COMPETITIVENESS, PRODUCTIVITY AND EXPORT PERFORMANCE OF INDIAN PRIVATE FIRMS

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Abstract

This paper studies the effects of firm size, import of raw materials, import of capital goods, in-house R&D investment, and competitiveness on exports of Indian private firm during 1975-1986. The paper finds that in-house R&D investment and import of capital goods had limited effects on exports. The firm size, import of raw materials, and competitiveness had significant positive effects on exports of Indian firms. Since liberalization policies positively affect these variables, the partial liberalization policies of 1980 had positive effects on exports.   The total effect on the economy was, however, limited because of the limited scope of those liberalization policies.

1. Introduction

India is currently one of the world's fastest growing economies with an average annual growth rate of income around 7% during 1992-2003, slightly below that of China. There are, however, marked differences in the development paths of these two economies. China depended mostly on foreign technology, foreign direct investment and foreign trade; until recently, India protected its economy from foreign competition, import of foreign technology, foreign goods and foreign capital. While India's import substitution

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policies led to a large industrial base and technological capabilities, India began to encounter many adverse effects of these policies. For instance, the growth in income and exports began to decline, and India's foreign exchange reserves began to dwindle fast. To cope with these untoward effects of import substitution policies, India introduced a set of partial liberalization policies in 1980, and a set of more extensive liberalization policies in 1991. Today India not only dominates world IT market, India is also a strong sourcing hub for manufacturing sectors such as auto components, textiles and pharmaceuticals. Much of this new development could be the result of India's past protective industrial, trade and technology policies followed by the recent liberalizations of those policies.

The main objectives of the liberalization policies were to provide incentives for firms to improve their growth in exports, value-added and total factor productivity. One form of these export incentives was to allow private firms to import raw materials and capital goods in commensurate with their export earnings and to invest in-house R&D. In this paper I investigate how these factors influenced Indian private firm's exports behavior.

There are not many studies in the literature that incorporate imperfect market structure at the firm level. The theoretical trade models that incorporate imperfectly competitive market structure assume that firms within an industry are homogeneous in terms of technology or cost function. The focus of this literature is to find conditions under which there is intra-industry trade and to study the welfare effects of various trade policies, see Helpman and Krugman (1985) and references there in. The firm level empirical analyses of exports, incorporating imperfect market structure, are limited mostly to developed countries. For instance, Glejser, Jacquemin and Petit (1980) test the implications of imperfect market structure on exports performance of Belgian firms, Wakelin [1998] studies the effect of firm level R&D expenditures on the export performance of British firms, and Sterlacchini (1999) studies the effect of non-R&D type innovative activities on exports of small Italian maniufacturing firms. Firm level empirical studies on India mostly focus on the effect of firm size and R&D expenditures on export performance, for instance,

see Kumar and Siddharthan (1994), Patibandala (1995) and Hassan and Raturi (2002). There are no theoretically grounded empirical studies on India's exports that also link export behavior to competitiveness and R&D at the firm level.

In this paper I first formulate a model of optimal export decisions of private firms within an imperfectly competitive market structure, incorporating the protected environment that was created by the policies mentioned above. While R&D investment could be endogenous and determined simultaneously with exports and output decisions, I treat R&D investment to be exogenously given. I use the theoretical model to predict the effects of firm size, R&D, and domestic and foreign competition on exports of private firms. I then use panel data for a sample of Indian private firms over the period 1975-1986 to examine these predicted effects. This 12 year period is also suitable for assessing the effect of the partial import liberalization and export promotion policies that India introduced in 1980.

Section 2 is an overview of Indian government's industrial, trade and technology policies that are relevant to this paper. Section 3 provides a model of optimal export of private firms and then examines the effects of firm size, competitiveness, and R&D on exports. Section 4 describes the empirical specification of the model and the related econometric issues. Section 5 describes the data set. Section 6 reports the empirical findings. Section 7 concludes the paper.

