.4)</td>
<td>(1.79)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ E, \ln E = a + b_1 (OSR) + b_2 (X) + b_3 (\frac{\text{NP}}{S}) + b_4 (\text{NP}) + i \]

<table>
<thead>
<tr>
<th></th>
<th>( a )</th>
<th>( b_1 )</th>
<th>( b_2 )</th>
<th>( b_3 )</th>
<th>( b_4 )</th>
<th>( k^2 )</th>
<th>( F )</th>
</tr>
</thead>
<tbody>
<tr>
<td>II.1.w ( \left( \frac{E}{S} \right) )</td>
<td>0.37</td>
<td>-0.014</td>
<td>-0.22</td>
<td>-0.86</td>
<td>-0.002</td>
<td>0.25</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td>(1.9)*</td>
<td>(1.84)**</td>
<td>(2.8)*</td>
<td>(0.25)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The figures in the bracket are 't' values.

\( N = 76 \)

* Significant at 0.025 level

** Significant at 0.01 level.

*** Significant at 0.10 level.
variable, (IM/S), is of negative sign but statistically significant. This result gives support to the argument that under the given domestic market characteristics, firm level imports and exports could be negatively associated. But this can not be generalized, as there is no consistency in the sign of the parameter estimated at the aggregate and disaggregate industry level estimations.

The estimated coefficient for variable, (NP), which is taken to capture firm level multi-product diversification, is of negative sign and statistically significant at large. If we go back to Tables 15 and 16 similar result occurred with respect to the variable (NP) in case of Steel tubes and pipes and Diesel engines and parts industries. This result supports the hypothesis that firm level multi-product diversification would result in the loss of economies of specialization in exports and in turn, lower exports.

The results obtained for equations I and II are, more or less, consistent both at the aggregate and disaggregate industry level. This facilitates to derive some generalizations regarding the primary relationship between firm size and export behaviour. From the above results, the major generalizable conclusion would be that it is the market structure conditions of the industry which determine the revealed exports of firms. In a long tailed market structure of an industry, large and small firms within the industry face differential market structure pressures. Larger is a firm higher would be it's domestic monopoly power. And under the existing domestic
market conditions, higher the domestic market power higher is the relative profitability of domestic sales in comparison to exports and consequently, lower the propensity to export. Under a fixed production capacity, large firms, due to their higher domestic market power, could charge higher prices in the domestic market than the small firms. Consequently, their relative profitability of exports in comparison to domestic sales would be lower.

IV.III.III. The Equation Three. The Specification.

The equation III, captures, apart from the domestic market structure arguments in terms of the implications of efficiency or cost differences of firm size strategic size groups on the their status in the domestic market (see Chapter III.1.1) and also the supply side factors like labour and capital intensity.

III. \( E, (E/S) = a + b_1 (ZS) + b_2 (X) + b_3 (ZS)(X) \)
\( + b_4 (LS/V) + b_5 (ZS)(LS/V) + b_6 (K/V) \)
\( + b_7 (ZS)(K/V) + b_8 (DP) + i \)

III.1. \( [dE/d(ZS)] = b_1 + b_3 (X) + b_5 (LS/V) + b_7 (K/V) \)
\( b_3 < 0 ; b_5 > 0 ; b_7 0 . \)

III. 2. \( (dE/dX) = b_2 + b_3 (ZS). \)
\( b_2 < 0 ; b_3 7< 0 . \)

III. 3. \( [dE/d(LS/V)] = b_4 + b_5 (ZS). \)
\( b_4 > 0 ; b_5 7< 0 . \)

III. 4. \( [dE/d(K/V)] = b_6 + b_7 (ZS). \)

As briefly discussed in case of equation II, firm size dimension may cause non-monotonicity in the effect of the various variables on firm level exports.
Equation III captures the possibility of non-linearities in the causality specified. There might be critical turning points in the firm size variable where the effect of the variables like firm level relative efficiency, labour and capital intensity on firm level exports and export propensity changes.

In III.2 if \( b2 \) and \( b3 \) negative, it would imply reduction in inefficiency after a critical point in size, results in proportionately higher exports. This result can be expected on the basis of possible scale economies and certain technological advantages of larger firm size in exports. On the other hand the most likely outcome could be that \( b2 < 0 \) and \( b3 > 0 \) (or \( b2 > 0 \) and \( b3 > 0 \)). This would mean that after the critically large firm size, it is the relatively inefficient firms which are more export oriented. After the critical point, at a given large size, a relatively inefficient firm might be more export oriented than a relatively efficient firm of the same size. As discussed in Chapter III, in the domestic market it may be the relatively efficient firms among the large oligopolists, who are the market leaders and are the ones who can impose the domestic market shares terms on the rest of the large firms. As a result, the relatively inefficient large firms might be pushed to export markets. This result could be an outcome of the oligopolistic rivalry of large firms in the domestic markets. The possibility of this result can also be
observed from the signs of the parameters of 'b1 and b3' in III. 1.

