Chapter 1
LIBERALISATION. COMPETITION AND BARRIERS TO ENTRY

The objective of liberalisation is to induct competitive forces into the economy. More specifically, liberalised industrial policies are targeted to increase competition and to obtain efficient outcomes in industry. In a world without market imperfections and externalities, liberalised markets would lead to a first-best Pareto optimal situation. But in a second-best world of imperfections, it becomes important to trace the implications of these liberalisation policies. Liberal industrial policies can have competitive outcomes only in the absence of entry barriers. Liberalisation policies remove artificial barriers to entry by new firms, and allow capacity expansion of incumbent firms. However, the existence of natural barriers indicates imperfect competition as reflected in the industry's structure. This chapter will review the existing literature on liberalisation, competition and barriers to entry keeping in view our case study is of the petrochemical industry.

LIBERALISATION: DEFINITION AND CONCEPT

Liberalisation in its broadest sense, is a shift towards decreasing government intervention in economic activity. Two significant forms of intervention have been — direct state participation in economic activity and government's regulatory role through industrial and trade policies. Liberalisation would then denote deregulation — a decrease in government role in resource allocation, production and distribution decisions in the economy and privatisation — a decrease in the government's direct participation in economic activity.

At one end of the spectrum liberalisation stands for minimum government activity [Guha 1990:1]; and at the other end a liberalised market where there are no quantitative restrictions either on buyers or sellers. Since all restrictions are not quantitative, liberalisation in a more general sense could be
defined as any policy action which reduces the restrictiveness of controls - either their complete removal or the replacement of a more restrictive set of controls with less restrictive ones [Kruegar 1986:16].

It is important at this point to make a distinction between liberalisation as it is understood an India as against its definition in the theoretical literature. India has had a history of myriad controls and regulation on industry especially, on the size of firms, output, location, production pattern and trade. Therefore, any relaxation of these controls constitutes liberalisation and deregulation of industry is part of this process. In the theoretical literature however, liberalisation is usually understood as an 'opening' up of the economy with respect to trade, both in terms of trade restrictions as well as exchange-rate controls.

LIBERALISATION POLICIES IN INDIA

Government liberalisation policies have been structured to revitalise Indian industry by infusing it with a greater degree of competition. As opposed to earlier policies which directed investment in industry to what were understood to be 'nationally desirous' in a protected environment, liberalisation allows a manufacturer greater liberty in selecting investment levels and output patterns according to the dictates of the market. Liberalisation, by systematically deregulating industry and cutting down restrictions on trade (especially imports), aims at infusing greater competition into the industrial sector and thereby increasing growth and efficiency.

Liberalisation policies in India had a modest beginning in the late 1960s to remedy the foreign exchange and fiscal problems faced by the economy. The relative merit of the market as opposed to state directed development began gaining support on account of three problems facing the economy from the late 1960s. The first was the prolonged stagnation in the industrial sector.
The second, an increasing inefficiency and low rates of return of the public sector as a whole into which the government had committed vast resources resulting in an internal resource crunch. The third was the recurring balance of payments crises. A conscious policy of liberalisation was advanced by policy-makers as an effective measure to counter these problems. Liberalisation was envisaged to tackle both the problems of resource mobilisation and efficiency and thereby the foreign exchange problem as well.

Policy-makers appear to have had the following two hypotheses on how liberalisation would tackle the above problems:

1. "Liberalisation of industrial and trade policies will improve industrial efficiency by:
   (a) providing greater access to imported intermediate inputs, capital goods and technology:
   (b) exposing domestic producers to competition, external and internal, and thereby force them to reduce costs, and
   (c) lifting curbs on the growth and size of firms so as to exploit scale economies.

2. Improvement in efficiency and the resultant reduction in costs will stimulate domestic demand and enable India's industrial products to compete abroad, thereby relaxing demand-side constraints on industrial growth." [Goldar 1990:603]

'Until 1991 there was no official policy statement setting out explicitly what the new economic policy was and what it intended to achieve. The novelty of the policy was perceived only when changes in policy and procedures relating to industrial licensing, exchange rate policy, import policy along with some observations about the need for rationalising and simplifying the systems of fiscal and administrative procedures were pieced together. Policies that are directed at the industrial sector can be classified into two categories: (a) domestic liberalisation and (b) trade liberalisation. This distinction is made because in the Indian context these two have not been implemented in tandem. Domestic liberalisation not only pre-dates trade liberalisation but has been more systematic.'
Domestic Liberalisation

Domestic liberalisation policies sought to redefine the contours of the state and market in favour of the market in the domestic sphere of economic activity. These policies were aimed at deregulation and privatisation. To translate these objectives into policy terms, the government formulated the following measures to facilitate capacity and output expansion and to remove procedural impediments to investment and growth of firms.

Delicensing: A number of industries (apart from the small-scale sector) were progressively delicensed by the time the New Licensing Industrial Policy (NILP) was enunciated in 1991. NILP delicensed all industries irrespective of size of investment or the ownership of the undertaking except 18 industries which still required licensing. The number of industries was later reduced to 15.

Broadbanding: Diversification in specified industries was permitted without obtaining an industrial license, initially subject to the condition that the firm did not come under the purview of Monopolies and Restrictive Trade Practices (MRTP) Act & Foreign Exchange Regulations Act (FERA). This policy was designed to introduce some flexibility into the licensing mechanism and to enable manufacturers to utilise their capacities more efficiently and fine tune their product mix in response to market demand. This scheme commenced with the machine tools industry in 1983, and the list grew steadily. In August 1988, the government announced that the broadbanding facility would be available for companies that came under the purview of the MRTP and FERA in Appendix A. and would be subject to export obligations in respect of non-Appendix A companies. This policy measure lost its relevance due to the liberalised licensing policy in the NILP (1991).

Re-endorsement of Capacity: Licensed capacity in selected industries was increased by an additional 257 over and above the highest production level achieved during the previous five years. Also, automatic growth was allowed. This policy became redundant after the NILP (1991) when licensing was limited to a small list of industries.

