Chapter II

EXPORT SPECIFICATIONS

1. Macro Level Model Building

A careful survey of studies of international trade indicates that a large number of empirical models have focused their attention on the estimation of price and income elasticities of import and export demand of a country at aggregate level. The estimated elasticities are used, among other things, to examine a country's balance of payments (BOP) equilibrium and to suggest whether the country's currency devaluation would help in improving its BOP position. However, at industry level, the elasticities reflect the price competitiveness of the export product and provide a useful guide to understand the underlying export demand and supply structure of industry, which in turn, may be useful to generate export forecasts of the product under consideration.

As the elasticity estimates are important aids to policy formulation, the methods of estimation as well as the approaches to model specifications have assumed a great deal of importance over time. For our convenience, export models are classified basically into four types, namely, those which follow (a) Demand equation approach, (b) Supply equation approach, (c) Demand and supply equations approach or Complete system approach and (d) Neither demand nor supply
equation approach. The last category is also commonly referred to as 'Reduced form' or 'Turnover type' equation approach. These are discussed below seriatum.

Demand Equation Approach. A large number of empirical studies have followed a typical specification of the export (or import) demand of a country which is expressed as a function of relative prices (a ratio of the country's export price to that of its competitors) and the world income. For instance, Houthakker and Magee (1969, pp.111-125) estimated the price and income elasticities of export demand of various countries including India from the following model specification using the annual data for the period 1951-66:

\[ x^d_j = f \left( \frac{P_X_j}{P_W_j}, Y_W_j \right) \]

where \( x^d_j \) is demand for \( j \)th country's merchandise exports to all other countries in dollar terms, deflated by its import price index in the importing countries. \( Y_W_j \) is the index of GNP for all the countries importing from \( j \)th country, each weighted by its share in the total exports of country \( j \) with respect to a base year.

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PX_j is the index of jth country's export prices measured in the base year dollar terms.

PXW_j is a weighted index of export prices of other exporting countries, weights being assigned in terms of each exporter's base-year share in the importing country.

In particular for India, attempts were made in the past to estimate price and income elasticities of export demand by Murty and Sastry (1951), Dutta (1964), Da Costa (1965) and Marwah (1970) whose model specifications are also akin to the one mentioned above. Their estimates were obtained by employing data for different time-periods.\footnote{Peera reviewed the literature of export demand models for India. See N. Peera, "Econometric Estimates of India's Export Demand Parameters," \textit{Review of World Economics}, Band 115, No.2, 1979.} In a more recent study by Aggarwal (1984), a variant of equation (1.1) was used to estimate export demand for India; his export function includes the 'exchange rate' variable in the model in addition to the usual relative price variable and the 'index of industrial production of the rest of the world'. The last one was probably used as a proxy for world income or as an 'activity' variable.

Demand-side models typically assume that price elasticity of export supply of a country is infinite. In the absence of this assumption, the price elasticity estimated from the export-demand relationship may not be
claimed to be free from the influence of supply behaviour of country in adjusting to the world demand for its exports. Nevertheless, this assumption pre-supposes a priori a guess about the supply price elasticity, which could be as hazardous as guessing the demand price elasticity itself.¹/

However, Goldstein and Khan (1978, p.275) observe that such an assumption could be a reasonable approximation to reality in the case of import demand relationship of a small country which depends on world supply for its imports. The same authors note, "unless idle capacity exists in the export (domestic) sector, or export growth is subject to constant or increasing returns to scale, it is unlikely that an increase in world demand for a country's exports can be satisfied without any increase in the price of its exports (at least in the short run)".²/ This criticism has thus emphasised the need for an empirical verification of export supply relationships.

Supply Equation Approach. The export functions hypothesising the supply behaviour of a country assume that the world demand curves faced by the country are highly elastic (analogous to the

¹/See Harberger (1953) for such an assumption on the size of supply elasticity and Prais (1962, p.562) for criticism on the guesses about the size of price elasticity.

assumption of infinitely large supply price elasticity in
the case of an explicit estimation of export demand specification)
Furthermore, for a small country whose share in world exports
is small, the export price is assumed to be exogenously given
while determining its export supply function explicitly.