In III.3, 'b4 and b5' can be expected to be positive on the basis of the argument that firms of any size that adopt labour intensive techniques can reap the country's comparative advantage and be able to export. On the other hand, it can be expected that 'b4' is positive and 'b5' is negative on the basis of the argument that after a critically large firm size, increase in labour intensity need not result in higher exports if the demand side factors like domestic monopoly power neutralizes the supply side advantage. After the critical size, increase in labour intensity might be counter productive to exports. This is because increase in labour intensity at very large firm size may result in large degree of x-inefficiency in labour management and utilization and consequent decline in overall efficiency and exports. This relationship or the outcome, in labour intensity's effect on overall efficiency and in turn on exports after the critical size, has to be seen in terms of the extent of contribution of labour intensity on the overall efficiency. This is necessary to derive consistency in the argument put forward regarding the possible positive relationship between relative inefficiency and exports after the critical turning points. Secondly the critical turning points in III.2 and III.3 could be different depending on the effect of (LS/V) and (K/V) on (X).
The signs of the coefficients 'b6' and 'b7' on the facet, can be expected to be negative on the basis of the argument that capital intensive techniques result in the deviation of production processes from the country's comparative advantage. Increase in capital intensity at any firm size should cause decline in a firm's ability to reap the country specific comparative advantage. But on the other hand 'b6' could be positive and 'b7' negative on the basis of the argument that certain level of capital intensity is necessary for a firm to be able to export. This implies that a threshold size of technological sophistication is necessary to produce the exportable products on a vertical product differentiation plane.

IV.III.IV. The Results. Equation III.

IV.III.IV.A. The Aggregate Industry Sample.

The results for equation III for the aggregate industry sample (1985/86) are as follows;

III.a. \[ E = -194 - 2.9 (ZS) - 1830 (X) + 893 (LS/V) \]
\[ + 159 (K/V) + 106 (ZS)(X) + 149 (ZS)(LS/V) \]
\[ + 159 (K/V) + 106 (ZS)(X) + 149 (ZS)(LS/V) \]
\[ (2.06) (0.21) (0.8) \]
\[ - 23 (ZS)(K/V) + 652 (DP) \]
\[ (2.3) (1.47) *** \]
\[ R^2 = 0.26 \quad F = 4.09 \]

Multiple correlation coefficient = 0.51

III.b. \[ (E/S) = 0.028 - 0.0057 (ZS) - 0.516 (X) \]
\[ (1.4) (3.07) * \]
The results of III.b with export propensity as the dependent variable are statistically more significant than the results of III.a where absolute exports are used as the dependent variable. In the following analysis the results of III.b are interpreted. By taking the first order derivatives III.b with respect to each of the independent variables, the shape of the curves and the critical turning points can be observed.

III.b.1. \( \frac{d(E/S)}{d(ZS)} = -0.005 + 0.0978(X) - 0.0901(LS/V) - 0.003(K/V) \)

III.b.2. \( \frac{d(E/S)}{d(X)} = -0.516 + 0.0978(ZS) \).

The turning point of the curve = \((5.27 \times 4332)\)

\( (ZS)\) = Rs. 22855 lakhs.

III.b.3. \( \frac{d(E/S)}{d(LS/V)} = 0.492 - 0.09(ZS) \).

The turning point of the curve = \((5.46 \times 4332)\)

\( (ZS)\) = Rs. 23681 lakhs.

III.b.4. \( \frac{d(E/S)}{d(K/V)} = 0.0193 - 0.0033(ZS) \).
The turning point of the curve = (5.84 * 4332)

\[(ZS)k^* = Rs.25335\text{ lakhs.}\]

The statistical significance of the coefficients, whose values are significantly different from zero, of the interactive terms reconfirms the non-monotonicity (non-linearity) hypothesis regarding the relationship between firm size and exports. The critical turning points of the relationships estimated with respect to \(X\), \((LS/V)\), and \((K/V)\) are, more or less, at a close range, \((5.27, 5.46\text{ and } 5.84)\).\(^{13}\) But it is interesting to take into notice that \((ZS)l^* < (ZS)k^*\), which will be discussed later.

The result of III.b.2 can be interpreted that until the firm size of Rs.228 crores sales turnover, increase (or decrease) in firm level inefficiency results in lower (or higher) export propensity.\(^{14}\) After the critical firm size of Rs. 228 crores sales turnover, increase (or decrease) in firm level inefficiency results in higher (lower) export propensity. In other words after the critical size, among the large firms, the firms which are more inefficient are more export oriented than the relatively more efficient ones at a given size.

\(^{13}\) It is important to keep in mind, here, the sample consists of only large and medium firms; the size distribution ranging from a minimum of Rs.43 crores to a maximum of Rs.4529 crores.