Minimum Economic Scale: Minimum capacities of operation were prescribed in select industries in order to exploit economies of scale. This was with a view to increase efficiency in units that could not exploit scale, economies because of the stringent licensing laws. As on February 1990, 106 products in 14 broad industrial groups had a prescribed minimum economic scale of operation.
MRTP Constraints: In many cases, large business houses and FERA companies were excluded from taking advantage of liberalisation measures announced since the late 1970s. The more recent measures have displayed a tendency to permit liberalisation for these groups but mostly with a caveat demanding either export obligations or the promotion of industrialisation in a backward area. The most important trend however, has been the gradual removal of the MRTP constraints themselves. The turnover limit by which a company came under the purview of the MRTP Act was gradually raised from Rs 20 crs to Rs 100 crs in 1985 and soon after to Rs 500 crs, till the ceiling was completely scrapped under the NILP C1991.

Opening up the Public Sector: Areas that were earlier under the exclusive purview of the public sector were gradually opened up to the private sector.

The policies of broadbanding, re-endorsement of capacity and the prescription of MES were part of the earlier liberalisation packages before the large-scale delicensing in the NILP (1991) made them redundant. Amongst these policies, the stipulation of MES was aimed at increasing the efficiency of industries where size was pivotal to efficiency. If firms had been constrained by small size in the pre-liberalisation period, they could expand to MES and beyond to obtain efficiency gains. But for the new firms, since entry had to be large-scale, the cost of entry increased creating an entry barrier. This policy thereby threw up two problematic outcomes when dealing with the question of MES and the anti-competitive outcomes of such a policy in terms of concentration and firm size. Industrial organisation has shown that the relationship between size of entry and the anti-competitive effect of large size is not so simple.

Minimum Economic Size and Concentration:

A rather simplistic assumption is often made that goes as follows: as entry increases, the level of concentration in a firm declines and a large MES is an impediment to entry. However, as Davies [1988: 93] has shown the causality is not so simple.

Suppose an industry has sales, initially of $ and a
Herfindahl index $OH$. The typical size of a firm in an industry is defined as:

$$Z = \frac{\sum_i S_i^2}{S^2}$$

where $H = \text{the numbers equivalent dimension of the Herfindahl index}$ & $Z = \text{equivalent size of the firm}$.

Now suppose a new firm enters the industry at size $XZ$ where concentration in terms of the Herfindahl index is:

$$OH = \sum_i \frac{S_i^2}{S^2}$$

The post-entry concentration in terms of the Herfindahl index is:

$$OH^* = \sum_i \frac{S_i^2 + \lambda S_i^2 OH^2}{S^2(1 + \lambda OH)} = \frac{OH(1 + \lambda OH^2)}{S^2(1 + \lambda OH)}$$

It follows that $OH^* > OH$ if $1 + \lambda OH > (1 + OH\lambda)^2$

i.e. if $\lambda > 2 + OH\lambda$ or $X > 2/(1 - OH)$

It is therefore possible that entry can increase concentration if the entrant is relatively 'large', where 'large' is made precise by $X > 2/(1 - OH)$. For instance, this is true for an entrant little more than twice the typical size in an unconcentrated industry, but larger-scale entry would be required as $OH$ increases.

**Minimum Economic Size (MES) and Firm Size:**

Economies of scale exist when the production cost of a single product decreases with the number of units produced. In this situation, the most efficient industrial structure would be one which could serve the entire market or at least one that is large relative to demand. However, if firms are much larger than MES, concentration will be greater than is strictly required by efficiency. Most firms do operate with a notion of MES, but in India since earlier policies had stringent rules about scales of operation without regard to MES, liberalisation policies had to prescribe MES of operation to enable firms to exploit economies of scale.
The setting up of MES of operation is based on a fundamental proposition in industrial organisation that there is a minimum efficient capacity (and thereby scale of operation) that firms must operate at in order to function efficiently or at least cost. Figure 1.1 illustrates two typical average cost curves at the firm level.

![Figure 1.1](image)

Long Run Average Costs at Firm Level

Price

C*

Scale

a) 'U' shaped average costs

Price

C*

Scale

MES

b) 'L' shaped average costs

In a competitive industry, firms have U-shaped average cost curves, where costs are minimum at C corresponding to ES (a given efficient size) that firms operate at. In a competitive market firms will compete till price - C and all firms produce at ES (see Fig. 1.1 (a)).

The number of firms that can exist in a market is definitely constrained by the size of the market. Therefore, if demand at price = C is Xc, then the market will support Xc/ES equally sized firms and this ratio will determine the level of concentration in
the industry. Therefore, given constant demand, the more concentrated an industry the larger is the efficient size relative to the market size. However, firms behave competitively because they are of equal size. For example, consider a market which supports only two equal-sized firms. The Herfindahl index is 0.5, which is not high. But both firms have to produce at C or else face entry.

However, U-shaped cost curves are rare and a more realistic assumption would be to have an L-shaped average cost curve such as that in Figure 1.1(b). This is especially so in the petrochemical industry where fixed costs are high and firms exhibit increasing returns to scale. Firms are prescribed an MES of operation such that at output below MES costs are higher than efficiency permits; and at output beyond HE'S costs are minimum and MES is a benchmark capacity. Therefore, anything that allows a firm to price in excess of C is an entry barrier. Let us consider the following possibilities:

(a) If p > C and output < Xc, and entry (for whatever reason) does not occur, the size of the market is deliberately reduced. The concentration in the industry becomes higher and it becomes a supply-led industry.

(b) If p > C, it becomes possible to survive in the market profitably at scales less than MES: in that this allows a sub-optimal sector of small-scale firms to survive and concentration is reduced.

(c) Without the competitive discipline of new entry, existing large firms may be able to increase their market shares, thus moving out along the cost curve and increasing size inequalities and concentration thereof.

The domestic liberalisation policies in India of delicensing, broadbanding, re-endorsement of capacity, removal of MRTF constraints and the opening up of the public sector were policies aimed at encouraging the entry of firms and increasing competition. The exception was the stipulation of MES that was essentially viewed as an efficiency-enhancing measure. However, its repercussions on industrial structure was much more complex. Firms required huge investments to set up capacity at MES. And
large investments in turn were barriers to entry. Even if entry occurs, it is likely to be subsumed by the already concentrated market, thus perpetuating the existing oligopoly. But if entry was completely deterred, existing firms would continue to operate within the dictates of an oligopoly thus further adding to increasing the anti-competitive nature of the industry.