2. Industrial, trade and technology policies

The broad objectives of India's industrial policies since the very beginning have been the improvement of growth in output and productivity in the industrial sector, the encouragement of production by small scale firms in order to generate higher employment, the control of monopolies to reduce concentration of business wealth, and the achievement of self-reliance. Another objective of Indian licensing policies was to encourage domestic production of most inputs needed for the production of infrastructure goods by the public

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sector. Influenced both by a perception of export pessimism and adherence to the principle of infant-industry protection, Indian policy makers have followed the import substitution strategy for industrialization. The principal policy instruments to achieve these goals have been a system of industrial licensing, reservation of certain goods for production by small scale firms, import tariffs and quotas, restrictions on import of foreign technology and a virtual ban on direct foreign investment. Many of these restrictions were, however, relaxed to some extent in later years as described in the following sections.

2.1 Industrial Policies

The Industrial Development and Regulation Act of 1951 required a firm to acquire a license to expand capacity or to produce new goods unless it belonged to the small scale industries group, or had total assets below a certain size, or did not exceed a certain foreign exchange limit for the import of raw materials and capital goods. In the mid sixties it was felt that the licensing policies did not curb the monopolies. The Monopolies and Restrictive Trade Practices (MRTP) Act was enacted in 1969, curbing expansion of big firms and restricting large firms from producing the goods that were reserved for production by small scale firms. Firms were allowed a normal expansion up to 25% in five years period. Later in 1975 the relaxation of the licensing policy allowed 15 engineering firms to have an automatic increase in their licensed capacity of an additional 5% per year. In 1980, the same privilege was extended to more firms in 19 other industries. At the same time, perversely, however, the number of reserved commodities for small scale production grew rapidly from 180 during 1967-1977, to 500 during 1977-1980, and to 800 since 1980.

2.2 Trade policies

I will sketch the development of only the policies that have a direct bearing on the present analysis.[2] India's import policy until the

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[2] A detailed analysis of India's trade policy regimes can be found in Bhagwati and

mid seventies had been guided by the objective of blanket import substitution originating from the announcements of the Imports and Exports (Control) Act of 1947 and the Import Trade Control Order of 1955. To protect the infant industries, the new entrants were required to acquire import licenses to import raw materials and components, and capital goods. Apart from these quantitative restrictions (QR), additional protection to domestic producers were provided by imposing high tariffs on import of all goods. The maximum possible protection was provided to a firm if it was undertaking production of an imported good that was not domestically produced, so long as the newly produced good would be available to the whole domestic market, import of the good was totally banned, and the producer of the good was given the privilege of charging any price, to import technology, raw materials and components initially. The small scale producers were given privileged access to imported raw materials, components, and capital goods. (Initially in the fifties and early sixties the output, especially in the capital goods sector grew rapidly in response to the import substitution policies and heavy investment in the capital goods sector). The adverse effects of all these policies were soon felt with the depletion of foreign exchange reserves and a negative rate of growth of exports. To improve the balance of payments, the Rupee was devalued in 1966, and the registered exporters were given temporary concessions to import raw materials commensurate with their export earnings.

2.3 Policies regarding FDI and import of foreign technology

Direct foreign investment in India has been directly discouraged by imposing severe limits on equity holdings by foreigners and also by limiting them to the production of only a few reserved goods. The detailed rules regarding this are laid down in the Foreign Exchange Regulation Act (FERA) of 1973 (the firms belonging to this group are known as FERA firms). This Act drove out virtually all foreign investors from Indian industries. The main channel of technology transfer was purchase of foreign technology.

Desai (1970), Bhagwati and Srinivasan (1975, 1993) and Srinivasan (1996).

To reduce foreign exchange use and also to encourage indigenous production of technology, the Government of India imposed severe limits on royalty payments to foreigners. However, to encourage indigenous generation of technology, the Indian government had provided tax incentives for investing in in-house R&D to any firm that has an established R&D laboratory.[3] As a result of the limit on royalty payments, the firms could not afford to purchase the most recent technology. This was particularly true in the machinery and heavy industries where technologies change very rapidly and new technologies are very expensive. As a consequence, Indian technologies lagged ten to fifteen years behind recently available technologies, especially in the heavy goods industries.

2.4 Consequences

The scopes to expand production, to use modern technology, and to face higher domestic and foreign competition were limited. These had important effects on the unit cost of production in many industries, especially in the machinery, metal products and petro-chemical industries in which the technology in the rest of the world changes rapidly. The above mentioned regulations created a large public sector, a high cost large industrial base, and stagnation of the overall economy. These basic production inefficiencies and high costs were transmitted down the line to other producers, who, being restricted from importing cheaper and better quality inputs, had to use the domestic producer's high-cost or low-quality products as inputs. A serious consequence was that up until the early eighties, the Indian manufacturers lost international competitiveness and export shares in the world markets, see Nayyar (1978). Another consequence was that almost all sectors exhibited severe stagnation and negative productivity growth during this period, see for instance the study by Ahluwalia (1985).