\(^{14}\) The estimated relationship between \((ZS)\) and \((X)\) in the same sample is as follows:

\[
\log X = -0.37 - 0.10 \log(ZS) - 0.63(DP)
\]

\((1.47)***
\( (3.47)*)
\]

\[R^2 =0.14, F=7.9, N=100.\] Figures in the brackets are \(t\) values. *Significant at 0.025 level. Significant at 0.10 level.
This result can be explained by the argument regarding the possibility of the outcome in the export behaviour of large firms out of their ologopolistic behaviour in the domestic market. As discussed in Chapter III.1 and in section IV.III.III of this Chapter, the relatively efficient large firms can be the market leaders in the domestic market and would be able to impose the domestic market shares on the relatively inefficient large firms. The relatively inefficient large firms which have to accept their domestic market shares determined by the leader firms might be pushed to undertake exports. This possibility may arise because, at the imposed domestic market shares, the relatively inefficient large firms may end up with higher excess capacity. The excess capacity, in turn, may allow these firms to undertake exports at prices just covering variable costs. The export activity, in turn, might enable these relatively inefficient large firms to compete in the domestic market (at a later stage) by facilitating fuller capacity utilization (and resultant lower average costs) and also by giving more access to imports. But this is a possible dynamic outcome of export activity which will be observed in the following chapter.

The result of III.b.3., for the labour intensity variable implies after the critical size of Rs.23601 lakhs sales turnover, increase in firm level relative labour intensity, among the firms within the size group, results in lower export propensity. This
result supports the argument that at a very large firm size, relatively higher labour intensity does not necessarily lead to higher exports. Relative higher firm level labour intensity does not necessarily would mean higher firm level comparative (advantage) efficiency in exports. What matters might be the type of labour that is chosen and the extent it is utilized in determining a firm's ability to reap the country's comparative advantage. Secondly, the supply side factors which determine relative advantages in exports are less significant at very large firm size group in determining their relative export orientation. At this size group it would be the relative domestic market power which is the principal determinant of revealed exports. Apart from this, as discussed in Chapter III, large firms may be highly x-inefficient in management of labour and consequently it may result in lower ability to realize the relative advantage in higher relative labour intensity.

The result of III.b.4 is similar to the above result. But the noticeable aspect of the result is that the critical turning point in firm size, (ZS)k* is the highest of all the others at Rs. 253 crores sales turnover. Until the firm size of Rs.253 crores increase in capital intensity is contributing positively and after the critical point negatively to export propensity. The noticeable aspect of the results is that (ZS)k* > (ZS)l* which is counter-intuitive. This is because given the view that India's comparative
advantage is in labour intensive techniques, in this sample (consisting of only medium and large firms), relative capital intensity is contributing positively to export propensity and that to until larger firm size than in the case of the relative labour intensive variable. This result can be explained by two possible reasons; i) there may be scale advantages in relative capital intensive operations or ii) the capital intensive factor could be causing exports due to excess capacity possibilities. As discussed in Chapter III.I, higher the capital intensity higher would be the possibilities of excess capacity due to domestic demand fluctuations. Excess capacity in the large firms could be a result of domestic oligopoly rivalry also. Consequently, higher the excess capacity among the large firms higher their need to export (possibly at variable cost pricing) to achieve fuller capacity utilization.

IV.III.IV. The Results for Equation III

IV.III.IV.B. The Disaggregate Industry Sample

(1983/84)

Unlike in case of the aggregate industry sample, the disaggregate industry sample for Hand, small and cutting tools industry consists of very large and small firms (see Table 6), which has significant implications on the critical turning points. Secondly, to recapitulate, the aggregate industry sample consists of firms belonging to a wide variety of engineering industries and as result the heterogeneity
in the type of labour and capital employed and the technological conditions across firms would be very high. In the present case of the disaggregate industry sample, the degree of heterogeneity would be a lot lower which gives a higher reliability to the interpretations of the results. Apart from this, in the present case the variable \( X \) and the variables \( \text{LS/V} \), and \( \text{K/V} \) can be expected to be highly correlated.

Although the efficiency aspects at the disaggregate industry level will be empirically examined more rigorously in the following chapter, the results with the variable \( X \) in the present case should help us to observe the reliability of the results at the aggregate industry sample. As expected, in the estimation of the equation III for the present sample the variable \( X \) has caused multi-collinearity. In order to avoid the multi-collinearity problem, the result with \( X \) is estimated separately.

III.b. \( \frac{E}{S} = 0.38 - 0.0083\text{ZS} - 0.359X \)  
\( (1.98)^* \quad (2.9)^* \)  
\( + 0.0014 \text{ZS}X \)  
\( (1.61)^{***} \)

R\(^2 = 0.17 \quad F = 5 \quad N = 76 \)

The figures in the brackets are 't' values.

* Significant at 0.025 level.