The additional problem with MES was that with large-scale 'efficient' operations, firms could no longer be constrained by domestic demand and would have to be internationally competitive. Therefore, apart from policies that were directed at inducing competition within firms in the domestic industry, the government initialised a series of measures targeted at increasing the competitiveness of Indian industry by allowing them freer access to imported inputs. These measures sought to liberalise trade.

Trade Liberalisation

Trade liberalisation attempts to lower trade barriers and improve industrial efficiency through exposure to foreign competition and improved access to imported machinery and raw materials. Policies that dealt with physical restraints on imports through quantitative controls or tariffs were gradually eased through trade liberalisation measures. The policies are:

Deletion of Items on Banned List: The Export-Import [EXIM] policy contains a list of products, the imports of which are banned on account of the country having reached self-sufficiency or, a product the import of which would affect domestic capability. Any deletion of an item on this list indicates a reduction of trade barriers and consequently a reduction in protection to domestic industry.

Shift to Open General Licence (OGL): A shift from the banned or restrictive list to the OGL and a further shift from a quantitative controls to tariffs constitutes a further step towards liberalisation.

Decreasing Tariffs: A progressive lowering of tariffs on imported items on the OGL list also constitutes liberalisation.

Trade barriers are essentially barriers to entry for firms across countries. In India, these barriers were erected by the
government to protect domestic industry by preventing the entry of foreign firms (i.e. goods). Any shift in trade policy to decrease its restrictiveness can be termed trade liberalisation.

Trade and domestic liberalisation, implemented in tandem, are expected to increase competition in the domestic industries and compel them to compete internationally. While domestic liberalisation is expected to introduce greater competition in the domestic industry, trade liberalisation is to expose domestic industry to foreign competition. There does seem to be a consensus that domestic liberalisation should precede trade liberalisation in order to enable heavily protected industries to 'ease' themselves into competitiveness without drastically disturbing other macro-variables. See Bhagwati 1987, Patel 1986 etc. However, the longer the gap between domestic and trade liberalisation, the stronger the tendency for the economy to revert to the old order of protection and regulation. What is clear, however, is that liberalisation policies sought to increase the level of competition in Indian industry. Several government committees have been set up by the government to recommend policies in order to increase the efficiency of the petrochemical industry in India, through liberalisation. Competition, being central to liberalisation, warrants an examination of how it is variously constructed in mainstream economics.

COMPETITION AND INDUSTRIAL STRUCTURE

Conventional economic theory makes a case for competitive markets on the grounds of efficiency. The concept of competition which is central to mainstream economic theory, has been the pivot around which production is organised and prices and incomes are determined. In fact, "In economic life, competition is not a goal: it is a means of organizing economic activity to achieve a goal. The economic role of competition is to discipline the various participants in economic life to provide their goods and services skillfully and cheaply " [Stigler 1968:5].
Competition, in the traditional sense, exists only when there are a large number of sellers and buyers and no one individual can influence prices. The economic case for competition is, therefore, made on the grounds that a competitive market system solves both the resource allocation and income distribution problems through its pricing mechanism. This pricing mechanism has an in-built process through which it maximises consumer and producer's surplus thereby taking care of the welfare problem. While the homogeneity of the product and an atomistic market structure are sufficient conditions for the existence of pure competition, an additional characteristic is the absence of barriers to entry by new firms. This was recognised by early industrial economists and emphasised repeatedly (see Bain 1954 & 1956, Scherer 1980:11 etc).

Numerous other factors are recognised as inhibiting the working of a competitive market, thus stamping perfect competition as first-best but ideal and ruling out its feasibility as a basis for policy prescriptions. Some of these factors are: a) externalities; b) economies of scale (or increasing returns to scale); c) product differentiation; and d) asymmetric information. The notion of a perfectly competitive market was thereby discarded as impractical, for policy making, and the conceptualisation of other forms of competition were formulated.

The effort to uncover the second-best competitive ideal led to the definition of the operational norms for a 'workable competition'. J.B. Clark declared that perfect competition "does not and cannot exist and has presumably never existed" (1940:2411) and went on to argue that some departures from the purely and perfectly competitive market were neither harmful nor avoidable in the long run (as was commonly supposed). He then formulated certain minimal criteria for judging the workability of competition which included the absence of entry barriers. Subsequently, conditions of entry were recognised as a crucial factor on which industrial structure and the nature of competition depended.
The vast literature on workable competition that followed was reviewed in Sosnick [1958]. Using Sosnick's general scheme, Scherer [1980:42] categorised the most commonly cited norms of workability into structural, conduct and performance criteria. The structural norms include:

(a) The number of traders should be at least as large as scale economies permit.
(b) There should be no artificial inhibition on mobility and entry. (Italics mine)
(c) There should be moderate and price sensitive quality differentials in the products offered.

Entry is significant not only when competition is important but efficiency too. For example, in Schwartzman [1973], the following assumptions of the competitive model underlie his conclusion relating to technical efficiency.

(1) Firms maximise profits.
(2) Firms have complete knowledge of available techniques and associated costs.
(3) Entry is costless.

It is significant to note that Schwartzman omits the usual condition of a large number of buyers and sellers common to other competitive models. Since the first two assumptions apply to monopolistic as well as to competitive firms, the assumption about entry becomes crucial. "The condition of entry and profit maximising behaviour, nevertheless, may be important for efficiency. Easy entry encourages efficiency which therefore may be higher under competition than under an alternate market structure. The condition of ease of entry, however, is not sufficient for superior efficiency, for there may be other sources of efficiency, including scale economies which favour monopolistic industry and these cannot be described without investigation..." [Schwartzman 1973:762]. Schwartzman in fact anticipates the contestability literature through his notion of entry conditions.