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[3] The effect of private R&D on creating industry-wide R&D spillover and the effect of individual R&D and spillover R&D on productivity growth of individual firms have been studied in Raut (1995). The factors that affect private firms' decisions to purchase technology from abroad, domestic sources, and to invest in in-house R&D laboratory are investigated in Lall (1983), Kartak (1989) and Raut (1988).

2.5 Policies in the early eighties

To correct these severe policy mistakes, the Indian government initiated limited import liberalization policies in its 1980 Industrial Policy Statement. The main focus of these policies was to improve productivity growth and increase export earnings. Since the exporters had lost international competitiveness - being forced to use high-cost domestic inputs, they were granted the opportunity to import raw materials, machine components and capital goods on more liberal terms; limits on royalty payments of exporting firms were raised substantially upward, and sometimes they were also given cash benefits and duty exemptions on imports to make up for their use of high-cost domestic inputs; the exporting firms were also allowed to expand capacity so long as it was not a MRTP or a FERA firm and it was not producing the goods reserved for small scale firms and the expansion of the excess capacity was exclusively for export purposes. MRTP or FERA companies were allowed to expand capacities either in certain restricted industries (known as Appendix I industries) or in the industry of their choice, provided they agreed to a 60% export obligation. In order to encourage direct foreign investment, a better environment was created for foreigners and non-resident Indians to invest in India. For instance, foreigners were allowed to hold up to 40% of the equity in FERA companies. Import restrictions, MRTP/FERA acts, and licensing policies were further liberalized in 1985. However, I do not discuss these since my data does not extend to that period. For details of these policy changes, see Economic Survey, Government of India, 1985-86.

3. A model of optimal export decisions of Indian firms

In this section I formulate a simple model of optimal export decision of private firms. I formulate this in an imperfectly competitive market structure that resulted from India's restrictive trade and industrial practices. I use the model to examine how the volume of export is related to the type of domestic competition conditioned by various industrial policies, foreign competition conditioned by import tariffs, quotas, and non tariff barriers, and to technological backwardness fueled by the restrictive technology

import policies. These predictions are then used to formulate an econometric model of export for empirical analysis at the firm level.

I assume that given the protective environment created by the Indian policies, the firms act as monopolists in the industry, each producing a product similar to others but differentiated by variety. Each firm takes the output levels and prices of other firms, the tariff rates and the volume of imports of similar goods as fixed and act as a monopolist in the residual market. The firm assumes that its actions in its own market do not influence other firms' demand curves, and hence, their actions, and also do not affect the volume of imports in the industry. Or in other words, each firm is small relative to the total size of the industry, but in its own market it acts as a monopolist. Thus, the firm takes the export price net of transport cost p_w as given and decides the volume of export (if it decides to export at all), and the price and quantity of its product for the domestic market. All other firms in the industry act the same way, but they are heterogeneous with respect to their technology and firm size. More specifically, I assume a monopolistically competitive industrial structure.

Assume that when the price is same, the consumers prefer a foreign variety over a domestic variety of a good. So the domestic producers act in the residual market. In this residual market, each producer may try to grab as much of the market share as possible by advertising and creating consumer confidence in their product by various methods. I assume that these activities to be either absent or all firms behave identically in this respect.[4] That means, all firms have identical inverse demand functions and the intercept and the slope of the identical inverse demand curve of firms depend on the strength of domestic competition and foreign competition. The higher is the either type of competition, the lower are the intercepts and slopes of the inverse demand curves. I parameterize the level of competition that a firm encounters by μ and denote its inverse demand function by $p(q;\mu)$, where q is the output level. A typical

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[4] This is a simplifying assumption for our empirical analysis, since I do not have information on such activities in my data set.

inverse demand curve and the corresponding marginal revenue curve are shown in figure 1 as AR and MR respectively.