*** Significant at 0.05 level.

\[ \frac{d(E/S)}{dX} = -0.359 + 0.0014(\text{ZS}) \]

The critical turning point, \( \text{ZS}^{x*} = \text{Rs. 1641 lakhs} \).
The signs of the parameters are similar to the results obtained for the aggregate industry sample. Obviously, the turning point of \((ZS)x^*\) is far lower than the previous case. The present result indicates that until the firm size of Rs.16.4 crores sales turnover firms which are relatively more efficient are able to export at higher propensity. After the critical size, it is the relatively inefficient firms which are more export intensive. This result reconfirms the argument regarding the implications of domestic market structure on the export behavior of different size groups. The firms below the critical size face highly competitive conditions in the domestic market. As discussed in Chapter III.I, the S&M firms within the size group which adjust to the domestic conditions by being efficient producers would tend to branch out into the export markets for their survival and growth. On the other hand, above the critical size, the firms within the size group which are relatively more efficient could achieve higher domestic market power. Consequently their propensity to export would decline. As observed earlier, the relatively inefficient producers within the size group would be pushed to export markets by the domestic market leaders.

III.a. \(E = 1190 + 26.5(ZS) + 3169(LS/V) - 830(K/V)\)

\[(4.0)^* \quad (0.64) \quad (1.46)^{**}\]

\[-147(ZS)(LS/V) + 27(ZS)(K/V)\]

\[(9.7)^* \quad (11.6)^*\]

\(R^{**2} = 0.80 \quad F = 58\)
Multiple correlation coefficient = 0.8

III.b. \((E/S) = 0.34 - 0.0005(ZS) - 0.606(LS/V)\)
\((1.83)\)** \((2.76)\)*
+ 0.016 \((K/V)\)
\((0.65)\)
+ 0.0001\((ZS)(LS/V) + 0.000005(ZS)(K/V)\)
\((1.55)\)*** \((0.056)\)

\(R^{2} = 0.18\)  \(F = 32\)  \(N = 76\)
Multiple correlation coefficient = 0.43

The figures in the brackets are 't' values.
* Statistically significant at 0.025 level.
** Significant at 0.05 level.
*** Significant at 0.10 level.

In the above results the estimated parameters associated with capital intensity variable are statistically significant only in III.a where the absolute exports is the dependent variable. In contrast the estimated parameters associated with labour intensity variable are significant only in III.b where export propensity is the dependent variable. This could be because given the size distribution in the present sample which consists of both very small and large firms, the specification of the equation is incomplete. There might be a certain threshold size, firms have to reach in order to export. Very small firms which operate with screwdriver and unsophisticated technology may not be able to produce the exportable products (vertically differentiated products within an industry). This would mean two critical
turning points in the specification. In order to test this argument the equation is respecified to capture the possible turning points. Before going into the results of the respecified equation the following analysis gives a brief interpretation to the statistically significant part of the above results.

III.a.4. \( \frac{d(E)}{d(K/V)} = -803 + 27(ZS) \)

The turning point \( (ZS)k^* = (307 \times 640) \)

\[ = \text{Rs.}196.7 \text{ lakhs} \]

III.b.3. \( \frac{d(E)}{d(LS/V)} = -0.606 + 0.001(ZS) \)

The turning point \( (ZS)l^* = (606 \times 640) \)

\[ = \text{Rs.}3878 \text{ lakhs} \]

The signs of the estimated parameters in the above results are opposite to those obtained in case of the aggregate industry sample. This could be, as argued above, because of the significant difference in the firm size distributions in the two samples.

The results indicate that the capital intensity factor is contributing negatively to absolute exports until the critical size of Rs.2 crores sales turnover. After the critical firm size it is positively associated with exports. The positive association can be straightforwardly explained. Because the dependent variable is absolute exports, the capital intensity is operating as the scale effect. Obviously the absolute exports of larger size firms would be more than smaller firms.

The labour intensity variable is negatively associated with export propensity until the critical
size of Rs.3B crores and positively above the critical size. The explanation for the result can be derived from the way labour intensity is measured. As discussed in section I of this chapter, labour, here, is taken in terms of salaries and wages paid rather than number of people employed. Salaries and wages measure puts the composition of skilled and unskilled labour into a single basket. Skilled labour and professional employees are generally paid higher wages than unskilled labour and family members employed (in relation to intensity of man hours put). As a result higher wages and salaries bill would imply either higher content of skilled labour or larger number of unskilled labour. Based on the argument, the result can be interpreted that among the S&M firms below the critical size, the comparative (advantage) efficiency in exports across firms might be in unskilled labour intensity or in other words the relative advantage is with respect to labour paid at lower wage rate. After the critical size the relative advantage among the firms in the size group could be in skilled labour intensity.