It is therefore clear that competition can be encouraged only when entry into an industry is not hampered by entry barriers. In other words, barriers to entry are essential for the existence of
non-competitive behaviour since free entry is bound to create competitive conditions.

In the literature that followed, what became clear was that the assumption about entry was crucial when examining the nature of competition in an industry. And the nature of competition determines industrial structure. The following table illustrates the linkages between industrial structure (as defined by the extent of competition) and the level of entry barriers:

<table>
<thead>
<tr>
<th>Industrial Structure Defined mainly by Market Share and Concentration</th>
<th>Entry Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure Monopoly</td>
<td>Ranging from high to low entry barriers</td>
</tr>
<tr>
<td>Dominant Firm</td>
<td></td>
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<tr>
<td>Tight Oligopoly</td>
<td></td>
</tr>
<tr>
<td>Loose Oligopoly</td>
<td></td>
</tr>
<tr>
<td>Poly monopolistic Competition</td>
<td>Free Entry</td>
</tr>
<tr>
<td>Pure Competition</td>
<td>Free Entry</td>
</tr>
</tbody>
</table>

Source: Shepherd [1979:12] Extracts of Table 4.2

The industrial or market structure is defined in terms of the extent of competition in an industry. And, what determines the extent of competition is industry-specific. A general definition would be that any characteristic of a firm that affects its price-cost margin or profitability comprises its market or industry structure. As Shepherd writes:

"The field of industrial organisation has acquired an abundance of hypotheses about what constitutes market structure. Neo-classical analysis was premised on the firm's market share, atomistic or pure monopoly. Then came the Chamberlainian group of the 1930s, Bain's entry barriers of the 1950s and firm size and advertising in the 1960s" [Shepherd 1972:25].
Hay and Morris [1979:2003 define the primary constituents of industrial structure as scale, concentration and product differentiation. Dichotomising each of these aspects of structure into high (x) or low (o), they obtain the following classification of possible market structures:

**Table 1.2**

Classification of Industrial Structures

<table>
<thead>
<tr>
<th></th>
<th>Scale</th>
<th>Concentration</th>
<th>Product Differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>x</td>
<td>x</td>
<td>o</td>
</tr>
<tr>
<td>2.</td>
<td>x</td>
<td>o</td>
<td>x</td>
</tr>
<tr>
<td>3.</td>
<td>x</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>4.</td>
<td>o</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>5.</td>
<td>o</td>
<td>o</td>
<td>x</td>
</tr>
<tr>
<td>6.</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>7.</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>8.</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>

Source: Hay and Morris [1979:2003]

A priori, possibilities (3) to (6) in the above table can be eliminated since large scale is not consonant with low concentration or vice versa. Possibility (8) represents the structural conditions for perfect competition, while (1) is that of a monopoly. Possibility (7) represents Chamberlainian monopolistic competition and (2) represents a homogeneous oligopoly which typifies the Indian petrochemical industry.

Although an abundance of factors constituting structure make for a comprehensive study, it is obvious that the selection of the most significant determinants of market structure are industry specific. Shepherd includes the following elements based on "theory and part empirical studies..., though without unanimity" [1972:25].

(a) Market share
(b) Leading firm group
(c) Entry barriers
(d) Firm size
(e) Advertising intensity
(f) Growth rate
However entry barriers appear to be a common denominator while determining industrial structure which in turn rests on the extent and nature of competition in an industry. A distinction is made between entry barriers and actual entry. This distinction is crucial to the theories that focus upon potential competition and not actual entry as important in markets that are typically imperfect. Potential competition relates to conditions of entry and consequent incumbent performance as a mechanism to control power (Gilbert 1989:).

The notion of potential competition was in fact put forth by J.B. Clark. It was however, resurrected and developed almost a century later by the contestability theorists such as Baumol, Panzar and Willig. What it essentially propounds is that as long as entry barriers are minimal or non-existent, there is complete freedom to enter and exit. The mobility in an industry is a market disciplining factor and it is one of the essential forces of competition irrespective of industrial or market structure.

The following section discusses the different forms that entry barriers take in industry.

ENTRY BARRIERS IN INDUSTRY: ARTIFICIAL AND NATURAL

Entry is defined as a new legal entity where a new production capacity is set up. Anything that impedes this entry is an entry barrier. Conditions of entry play a crucial role in determining the structure of an industry and has been of continuing concern to industrial organisation economists. Industrial Organisation literature is replete with definitions of entry barriers which are paradigm-specific, and will be discussed in the next section. In this section we discuss the broad categorisation of entry barriers into artificial and natural barriers, and their implications for liberalisation policy.

There are two types of entry barriers in an industry artificial and natural. Artificial barriers are legal exclusions that arise from government constraints such as licensing, quotas,
permits, patents etc. Natural barriers are those that are intrinsic to the nature of the industry or those that are a result of firm strategies. While industrial organisation literature has emphasised natural entry-barriers, it is literature on regulation of utilities that has dealt with artificial entry-barriers.

In India, early industrial policy has revolved around putting up artificial entry barriers in industry. And in this context it is important to study both artificial and natural entry barriers.

Artificial entry-barriers include government policies that restrict the growth of the firm (in terms of asset limits) and licensing rules that dictate what firms should produce and where.

Natural entry-barriers are either intrinsic to an industry or arise out of firm strategies. Barriers that are intrinsic to the industry are high cost of investment (and/or positive sunk costs). For example, in an industry where scale economies are significant, output is definitely constrained by the size of the market and that makes it 'efficient' to have only one firm. In this case, scale economies becomes a natural entry-barrier.

Natural entry-barriers that can result out of firm strategies are concentration, vertical integration and excess capacities. Natural barriers can be further classified into those that are natural to a firm and those that arise as a result of a firm's operating strategies. In Salop's [1979] terms they are 'innocent' and 'strategic' entry-barriers respectively. "An innocent entry-barrier is unintentionally erected as a side effect of innocent profit maximisation. In contrast, a strategic entry barrier is purposely erected to reduce the possibility of entry" [Salop 1979:335].