3.1 Technology of the Firm

The cost function represents the production technology of the firm. I assume that the average cost to produce a given level of output consists of a fixed cost, which depends on the installed capacity, and a variable cost, which is assumed to be increasing at the output levels above the installed capacity. This leads to a U-shaped average cost curve, shown in figure 1 as AC. The output level at which the average cost is minimized depends on the installed capacity: The higher the installed capacity is, the higher is the output level q at which the average cost is minimized. Thus installed capacity can be characterized by the horizontal position of the tip of the average cost curve.

The Indian firms were restricted from importing foreign technology in every possible way: They were restricted in importing blue prints of technology due to limits on royalty payments to foreigners, and also from importing capital goods with embodied foreign technology because of high tariff rates on such imports. I assume that given a firm's licensed capacity, the firm obtained its technology from various sources at different times and that the firms varied in their managements, and thus differed in their cost curves. In the empirical specification, however, I assume two main sources of technology to be imported capital goods, which has embodied technology, and in-house R&D investment, which produces cost saving new technology or cost saving adaptation of foreign technology. Given their licensed capacity, I represent the variations in cost curves across firms by a parameter θ and denote the cost function by C(q; θ). The corresponding marginal cost curve and average cost curve are shown in figure 1 as MC and AC respectively.

Under the assumption that production function is homothetic, and technological change is factor neutral, the cost function can be represented by $c(w, y; \theta) = f(w) \cdot g(\theta) \cdot h(y)$,

where *w* is a vector of factor prices and f, g and h are functions. I assume that the technologies across firms are such that the firms have a common input aggregator function, but firms vary in their productivity level and the factor prices are constant across firms and over time. It is then easy to see that $g(\theta)$ represents the growth factor of total factor productivity with respect to a reference firm in the base period for which $g(\theta)$ is normalized to 1.

Thus for firms with a given level of capacity, the technological variations can be represented by $g(\theta)$ which can be indexed by the vertical position of the tip of the average cost curve. I take the main determinants as foreign technology embodied in imported capital goods, and in-house R&D investment.

I assume further that the firms in the world market are perfectly competitive and have achieved their long-run equilibrium and thus the world price p_w is the same as the tip of the long-run average cost curves of the exporting firms in the world market. Because of the limitations mentioned above the unit cost of production of an Indian firm is higher compared to that of its peers in the world economy. This fact is reflected in the following diagram in having the tip of an Indian firm's average cost curve at a higher level than the world price level p_w.

Thus, three parameters that characterize the market structure of an industry in this set-up are 1) the slope and the intercept of inverse demand curve, represented by the parameter μ, 2) the vertical position of the tip of the average cost curve, represented by the parameter θ and 3) the installed capacity or the firm size which determines the horizontal position of the tip of the average cost curve in figure 1.

Figure 1. Determination of exports at the firm level

3.2 Optimal export behavior of the firm

Assuming exporting of this product by any resident other than the monopolist is prohibitively costly, the profit maximizing optimal strategy of the monopolist is to quantity discriminate in the two markets – by controlling domestic supply q_D, it sets a domestic price p_D which is higher than the world price p_w and it acts as a price taker in the world market and exports the residual output, $q - q_D$. Formally, the profit maximization problem is given by

$$\pi(\mu,\theta) \equiv Max_{q,q_D} \; p(q_D;\mu) \cdot q_D + p_w \cdot (q - q_D) - C(q;\theta)$$

where $\pi(\mu,\theta)$ is the profit for a firm parameterized by (μ,θ).

The first order conditions of the problem are

With respect to q, $C'(q;\theta) = p_w$:

MC = world price level.

With respect to q_D, $p'(q_D;\mu)q_D + p(q_D;\mu) = p_w$:

MR = world price level

The above solution is obtained as follows: The firm produces output level q that equates its marginal cost to the world price p_w, it supplies the output level q_D to the domestic market that equates its marginal revenue to the world price level p_w. Thus the optimal export volume of this firm is $q - q_D$.

It is clear from the above diagram that export as a function of firm size will have the property that a firm will not export if its size is up to a critical level, q_D. Above this critical level, the firm will have higher export, the higher is its size (measured in terms of capacity to produce). Thus, in this set-up, whether the firm size has any effect on export depends on whether capacity constraint of a firm implied by the MRTP Act is below the critical firm size q_D or not. If the Act restricts the size of the firm to be below q_D, then it has eliminated the firm's incentive to export completely.

