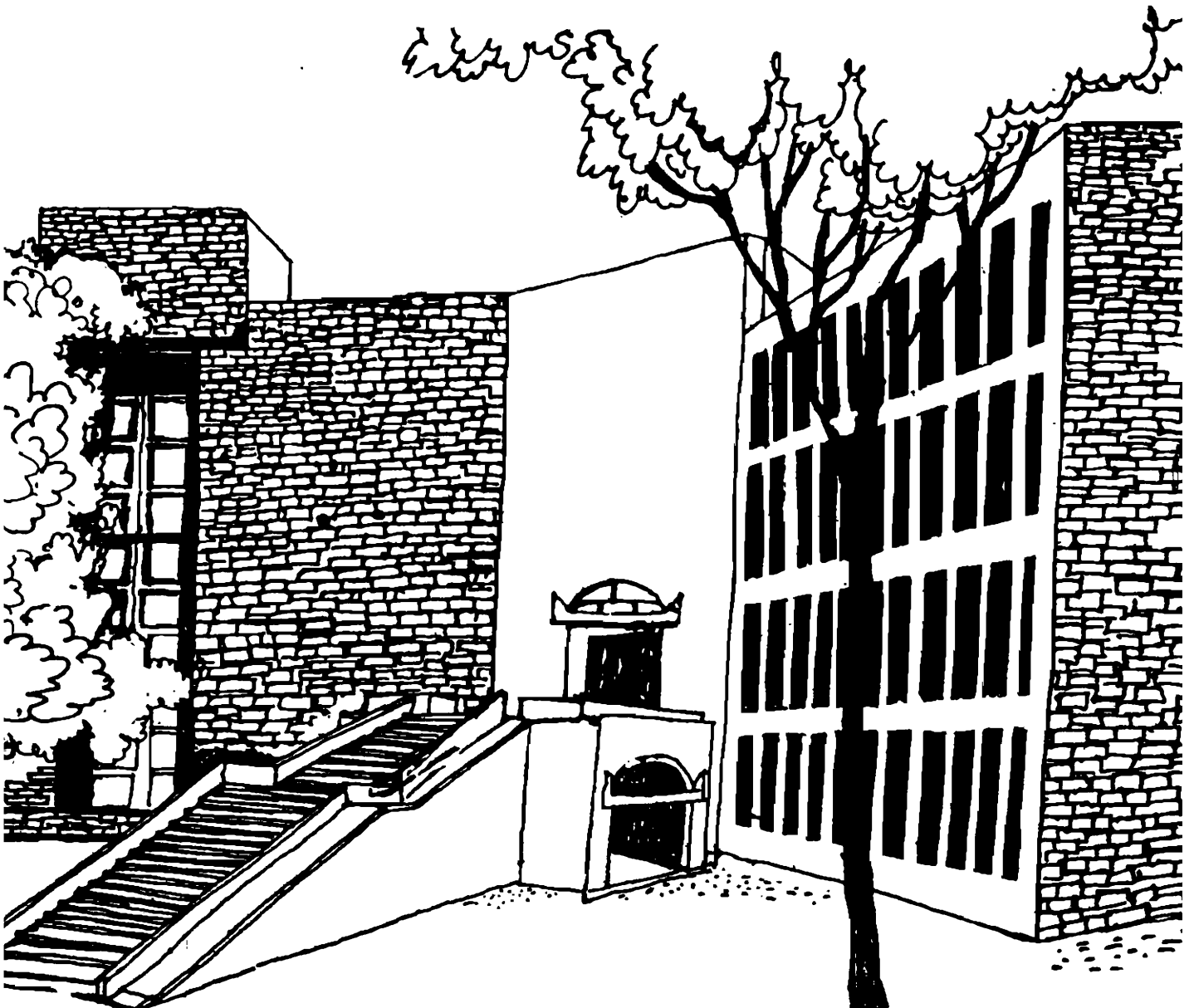




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Working Paper



THE POLICY REFORMS EVOLUTION OF DOMESTIC
MARKET STRUCTURE AND EXPORTS: A STUDY OF
INDIAN ENGINEERING INDUSTRY

By

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The Policy Reforms, Evolution of Domestic Market Structure and Exports: A Study of Indian Engineering Industry

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Abstract:

The policy reforms initiated in India since the eighties have caused entry of quite a few multinational firms into Indian industries. This has significant implications on the evolution of domestic market structure into a competitive one and consequent increase in exports. This paper builds a simple theoretical model in tracing out the evolution of domestic market structure by considering asymmetries in terms of time of entry and costs of production under oligopolistic competition. The main propositions of the model are empirically verified by econometric exercises based on firm level panel data for a set of industries. The results suggest a positive explanation of domestic market shares of firms by their relative technical efficiency in production. Increased competition from new entrants, especially multinational firms is driving domestic firms to undertake deliberate technological efforts for enhancing production efficiency. Research and development expenditures appear to be more important for domestic firms than multinationals (which possess superior technology) in increasing technical efficiency in production. Increase in industry output, because of new entry and increased production efficiency of firms, appears to make firms to augment their export orientation.

JEL Classification: L13, F12

Key words: Incumbent; New entrant; Competition; Production Efficiency; Domestic Market Shares; Exports.

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The Policy Reforms, Evolution of Domestic Market Structure and Exports: A Study of Indian Engineering Industry

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1. Introduction

The industrial policy reforms initiated in India since mid-eighties are expected to increase domestic competitive conditions by encouraging new entrants. The major components of the reforms since the mid-eighties are (see Mani,1995):

1. The abolition of the complex system of industrial licensing in most industries except for a small list of strategic and potentially hazardous industries and a few industries that are reserved for small scale industries.
2. The new policy encourages Foreign direct investment. Initially, it allowed investment with little or no restrictions in a defined list of 34 industry groupings subject to a limit of 51 per cent foreign equity holdings. The restrictions of various types, applied to companies with more than 40 per cent foreign equity have been abolished. In the very recent times, the equity participation for multinationals has been increased to 84 per cent.
3. Devaluation and exchange rate management by the Reserve Bank of India is undertaken to encourage exports.
4. Quantitative restrictions on imports have been abolished except for a few final consumer goods industries. Tariffs on imports have been reduced significantly. But differential tariff structure on final and intermediate and capital goods is followed. According to the budget of 1994-95, the final consumer goods are subject to a peak rate of 65 per cent and intermediate goods are subject to an average duty of 30 per cent and duties on capital goods have been reduced to 35 per cent.

In terms of sequence, the domestic market reforms of industrial licensing and liberalization of entry of multinational investment have been undertaken first and trade policy reforms in terms of reduction on tariffs have been undertaken at a later stage. The sequence to the internal and external reforms have important

implications on the evolution of domestic market structure. The initial internal industrial reforms has supposed to have enhanced domestic competition by encouraging new entrants. Competition from imports is being introduced in gradual stages. In simple theoretical terms, new entry of domestic and multinational firms is supposed to cause evolution of domestic market structure into a competitive one and subsequently increase production efficiency of firms and industries. This, in turn, is expected to cause downward shifts in supply curve and increase in exports (Patibandla, 1996). Porter (1990) shows the key role of competitive domestic market conditions in generating internationally competitive industries. For example, the Japanese success stories, e.g., cars, motorcycles, cameras, video-recorders and musical instruments, etc., are those industries in which domestic competition is intense.