Natural entry-barriers that are intrinsic to an industry are the high cost of investment and sunk costs. These are significant where scale economies are important and confers first-mover advantages to the incumbent firm. With the existence of scale economies output is constrained by the size of the market. In this case, an efficient entrant may be deterred by an established
firm who has sunk sufficient costs to make his own exit uneconomical and entry mutually destructive.

Natural entry-barriers that arise out of firm strategies are industry specific and numerous. Firms may choose a variety of ways to deter entry and retain market power. Firms may hold excess capacities, integrate vertically or differentiate their products. Though these strategies are employed to maximise profits, they certainly constitute an entry barrier if they contribute to the strengthening of oligopolistic hold of the industry.

Trade barriers are analogous to our notion of artificial and natural entry-barriers in industry. Trade barriers are a myriad combination of government-dictated artificial and natural obstacles to trade. Government-imposed artificial barriers include tariffs, quantitative restrictions, laws on patents and controls on exchange rates. The natural barriers are the asymmetry between the technological and structural characteristics of foreign vs. domestic industries and restrictive trade practices such as dumping.

Liberalisation policies attempt to remove artificial barriers to entry. And since they are imposed by legal dictate and constitutional authority, they can also be similarly removed. Kahn [1988:116] states, "No barrier to entry is more absolute than one imposed or enforced by the sovereign power of the state. All others are potentially subject to hurdling, erosion or circumspection." On the contrary, our contention is that while artificial barriers can be easily removed, other barriers persist. The persistence of these natural barriers to entry negates the objective of building a competitive market by eroding artificial barriers. The removal of artificial barriers allows firms to behave in ways that accentuate natural barriers. Therefore, the problem of inducing competition in certain industries (such as those with economies of scale) through policy measures becomes or more complex. Industrial Organisation (IO) theory has attempted to unravel this complexity by focusing on entry barriers.
ENTRY BARRIERS IN INDUSTRIAL ORGANISATION LITERATURE

The most appropriate definition of industrial organisation is perhaps by Shepherd [1984:574]. He says "Industrial organisation is about the nature of the competitive process and the effects of monopoly distortions (and possible benefits) in the variety of actual markets." This definition emphasises the point that industrial organisation theory draws sustenance from the actual working of the market, the framework of any particular study not withstanding.

The entire mainstream industrial organisation literature can be categorised into four quasi-chronological perspectives:

(a) The S-C-P paradigm/ Old Industrial Organisation
(b) The Chicago School
(c) Theory of Contestable Markets
(d) The New Industrial Organisation

Industrial economics (or what is now called Industrial Organisation) came to be known as such when it branched off from the micro-theory of the firm with the work of Mason, Clark and Bain. Bain's seminal contribution to IO was instrumental in dubbing the initial phase the Structure-Conduct-Performance paradigm, now called the 'old' industrial organisation. Industrial economics evolved from new ways of looking at the firm. Orthodox neo-classical theory of the firm was based on the technical nature of the firm as represented through a production function. The departure came from a desire to analyse the economic behaviour of firms through structure, conduct and performance relationships which could be empirically supported.

The Chicago School opposed the establishment of a separate branch of economic work called Industrial Organisation. But their critique of the Old IO formed a framework which was distinct enough to be called the Chicago School. The Contestability theorists offered an alternative definition of competition and their analytical work took the Chicago School's work to its logical end.
At the same time, the 'New' Industrial Organisation grew out of the 'Old' Industrial Organisation, which was dubbed as empirically-led theory and started using game-theoretic models to analyse firm behaviour. This departure is exemplified in Tirole [1988] where he examines the firm from both the technological and contractual points of view— with special emphasis on the latter [1988: 15-603]. Tirole in fact blends the older (neo-classical/production function) and newer (more microanalytic/contracting) theories as complementary theories. Williamson [1990] calls this entire set of non-neoclassical work on the theory of the firm a 'nexus of treaties'.

The following section will outline how entry barriers are analysed in Industrial Organisation theory. Our review is restricted to entry which manifests itself as a new firm where fresh production capacity is set up. An entry barrier is any impediment, intentional or unintentional, to entry. Entry can also occur by other means, like acquisitions or mergers. Such entry is not typical of firms in India. And keeping in view that our case study is that of the petrochemical industry, a homogenous oligopoly, our review is restricted to studies in industrial organisation pertaining to entry through investment, and entry barriers in a homogeneous oligopolistic industry to prevent such entry.

S-C-P Paradigm: The Old Industrial Organisation and Entry Barriers

This phase of industrial organisation theory was synonymous with the work of J. Bain in the 1950s, and was loosely referred to as the Harvard School. Industrial economics was a marked departure from the theory of the firm, managerial economics or even price theory. This branch of economics evolved an identity of its own through the work of Mason, Clark and Bain. Bain’s work stemmed from attempting to explain inter-industry difference in profits which led to his main contribution to industrial organisation theory: that of highlighting the role of entry barriers and the notion of limit pricing, both set within the
S-C-P paradigm which survives even today in various forms. The S-C-P paradigm "...established an analytical and empirical methodology which was to dominate the subject for at least 20 years." CDavies et al 1988:21. The S-C-P paradigm is illustrated in Figure 1.2.

It is important to note that the S-C-P paradigm does not require a specification of market or industrial structure but can be used to analyse industries that conform to any industrial structure. Given that the pre-requisites of perfect competition do not exist, the novelty of this approach was that it could be used to analyse a situation with any degree of imperfection since market structure, conduct and performance depend on relatively stable and observable conditions. In addition, the S-C-P paradigm is structured in a form so flexible that it could be modified to form the basis for much of the empirical work that was carried out for decades to come. In fact the S-C-P paradigm "... entailed theoretical analysis of one or more of the causal links in the S-C-P trilogy which was typically subjected to empirical testing against large scale inter-industry data, increasingly with the use of econometric techniques" CDavies et al 1988:21.

The importance of entry barriers as a significant deterrent to competition gained currency on account of Bain's seminal work on "Barriers to New Competition" [1956]. In early industrial economics, inter-industry differences in profits were expected to disappear in the long run under conditions of perfect competition which implied free entry. The same outcome would also be expected under conditions of monopolistic competition. However, there was substantial empirical evidence that inter-industry differences in profitability was a persistent phenomena. Such differences were first explained in terms of a single variable, i.e. concentration. However, Bain's work showed that it was not concentration per se that was the root of the problem, but barriers to entry were.