It is clear from figure 1 that while for a given market condition, μ, the critical level q_D that determines whether to export or not, does not depend on the productive efficiency level θ of the firm, the volume of exports $q - q_D$, however, depends positively on the productive efficiency level. Furthermore, notice that as the efficiency level θ becomes lower, i.e., the tip of the AC curve moves to a higher level, the export amount (q – q_D) becomes smaller, and there exists a productive efficiency level if a firm's efficiency level falls below this level then the firm does not export at all, and above this level the firm exports a positive amount; furthermore, the volume of exports is higher, the more cost efficient the firm is.

The degree of competitiveness of a firm can be measured by the Learner index, also known as the price-cost-margin, $PCM = (p_D - MC)/p_D$. A firm with it's demand elasticity *e* has *PCM = -1/e*. In the extreme case of perfectly competitive market, *1/e = 0,* and thus $p_D = MC$. It is also clear from figure 1 that the higher is the competitiveness of an industry, a member firm faces a more elastic (i.e., flatter) inverse demand curve, and hence a lower value for PCM. In the limiting case of monopolisitic competition with free entry and exit, the operative firms will have the marginal revenue curve tangent to the average cost curve as shown by the flatter marginal revenue curve MR* in figure 1. The PCM attained at the monopolistic competition is the lowest level of PCM that can be attained only with domestic competition. To attain any further competitiveness in the industry (and in the limit to achieve the perfectly competitive equilibrium outcome), the industry must allow foreign competition by lowering the tariff rates. So long as the tariff rate is positive, the model can explain intra industry trade. Also notice that the firms that do not export will have higher values of PCM.

What could be achieved in the long-run by introducing domestic competition with free entry and exit? In this limiting case of monopolistic competitive equilibrium, the firms will have the marginal revenue curve tangent to the average cost curve as shown by the flatter marginal revenue curve MR* in figure 1. As the economy moves towards this equilibrium due to free entry and exit, the PCM of the firms will fall and exports will rise.

The PCM level corresponding to the monopolistic competition is the lowest level of PCM that can be attained only with domestic competition. To attain any further competitiveness in the industry (in the limit to achieve the perfectly competitive equilibrium outcome), the industry must allow foreign competition by lowering the tariff rates. So long as the tariff rate is positive, the model can explain intra industry trade.

4. Econometric Specification

From the properties of the optimal solution in the previous section, we see that we have a censored regression model in which firms either do not export, or export a positive amount. I use a Tobit model to estimate this exporting behavior. More specifically, according to the predictions of the previous model, I specify that export as a share of total sales is a function of firm size, the market structure represented by the parameter μ, and the state of the technology or cost structure determined by in-house R&D investment, imported raw materials and imported capital goods, and represented by the parameter θ. I assume that the observed export volume as a share of total sales is zero if the optimal export level is below some critical level.

While import of capital goods may signify import of embodied foreign technology and should be already captured in the term θ, I include it and the import of raw materials as independent regressors to see if the export incentives regarding these two inputs were effective in generating higher exports for the Indian firms. I use in-house R&D as a share of total sales to examine the effect of in-house R&D in producing cost saving technology or innovating quality products for the purpose of export competitiveness.

For estimation, I specify the above as a model a Tobit regression model. The firm size is taken to be the logarithm of fixed capital. All other variables are measured as percentage of net sales. I also included the square terms of these variables to capture their non-linear effects. I included a time dummy variable y_80s, defined by y_80s = 1 if year $\geq$ 1981, and y_80s = 0 otherwise. This dummy variable is useful to see if exports were higher in the eighties, after controlling for the effects of firm size, competitiveness, productivity growth, and import of raw materials and capital goods.