The other major explanatory variables included in the
supply function are domestic price or a ratio variable of
export price to domestic price reflecting export versus
domestic profitability, a shift variable like capital stock
or output which is supposed to reflect shifts in supply curve
over time and governmental export promotion efforts.

The hypothesis for inclusion of domestic demand
variable or a proxy variable like domestic price stems from
Kindleberger (1962, p.32) who argues that exports can be
developed in those products for which there is significant
and Hsu (1972, p.201) also share a similar opinion that
production and exports especially of manufactures require
the existence of a sizeable domestic market.

However, presence of large domestic demand may often
be a hurdle to export growth. Studies by Ball et al (1966),
Cooper et al (1970) and Arthus (1970) reveal that domestic
demand has a negative effect on export performance. On the
other hand, Wells (1964) has argued that domestic demand does
not affect exports of a country in the short run. In the cases of some products, domestic markets may form even a cushion against export slumps, as exports spread at home. This proposition is phrased as 'export spread hypothesis' (see Rao, 1971, p.52).

Some studies, especially, Halevi (1972) and Zilberfarb (1980) have included governmental incentives like export subsidy, import replenishment and exchange rate variations, in the 'effective' export price received by exporters while specifying the macro level export supply function for Israel. A similar attempt was made by Ali (1984) for India.¹ A typical export supply function of manufactures estimated by Zilberfarb using time-series data is as follows:

\[ X_s = f(\text{RP, IP, DDP, ...}) \]

where \( X_s \) = Export supply of manufactures measured at constant prices;

\[ \text{RP} = \frac{\text{ER, } P_x}{P_d} \]

where ER, the effective exchange rate measures the amount of Israel pounds that the exporter receives for each dollar of exports,

\( P_x \) = the index of export prices and \( P_d \) = the index of domestic prices;

DDP = an index of domestic demand pressure measured by the difference between potential and actual output, and

IP = the index of industrial production which is used to represent shifts in production possibility frontier over time following Halevi (1972) who used capital stock as growth variable.

The inclusion of DDP variable in addition to domestic prices in the function, as argued by the author, is owing to market imperfections like delivery delays, queue lengths arising on account of increased domestic demand which adversely affect exports. These are however, not represented by relatively downward-rigid domestic prices. The author points out that the erroneous exclusion of DDP variable from the export function may lead to an upward bias in the price elasticity estimate.

1/ Potential output, as quoted by Zilberfarb is defined originally by Okun (1962). It is "the maximum production that can be attained by an optimal use of existing technology and inputs without inflationary pressure." Potential output is estimated from \( X^* = f(X, UNR) \) where \( X^* \) is the potential output, \( X \), the actual output and UNR, the rate of unemployment in the economy. See for more details, A. Pechman (ed.), Economics for Policy Making, Selected Essays of Arthur M. Okun, (The MIT Press: Massachusetts, 1983) pp.145-158.

However, for India, Ali (1984) estimated export supply function without including DDP variable. His function includes only relative price variable (as defined before but in rupee terms) and 'capital-output ratio' or simply output from the primary and secondary sectors in India as a shift variable. He estimated export supply price elasticities (in relative price terms) assuming both an instantaneous adjustment and a one-year lagged adjustment situation. Briefly, Ali's export specifications are as follows:

1.3 \[ \ln X_t^s = a_0 + a_1 \ln R_P t + a_2 \ln Z_t \]

where \( a_1 \) and \( a_2 \) are hypothesised to be positive.

1.4 \[ \ln X_t^s = b_0 + b_1 \ln R_P t + b_2 \ln Z_t + b_3 \ln X_{t-1}^s \]

which has been derived from equation (1.3) and an adjustment function which is given as follows:

\[ \Delta \ln X_t^s = \lambda(\ln X_t^s - \ln X_{t-1}^s) \]

where \( \lambda \), the coefficient of adjustment, which lies between 0 and 1 can be estimated from \((1-b_3)\).