Bain shifted the focus of empirical research in industrial economics away from the case study approach to the analysis of
Figure 1.2
Structure - Conduct - Performance
(A Model of Industrial Organisation Analysis)

Basic Conditions

Supply
Raw Materials
Technology
Unionisation
Product Durability
Value/Weight
Business Attitudes
Public Policies

Demand
Price Elasticity
Substitutes
Rate of Growth
Cyclical &
Seasonal Character
Purchase Method
Marketing Type

MARKET STRUCTURE

No. of Sellers and Buyers
Product Differentiation
Barriers to Entry
Cost Structures
Vertical Integration
Conglomerateness

CONDUCT

Pricing Behaviour
Product Strategy and Advertising
Research and Innovation
Plant Investment
Legal Tactics

PERFORMANCE

Production and Allocative Efficiency
Progress
Full Employment
Equity

Source: Scherer, F.M. [1980:4]
industries by using statistical tools on cross-industry-level data. He used profits as a 'litmus test' for entry barriers to substitute for real barriers since the possible outcome of entry barriers were high profit rates. This proxy has been used by many economists who have regressed profit rates on a host of industry specific variables to denote entry barriers.

In Bain's definition, barriers to entry are factors that make it possible for established firms in an industry to enjoy supra-normal profits without attracting new entry. Without entry barriers, firms cannot sustain long-run market power. Thus, preventing the entry of new firms was crucial to retain such power. Bain listed four sources of entry barriers:

(a) Economies of scale (e.g. Fixed Costs): Bain argued that if the minimum efficient scale is a significant proportion of the industry demand, the market makes supra-normal profits without inviting entry.

(b) Cost advantage of established firms: The established firms may own superior production techniques, learned through experience (learning by doing) or through R & D (patented or innovations). They may have accumulated capital that reduces their cost of production. They may also have foreclosed the entrant's access to crucial inputs through contracts with suppliers.

(c) Product differentiation advantages: Incumbents patent product innovations (which of course, can be seen as a cost advantage relative to the product), or they may corner the right niches in the product space and hence enjoy consumer loyalty.

(d) Absolute capital costs: Large capital requirements, in absolute terms, constitutes an entry barrier. Entrants, in this case have trouble financing their investments for two chief reasons: banks are less eager to lend to entrants who are less well known than incumbents and in case of entry, incumbents can inflict losses on entrants in the product market in order to reduce their ability to finance new investments.

Bain further categorised entry barriers in terms of incumbent behaviour in the face of an entry threat (cited in Waterson 1984:57):

(a) Blockaded Entry where barriers are such that established firms could price even at the monopoly level yet still not incur entry.
(b) Easy Entry where barriers are so small that pricing even very slightly above costs allows entry.

(c) Ineffectively Impeded Entry where pricing at a level at which no entry will occur is less profitable than maximising short run profits and allowing entry.

(d) Effectively Impeded Entry where pricing at the level at which no entry will occur is more profitable than maximising short run profit and allowing entry.

Bain's argument that a potential entrant might be deterred if the capital requirements of entry were large in absolute terms did not command much respect. But the more recent contestable market theory implies that entry will be deterred if a large fraction of entry costs are sunk and, therefore, the relative importance of sunk costs are correlated with the absolute level of capital requirements. Schmalensee C19B9: 9693 in fact states the following as a 'stylised fact': "Measures of scale economies or capital requirements tend to be negatively related to entry. In other words, both scale economies and high capital costs are potential entry deterrents."

Bain's systematic attempt to reveal a correlation between measures of market concentration, conditions of entry and supra-normal profits revealed that in the absence of substantial barriers to entry, the correlation between profits and market concentration was weak. This revelation led to Bain's theory of limit pricing which was later modified by Sylos-Labini and Modigliani.

The Bain-Sylos-Labini-Modigliani Limit Pricing Model:

The essential assumptions of the Bain-Sylos-Labini-Modigliani Limit Pricing Model are:

(a) There are two periods: pre-entry \((t=0)\) and post-entry \((t=1)\). Entry may occur only in period 1.

(b) There is a single established firm or a co-ordinated cartel, the incumbent \((i)\), and a single potential entrant \((e)\).

(c) Consumers are indifferent between purchases from the
incumbent or the entrant and have no costs of switching supplies.

(d) Demand does not change.

(e) In period $t=1$, the incumbent can commit to an output level $x_i$ which it must maintain at all future periods.

The market price is $P(x_i)$ in the first period and $P(x_i + x_o)$ in the second period, where $x_o$ is the entrant's production. Suppressing price factors, the entrant's profit is:

$$\Pi_o(x, x_i) = P(x_i + x_o)x - C_o(x)$$

where $C_o(x)$ is the entrant's cost function. Let $x$ be the entrant's profit-maximising output taking $x_i$ as given. The firm should enter if its maximum profits are positive and should stay out otherwise. The limit output, $Y$, is the smallest $x_i$ for which $x_o$ is zero (no entry). The associated limit price is $P_L$. This is illustrated graphically in the following figure.

Figure 1.3

Limit Pricing

The incumbent and the potential entrant have the same average cost curve, AC. The potential entrant takes the
incumbent's output as given and maximises its profit given the residual demand curve $D(P) - x_i$. This is shown by using $x_i$ rather than the original axis as the ordinate for the entrant's demand and cost curves. Given $x_i$, there is no output at which the entrant can earn a positive profit. This is the smallest output that yields everywhere negative profits for the entrant, hence $x_i = Y$. The associated price is the limit price, $P_L$. Limit pricing and variations thereof have been extensively discussed in the literature (see Gilbert 1989a, 1989b). While Bain emphasised the supply-side aspects of entry barriers, other economists included demand aspects too. For example, Scherer [1980:2463 states three conditions under which potential entrants expect existing firms to maintain their output in the face of sizeable new entry. In this case, price can be held persistently above the competitive level by a greater percentage margin without attracting entry. The three conditions are:

(a) The less elastic demand is,
(b) The higher the proportion of total industry output a firm of minimum optimal scale must produce, and
(c) The more a firm operating at less than minimum optimal is disadvantaged by high unit costs.