But in case of the results with the aggregate industry sample it has been argued that at a very large firm size there would be negative economies in labour intensity which is not shown by the present result. This might be captured in the estimation of the respecified equation, the results for which are as follows.
III.b. \((E/S) = 0.33 + 0.00016(ZS) - 0.616(\text{LS/V})\)

\[\begin{align*}
(0.34) & \quad (2.67)^* \\
+0.034(\text{K/V}) +0.0031(\text{ZS})(\text{LS/V}) & \quad (1.32) \quad (1.6)^{**} \\
- 0.00122(\text{ZS})(\text{K/V}) & \quad (2.15)^* \\
- 0.0000032(\text{ZS})^{**2} (\text{LS/V}) & \quad (2.08)^* \\
+ 0.00000096(\text{ZS})^{**2} (\text{K/V}) & \quad (2.2)^* \\
\end{align*}\]

\(R^{**2} = 0.24\) \(F = 3.08\) \(N = 76\)

Multiple correlation coefficient = 0.49

The figures in the brackets are 't' values.

* Statistically significant at 0.025 level.

** Significant at 0.05 level.

***. Significant at 0.10 level.

The results of the above equation are statistically far more significant than the previous results, with higher 'F', 't' values and \(R^{**2}\). This equation was estimated with absolute exports also as the dependent variable. Since it is statistically less significant it is not presented.

The statistical significance and the respective signs of the estimated parameters support the argument regarding the possible two turning points in the non-monotonic relationships. The partial derivatives with respect to the variables and the critical turning points are as follows:
III.b.3. $\frac{d(E/S)}{d\text{LS}/V} = -613 + 0.003(ZS) - 0.000032(ZS)^2$

The turning point at the minimum,

Min $\langle ZS \rangle^* = (483 \times 640) = Rs.3091$ lakhs

The turning point at the maximum,

Max $\langle ZS \rangle^* = (487 \times 640) = Rs.3118$ lakhs

III.b.4. $\frac{d(E/S)}{d(K/V)} = 0.034 - 0.0012(ZS) + 0.0000096(ZS)^2$

The turning point at the minimum,

Min $\langle ZS \rangle^* = (12.4 \times 640) = Rs.79.5$ lakhs

The turning point at the maximum,

Max $\langle ZS \rangle^* = (1264 \times 640) = Rs.7958$ lakhs

The signs of the parameters and the critical turning points of the curves estimated are subject to very interesting implications. From III.b.3 it can be seen that increase in labour intensity until the firm size of Rs.3091 lakhs sales turnover, results in lower export propensity. Between the firm size range of Rs.3091 lakhs and Rs.3110 lakhs increase in labour intensity is positively associated with export propensity. And after the critical size it is again negatively associated with export propensity. The results imply that comparative (advantage) efficiency in labour intensity appears to be most effectively utilized at the firm size of Rs.31 crores sales turnover.

Secondly the explanation for the negative association below the firm size of Rs.30.9 crores sales turnover can be derived, as before, from the way the labour is measured. The firms below the critical size may have
comparative (advantage) efficiency in employing labour at lower wages and skills. Furthermore, within this size group those firms which are able to realize more value-added for a rupee spent on labour input are able to export at higher propensity than the others. As argued in Chapter III.III, the small firms which are run by owner-managers and family members tend to put highly intensive effort and tend to be very x-efficient. As a result these firms realize higher output for given levels of inputs and would be able to produce exportable products, cost-efficiently. As far as the negative association after the critical size of Rs.31 crores is concerned the explanation of x-inefficiency in the utilization of labour at larger firm size may be more valid than the unskilled and low-waged labour argument put forward in case of the small firms. This is because larger firms are generally run by professional managers and employ organized and skilled labour at higher wages.

In case of III.b.4, the results indicate that until the firm size of Rs.79.5 lakhs increase in capital intensity is positively associated with export propensity. This result supports the technological threshold size argument in relating firm size and exports. Capital intensity variable captures the technological level of a firm and also the size dimension. The firms within the size group below the critical size of Rs. 79 lakhs, which operate with lower capital intensity would tend to operate with outdated
and crude technology and as a result may not be able to produce exportable products.

Between the firm size range of Rs.79.5 lakhs and Rs.7,985 lakhs export propensity and capital intensity are negatively associated. In this size range comparative advantage in lower capital intensive production processes is in operation. These results suggest that after reaching the technological threshold size, firms which operate with lower capital intensive techniques are able to export more effectively. Above the critical size of Rs.7985 lakhs, increase in capital intensity, within the size group, is contributing positively to exports. This could be because the firms within the group which are more capital intensive might have certain technological advantages in exports. On the other hand, as argued in case of the results of equation II and also the results with respect to \( \langle X \rangle \) in equation III, the larger firms which are more capital intensive might be more prone to excess capacities due to domestic oligopoly rivalries and also domestic demand fluctuations. Consequently these firms would tend to branch out into exports.

The notable outcome of the above results is that there is a technological threshold size which firms have to reach to be able to produce exports and to be effective exporters. Secondly, under the existing conditions there appears to be a size range where the domestic comparative advantage in relative factor endowments is
effectively reaped. But one of the puzzling aspects of the results is that between the firm size range of Rs. 79 lakhs and Rs. 3091 lakhs sales turnover, increase in both capital and labour intensity is negatively associated with export propensity. One possible explanation for this could be that the efficiency factor, in the size group might be the most predominant determinant of exports. In other words, those firms within the size group, which derive maximum output at lowest possible expenditure on the inputs, capital and labour, could be the most effective exporters compared to other firms belonging to all size groups. The efficiency aspect will be examined explicitly in the following chapter.