An understanding of the dynamics of evolution of domestic industrial structure from a highly protected one to a competitive one requires addressing of questions such as: how incumbent firms who functioned under protected market adjust to new entrants and whether the incumbency advantages of dominant oligopoly producers will erode because of entry of more efficient multinational firms; if new entrants are mostly multinational firms will it lead to increase in average production efficiency of industries; if increase in new entry leads to competition through higher production efficiency, whether it leads to increase in concentration. What kind of strategies firms will adopt towards domestic and export markets under the changing domestic market conditions. This paper attempts to address some of these questions.

The recent theoretical developments in industrial organization show that definition of a competitive market does not necessarily imply presence of large number of firms. Competition could be intense in the presence of oligopoly and monopoly market structure when markets become highly contestable. Contestability is defined in terms of zero entry and exit costs to new firms (Baumol et al, 1982). Entry barriers can arise out of not only government policies such as industrial licensing but also capital market imperfections and presence of sub-optimal economic institutions. As the policy reforms have been only partial and other forms of entry and exit barriers such as capital market imperfections and high market transaction costs due to sub-optimal institutions still exist in Indian economy, absolute new entrants will have a disadvantage in relation to incumbent large firms. In such a case, new entrants would be mostly multinational firms with large purses and established

domestic corporate houses diversifying into new industries rather than absolute new entrants. This has been the case in most Indian industries; since the reforms have been initiated it is multinational firms with joint ventures who have entered the domestic market as the major new players. This, in turn, will have significant implications on the evolution of domestic market structure by altering the behaviour of incumbent domestic firms.

The issue of multinational investment in this context refers to two main issues: implications of multinational investment on the evolution of domestic market structure and export behaviour of multinational firms. The later aspect requires the framework of multi-market oligopoly as multinational firms operate in different international markets simultaneously. In other words, the assumption of price taking in the world market can not be applied to large multinational firms. The export behaviour of multinational firms in India depends on their market strategies in different markets. If investment in the Indian market makes a significant difference to costs of production owing to India's comparative advantage in factor endowments, locating production in India will give them an advantage in world markets. If there is no clear cut cost advantage in locating production in India, multinational investment will be more towards serving the domestic market by overcoming the tariff and other barriers like high transport costs to imports. This strategy also may lead to increase in exports by increasing the domestic competitive conditions and pushing domestic firms to extend market size through exports.

The analysis of implications of multinational investment on domestic market structure has to take into account of industry specific conditions in terms of importance of knowledge specific capital versus physical capital. This is because relative advantage of multinational firms in the host country arises out of knowledge intensity of production (Markusen, 1995). Entry of multinational firms into capital and knowledge intensive industries could alter the behaviour of domestic firms in terms of increased investment in R&D and marketing. Secondly, if multinational investment leads to knowledge (Romer's 1993, idea of reduction in 'idea gap') and technology spillovers, average production efficiency of industries could increase. On the other hand, if multinationals cut

into the market shares of incumbent domestic firms, their production efficiency could decline by making them to produce at sub-optimal scales (excess capacity). This, in turn, may push domestic firms to export more.¹

This paper undertakes empirical analysis of the above issues for a set of Indian industries. Section 2 presents a theoretical framework which adopts a simple industrial organization theory in terms of sequence of entry of firms as a reference point in tracing out the evolution of market structure in response to the policy reforms. Section 3 presents the empirical analysis. The empirical analysis is based on firm level panel data drawn for a set of Indian engineering industries. The empirical exercise test for the behaviour of firms in the post-reforms period of 1986 to 1996. The domestic industrial policy reforms were initiated in the middle of eighties and the eighties had seen entry of quite a few multinational firms into Indian industries. Panel data analysis is undertaken in measuring relevant variables. Concluding remarks are presented in Section 4.

2. The Theoretical Framework

We take the domestic and export markets segmented through import protection. This assumption is justified as most final goods industries have been subject to high import tariffs: as of 1997, the average import tariff is 60 per cent on consumer goods and 30 per cent ad valorem on intermediate and capital goods. In order to keep the analysis simple we ignore imports. On the basis of small country assumption, domestic firms are price takers in the world market. Firms are strategically interdependent in the domestic market, i.g., domestic competition is in terms of oligopolistic strategic interdependence. Firms ability to capture higher market shares depends on strategic advantages of time of entry, lower costs of production, and market strategies. Whether firms compete with capacity choices (a la Cournot) or prices (a la Bertrand) or a combination of these two, increase in the number of firms and increase in market share of any one firm lead to increase in industry supply. Given domestic demand curve, downward shifts in supply curve leads to increase in exports. In other words, exports, which extend market size, are a result of domestic market rivalry.

¹ Aitken et al. (1994) report that Mexican manufacturing firms were significantly more likely to export when foreign firms were located nearby. The explanation is in terms of information and other externalities.

The policy reforms lead to increase in number of players in the domestic market and consequently market supply. If we assume there is no change in technology of existing firms in the immediate period, whether increase in number of firms in the industry leads to increase in production efficiency of individual firms depends on the market structure. If reforms are taken in terms of movement from monopoly to competitive structure, individual firm's production efficiency increases because a firm moves down on declining average cost curves as market price goes down due to new entry: it moves towards optimal capacity utilization (production at the lowest point on the 'u' shaped average cost curves). This leads to a downward shift in the market supply curve. Given the domestic demand curve and world market price, a downward shift in the supply curve results in an increase in exports.

Under oligopoly conditions, when we take firms to compete with capacities a la Cournot, increase in number of firms makes market price and supply to approach competitive level, benefiting consumers. But individual firms efficiency declines, if we take an 'u' shaped average cost curve. This is because as new firms enter, existing firms would contract their production, although less than proportionately to the increase in the supply of new entrants (as the reaction curves are downward sloping and their slope is less than one). In other words, existing firm's production moves backward on the declining average cost curves which results in production at sub-optimal capacities.² Increase in efficiency has to come from downward shifts in cost curves.

If multinational firms enter with better technology, superior brand names and international reputation, they may be able to capture higher share of domestic market. This, in turn, could alter incumbent firms market behaviour: they may undertake efforts towards shifting cost curves downwards and also increase advertisement expenditure. This is given a theoretical foundation in the following.

We characterize the evolution of market behaviour of firms by introducing an initial asymmetry of time of entry into the market in terms of pre-reforms and post reforms periods. While the industrial licensing policies were

² This could be one of the reasons for the empirical finding of Aitken and Harrison (1993) for Venezuela that while foreign investment raises productivity overall, the gains are internalized or captured by other foreign firms, with productivity in domestic firms actually declining.

in practice, certain firms could corner the licenses.³ These firms are the first entrants and would be in a position to derive the asymmetric advantage of first entry over new entrants in the post-delicensing period. In such a case, the incumbent firms could remain to occupy major part of the domestic market and make new entrants to behave as followers. This behavioral outcome can be theoretically analyzed by applying Spence-Dixit's (1980) model of entry. This model is based on a two period (stage) game. Take the case of duopoly of firm *i* and firm *j*. In the first period (prior to the reforms), firm *i* makes irreversible capital stock decision (capacity creation). In the second period (after the reforms), new entrant (*j*) and incumbent compete in Cournot quantity space. New entrant attempts to find profit maximizing output on the residual demand curve. This earlier investment by firm *i* in capacity or sunk costs alters the second period game in favour of firm *i* and it will be a Stackelberg leader in the second period.⁴ Consequently, the first entrant *i* captures higher share of the protected home market and makes firm *j* to behave like a follower on the residual part of the home market demand curve. Assuming both firms have similar technology, the incumbent leader firm would maintain higher home market share and export at lower intensity than new entrants. The licensing policies could facilitate incumbent firms decisions to invest in capital stock in the first period. If there is a time gap between the announcement and implementation of industrial delicensing, it could induce incumbents to invest in additional capacity (capital stock) as in Dixit's model which provides them with a relative advantage in the post-entry period. We introduce an additional factor that there is a premium to serving the protected domestic market or that firms may possess intangible assets that provide them with a relative advantage in the domestic market. The basic model is as follows;