Notice that μ depends on the tariff structure of the industries, the government policies mentioned earlier regarding entry and exit and monopoly power. The detailed information about these variables is not available, so I take PCM to capture the monopoly power of a

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firm in a given industry. I follow the general empirical convention in the industrial organization literature to estimate PCM by, *PCM = (total sales – total wages and salaries – raw materials)/total sales.*

I also estimated a time varying translog production function to obtain estimates of the total factor productivity growth at the firm level as follows:

$$Y_{it} = A_{it}F(K_{it}, L_{it})\,\varepsilon_{it,}$$

I assume that firms have technologies that differ over time and across firms by a multiplicative scalar A_{it}, which represents the productivity level and it is the parameter θ in our previous notation. The term ε_{it} represents the functional approximation error, measurement error and the effect of any other left out inputs such as quality of inputs and managerial abilities of the firm i in period t. I further assume that $\{\varepsilon_{it}\}$ is an I(1) process, i.e., $\varepsilon_{it} = \varepsilon_{it-1} + u_{it}$, where $\{u_{it}\}$ is a mean zero stationary processes for each i. Let $a_{it} = ln(A_{it})$. I specify $a_{it} = a_{i0} + b_i t$, $t > 0$. To estimate b_i for each firm, I used a fixed effect estimation procedure. I also corrected for the cyclical effects of business cycles on the estimates of total factor productivity growth. One important determinant of the total factor productivity growth is in-house R&D. But there are many other factors that also influence total factor productivity growth. I report the total factor productivity growth rates of different industries in table 2. I take in-house R&D investment as the main determinant of θ, since we do not have data on managerial practices, and other innovative activities of the firms that affect θ.

5. The Data Set

Data on variables such as net sales, fixed assets, and wages and salaries were taken from Bombay Stock Exchange Directory. Data on exports and imports of capital goods and raw materials came from annual reports of the individual companies that are registered with the Ministry of Company Affairs. According to each firm's primary output, I assigned a 3-digit Standard Industrial Classification (SIC)code taken from the Annual Survey of Industries (ASI)

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volumes published by CSO (Central Statistical Organization). The nominal variables were converted into real terms by using wholesale price index numbers, which came from Revised Numbers for Wholesale Price Indices, the Ministry of Industry, Government of India. The variables output, value-added, capital stock, and labor hours were not directly available for firms. The output variable was measured by real value of net sales; the variable labor hours was constructed by dividing the wages and salaries of a firm by the wage rate of the industry at the three digit SIC level that the firm belonged to. Similarly, the value-added was constructed by multiplying the output level of a firm with the three digit industry level ratio of value-added to output. Capital variable was taken to be the real value of fixed assets.

I restricted the sample to those firms that were registered with the Bombay Stock Exchange Directory and the ministry of Company Affairs and had their paid-up capital at least 50 lakhs. There were about 2500 firms registered with the Ministry of Company Affairs, out of which only about 900 firms were registered with the Bombay Stock Exchange Directory. I had to further restrict the sample to firms having at least three consecutive years of data during the two periods to satisfy the data requirements for the econometric analysis. This led to 415 firms in the sample. I defined a firm to be exporting if it had positive exports during the period 1975-1986.

Although it would be ideal to carry out the study at the 2-digit industry level, due to paucity of data in certain industries, I regrouped the two-digit industries according to their technological similarities into five broad categories as shown in column 2 of table 2. Column 3 of the table gives the number of firms and column 4 reports the percentage of firms that are exporters in each industry.

6. Empirical Findings

I first present the summary measures of overall performance of the Indian firms in various industries and then report the empirical

estimates from the Tobit model of exports. Table 1 shows the industry categories of this study, and also in each category, it shows the number of firms and the percentage distribution of exporting firms in the sample.

Table 1. The industrial Classification of our Study

Industry	2-digit industries	nº firms	% of exporting firms
Food and Beverages	food products (20-21); beverages and tobacco (22)	47	32.35
Textiles	cotton (23); wool, silk, and synthetic fiber (24); jute (25);and textile products (26)	98	32.61
Petro-Chemical	rubber, plastic, petroleum and coal products (30); chemical products (31); non-metallic mineral products (32)	149	40.54
Metal Products	basic metal and alloys (33); metal products (34)	56	39.34
Machinery	machinery and machine tools: non-electric (35), and electrical (36)	65	42.86
Overall		415	37.94

6.1 Overall Performance

In table 2, I report the aggregate performance of productivity growth and competitiveness of various industries during the pre and post partial liberalization periods. In this table, I also report the average exports, imports of raw materials and capital goods as percentage of total sales of various industries during the two periods.

From these figures I find that with the exception of food and beverages industry, the growth in PCM is negative in all industries in

the eighties. Thus the firms in all industries (except the food and beverages industry) became more competitive in the eighties. The competitive pressure in the machinery industry, however, began even earlier, in the seventies.