IV.V. The Possible Generalizations.

The results for equations II and III are, more or less, consistently similar both at the aggregate and the disaggregate industries levels. The generalizable observation is that exports decline proportionately as firm size increases and after a critical large firm size the relationship is negative. But the results of equation III show that this relationship operates only after a critical (technological) minimum threshold size is reached by firms. Although the concept of the critical minimum size is generalizable, but the critical size observed in the results is not. This is because the critical size is established with the sample of firms belonging to a specific light engineering industry. The basic explanatory factor for
the non-monotonic relationship between firm size and exports is derived from the domestic market structure conditions. Under the characterized market structure of the industry, large and small firms within the industry face differential domestic market structure pressures, which determines their respective export behaviour. This is generalizable for the engineering industry as a whole, to a large extent.

IV.VI. The Temporal Aspects.

The following analysis of the temporal aspects will help not only to check whether the relationship estimated between firm size and exports at cross section series holds over a time period but also to test some of the arguments regarding dynamic economies. The exercises based on the temporal firm level data can be useful to test for the generalisability and further support for some of the previous results obtained. The analytical arguments for the specification of the following equations are, more or less, similar to the ones in case of equations I and II.

The variables capturing the temporal aspects represent a six year period of 1978/79 to 1983/84.

The Notations of The Variables.

\( E_t \) = Exports at period 1983/84.
\( (E/S)_t \) = Export propensity at period 1983/84.
\( (ZS)_t \) = Firm size at period 1983/84.
\( (ZS)_0 \) = Firm size at the base period 1978/79.
GE = Growth rate of exports.
GK = Growth rate of total capital employed.
GDS = Growth rate of domestic sales turnover.
GIM = Growth of firm level imports of raw materials and components.
CE = Cumulative Exports from 1978/79 to 1983/84.
SE = Firm level scale economies index, based on Christensen and Green (1976):

$$ SC = \left[ 1 - \left( \frac{\Delta \log C}{\Delta \log V} \right) \right], $$
where

- \( C = \) total costs, \( (LS + D + M) \)
- \( V = \) the output, value-added

SC > 0 implies positive scale economies.
SC < 0 implies diseconomies of scale.

One of the possible drawbacks of the measure SC is that depreciation figures are taken to represent the present value of capital costs in measuring total costs. The depreciation figures are subject to incorrectness, as they are influenced by the tax provisions and a firm's capital-raising strategies. But since it is intended to represent a relative measure across firms, one can assume these biases are uniform across firms in the sample.

The variables GK and GDS capture facets of the growth of firm size. The variable CE, cumulative exports, capture the possible dynamic economies of the learning by doing type in export activity.
IV.VI.I The Data.

Sample III.

The empirical exercises for the temporal aspects are done with a sample of firms at the aggregate industry classification of the engineering industry. Times series data for 71 firms is collected for the period of 1978/79 to 1983/84. The basic characteristics of the firm size distribution in the sample is shown in Table 18. As obvious in the table, the sample consists of only large and medium sized firms.

IV.VI.II. The Specification of The Equation IV.

IV.1. Eq. \( E_t = a + b_1 ZS_t + b_2 GDS + b_3 (GK) + b_4 (CE) + b_5 (IM/S)_{t-3} + b_6 (SC) + b_7 (DP) \) + i

\( b_1 < 0; b_2 \geq 0; b_3 \leq 0; b_4 \geq 0; b_5 \geq 0; b_7 \leq 0. \)

The expected sign for \( b_1 \) is obvious from the results obtained for the equations I and II. The coefficient \( b_2 \) can be expected to be positive if there is a scale effect of access to large protected domestic market, facilitating exports by causing scale economy advantages as argued by Krugman (1984). The scale effect turns domestic sales and exports into complimentarities. On the other hand, it can be negative if exports and domestic sales are substitutes. Secondly, it could be negative if higher domestic market performance, from the market structure argument, results in lower incentive to export. This is expected, as argued in
### Table 18: Characterisation of Firm size Measures - Sample 3:
The Time series Data of the Aggregate Industry
Rs. Lakhs