We assume a homogenous commodity for starting. The linear inverse home market demand function is:

$$P = a - b (X) \tag{1}$$

$$X = x_i + x_j$$

³ A number of large firms in Indian industry could use the licensing and MRTP (Monopoly Related Trade Practices) policies as an entry-deterrent strategy. The auto-tyre industry is observed to be a classic example of where existing firms used the licensing policy as an entry deterring mechanism thereby maintaining their sway over the industry. See Mani, 1995.

⁴ In other words, investment in sunk costs allow an established firm to commit to preferred output.

$$X_i = \sum_{i \neq j} x_i \quad i = i, j$$

$$P \geq P_w (1+t)$$

x_i refers to domestic sales and x_i^* refers to exports of firm i . P_w is world market price and t is tariff rate on imports and P refers to domestic market price. In equilibrium, $P > P_w$. The profit function of firms facing protected domestic market and competitive export markets is:

$$\Pi_i = P()x_i + e_i x_i + P_w x_i^* - c_i / 2 (x_i + x_i^*)^2 \quad (2)$$

$$\Pi_j = P()x_j + e_j x_j + P_w x_j^* - c_j / 2 (x_j + x_j^*)^2 \quad (3)$$

We introduce the premium on domestic sales as e_i ; it can be treated as an intangible asset firms possess which gives them a relative advantage in the domestic market. The premium on domestic sales can be viewed to arise out of the condition that in equilibrium $P > P_w$: a firm that has higher share of the protected domestic market will have higher profits. By equating the first order derivatives with respect to export sales to zero, we obtain;

$$x_i^* = (P_w/c_i) - x_i \quad (4)$$

$$x_j^* = (P_w/c_j) - x_j \quad (5)$$

The follower firm j takes x_i as given and solves;

$$\text{Max } \{\Pi_j = (a - bx_i - bx_j)x_j + e_j x_j + P_w x_j^* - c_j/2 (x_j + x_j^*)^2 \quad (6)$$

$$\frac{\partial \Pi_j}{\partial x_j} = (a - bx_i - 2bx_j) + e_j - c_j (x_j + x_j^*) = 0 \quad (7)$$

From equation (5), we know that $x_j + x_j^* = (P_w/c_j)$. By substituting this into equation (7), we get;

$$x_j = (a + e_j - P_w - bx_i)/2b \quad (8)$$

Equation (9) is the reaction function of the new entrant who believes incumbents capacity choice does not change to its capacity decision, a la Cournot. As the incumbent behaves like a Stackelberg leader, the reaction function of j enters the profit function of firm i . By solving for the profit function of firm i , we obtain;

$$x_i = (a - P_w - e_j + 2e_i)/2b \quad (9)$$

By substituting equation (10) into (9), we obtain the equilibrium home market sales of the follower;

$$x_j = (a - P_w + e_j - 2e_i)/4b \quad (10)$$

The exports of firms in equilibrium;

$$x_i^* = (P_w/c_i) - (a - P_w - e_j + 2e_i)/2b \quad (11)$$

$$x_j^* = (P_w/c_j) - (a - P_w + e_j - 2e_i)/4b \quad (12)$$

$$a > P_w$$

From equations (11) and (12), it can be observed that the follower firm has higher export orientation than the leader when we assume e_i and e_j are equal to zero and there is symmetry in costs. The leader firm i , by the sheer advantage of being the first entrant, is able to capture higher share of the protected domestic market.⁵ But if the leader's costs are sufficiently lower than the follower, the above outcome can be reversed- the leader will have higher home market sales and also higher exports than new entrant. This possibility may take place if there are strong learning economies in production, internal to a firm, which are exclusive to the firm. The leader being the first entrant will be able to realize these learning economies which are a private good and will have lower costs of production than new entrants.

As we can observe from equations (11) and (12) that asymmetries in production costs across firms i and j have implications only on exports but not on domestic sales. This will be the case if we take pure production costs. An important component of firms behaviour or strategic advantages in the domestic market arises out of asymmetries in e_i , which, as mentioned before, refers to possession of intangible assets by firms. These are caused by certain exogenous factors and factors endogenous to the competition in the post-reforms period. The exogenous components could be incumbents accumulated experience in dealing with market institutions specific to India, and the international reputation and brand names of new entrant multinational firms. To elaborate this,

⁵ The dynamics of changes in domestic market shares and export intensity of firms can be seen through comparative statics of equilibrium by changing c_i and e_i .

if the incumbency advantages of accumulated learning economies are in terms of their ability to deal with market conditions and institutions specific to India (the Indian bureaucracy and legal system), it provides them an additional advantage in the domestic market. Similarly, multinational firms enter the domestic market with international brand names and reputation which, in turn, may provide them a relative advantage over domestic incumbents (for example, Honda motorcycle was well known in India prior to its entry into Indian market. Other example is Coca Cola). On the production costs side, multinationals superior technology which they already possess prior to entry and incumbents learning economies in production acquired in the pre-reforms period can be taken to be exogenous factors. In other words, presumably multinationals have access to productive knowledge which is not available to domestic producers. As Caves (1982) others have shown, multinational firms, apart from their superior production technology, possess intangible assets such as technological know how, marketing and managing skills, export contacts, coordinated relationships with suppliers and customers and reputation. This, in turn, could provide them a significant relative advantage in the host developing economies's markets.

In the post-reforms period, firms compete in Cournot quantity space in the domestic market. Asymmetries in c_i and e_i that are endogenously generated by firm's behaviour determine subsequent changes in relative domestic market shares and export intensity. The competitive process in the post-reforms period induces firms to undertake technological and marketing efforts to shift both e_i and c_i in their favour. Multinational firms, which enter with a relatively strong advantage in production costs may have higher export orientation in the beginning and subsequently make efforts at enhancing e_j . As the new entrants gain domestic market share by enhancing e_j , domestic firms may lose their dominance of domestic market and may have to look for export markets. This, in turn, induces them to make technological efforts to reduce costs to be able to serve in the competitive world market. Furthermore, firms in general may increase advertisement expenditure to compete in the domestic market. Advertisement expenditure might be more towards gaining an edge in the domestic market rather than increasing exports as we assume firms are price takers in the world market. We explain this observation in detail in the following.