From the estimates of TFPg in table 2 it is clear that only the food and beverages and petro-chemical industries showed a significant improvement during the second period, and other industries continued to have falling TFPg during the second period. These two industries contributed only about 28% of the total value-added in the manufacturing sector. Thus, I conclude that even though a few industries responded favorably to the partial liberalization policies, the productive efficiency of most Indian manufacturing firms did not improve significantly in the early eighties.

From table 2 it appears that the value added growth rates had significantly improved in all industries with the exception of textiles industry; the growth rate of value added in the metal products industry, however, remained negative during the eighties. The textile industry's poor performance in value-added growth might be, however, due to its serious labor disputes and strikes that occurred in the early eighties.

The impact on the overall economy of such diverse growth performances of the industries could be understood from the value added contributions of these industries. The food and beverages, petro-chemical, and machinery industries which had significantly high positive value added growth rates in the eighties contributed about 41 percent of total value added in the manufacturing sector; the textile and metal products industries, which showed negative growth rates in value-added, contributed about 36 percent. Thus, it is apparent that a major part of the manufacturing sector did not come out of stagnation in the early eighties.[5]

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[5] This supports Ahluwalia's (1985) findings based on 2-digit industry level study that the manufacturing industries did not come out of stagnation until 1982.

Notice that the incentives in the partial liberalization policies were not strong enough for firms to increase their import of capital goods, raw materials and exports significantly during the post liberalization period.

Table 2. Performance before and after partial liberalization
(all numbers are in percentage term)

Variables	Food	Textiles	Petro-ch.	Metal Prod.	Machine	Overall
Annual average Δ value-added						
1975-80	5.80	6.82	1.27	-1.72	6.68	4.05
1981-1986	8.95	-0.28	4.75	-1.14	11.11	5.05
Annual average Δ TFP						
1975-80	3.52	32.69	14.37	19.9	14.79	17.05
1981-1986	14.05	3.16	12.24	3.9	6.29	7.93
Annual average Δ PCM						
1975-80	15.25	208.01	18.77	-9.83	-5.41	45.36
1981-1986	55.25	-20.34	-32.97	-114.25	-4.31	-23.32
R&D/net sales						
1975-80	4.75	0.01	1.74	2.69	1.50	1.15
1981-1986	0.09	0.01	0.66	0.95	0.51	0.47
Exports/net sales						
1975-80	22.70	35.39	25.66	18.70	61.24	38.42
1981-1986	6.62	21.57	13.87	3.89	10.67	13.81
Import capital goods/net sales						
1975-80	1.68	1.69	4.45	8.16	13.58	7.43
1981-1986	2.10	7.05	4.58	4.81	8.98	6.11
Import raw materials/net sales						
1975-80	30.45	41.41	22.81	17.13	45.10	31.54
1981-1986	16.25	21.81	20.69	19.04	14.37	19.05

6.2 Estimates from the Tobit model of exports

I now present the regression estimates from the Tobit model in table 3. It is clear from the coefficient estimates of y_80s that after controlling for the effect of firm size, PCM, R&D investment, and import of capital goods and raw materials, the firm level export in all industries with the exception of textile industry did not improve in

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the early eighties. For machinery industry, the estimate is even significantly negative. Thus, the deregulation of the early eighties did not have any independent effect on exports other than through its effects on the included regressors in the above Tobit model.