In the above functions, \( R_P \), the relative price variable is given by

\[ R_P = R(1+S) \cdot \frac{P_X}{P_H} \]

where \( R \) is the official exchange rates, \( S \), the \textit{ad valorem} rate of export subsidy and \( P_X \), the index of export prices and \( P_H \), the index of domestic prices.
In computing the rate of export subsidy S, Ali (1984, p. 8) has included the total export incentives, obtained by adding together the annual government expenditures under the heads: (a) foreign trade and export promotion, (b) duty drawback, (c) subsidy from export credit and (d) the market premia on import replenishment. Of the above, the government expenditure under the head (a) is also referred to as Market Development Assistance under which expenditures are met towards cash assistance or cash compensatory support (CCS), grants-in-aid for schemes and projects for the development of export commodities and markets abroad, which largely include (i) market research, commodity research surveys etc., (ii) export publicity and dissemination, (iii) participation in trade fairs and exhibitions, (iv) establishment of offices and branches abroad and (v) grants-in-aid to export promotion councils and other export organisations etc.1

Among the foregoing items of government expenditure, only the CCS can be viewed to affect the price competitiveness of export products. Whereas, the balance amount of the expenditure under 'foreign trade and export promotion' head cannot be viewed as export subsidy but as an 'export investment' made by government in the form of requisite

infra-structure for exports; since even at macro level, all such governmental expenditures are not received in the hands of exporters as subsidy. In which case, gains from export investment cannot be instantaneous but may span some time. Thus merging all such export promotion expenditures with the export price or relative price would lead to an overstatement of export price and its estimation, as attempted by Ali creates bias in the supply price elasticities.

Moreover, with such model specifications as shown in equations (1.2) to (1.4), it is difficult to measure explicitly the effect of export incentives on exports and one may not be able to gauge, in isolation, the subsidy effects on exports.

Demand and Supply Equations Approach

According to this approach, the observed quantity and price of exports are determined simultaneously under an equilibrium condition that export supply is identical to export demand at the observed price. The model specifications may be hypothesised to represent demand and supply behaviour of exports in the economy or in an industry at a country level. In the past, a two-equations trade model has been hypothesised and empirically verified for a number of
countries by Goldstein and Khan (1978). It is as follows.

Export demand equation is given below:

\[ 1.5 \ln X_d = a_0 + a_1 \ln \left( \frac{P_X}{P_W} \right) + a_2 \ln Y^W + e, \]

Export supply equation is given below.

\[ 1.6 \ln X^s = b_0 + b_1 \ln \left( \frac{P_X}{P} \right) + b_2 Y + u \]

Identity:

\[ 1.7 X_d = X^s = X \text{(say) in equilibrium,} \]

where \( X_d, X^s \) = Quantity index of exports demanded and supplied respectively,

\( P_X \) = Index of export prices,

\( P \) = Index of domestic prices

\( P_W \) = A weighted average index of export prices of supplying countries

\( Y^W \) = World real income

\( Y \) = Logarithmic trend of real income of exporting country to reflect the level of economic activity

\( e, u \) = error terms.

Ceteris paribus, it is presumed that the export demand of a country increases with a decrease in its own export price relative to its competitors \((a_1 < 0)\) and increases with

\[ \text{op.cit., pp.275-286.} \]
an increase in world real income \((a_2 > 0)\). Similarly, the export supply of a country increases with an increase in its own export price relative to domestic price \((b_1 > 0)\) and with an increase of economic activity \((b_2 > 0)\). These form a priori restrictions on the model. Furthermore, \(a_1\) and \(b_1\) represent the relative price elasticity of export demand and supply respectively as equations (1.5) and (1.6) are in the long-linear form.