The apriori commitment to capacity or sunk costs (without an option of withdrawal in the second period) works as an advantage to an incumbent in Dixit's model as she has to make all efforts to safeguard her position in the second period. On the other hand, on the basis of path dependency argument (David, 1985), being the first entrants into the Indian market during the pre-reforms period may be a source of disadvantage in the post-reforms period, if new entrants come with superior technology and marketing practices. Dosi et al (1991) argue that firm's accumulation of capabilities and assets is local, cumulative path dependent: the idea of path dependency implies that history matters, and that sunk costs are not bygone. They explain: "...a firm's previous investments and its repertoire of routines (its history) constrains its future behaviour. This follows because learning tends to be local. That is, opportunities for successful new developments will be "close in" to previous activities...' In the pre-reforms period, large oligopoly firms in most Indian industries were able to derive long run market power due to the policy regime that heavily protected them from both internal and external competition. This, in turn, facilitated many firms to realize supernormal profits despite being highly X-inefficient in production (Patibandla, 1996a). Consequently, the incumbents firms that got used to easy life might not be able to adjust efficiently to new market conditions in the post-liberalization period.⁶ Furthermore, the incumbents might be stuck with outdated technologies and capacities. If the new entrants can leap-frog and bring in superior technologies in the post-liberalization period, the incumbents may lose out the advantage of being the first entrants. This will particularly be the case if the new entrants are multinational firms. This, in turn, will force incumbents to alter their capacities and technology and look for export markets. In order to increase exports as a response to new entry, they have to reduce their costs.⁷ Furthermore, entry of new firms increases domestic supply which, in turn, reduces the market price. To be able to supply at a lower price in domestic market and competitive price in export markets, domestic firms have to make efforts towards improving production efficiency.⁸

⁶ If new entrants have the information that incumbents have higher costs, it gives phillip to their entry in the market.

⁷ For example, in the light commercial vehicle industry, Tata Engineering and Locomotives ltd company which is a major domestic firms has been making significant technological efforts to become a major exporter since last few years.

⁸ But, here, the qualifying statement is that if there are tariffs on imports, and firms face protected domestic and competitive export markets, new entry may not lead to increase in domestic supply and decrease in domestic price below $P_w(1+t)$. If all firms are characterized to compete in Cournot quantity space, the increase in supply will be diverted to export markets in order to keep domestic price at

The essential point is that the entry of multinational firms, with superior technology, brand names and managerial practices and accumulated learning economies through their operations in multi-markets, may erode incumbency advantages of domestic firms particularly in knowledge capital intensive industries and alter their behaviour (Dunning, 1981; Markusen, 1995). In such a case, subsequent market evolution could reverse the above theoretical result: while the new entrants will become market leaders and incumbents followers.⁹ If incumbent firms become followers, their market behaviour would change in terms of undertaking efforts to reduce costs and increase advertising expenditure and to look for export markets.

In order to enhance their cost competitiveness, domestic firms have to make deliberate technological efforts and increase R&D expenditure.¹⁰ R&D investment may be made to reduce costs of production and to differentiate a product (both outcomes shifts a firm's reaction curve). Firms will also increase advertisement expenditure to enhance brand image and domestic market reputation (increase in e_i). Firms in general may increase advertising expenditure as a response to new entry (especially in consumer goods industries). This increase in advertising expenditure may not only be towards competing with rivals that have entered the market but also to make further entry more difficult¹¹ (Geroski, 1991).

$P_w(1+t)$ (Patibandla, 1996).

⁹ For example, the multinational firms, Hero Honda company in the two wheeler industry and Maruti Suzuki in the automobile industry became major players within a short period.

¹⁰ Dasgupta and Stiglitz show that under Cournot oligopoly with barriers to entry increase in number of firms leads to reduction in R&D expenditure by firms but total industry level goes up. This is because as N increases, firms profit levels (surplus) goes down. In Indian industry this has to be seen in a different manner, because new entrants are more efficient multinationals. If high costs incumbents do not reduce costs, they could be eliminated by more efficient new entrants. Domestic firms that succeed in (R&D) reducing costs are the ones that will survive. If one looks at the qualitative evidence, many domestic firms in the T.V., automobiles and two wheeler industry (Enfield India Ltd) which could not adjust efficiently to the reforms either exited or became very marginal players.

¹¹ The nature of response to changed (changing) environment may not be uniform across all domestic firms. Some firms which were used to stagnant (or predictable) environment of the pre-reforms period may remain to be risk averse and prone to inertia. Some firms may simply go in for a joint collaboration with a multinational. Some firms may increase in-house R&D towards reducing costs and improving upon the product characteristics and also increase advertisement expenditure. The qualitative evidence shows that quite a few domestic firms with a few exceptions have been resorting to joint collaborations with multi-national investment and introduce new products borrowed from developed countries rather than increasing in-house R&D.

Apart from this, if there are significant technology and knowledge spillovers of foreign direct investment, domestic firms would benefit from this. Domestic oligopoly rivalry through lower costs and positive externalities of FDI leads to fall in overall costs at industry level which shifts market supply curve downward and consequently increase in exports.

The assumption of price taking in the world market may not hold for the explanation of export behavior of multinational firms. One has to extend the analysis to multi-market oligopoly behaviour as these firms produce in different countries simultaneously. The export behaviour of multinational firms requires analysis of underlying strategies of multinational firms in investing in domestic market which requires information on variables such as import tariffs, transport costs, domestic comparative advantage in factor (skilled labour) endowments, domestic market size and multi-market strategies of multinational firms. These firms will be interested in exporting if locating production in India makes a substantial difference to cost of production in relation to production costs in other countries which, in turn, provides them an advantage in international market oligopoly rivalry. If location of production in host market makes no significant difference to their relative costs, their investment decision will be mainly to serve domestic market by overcoming tariff and transport costs. If the capacity made in Indian market is small, its exports does not make a difference to world market price as volume of exports will be low. Apart from this, investment in capital intensive technology industries is made at small scales, the production advantage through availability of inexpensive skilled labour in the domestic market in relation to world market may not be dominant. For example, given the relatively small size of domestic market, investment in automobile industry is generally made at sub-optimal scales. Recently, several multinational firms entered the Indian industry through joint ventures (especially in the luxury car segment). India's share of world vehicles sales volume is at 1 per cent and now there are about 18 producers of cars. There is a critical minimum level of fixed investment that has to be made in capital intensive industries. Once investment is made in these industries (with the motive of serving domestic market), small size of domestic market may force firms to export in order to extend the market size and realize optimal scales. This is especially true if there is no exit of firms despite overcrowding in domestic investment (assuming new entrants do not adopt 'hit and run' strategies).

From the above discussion, the evolution of market structure in terms of increase or decrease in market shares and export intensity of domestic and multinational firms is determined by the asymmetries in production costs and domestic market advantages in e_i . As mentioned before, the asymmetries in these factors across firms could be due to both exogenous and endogenous factors. For example, multinational firm's superior technology can be treated as an exogenous factor but its learning economies in the host economies depends on its cumulative output growth. Similarly, if domestic firms had the accumulated learning advantages of being the incumbents, these can be treated as exogenous as these are a result of their operation prior to the policy reforms. New entry into the industry could alter the behaviour of domestic firms both in the demand and supply side. If the new entry makes the domestic firms to undertake cost reducing efforts through R&D expenditure, this can be treated as endogenous to the competition process. To illustrate this, for new entrant multinationals (entering with relatively latest technology), productivity gains will be mostly through growth in cumulative output but not investment in R&D. On the other hand, domestic firms have to invest in R&D to catch up technologically with new entrants. For example, since entry of multinationals in the two wheeler industry, the domestic firm Bajaj auto increased R&D expenditure significantly while the new entrant multinational firm Hero-Honda does not invest in R&D at all. Another example is the domestic firm TELCO in the light commercial vehicles industry which has been increasing R&D expenditure significantly during the last few years.