The early works of Bain et al spawned a great deal of empirical work on entry barriers. Research in the old IO essentially involved econometric analysis of industry specific/cross-industry data by regressing profitability on various proxies for entry barriers.

Bain's work and methodology became popular in the 1960s and 1970s as is evident from the numerous studies that followed that ran regressions to explain differences in inter-industry profits. The independent variables were picked up from the S-C-P norms depending on industry specific characteristics, data availability as well as the objectives of the study.

Bain [1956] examined 20 U.S. industries and concluded that the most significant barriers to entry were product
**differentiation**, economies of scale and control of patents (or scarce resources). This study was the forerunner of numerous econometric analyses which tried to unravel the relationship between structure as determined by barriers to entry, and performance as determined by **profitability**. The difficulty of measuring barriers to entry was somewhat surmounted by adding proxies for various sources of entry barriers to regressions of **profitability** on concentration. [Also see Comanor and Wilson 1967, Orr 1974 etc. which are examples of econometric work in the pattern of Bain] Other studies that investigate the relationship between size, concentration and entry include Dunne, Roberts and Samuelson [1989], Bresnahan & Riess [1991] and Hause & du Rietz [1984]. These papers are slight variations on Bain's schemata, but within the old IO paradigm.

**Lieberman's** study of the U.S. chemical industry explores several relationships between various determinants of market structure and their anti-competitive effects. **Lieberman [1987]** investigates the factors that determine the size of new industrial plants in the U.S. chemical processing industry.

Lieberman also examined the entry deterring effects of excess capacity, where he **differentiates** between firms that build and maintain excess capacities for strategic and non-strategic reasons. Profit maximising firms, he says, hold non-strategic excess capacities in markets where demand is cyclical or stochastic or where plants are inherently lumpy or subject to economies of scale [Lieberman 1987a:238]. This point is particularly relevant in industries which require huge investments (such as the petrochemical industry) and which have other entry barriers apart from the high cost of entry such as economies of scale and the resultant excess capacities. The potency of these entry barriers may be **under-cut** by market growth, free-rider problems and demand-related effects but there nevertheless remains a strong incentive to deter entry on the part of the incumbent.

Strategic excess capacity may be built either to deter entry or to preempt existing rivals. The basic entry deterrence
argument is that excess capacity enables incumbents to threaten to expand output and cut prices following entry, thereby making entry unprofitable. Entry deterrence is therefore achieved by intensifying the post-entry competition anticipated by the entrant.

Capacity built by incumbents after the announcement of entry may also serve entry deterring objectives. If incumbents have a shorter construction lead time than entrants, i.e. if incumbents can expand existing facilities more rapidly than entrants, it might be as good as (but less costly than) excess capacity held in advance of a specific entry threat. Even if initial entry occurs, incumbents by responding aggressively, may be able to establish a predatory reputation sufficient to deter further entry. Empirical evidence, however, appears mixed and even contradictory. (See Lieberman [1987a] & Hilke [1984].

A third method by which firms can deter entry is by vertical integration. A firm can be described as vertically integrated if it encompasses two single output production processes in which either (1) the entire output of the 'upstream' process is employed as part or all of the quantity of one intermediate input into the 'downstream' process; or (2) the entire quantity of one intermediate input into the 'downstream' process is obtained from part or all of the output of the 'upstream' process [Perry 1989:1853. "The former is called forward integration and the latter backward integration. Silberston C19723 terms vertical integration, 'depth of production' which is partly a function of the history of the plant and partly of technical and economic considerations.

Perry [1989:1873 lists three broad determinants of vertical integration:

(a) Technological economies,
(b) Transactional economies, and
(c) Market imperfections.

Vertically integrated firms in an industry can develop incumbent power which in turn acts as an entry deterrent. While
vertical integration has **theoretically** been understood to deter entry, it has been difficult to establish this in an empirical fashion in the old IO perspective. In fact the question of whether vertical integration is an anti-competitive strategy or not, and the role it plays as an entry deterrent has been the subject of a long-standing debate.

Williamson [1971:112] points out that "Policy interest in vertical integration has been concerned mainly with the possibility that integration can be used **strategically** to achieve anti-competitive effects." The anti-competitive effects of vertical integration are of two types:

(a) Price discrimination, and  
(b) Barriers to entry.

He also lists price discrimination and barriers to entry as one of the incentives for a firm to integrate.

While **theoretically** it has been well understood that vertical integration is entry deterring, it has been difficult to establish this empirically in the old IO perspective.

The numerous empirical studies that were conducted by picking up strands from the S-C-P paradigm, and testing hypotheses on their relationship using econometric tools, did not develop into a generalised framework for analysis. Nor were the results consistent, partly because the studies were too relationship and industry-specific. The two main shortcomings of these inter-industry studies were: (a) the limitations of data and (b) the difficulty of using cross-section data to identify key structural parameters [see Schmalensee 1988]. Economists reacted to these shortcomings by reverting to industry specific analysis (rather like the pre-Bainian case studies approach) while using econometric tools. So much so that "...there was a growing unease at what some would call catholic and others call ad hoc theorising behind the new empirical work. This gave rise to an approach which is perhaps most appropriately described as 'empirically driven theory'. By this we mean research with an ultimate
empirical objective, but based on explicit theoretical-model building designed to establish a formal relationship between the variables concerned: the theoretical model is then used to guide the specification of estimating equations." CDavies et al [1988:6]

This in turn led to the use of mathematical modelling using game theoretical principles to partial equilibrium analysis in microeconomics to formulate new models of entry-deterring strategies.

In the late 1970s, this movement towards empirically motivated theory was joined by mathematically trained economists and led to what Davies et al call the 'New industrial organisation'. But parallel to the development of the S-C-P paradigm was the work of the Chicago School which is best defined by their differences with the old IO.