<table>
<thead>
<tr>
<th></th>
<th>1978/79</th>
<th>1983/84</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Total Sales</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Minimum Value</td>
<td>1180</td>
<td>3300</td>
</tr>
<tr>
<td>b. Maximum Value</td>
<td>67100</td>
<td>134000</td>
</tr>
<tr>
<td>c. Coefficient of variance</td>
<td>140</td>
<td>133</td>
</tr>
<tr>
<td>d. Standard deviation</td>
<td>8.46</td>
<td>6.3</td>
</tr>
<tr>
<td><strong>2. Total Capital Employed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Minimum Value</td>
<td>220</td>
<td>420</td>
</tr>
<tr>
<td>b. Maximum Value</td>
<td>54800</td>
<td>99600</td>
</tr>
<tr>
<td>c. Coefficient of variance</td>
<td>180</td>
<td>149</td>
</tr>
<tr>
<td>d. Standard deviation</td>
<td>39.4</td>
<td>38.9</td>
</tr>
<tr>
<td><strong>3. Valu Added</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Minimum value</td>
<td>326</td>
<td>931</td>
</tr>
<tr>
<td>b. Maximum value</td>
<td>28921</td>
<td>55027</td>
</tr>
<tr>
<td>c. Coefficient of variance</td>
<td>138</td>
<td>195</td>
</tr>
<tr>
<td>d. Standard Deviation</td>
<td>15.4</td>
<td>16.2</td>
</tr>
</tbody>
</table>

N = 71

* C and d are the parameters of the normalized measures.
Chapter III.I and III.II, because in an inward oriented regime exports are based on the domestic demand and market structure conditions. In such a case exports would be based on the residual terms. Furthermore as argued in Chapter III.II., because of significant differences in the nature of demand between the domestic and export markets, exports may require large degree of product differentiation reducing the complimentarity between exports and domestic sales.

The causality between exports and growth rate of total capital (GK) employed could operate both ways, especially if exports operate as a source of growth and also dynamic economies. By taking the causality as it is specified here, b3 can be expected to be negative, if GK captures (a facet) growth in firm size. When a firm grows in size it might increase it's domestic market power and profits and consequently it's incentive to export declines. On the other hand, if export oriented firms are growing faster and that to from a lower base, with a commitment to exports the relationship could be other way round. But this is more of the causality operating other way round.

The cumulative exports variable, CE, is taken to capture the dynamic economies in exports activity explicitly. If these economies are strong the coefficient b4 is expected to be positive and significant. The expected sign of the coefficient b5 with respect to the variable (IM/S)\textsubscript{t-3} is based on the similar argument regarding the (IM/S) variable in
Equation II. But the variable, here, is taken with a three year period lag under the hypothesis that the possible positive effects of imports on exports might be operating with a time lag on a cyclical basis. If so, $b_5$ is expected to be positive.

As argued in Chapter III. II and in case of the variable GOS, under the given nature of the domestic demand and market size conditions, if the scale economies advantages towards exports are insignificant, the coefficient $b_6$ associated with the scale economies index is expected to be insignificant.

IV.2. $GE = a + b_1 (ZS) + b_2 (GDS) + b_3 (GK) + b_4 (GIM) + b_5 (SC) + \epsilon$

$\forall b_1 \geq 0; b_2 \geq 0; b_3 \geq 0; b_4 \geq 0; b_5 \geq 0.$

In the above equation the dependent variable itself is a growth variable. As a result, the parameters, $b_2$, $b_3$, and $b_4$ turn out to be elasticities. The underlying reasoning for the expected signs of the coefficients is similar to the common variables in Equation IV.1.

IV.VI.III. The Results. Equation IV.

As mentioned earlier, when the variables represent the temporal dimensions, the causalities are not straightforward. The causalities might be operating both ways, especially if there are significant dynamic economies in export activity, as theorized in Chapter III. One has to take this into account, while interpreting some of the following results.
IV.1.a.  \( E_t = 82 - 21.3 (ZS)_t - 0.58 (GDS) + 0.74 (GK) \)
\[
(2.02)^*  
(2.27)^*  
(2.2)^*  
\]
\[
+ 0.14 (CE) - 309 (IM/S)_t-3 + 51 (SC)  
(9.2)^*  
(0.64)  
(0.95)  
\]
\[
+ (49) (DP)  
(0.36)  
\]
\[R**^2 = 0.69 \] \[F = 20\]

**Multiple correlation coefficient = 0.83.**

IV.1.b.  \( \log E_t = 3.23 - 0.005 (ZS)_t - 0.002 (GDS) \)
\[
(0.08)  
(1.21)  
\]
\[
+ 0.004 (GK) + 0.0002 (CE)  
(1.8)**  
(2.78)*  
\]
\[
- 0.63 (IM/S)_t-3 - 0.54 (SC)  
(0.2)  
(1.56)**  
\]
\[
+ 0.42 (DP)  
(0.48)  
\]
\[R** = 0.27 \] \[F = 3.37\]

**Multiple correlation coefficient = 0.25**

IV.1.c.  \( (E/S)_t = 0.02 - 0.0037 (ZS)_t - 0.00005 (GDS) \)
\[
(2.93)^*  
(1.72)**  
\]
\[
+ 0.0004 (GK) + 0.00006 (CE)  
(1.35)  
(3.4)^*  
\]
\[
- 0.04 (IM/S)_t-3 + 0.0042 (SC)  
(0.75)  
(0.65)  
\]
\[
+ 0.011 (DP)  
(0.73)  
\]
\[R** = 0.23 \] \[F = 2.76 \] \[N = 71\]
Multiple correlation coefficient = 0.48

The figures in the brackets are 't' values.