The above analysis is based on the assumption of taking domestic market demand curve to remain unchanged. If domestic demand increases due to some exogenous factors of increase in incomes, increase in supply due to evolution of market structure may not lead to increase in exports if domestic market absorbs increase in supply.¹²

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¹² This is especially true when firms give priority to serving domestic market over export market which is captured by e_i in the profit functions.

Secondly, efficiency levels of firms and industries may depend not only on the micro level technological efforts but also on the industrial growth in general. In a growing domestic market, there could be significant external economies in production to firms. Apart from this, it also facilitates economies of scale in production which enhances export competitiveness of firms.

3. Empirical Analysis

The objective of the empirical exercise is to explain the behaviour of firms in the post-reforms (post-entry) period rather than comparing the behaviour across the pre and the post-reforms periods.¹³ Some of the main propositions of the previous section are tested by examining the econometric explanation of firm level export intensity, domestic market shares by a set of variables like relative production efficiency, advertisement intensity, ownership (domestic versus new entrant multinationals) and explanation of relative production efficiency by research and development expenditure. These variables are taken to capture the competitive dynamics of the post reforms period. The main propositions are as follows:

1. One straight forward hypothesis from the theory is that if incumbents and new entrants have similar production efficiency and there is symmetry in e_i , incumbents will have higher domestic market share and new entrant will export at higher intensity. If incumbents have lower costs (because of learning economies of being first entrants in domestic market), they will have higher domestic market share and also higher export intensity.
2. One other general hypothesis (valid for both pre and post reforms period) is: as total industry output increases, exports increase. Industry output increases because of increase in number of firms and decline in costs of production. As equations (11) and (12) show, this leads to increase in total output and exports. The underlying reason is that oligopoly firms may increase exports in order to avoid expansion in the protected domestic market which depresses domestic market price.¹⁴
3. Higher the production efficiency higher is the export intensity of both domestic and new entrant firms. Entry of new firms induces domestic incumbent to make technological efforts in terms of increasing R&D expenditure to reduce production costs. R&D expenditure is more important for domestic firms

¹³ The pre-reforms behaviour of Indian oligopoly firms has been well documented in several studies (see Mookherjee, 1995).

¹⁴ This is similar to a price discriminating monopolist facing a protected domestic market and competitive world market. Patibandla, 1996. An example of this in Indian industry is that in the automobile industry Maruti Suzuki sells its small car at a lower price in export markets and higher price in domestic market and there is waiting period for consumers between booking and delivery.

than for new entrant multinationals as they enter domestic market with superior technology. New entry also induces increase in advertisement expenditure and it should explain relative domestic market shares of firms positively.

3.1 Data

The empirical analysis is based on firm level panel data for a set of Indian engineering industries. The time period covers 1986/87 to 1995/96. The data sources are Top Hundred Indian Firms of Confederation of Indian Industry and Corporate Analysis Data of Centre for Monitoring Indian Economy. The sample is drawn from Two-wheelers (TW), Light commercial vehicles (LCV) and Motors and transformers industries. The sample for Two wheeler industry consists of four firms out of which two are new entrant multinationals and for the Light commercial vehicles industry it consists of five firms out of which one is a new entrant multinational (Daewoo motors). In the case of Motors and Transformers industry, there are no new entrants. Therefore, the distinction is made only between domestic and multinational firms.

There are a few firms which can be identified as new entrants straightaway. But in case of some firms it is difficult to classify them: these are incumbent joint venture firms. These firms simply increased foreign ownership from 40 per cent to 70 per cent equity after the reforms. Because of this, we take qualitative variables that represent new entrant multinationals and also multinational firms in general. Firms with foreign ownership at 51 per cent and above are considered multinationals. Since the exercises are based on panel data, each observation of the variables refers to a firm in an industry for a particular year.

3.2 Measurement of Production Efficiency

Firm level efficiency indices are measured on the basis of Farrell's (1957) production frontier approach. Recent developments in the efficiency frontiers literature show the derivation of plant-specific time-variant technical efficiency indices by using panel data. The production function defines the maximum possible output a firm can realize for a given level of inputs employed, given the technology level. Farrell's method shows relative technical efficiency as the extent of deviation of output realized by a firm (for a given level of inputs employed) from the best practice in an industry.

The panel data techniques of measuring efficiency overcome several well known shortcomings of the estimates based on cross-sectional data (see Pitt and Lee, 1981). The panel data captures cross-sectional information of firms in an industry and also repeated observations over time for a given firm. This, in turn, overcomes the shortcomings of strong distributional assumptions about composed error terms. Furthermore, this method does not impose the assumption that technical efficiency is independent of factor inputs.

By taking Cobb-Douglas functional form, we can represent the technology as follows:

$$Y_{it} = \alpha + \beta X_{it} + v_{it} - u_i \quad (13)$$

where Y_{it} is the observed output, X_{it} is a vector of K inputs: i index firm ($i = 1 \dots N$); t index time ($1 \dots t$). α and β are the unknown parameters to be estimated. v_{it} represents random errors. u_i ($u_i \geq 0$) represents technical inefficiency with one-sided distribution which means that output must lie on or below the frontier.

The random error v_{it} is assumed to be identically and independently distributed across firms and time with identical zero mean and constant variance. It is also assumed to be un-correlated with factor inputs. The other error component, u_i , is assumed to be independently and identically distributed across plants with mean μ and variance σ_m^2 .

We can rewrite the above equation (13) as

$$Y_{it} = (\alpha - u_i) + \beta X_{it} + v_{it} \quad (14)$$

Cornwell et al (1990) introduce a parametric function of time into the production function to replace the coefficient of plant-specific technical efficiency. The functional form is

$$Y'_{it} = X'_{it} \beta + \alpha_{it} + v_{it} \quad (15)$$

where

$$\alpha_{it} = w'_{it} O_i, \quad w' = (1, t, t^2), \quad O_i = (O_{i1}, O_{i2}, O_{i3})$$

and other variables are as defined before.

The model allows the rate of productivity to vary over time and firms. The production function can be estimated by OLS, which is referred to as the 'within estimator' in the literature (Krishna and Sahota, 1991). The residuals of the estimated function are used in deriving the efficiency indices. OLS estimation of the production function can be justified in terms of the Zellner-Kmenta-Dreze proposition that under the assumption of maximization of expected profits, the explanatory variables and the disturbance term are un-correlated. However, $\hat{\alpha}_{it}$ is not consistent as T goes to infinity if factor inputs are correlated with firm and time specific effects. Under these conditions, the consistent estimators of $\hat{\alpha}_{it}$, as time goes to infinity, can be derived by estimating equation (3) using OLS directly (see Liu, 1993). The production function is estimated by the two input Cobb-Douglas functional form with value-added as output, and L and K as inputs.

3.3. The Variables

TE = relative production efficiency of firms in an industry

DS = domestic market share of firms

E = exports

S = Total sales turnover

ES = (E_i/S_i) , export intensity of a firm

SES = $(E_i/S_i)/(\sum E_i/\sum S_i)$, it measures relative export intensity of a firm in relation to industry average. This variable should reduce simultaneity bias in estimations.