In order to make the two-equations-system 'complete', it is necessary to have two endogenous variables in the model. As the observed quantity \((X)\) is one endogenous variable, the other one, by assumption, is the observed export price \((P_X)\). Further, it is required to specify the equations of the model keeping the endogenous variables on the left hand side of the equations. The export supply equations, by convention, is normalised for the export price.\(^1\) In that case, equation (1.5) is retained as it is, while (1.6) is transformed to (1.8).

\[(1.8) \quad \ln P_X = c_0 + c_1 \ln X^S + c_2 \ln Y + c_3 \ln P + w\]

where \(c_0 = -\frac{b_0}{b_1}\); \(c_1 = \frac{1}{b_1}\); \(c_2 = \frac{b_2}{b_1}\); \(c_3 = 1\) and \(w = u/b_1\).

Furthermore, \(c_1, c_2 > 0\) and \(c_3 < 0\), since a priori \(b_1 > 0\) and \(b_2 > 0\).

Equations (1.5) and (1.8) are termed as 'Structural' equations.

\(^1\)However, it is not necessary to normalise the supply equation only. One could retain it as shown in (1.6) and specify the export price as a dependent variable in the demand function. For instance, Biswas has estimated the demand and supply equations for India without normalising for export price. See Basudeb Biswas, "Declining Share of India in World Exports, 1950-70", The Indian Economic Journal, No.3, January-March 1983, pp.75-86. For a more detailed discussion, see also Stephen E. Haynes and Joe A. Stone, "Specification of Supply Behaviour in International Trade", Review of Economics and Statistics, Vol. LXV, No.4, November 1983, pp.626-632.
The supply price elasticity in relative price terms \( (b_1) \) may be estimated from equation (1.8). 

There has been a limited use of this approach in the literature particularly at a disaggregated level either because researchers did not find it appropriate to relax the demand or supply assumptions about the size of the price elasticities or because the underlying methods of estimation, namely, Two-stage Least Squares (2SLS) or Limited Information Maximum Likelihood (LIML) call for sophisticated software and cumbersome procedures to be deployed.

Reduced Form Equations Approach

It is argued by Leamer and Stern (1970), Linnemann (1966) and Cohen (1964) that the observed quantity of exports depends upon both demand and supply factors. Thus, one may hypothesise a cause-effect relationship of export quantity as a function of factors like world demand or income.

1/ Goldstein and Khan (1978, p. 278n) notes that the estimates of the parameters are invariant with respect to normalisation procedure, when a system method of estimation like 'Full Information Maximum Likelihood' (FIML) is adopted.

2/ The usefulness of these estimation methods is further limited by our incomplete knowledge about the procedures of 'hypotheses testing' of the underlying structural parameters. For instance, Goldstein and Khan (1978, p. 278) mention that in the context of simultaneous model estimation, the distributional properties of the Durbin-Watson (D-W) statistic of the standard error (S.E.) of the estimate are not clear. Similarly, the ratios of the estimated coefficients to their respective SE's (commonly referred to as the T-values) do not exactly follow the T-distribution but resemble an asymptotic normal distribution. Thus, these problems render it difficult to examine the 'test of significance' of the estimated parameters unlike the case of the OLS method.
domestic demand, competitor's price, own price etc., without explicit mention of the underlying structural equations of export supply and export demand. Such export functions are referred to as a sort of equilibrium equations. Following Tinbergen (1951, 1962), they could also be termed Turn-over or Trade-flow equations.

Further, given a structure of export demand and supply in linear or log-linear form, one can derive the corresponding 'reduced form' equations under an equilibrium condition. In the 'reduced form' equations, each endogenous variable is expressed as a function of all exogenous variables in the system. Hence, the export functions which posit neither demand nor supply behaviour exclusively can be viewed as reduced-form equations relating to some 'unknown' structure.

In an attempt to explain India's export performance of cotton fabrics (CF), Rao (1980, pp.80-98) hypothesised India's export functions by considering a set of plausible variables like, external demand (WM) for cotton fabrics, f.o.b. unit value of India's cotton fabrics exports (UV), domestic demand pressure (DWPI) as measured by domestic wholesale price index, raw cotton price in India (RCWPI), wage rate (w), raw cotton productivity (RCP), and labour productivity (LP) etc.
Regressions were run using annual data for the period 1951-1975 and quarterly data for the period 1961 I - 1970. III considering alternative specifications by including not all of the aforementioned variables at a time. The most important specifications according to the author are as follows.