* Statistically significant at 0.025 level.

** Significant at 0.05 level.

*** Significant at 0.10 level.

The statistically significant negative sign of the estimated coefficient of the firm size variable in the above results reconfirms the results of the equation I. The statistically significant negative sign of the estimated parameter of the variable of growth rate of domestic sales turnover, implies that higher the growth rate of firm level domestic sales turnover lower would be both absolute and export propensity of firms. This result gives further proof to the argument that under the existing domestic market conditions exports and domestic sales or activity are substitutes rather than complimentary. It was argued in Chapter III.II., (based on Linder's representative demand argument), that the nature of the domestic demand for many engineering products like Bicycles etc does not permit complimentarity between export and domestic activity. Secondly, the results also indicate that firms which are performing well in the domestic market, in terms of growth in their domestic sales turnover, have low propensity to export. This result gives further support to the interpretations of the results made for all the previous equations under the argument that it is the domestic market structure (conditions) pressures which
determine the relationship between the supply and demand side factors and exports through the firm size variable.

The above result reconfirms the interpretation made in case of the results for Equation III, that exports could be undertaken to overcome the expansion barriers in the domestic markets and also the leader and follower firms argument. For example, to recapitulate, among the large firms, the large firms which can not perform well in the domestic markets are observed to be more prone to export. Small firms as a group are observed to face expansion barriers in the domestic market. Since as they could grow or perform well in the domestic market they would more prone to export. Furthermore the result can also be interpreted that firm level exports, in general terms, are based on residual terms, rather than any long term commitment.

On the contrary to the above result, the variable of growth rate in total capital employed (GK), which is taken to represent a facet of growth in firm size, is positively associated with exports. The estimated coefficient of the variable is statistically significant in the cases of (a) and (b) where absolute exports and log of exports are used as dependent variables. The comparison of the estimated coefficients of (GDS) and (GK) indicate that they represent different facets of firm size growth. The growth in domestic sales turnover represents, mostly, a firms market power or performance in the domestic market, which is not necessarily the case with
the growth rate in the total capital employed. The result could be an outcome of the relationship between total capital employed and the incidence of excess capacity. As argued before, higher the growth in total capital employed (or capital intensity), higher would be the incidence of excess capacity. Higher the excess capacity higher could be the need to export. Secondly, if we look at the causality other way round, the firms which are exporting more might be able to achieve growth in terms of capital employed and exports might be functioning as a source of this kind of growth.

The statistical significance of the positive sign of the estimated parameter associated with the variable of cumulative exports (CE), indicates the presence of the dynamic economies in export activity. In a direct way, we can not say which size group is able to realize these economies, on the basis of the above result. But, since it is the firms at the lower down the size ladder which are more export intensive, one can say that these are the firms which are realizing these economies at a higher degree. This does not necessarily mean that a large firm at the same level of export propensity as a small firm, will be able to realize these economies at the same or higher (or lower) level. On the basis of the results, although we are not qualified to make any empirical observation regarding the above question, one can say the ability to realize these economies depends on the level of x-efficiency of a firm. Higher the efficient co-ordination between
different branches of a firm, higher could be the effective application of the feedback from the export activity.

The import intensity variable (IM/S), is taken with a three year time lag with a hope that firm level imports might be explaining exports with a time lag. This has not made any difference from the results obtained in equation II. Firm level imports are not explaining exports in any positive way. Thus the larger firms which have higher access to imports do not seem to have additional advantage in the revealed exports. (As a matter of qualification, higher access to imports appears to be causing lower propensity to export.)

The scale economies variable (SC) is not explaining exports significantly except in the case of semi-log estimations. In the semi-log estimations, the estimated coefficient is of negative sign, but statistically significant only at ten per cent. This implies that firms which are reaping these economies at relatively higher level are less prone towards exports. On the basis of this result along with the result associated with the variable GDS, one can say that (large) firms are not reaping scale economies advantage towards exports.

15 The variable is tried with two, four and five year time lags. The results are the same.

16 The average value of SC indices for the sample is 0.14 with a coefficient of variance of 595.

17 Panchamuckhi (1978) also obtained a negative association between scale economies and exports, pp 121-122.
IV.2. GE = - 46890 - 219 (ZS)o - 97 (GDS) + 448 (GK)

\[ \begin{array}{ccc}
(0.15) & (1.46)*** & (4.78)* \\
- 3.1 (GIM) + 1912 (SC) \\
(0.4) & (0.13)
\end{array} \]

\[ R^2 = 0.26 \quad F = 4.72 \quad N = 71 \]

Multiple correlation coefficient = 0.51

The figures in the brackets are 't' values.

* Significant at 0.025 level.

*** Significant at 0.10 level.

As mentioned earlier, the difference between the present and the previous equations is that in the present case the dependent variable is the growth rate of exports. These results reconfirm the results of the previous equation IV.1 with similar underlying explanations.