- RDS* = (Research and development expenditure/sales): this variable captures only a limited dimension of technological efforts of firms as it is based on the book value of R&D expenditure. Firms do undertake deliberate technological efforts on the shop floor towards improving efficiency with varying intensity which may not be captured by this variable. The other drawback of this variable is that several Indian firms report R&D expenditure figures just to avail of the tax incentives.
- D1* = dummy variable that takes value 1 for new entrant multinationals and 0 for incumbent firms.
- D2* = dummy variable that takes value 1 for multinational firms and value 0 for domestic firms.
- ADS* = (promotional expenditure/sales). Promotional expenditure includes expenditure on advertising, distribution and marketing.
- CUM* = cumulative value-added that captures learning economies
- TDS* = total domestic annual sales of an industry
- V* = value-added
- L* = salaries and wages as labour input
- K* = rental value of capital.. $(TK * r) + DP$, where TK is total capital employed, r is the bank lending interest rate, and DP is the depreciation.

The arguments regarding e_i of Section 2 are captured to some extent by the Promotional expenditure variable and also the Ownership dummy variables. Promotional expenditure, which includes advertising and marketing, enhances domestic reputation. Multinational firms international reputation is an intangible asset in the domestic

economy. Incumbent domestic firms accumulated experience of market and institutional conditions specific to Indian economy is an intangible asset.

The main propositions, as listed earlier, are econometrically tested by estimating the following equations.

Equation 16: it tests for the explanation of domestic market shares of firms by relative production efficiency, advertisement expenditure and ownership:

$$DS = f(TE, ADS, D1, D2) \quad (16)$$

Equation 17: its tests for the explanation of export intensity of firms by relative production efficiency, ownership (domestic versus multinational firms), and total industry domestic sales.

$$(E/S) = f(TE, D1, D2, TDS) \quad (17)$$

Equation 18: it tests for explanation of relative production efficiency of firms by R&D intensity, cumulative value-added) and ownership.

$$TE = f(RDS, CUM, D1, D2) \quad (18)$$

3.3. The Results

The equations are estimated by Tobit maximum likelihood method as the dependent variables, export intensity, domestic market shares and TE are limited to take values from 0 to 1. And in case of export intensity a few observations take zero values. If observations are clustered around zero and limited in their values, OLS estimates provide biased estimates (Maddala, 1983). Tobit technique avoids this bias. A high correlation (multicollinearity) among the explanatory variables could produce high standard errors and also wrong signs for the estimated parameters. This could be especially true when we introduce interactive variables. Therefore, in order to avoid this problem, we introduce minimum number of core explanatory variables in the estimation of the main equations.

Tables 1, 2 and 3 present the results for equations 16, 17 and 18 respectively. The statistical significance of the results is reasonably high and the signs of the estimated parameters are generally similar for both the industries. The results provide reasonable support to the main propositions of the model. One of the strong

results, as shown in Table 1, is that relative production efficiency of firms (TE) is explaining their domestic market shares positively and at high statistical significance. This result can be interpreted that in the post reforms period, Indian market has become competitive because of entry of multinational firms and under competitive market conditions the relative production efficiency of firms is the major determinant of their market performance. Advertisement intensity variable is explaining domestic market shares negatively in TW and LCV industries and positively in MT industry. One explanation for this can be derived from the advertisement fatigue argument: excessive advertisement could be counter productive. The positive sign of the estimated coefficient associated with the interactive variable ($ADS*DI$), which is statistically significant only in the case of LCV industry, implies that increase in advertisement intensity for new entrant multinationals contribute positively to their domestic market shares. In other words, for new entrants it is important to build up marketing, distribution channels and reputation through advertisement in order to enhance their domestic share. Since new entrant multinationals are presumably more production efficient than domestic firms (see the results in Table 3), promotional activity might be more important for them in enhancing their domestic market share (i.e. strategies towards enhancing e_i). In MT industry, since it is a capital goods industry, the important component of promotional expenditure is on distribution rather than advertising and it is increasing from a low base which could be the reason for the positive sign of the estimated coefficient of ADS variable.

Table 2 presents the results for the explanation of export intensity of firms. TE variable is explaining export intensity positively and at a high statistical significance in case of TW industry. In the case of LCV industry, it is statistically significant only when relative export intensity variable SES is taken as the dependent variable. This could be because there may be a two way causality between export intensity of a firm and its' TE level. This bias could be reduced when firm level export intensity is normalized by the industry average. The result associated with qualitative variable (DI) shows that new entrant multinationals have higher export orientation in LCV industry but in Two wheeler industry they have lower export intensity compared to domestic firms. The interpretation of this result has to take into consideration of the industry specific conditions. The new entrant firm in LCV industry, Daewoo motors is relatively new (started production only in 1988) compared to the new entrants, Hero-Honda and TVS-Suzuki in the Two wheeler industry. Hero-Honda became a major player in the Two wheeler industry in the domestic market within a very short period of time. This might have reversed the

Table 1: Econometric Results. Equation 16				
Independent Variables	Dependent Variables			
	Light Commercial Vehicle Industry		Two-Wheeler Industry	Motors and Transformers
	DS	DS	DS	DS
TE	0.56 (8.2)*	0.57 (7.4)*	0.80 (7.79)*	0.13 (2.02)*
ADS	-3.3 (2.4)*	-3.68 (1.23)	-4.6 (2.5)*	5.9 (3.5)*
D ₁	-0.48 (2.3)*	-	-0.38 (1.96)*	-
D ₂	-	-0.38 (2.0)*	-	0.19 (3.08)*
ADS.D ₁	6.3 (1.46)**	-	2.46 (0.51)	-
ADS.D ₂	-	6.5 (1.0)	-	-10.7 (3.6)*
Log-Likelihood	25	23	9.03	42
N	48	48	40	55

Figures in parentheses are 't' values.
 Significant at 0.01 level.
 Significant at 0.05 level.

Table 2: Econometric Results. Equation 17

Independent Variables	Dependent Variables						
	Light Commercial Vehicle Industry				Two-Wheeler Industry		Motors and Transformers
	ES	SES	ES	SES	ES	SES	ES
TE	0.002 (0.14)	0.74 (2.59)*	-0.004 (0.2)	0.65 (2.17)	0.028 (2.2)*	2.34 (4.3)*	0.005 (0.18)
D ₁	0.05 (3.17)	0.53 (2.23)*	-	-	-0.015 (1.84)**	-0.74 (2.0)*	-
D ₂	-	-	0.034 (2.91)	0.37 (2.0)*	-	-	0.09 (5.5)*
TDS	0.00000007 (4.12)*	0.0000005 (2.02)*	0.0000000 6 (4.0)*	0.0000005 (2.0)*	0.0000001 (3.1)*	-0.0000001 (0.07)	0.0000002 (2.17)*
Log-Likelihood	89	-40	89	-40	91	-58	75
N	48	-	-	-	40	-	55

Figures in parentheses are 't' values.

Significant at 0.001 level.

Significant at 0.005 level.

role of incumbent domestic firms, who have to increase their export orientation as a consequence of increased competition in the domestic market as discussed theoretically in Section 2. The positive sign of the estimated coefficient associated with ($D2$) in the case of LCV and MT industries implies that multinationals in general have higher export orientation than domestic firms.

In case of all the three industries, total domestic sales variable (TDS) is explaining export intensity of firms positively and at a high degree of statistical significance. There can be two underlying explanations for this. As discussed in Section 2, increase in domestic industry sales (or total output) either because of new entry or increase in production efficiency of individual firms, leads to a fall in domestic market price by increasing total industry sales. In order to avoid the fall in market price of the protected domestic market, firms resort to price discrimination and divert additional output to the competitive world market. The second explanation is that increase in total industry output could cause external economies which enhances production efficiency and consequently export competitiveness of firms.