1.9 \[ CF = f(WM, UV, t) \]
1.10 \[ CF = f(WM, W, RCP, t) \]
1.11 \[ CF = f(WM, UV, DUM, SLP_{73-76}, t) \]
1.12 \[ CF = f(WM, DWPI, DUM_{72-73}, SLP_{73-76}) \]

where \( SLP_{73-76} \) is a dummy distinguishing the pre- and post-oil price hike and other variables as mentioned before.

He has offered no theoretical reasoning for the inclusion (or exclusion) of a variable in the above functions. This implies that the choice of estimating export price elasticity from the above functions seems to be arbitrary. Moreover, as the above specifications do not represent either supply or demand, the estimated price elasticity will be of little use for policy makers. Particularly, one is not certain of the expected sign associated with it, unless one is clear about the dependent variable. For instance, Rao's export price elasticity, as estimated from (1.9) or (1.11) is negative and falls around \(-0.38\).
Accordingly, one should call his dependent variable as export demand. If that were so, one would find it difficult to explain how wage rate and raw cotton productivity variables (W and RCP) are included in the specification (1.10).

Thus, a serious limitation of this approach seems to be that one may err due to specification biases. However, the reduced form equations approach may be useful for forecasting purposes, if one is not interested in the underlying structure.

2. Approaches to Micro Level Model Building

In the previous section, we discussed the approaches to specifying the export demand and supply equations at industry (or macro) level. Similar approaches can also be applied to model firm (or micro) level export demand and supply equations. The theory of consumer demand suggests that the demand for a firm's product may also be determined in the same manner as that of industry which consists of a number of firms. It is clear that if all firms produce a homogeneous product, industry demand is the sum total of the firm level demands. However, in reality products produced by different firms are often differentiated by consumers and therefore, consumer demand functions can be different firm-wise. For instance, export demand function may be defined for a
firm as follows:

\[ x^d_t = f(RP_t, Y_t) \]

where \( x^d_t \) = quantity exported by a firm in a given period, say, a year \( t \), for \( t = 1, 2, \ldots, T \)

\[ RP_t = \left( \frac{P_t}{P^*_t} \right) \]

is the ratio of firm's own price (\( P \)) to that of its competitors (\( P^* \)). Hence \( P_t \) can be the average export price that the firm has realised in a year 't' and \( P^*_t \) may be a weighted index of the average export prices realised by its competitors in the same year with their respective export shares being chosen as weights.

\[ Y_t \]

is real income of the foreign consumers, or total market demand in the year which may represent shifts in the firm level demand schedule over time.

The above equation (2.1) may be estimated using data from a cross-section of \( T \) consumers or a time-series of \( T \) periods (years, say) for a given firm.

In practice, it may be difficult to have an access to such data at firm level, unless the firm itself is interested in estimating the export demand for its product and is willing to conduct a consumer survey in its foreign markets, which may be a costly proposition. Secondly, most of the firms may not even release export data even
for academic purposes. Sometimes, even if they wish to do so, they may not be maintaining the old records to enable the investigator to construct sufficiently long time-series data. Thus, it is less feasible to estimate the export demand equation for a firm following this approach.

Alternatively, firm level demand can be derived from its industry demand by using market share approach. First, industry level demand function is estimated as shown earlier and then firm level demand is derived by applying the market share of the firm to the estimated industry level export demand. Although this approach seems to be more feasible than the one mentioned before, it also suffers from the following limitations.

First, all firms in the industry are assumed to produce a homogenous product which may be a restrictive assumption. Secondly, under the assumption of constant market share, if the industry demand is likely to fall or rise in the future, the firm level demand is also expected to behave in the same manner, which need not necessarily happen. Thirdly, whatever assumptions are made for estimating industry demand functions, they should implicitly be true in the case of the firm level demand. For instance,
for estimating industry demand it is assumed that export supply elasticities are infinitely large, implying that there exists idle capacity in the industry, which may not be true for the firm for which export demand is derived. Similarly, contribution from the other factors like firm's size, marketing costs on foreign travel, trade fair participation and market research cannot be measured through the demand side approach, as these variables generally appear in supply functions.