Table 3. Parameter Estimates from the Tobit Model of Export

Variables	Food	Textiles	Petro-ch.	Metal	Machine	Overall
Constant	-0.7599	0.0827	-0.3561	-0.1815	-0.0002	-0.3225
	(3.20)	(0.19)	(2.61)	(0.74)	(0.00)	(3.25)
Dummy y_80s = 1 if 1980's	0.0154	0.5648	-0.0291	0.1115	-0.2314	0.0284
	(0.20)	(3.98)	(0.65)	(0.69)	(2.79)	(0.84)
Firm Size	0.3086	-0.3024	0.1540	-0.0473	0.0926	0.0953
	(2.83)	(1.72)	(2.62)	(0.53)	(0.69)	(2.30)
Square of firm size	-0.0334	0.0338	-0.0185	0.0089	-0.0043	-0.0092
	(2.51)	(2.01)	(2.87)	(0.87)	(0.28)	(2.05)
Import of capital goods	0.6644	1.1097	1.7880	0.2363	-0.3094	0.3409
	(0.94)	(1.33)	(3.77)	(0.36)	(0.64)	(1.59)
Square of imp. cap. goods	-0.5962	-3.1768	-3.5992	-0.1253	0.1075	-0.6508
	(0.41)	(1.56)	(2.82)	(0.14)	(0.19)	(2.05)
Imports of Raw Materials	1.1239	0.9304	1.1140	-0.4207	0.8673	0.9677
	(4.19)	2.57	(6.00)	(0.82)	(2.86)	(7.36)
Square of Imported Raw Materials	-1.3389	-1.2509	-1.0486	0.7934	-1.1150	-1.0116
	(3.91)	(2.40)	(4.36)	(1.19)	(2.31)	(5.61)
R&D Expenditures	0.2642	-98.008	1.0750	2.7534	-0.2035	0.4900
	(0.36)	(2.03)	(1.87)	(1.88)	(0.45)	(1.52)
Price-Cost-Margin (PCM)	-0.3409	-0.9708	-0.2861	-0.6699	-0.5333	-0.2236
	(2.49)	(3.46)	(2.11)	(1.31)	(1.75)	(2.33)
Scale	0.1442	0.2952	0.2698	0.3185	0.2857	0.2970
	(8.61)	(13.98)	(20.79)	(8.06)	(13.06)	(30.41)

Note: The absolute value of t-statistics are in parentheses.

From the estimates of the effect of firm size, it is clear that bigger firms exported higher fractions of their output in the food, textile and petro-chemical industries. This is true, however, for firms that are below a critical size in the food and petro-chemical industries, and above a critical size in the textile industry. So the

industrial licensing policy that limited the firm's capacity to expand did hurt exports of the food, textiles, and petro-chemical industries.

Notice that imports of capital goods and hence embodied foreign technology had positive significant effect on export only in the petro-chemical industry, provided the imports of capital goods were below a threshold level. Thus, restrictive capital import was not the main impediment to Indian export performance. The Import of raw materials, however, was a significant determinant of exports in all industries except metal products industry, provided that the import was below a threshold level. But from table 2, however, we see that import of raw materials did not go up in most industries during the eighties. Thus the incentives that were given to the firms to import raw materials in order to encourage exports were not strong enough and effective.

The R&D investment has positive significant effect on exports at 10% significance level in the petro-chemical and metal product industries, and has negative significant effect on the exports of firms in the textile industry. The effect is insignificant in food and machinery industries. Thus we see that R&D was somewhat important for exports in the eighties, but only in petro-chemical and metal products industries.

Finally, notice that PCM has significant negative effects on exports of all industries except the metal products industry. Higher PCM means the less competitive the firm is. Thus, our Tobit estimates and the estimates of the PCM growth in table 2 show that competitiveness of the firm is the most important determinant of firm level exports and the competitiveness did improve to some extent in the early eighties in response to the partial liberalization policies of 1980.

7. Conclusions

In this paper I have formulated a model of optimal export decision of private firms operating in a protective industrial structure. I used the theoretical model to predict the effects of firm size, import of raw materials, capital goods, in-house R&D and competitiveness on

exports of private firms. The theoretical model led to the empirical specification of optimal exports at the firm level as a Tobit model. I estimated the Tobit model using data on a sample of Indian private firms over the period 1975-1986. I used these estimates to examine the effect of the partial liberalization policies of 1980 on exports.

Judging on the basis of value-added growth, I found that while most industries had significant improvements in the early eighties, the textile and metal products industries which constituted about 36 percent of total manufacturing value-added, continued to have negative growth rates.

Based on the parameter estimates from the Tobit model I find that firm size had significant positive effect on export so long as the size was below a threshold level in the food and petro-chemical industry, and above a critical size in the textile industry. The imported capital goods had limited impact on exports in all industries with the exception of the petro-chemical industry. The in-house R&D also had limited impact. I found the most important determinants of exports to be import of raw materials and competitiveness. Thus, partial liberalization policies of the 1980, although limited in scope and coverage, had positive effects on exports since those policies positively affected import of raw materials and competitiveness.

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