Table 3 shows the results of explanation firm level relative TE . For all the three industries, research and development variable (RDS) is explaining TE positively with a high degree of statistical significance. The statistically significant positive sign of the estimated coefficient associated with the dummy variables ($D1$) and ($D2$), the new entrant multinational firms and multinational firms in general have higher production efficiency. The interesting aspect of the results is that the negative sign of the estimated coefficients associated with the interactive variables ($RDS*D1$) and ($RDS*D2$) implies that research and development expenditure is more important for domestic incumbent firms to realize higher TE than for new entrant multinationals. This result supports the argument of Section 2, that new entrant multinationals enter the domestic market with superior technology (superior technology generated through R&D expenditure incurred in the home country) and they do not have to invest in R&D in the host developing economy. Whereas domestic incumbent firms in order to compete with new entrant multinationals, have to invest in technological efforts towards improving production efficiency. This is evident from qualitative evidence also that domestic firms like TELCO in LCV industry and Bajaj auto in the Two wheeler industry have increased their R&D efforts during the last few years significantly.

Table 3: Econometric Results. Equation 18					
Independent Variables	Dependent Variables		Two-Wheeler Industry		Motors and Transformers
	Light Commercial Vehicle Industry				
	TE	TE	TE	TE	TE
RDS	15.2 (6.2)*	13.8 (6.4)	81.0 (7.5)*	85.0 (8.06)*	35.6 (3.37)*
D ₁	0.7 (2.4)*	-	0.73 (10.0)*	0.59 (6.01)*	-
D ₂	-	0.66 (4.8)*	-	-	0.52 (4.9)*
RDS.D ₁	-31.0 (0.7)	-	-71.8 (4.5)*	-71.0 (4.6)*	-
RDS.D ₂	-	-23.7 (2.0)*	-	-	-35.5 (3.2)*
CUM	0.0000005 (3.7)*	0.0000005 (4.1)*	-0.000001 (3.0)*	-0.000001 (3.5)*	0.000005 (0.51)*
CUM.D ₁	-	-	-	0.000004 (1.96)*	-
Log-Likelihood	-9.7	-2.4	1.39	3.38	-2.3
N	48	-	48	-	55

Figures in parentheses are 't' values.

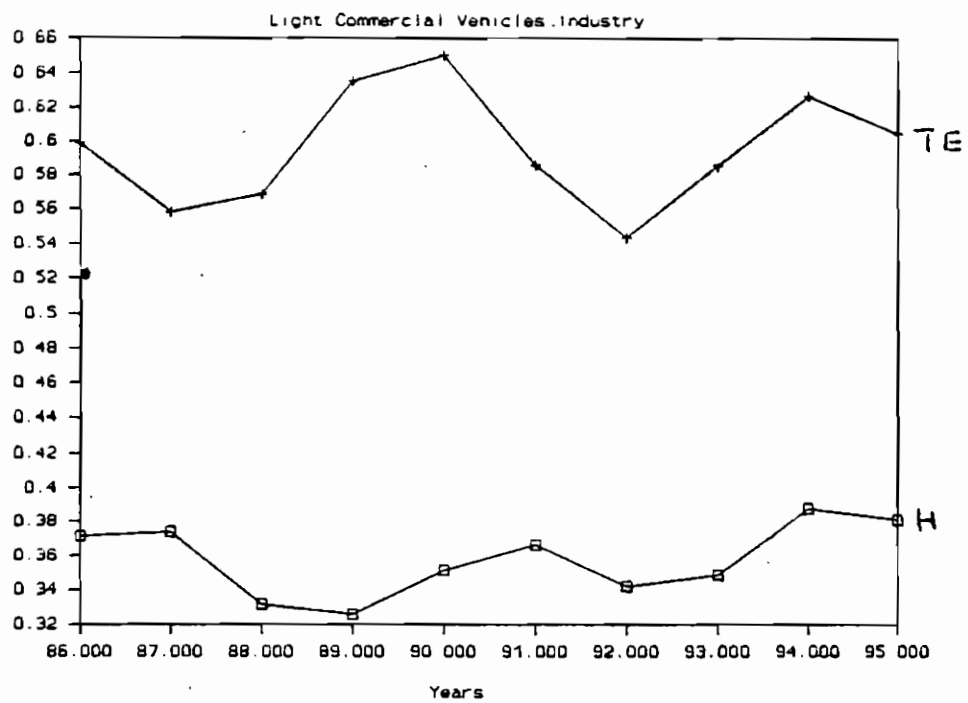
The estimated coefficient associated with cumulative value-added variable (*CUM*) is statistically significant for TW and LCV industries but it has positive sign in the case of LCV industry and negative sign in the case of the TWO wheeler industry; the learning economies through increase in cumulative value-added are very dominant in the LCV industry but not in the Two wheeler industry. One explanation for this contradiction has to come from the industry specific conditions in the period under consideration. In the LCV industry, introduction of number of new models might had been less than in the Two wheeler industry. Whereas in the Two wheeler industry a lot of new models of two wheelers have been introduced into the market during the last few years. Secondly, incumbent domestic firms like Enfield India have gone through a lots of up and downs and experiments towards facing the new competition and market conditions. Under the repeated stop and go production conditions, the economies through learning will be low or even negative. On the positive side, the statistically significant positive sign of the estimated coefficient associated with the interactive variable (*CUM*DI*) shows that the production efficiency gains through learning effects are quite significant for the new entrant firms in this industry.

Figures 1, 2 and 3 plot average technical efficiency at industry level and Herfindal indices (sum of squared domestic market shares) that measure degree of market concentration against time for the three industries. For this period of 1985 to 1995, the degree of concentration has gone up in case of Motors and transformers industry very significantly and in the case of LCV industry it increased marginally. In case of Two wheeler industry, the degree of concentration is declining. The figures show that industry average technical efficiency and values of Herfindal indices are, more or less, moving together in the direction. To recapitulate, relative technical efficiency of firms is explaining their domestic market shares positively. In other words, degree of concentration increases if individual firms become efficient and capture higher market shares which, in normative terms, is a good thing as it will reduce market price by increasing industry supply.

4. Conclusion

Since the early eighties, industrial policy reforms in terms of removal of industrial licensing and liberalizing entry of multinational firms have been implemented in India. These policy reforms led to entry of quite a few new multinational firms into Indian industry. This has important implications on the evolution of domestic