Supply-side Approach

Firm level exports can be estimated by specifying supply functions explicitly following Ali's (1984) supply model at an industry level with some modifications. As discussed earlier, Ali's export supply function at a macro level includes relative price and a shift variable like 'output' or capital-output ratio. This specification is based on the assumption that export demand function for a country is infinitely elastic. This assumption seems to be more reasonable at firm level.\footnote{As pointed out by Hirsch (1971,p.xv), in international markets an exporting firm can only be viewed as a robot adjusting itself to changes in world demand and supply conditions from time to time.} The export supply function is derived from a maximisation exercise, where the sum of consumer's and producer's surplus is maximised as shown in the following manner.
2.2 \[ \max \prod = \int_{0}^{H} (a-bH) dH + P_X X - C_X(X) - C_H(H) - C_T(X+H) \]

where \( H \) and \( X \) represent quantities sold at home and abroad respectively and home price \( P_H \) is given by \( P_H = a-bH \); \( C_H, C_X \) and \( C_T \) are respectively the cost functions due to home sales, foreign sales and the interaction between them. \( P_X \), the export price is assumed to be exogenously given under a 'small' country assumption.

For simplicity, if we assume that the firm is totally export-oriented and does not sell at home, the maximising function (2.2) becomes (2.3) as follows:

2.3 \[ \max \prod = P_X X - C_X(X) \]

Then the first order condition yields

\[ \frac{d\prod}{dx} = P_X - \frac{C_X}{dx} = 0 \]

which implies that at the optimum, given \( P_X \), the volume of exports supplied by a firm is determined by its marginal export costs. In other words, given the export price, export supply can be determined by all those variables that affect its selling efforts, and manufacturing costs. Thus one may specify an export supply function for an \( i \)th firm as follows.

2.4 \[ X_i = f(P_i, SE_i, S_i) \quad i = 1, 2, \ldots, m \]
where \( X_i \) = quantity of exports supplied

\( P_i \) = price at which \( X_i \) is supplied

\( SE_i \) = index of selling efforts

\( S_i \) = size of the firm.

The above specification can be estimated using time-series data for 'm' periods, usually m years for a given firm or using cross-section data from a sample of 'm' firms in an industry. It is also possible to estimate it by using data on a cross-section of 'm' categories of a product group, provided the firm exports a diversified range of similar commodities.

It is easy to note that \( P, S \) and \( SE \) are expected to be positively correlated with \( X \). \( X \) is measured in physical units and can, therefore, be added up to arrive at a total quantity exported by a firm in a given period. \( P \) can be specified as an average price realised in the same period. The rationale for the inclusion of the two variables selling efforts (SE) and size (S) merit explanation.

Economic theory is often silent about the 'selling efforts' by a firm, whereas, it is marketing theory which is mainly concerned about this aspect. Particularly for an export firm, this issue is largely dealt with in the area of export marketing.
Selling efforts include all those efforts by a firm to promote its sales or the efforts to increase its export volume at a given price to different target markets. Largely, these include the costs incurred on advertising, foreign trade participation, foreign travel for getting export orders, market research on product design and packaging and distribution.

An exporting firm may or may not deploy its resources on all these efforts depending upon what it thinks desirable. Efforts may vary across the firms and so do their levels of exports. Thus, selling efforts reflect differential characteristics of firms.

However, some of these effects are overlapping. For instance, the effect due to advertising cannot be distinguished from that of foreign travel or that of foreign trade participation, though one can be explicit about 'costs' on each of them. Hence, for estimation of their combined effect on a firm's exports, it is desirable to construct an index of selling efforts.

As regards 'size' variable, Hirsch (1971) has discussed its relationship with export performance. It has been argued that size of a firm may determine its efficiency, which in turn affects its export performance.
Here, efficiency of a firm is considered with respect to production, management, finance, marketing and capacity for risk-taking. Size of a firm can affect economies of scale in each of these elements.

On the other hand, size of market itself can affect the size of a firm. Firms may consider it worth their efforts to increase their size only if their markets are large enough to absorb high marketing costs involved in exporting. As noted earlier, export marketing costs are always higher than domestic marketing costs per unit of output because the former calls for additional selling efforts in communications, transportation and in adapting to customs regulations in home country and abroad, export quotas at home and import tariffs in foreign countries etc. For the firms which operate only in export markets, size becomes dependent upon their level of exports.

Hirsh (1971, ch.4) found that when firms are small, the correlation between size and export performance as measured by the share of exports in total output is negligible. As the size increases, firms tend to export more of their total output up to a point beyond which larger firms do not necessarily export a higher share of their output than the smaller ones. This point, Hirsch refers to as the point of optimum since the economies of scale in production, marketing, finance and risk-taking are exhausted beyond this point.
In addition to theoretical problems, size variable poses measurement problems as well. As Penrose (1959) mentioned it, notionally, size refers to the volume of resources available to a firm. She said, ideally it should be measured by the present value of the total resources (including its personnel) used for its own productive purposes. However, for the purpose of analysis of growth of firms, she had used the 'value of fixed assets' as a proxy for measurement of size.

Hirsch has considered alternative proxies such as 'average value-added', 'number of employees' and 'sales' of a firm. However, Sargant (1961, p. 23) observes that there is 'no representative size for a plant in an industry and therefore, it is more meaningful to consider size distribution of firms in an industry (i.e., the firms arranged by various groups according to their total sales or number of employees etc.). Following this, Hirsch proposed an alternative measure of relationship between size and export performance of a firm by use of Lorenz curve analysis. It seeks to provide a measure of the degree of inequality in distribution of exports by firms which are arranged according to various size-groups.

1/ Hirsch (1971, p. 72) has criticised it saying that the value of fixed assets may underscore the contributions of other inputs like skilled and unskilled labour, research and development etc., and also of hired value of capital equipment which may not be included in the value of fixed assets.
The export supply function (2.4) could also include other economic variables like factor productivities as examined by Rao (1980) (in his export functions for India's cotton textiles and engineering products); other marketing variables like transportation and communication costs and organisational variables like managerial aspirations for growth and profits, and level of commitment to exports etc.

In export marketing research area a large number of empirical studies at a firm level have recognised the importance of non-economic factors to explain firm level export behaviour. These factors are mainly drawn from theories of marketing and organisational behaviour. Bilkey (1978) reviewed the literature on these studies. The one which is relevant for our purpose is due to Bilkey and Tesar (1977) who formulated a six-stage model within a regression framework to explain what they have called the firm's export activity. All firms are classified into six stages depending upon their export activity as follows.

"... the firm is unwilling to export because of apathy or dislike of foreign activities (Stage One), the firm fills unsolicited export orders, but does not explore the feasibility of exporting (Stage Two), the firm explores the feasibility of exporting (Stage Three), the firm exports experimentally to one or a few markets (Stage Four), the firm is an experienced exporter to those markets (Stage Five), the firm explores possibilities of exporting to additional markets (Stage Six)".  \(^2/\)

Based on questionnaire - data from 423 Wisconsin manufacturing firms, the following type of regression equation was estimated:

\[
A = \alpha + \beta E - \gamma I + dF + eM + u
\]

where \(A\) = the firm's export activity as measured by the export share in total sales, by firms which are associated with the stage in question,

\(E\) = the management's expectations regarding the benefits of exporting,

\(I\) = the index of 'inhibitors' like infrastructural and institutional obstacles that management perceives to initiating exporting.

\(^2/\) See Bilkey (1978), \textit{op. cit.}, p. 40
F = the index of 'facilitators' like unsolicited export orders, information, government subsidies, infrastructural and institutional facilities that management perceives to initiating exporting,

M = quality and dynamism of the firm's management and organisational characteristics that affect exporting,

a, b, c, d and e are the associated coefficients and u, the error term.