Herfindal Index and Average Efficiency

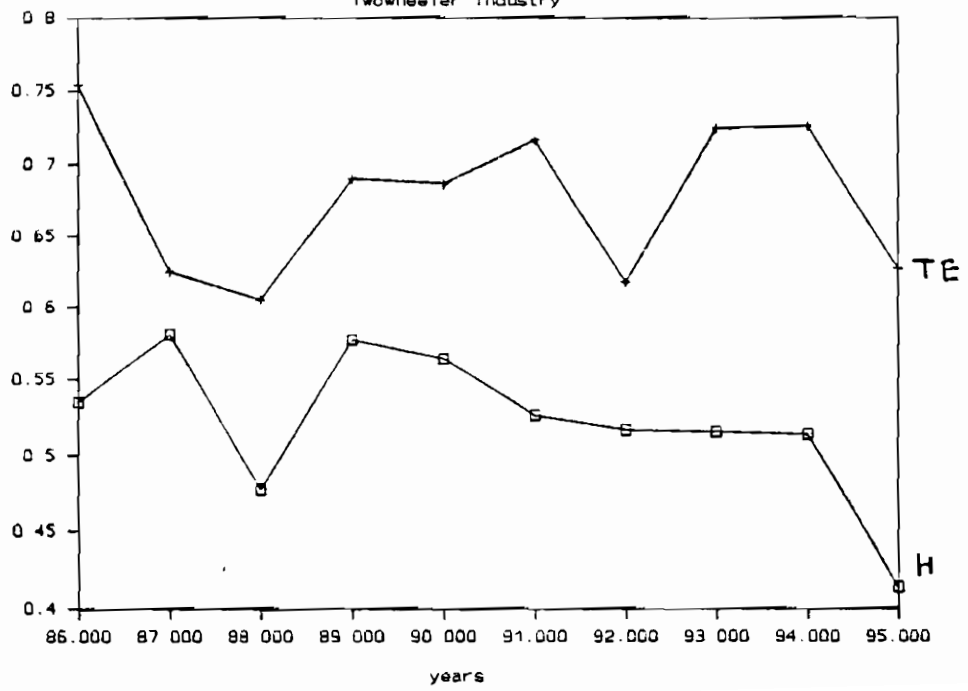


TE = Technical Efficiency

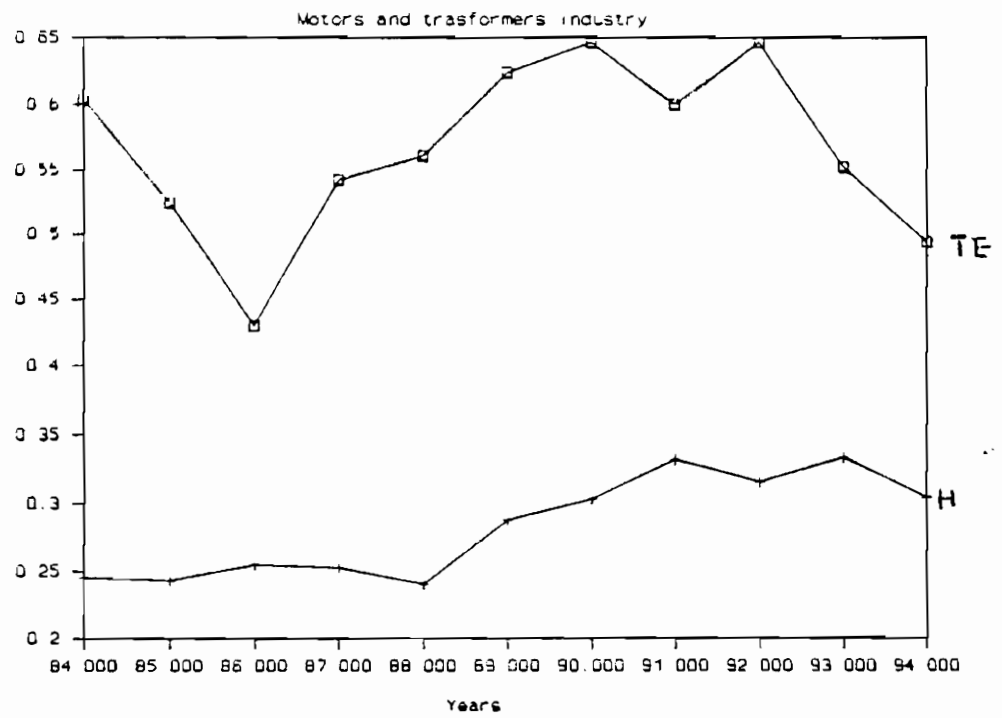
H = Herfindal index.

Herfindal Index

Two Wheeler Industry



Herfindal indices and Average TE



market in terms of increasing domestic competitive conditions and consequently exports. This paper has adopted a simple theoretical model in tracing out the evolution of domestic market structure by considering asymmetries in terms of time of entry and costs of production under oligopolistic competition. Spence-Dixit model of entry is taken as reference point in considering asymmetry in time of entry. Incumbent firms are those who entered the Indian industry during the pre-reforms period. The model shows that if there is symmetry in costs and in any intangible assets of firms, new entrants behave as followers in the domestic market and will have higher export orientation. Since the reforms are only partial and other forms entry barriers like capital market imperfections still exist in Indian economy, the new entrant firms are mostly multinationals. If new entrants are mostly multinationals, assuming multinationals possess superior production technology, there would be asymmetry in costs of production across incumbent domestic firms and new entrant multinationals. This, in turn, could alter behaviour of domestic firms both on the production and market side. On the production side, domestic firms have to enhance production efficiency through deliberate technological efforts in order to compete with new entrants. On the market side, they may have to start looking at export markets and also increase marketing expenditure.

The empirical results, on the whole, support the main propositions. In the LCV industry, the new entrant multinational firm, although it has higher production efficiency, appears to behave as a follower in the domestic market and exported at higher intensity. On the other hand, in the Two wheeler industry, once the new entrant multinational firms established themselves as major players in the domestic market appear to push the incumbent domestic firms to behave as followers and export at higher intensity. Apart from this, the increased competitive conditions in the domestic market appears to make domestic firms to make deliberate technological efforts in order to compete in domestic market and also to be able to increase their export orientation.

As recorded in several previous studies, during the pre-reforms period firm's ability to capture higher market share was dependent more on their lobbying abilities with government for licenses and other rent seeking activities rather than their relative production efficiency. The positive explanation of domestic market shares of firms by their relative technical efficiency in production is a clear evidence of increased competitive conditions of the domestic market after the reforms. The positive explanation of relative production efficiency

of domestic firms by research and development expenditure indicates that domestic firms have to make deliberate technological efforts towards improving their production efficiency in order to face increased competitive conditions. The consequence of the increased domestic market conditions is increase in exports. Increase in domestic competition through increase in number of players and also consequent increase in relative production efficiency causes expansion of total industry sales. Consequently, given the domestic demand curve and competitive world price, firms, especially the domestic firms may expand their exports as a price discriminatory mechanism. This observation is supported by the empirical result of positive explanation of firm level export intensity by total domestic sales. This is particularly valid when the domestic market continues to be protected from imports.

The empirical results show that the degree of concentration is exhibiting an increasing tendency. On the positive side, the relative technical efficiency of firms is a dominant explanatory variable of relative domestic shares of firms. In other words, degree of concentration would increase if some firms are able to capture higher market share because they are more efficient than others. In normative terms, it is a good thing because it will increase supply and reduction in market price benefitting consumers. It is extremely important to design and implement an effective competition policy especially when the market shows a tendency towards increase in concentration. Once a few firms become dominant players they could practice anti-competitive conduct towards blocking new entrants by imposing entry barriers. It is necessary to monitor the behaviour of dominant firms and restrain them from practising anti-competitive conduct.

The policy reforms that have been implemented so far have eliminated only a part of market imperfections that had prevailed in the domestic market. Sources of entry barriers such as capital market imperfections, high market transaction costs due to sub-optimal institutions and also high exit costs still exist in the Indian economy. In such a case, as observed earlier, new entrants will be mostly multinationals (with large purses) and established domestic corporate houses diversifying into other industries but not absolute new entrants. It is necessary to reduce these imperfections through institutional reforms in order to make the domestic market contestable.

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