Bilkey-Tesar results explain the export activity better for those firms which entered stages Three and above, i.e., roughly those which are more serious exporters than the other firms which have not even explored the possibility of exporting. This is indicated by their reported values of regression fits, i.e., $R^2$ - value for firms in stages Four and above was more than 0.69 and the $R^2$-value for firms in stage Three and below was lower than 0.25. This shows that the factors associated with successful exporting can be identified from the variables included in their model.  

Bilkey and Tesar have found that movement from earlier stages to stage Four correlated directly with the possibility that the firm received an unsolicited initial export order; directly with the quality of the firm's management; and, to a small extent, directly with the firm's size. ... the per cent of sales exported by stage Five firms correlated directly with management's perceptions of the gains from exporting, inversely with the number of perceived inhibitors to exporting and inversely with the quality of the firm's management”.1/

The foregoing discussion indicates that it is important to include also the non-economic variables such as those mentioned above in an export supply equation if the model has to be realistic in nature. Moreover, the implications of the stage approach adopted by Bilkey and Tesar and a similar approach later on pursued by Czinkota and Johnston (1981, pp.353-365) are important for the government and policy makers who wish to design an export promotion programme intending to satisfy the group-needs of exporters by aiming at individual segments (or stages) of firms rather than the total economy.2/

1/As reported in Bilkey (1978), op.cit., p.40.

To continue the discussion on firm level approaches it should be emphasised that just like in the case of export demand, as mentioned earlier, one can also derive firm-level supply from industry supply using the market-share approach. In doing so, one may assume as before, that market share of a firm in industry is constant over time or estimate a market-share function for a firm independently as attempted by many researchers in the past. The studies adopting latter approach are discussed below.

**Market-Share Approach**

The analysis of market shares of a firm in an industry has often been made in a closed-economy framework, particularly in relation to typical market structures, *viz.* monopoly, oligopoly and monopolistic competition. The estimation of market share functions has emerged as an important tool of analysis in the area of market research.¹ Market share is considered to be a good indicator of market competition and the performance of a firm in terms of its comparative advantage over other firms.

In the context of international trade, however, the use of market share approach has acquired importance only

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at aggregate level. Adams (1969) explicitly introduced market share as an explanatory variable for estimating export demand equations for OECD countries at an aggregate level. Biswas (1983) tried to explain the growth of India's exports using market shares of individual commodities in total exports in a base year as weights. Export demand and supply specifications hypothesised by different authors like Houthakker and Magee (1969), Goldstein and Khan (1978) have also used export shares as weights in the aggregate index of price and income.

As against this, at a commodity level like India's tea exports to its major markets like the UK and USSR, Wadhva and Narayana (1981) have attempted to estimate the effect of relative prices on market shares in a disequilibrium framework. For example, the market-share function specified by them for examining India's market share for its tea exports to the UK is as follows.

\[ 2.6 \quad \text{Im}(\frac{T}{UK})_t = f\left(\frac{P(T)}{L}, \frac{P(T)}{BR}, \text{Im}(\frac{T}{UK})_{t-1}\right) \]

\[ \text{Im}(\frac{T}{UK})_{t-1} \]

where $I_{UK}^{(I)}_t$ = the share of India's tea exports in total tea imports into the UK

$P(I/L)$ = the ratio of Indian tea prices to the international auction price at London

$P(I/Br)$ = the ratio of Indian coffee price to the Brazilian coffee price

$T$ = trend variable.

Using time-series data for the period 1961-76, they estimated (2.6) in log linear form and determined market share elasticity of tea prices in relative terms.

Further, they have argued that in the case of a 'small' country whose export share of a commodity in the total world exports is negligible, the market share elasticity tends to be the same as the elasticity of substitution between exports of the country and the rest of the world in the conventional sense; whereas, in the case of a large country having a dominant share in the world exports, these two elasticities would differ. Mathematical proof has been provided by the authors to show this result.

If this result is applied to a set of exporting firms within an industry in a country, estimation of its export market-share function seems to be relevant only in the case of a large firm, at least in so far as to examine the effect of its pricing policy on its market share in total exports of the country vis-a-vis other competitors. Thus, this approach may shed light on inter-se competition among exporters in a country.