The Chicago School

A major voice of dissent against the development of industrial organisation as a separate branch of economics has been by proponents of what can be loosely termed the Chicago School. The root of the Chicago School's criticism has been that industrial organisation rests on nothing but the basics of neo-classical price theory. Stigler in fact declared that "...there is no such thing as industrial organisation" [1968:1] and went on to say that what was considered industrial organisation was precisely that content of economic theory - price or resource allocation theory - now given the 'infelicitous' name of microeconomics. He, nevertheless, conceded that there were two somewhat 'honourable' reasons for industrial organisation to branch off from traditional microeconomics. That the formality of economic theory did not allow for studies that dealt with the details of empirical measurements and industrial organisation took on the chores of dealing with public policy questions, in particular those proposed by anti-trust laws and public regulation which traditional economic theory did not deal with. Nevertheless, he stated that much of industrial organisation
literature has been "so non-theoretical or even anti-theoretical, that few economic theorists were attracted to it." [1968:1]

Both Bain and Scherer were anxious to relate their work to policy issues and "given the underlying assumptions of the paradigm, it carries the undeniable presumption against monopoly power and big business" CDavies *et al* 1988:43. This must have been anathema to the Chicago School economists since the gist of their critique revolves around the Harvardians' benign view of the market. This view rests on a conviction that inter-industry differences in market shares and profits can be explained solely by differences in efficiency. The Chicago School does not reject the concept of barriers to entry but believes that they play a minor role [Gilbert 1989c:1123.

The salient features of the Chicago School can be summarised as follows CGilbert 1989c:1133:

(a) Gains from incumbency should be modest and temporary.

(b) Strategic behaviour of established firms influencing the conditions of entry should be minimal.

(c) Industry structure and profits should reflect cost differences and not accidents of history that determine the order of entry of the firm.

(d) Market concentration should not, by itself be a determinant of price.

Stigler, a staunch proponent of the Chicago School, defines a barrier to entry as "a cost of producing (at some or every rate of output) which must be borne by a firm which seeks to enter an industry but is not borne by firms already in the industry" [Stigler 1968:67]. Essentially, this means that the different conditions that entrants and incumbents face in an industry is in itself an entry barrier. As Gilbert [1989a:476] points out, Stiglerian barriers to entry do not exclude demand considerations. For example, consumer loyalties affect the costs that a new firm must incur in order to reach a particular level of sales. To the extent that the new firm has to overcome more consumer resistance
than the established firm, the entrant would experience a
Stiglerian barrier to entry.

Stigler's definition of an entry barrier is akin to the
notion of sunk costs in contestability. The entrant has to ensure
that expected revenue will be sufficient to compensate for the
risk of losing irreversible investment. If production exhibits
increasing returns to scale, an 'efficient' market structure calls
for a single firm. This in turn calls for large plants where the
Minimum Economic Scale (MES) is large. But large MES does not
automatically imply that entry barriers are high. Caves,
argue that even if MES is large relative to the market, small-scale
entry may be attractive unless the cost penalty for
operation at sub-optimal scale is substantial.

The main contention of the Chicago School is that anything
that increases the efficiency of a firm is not a barrier to entry.
In fact, in their parlance, concentration, excess capacities (as a
result of scale economies) or vertical integration cannot be entry
barriers if they are the outcomes of efficiency. As Shepherd
remarks, "The Chicago School regards all elements of market power
(internal and external) as small and/or short lived. Any existing
market power is held to reflect economies of scale; therefore it
is justified by efficiency" CShepherd 1984:575].

Demsetz, a strong proponent of the Chicago School in fact
declares that economies of scale and concentration are not
barriers to entry but arise out of efficiency on the part of
incumbents. He attributes even informational and reputational
advantages of early entrants as part of the costs of doing
business and not barriers to entry [Demsetz 1982].

Demsetz alleges that the previous studies of Bain, Stigler,
and others of that genre have presented too narrow a view of
barriers to entry, a view that focuses on the cost of producing
the physical output of an existing firm. Defining barriers to
entry thus, Demsetz claims, not only diverts attention from other
types of barriers but also hides the value **judgment** implicit in the notion of barriers. He says that these early studies either ignore or treat the costs as "unproductive" that must be incurred "to create and to maintain a good reputation, to bear risks of innovation and to build a scale of operations appropriate to the economical servicing of consumer demands, and it tends to neglect the incentives that will face future decision-makers as a result of today's policy. Licenses, trademarks, copyright, patent, entitlement to the fruits of past investment including the investment in an honourable long history, and the right to reduce price may or may not be desirable, depending on how these implications are valued" [Demsetz 1982:573.]

The Chicago School's view that even vertical integration is not an entry barrier is exemplified by Stigler. He points out "...there is no reason to expect that vertical integration has any monopolistic implications as long as every stage of production is competitive" [1968:3033. In this case, the value of transaction costs as an entry barrier loses its validity since vertical integration merely substitutes internal organisation for market exchange.

Bork supports the view that vertical integration is an outcome of sound business acumen. He argues that "In general, if greater than competitive profits are to be made in an industry, entry should occur whether the entrant has to come in both levels at once or not. I know of no theory of imperfection in the capital market which would lead suppliers of capital to avoid areas of higher return to seek areas of lower return" [1969:148].

The Chicago school disregards the existence of entry barriers as **insignificant** and if at all they exist, as temporary. This view was further polished by economists who went on to **re-define** the notion of perfect competition giving birth to the theory of contestable markets.
Contestability, Sunk Costs and Barriers to Entry

The contestable market theory has sought to provide an alternative to the unrealistic notion of perfect competition in traditional industrial organisation literature. This theory branched off from the Chicago School approach to take the 'pro-market' view to its logical end and, further, to argue that potential entry was sufficient to discipline all markets including natural monopolies. "Contestability is merely a broader ideal, a benchmark of wider applicability than is perfect competition" [Baumol 1982:1]. Its proponents Baumol, Panzer and Willig call it the "uprising in the theory of industrial structure", "a new theory of industrial organisation" which offers "a unifying analytical structure to the subject area, and ... useful insights for empirical work and for the formulation of policy" CBaumol 1982:13.

What the theory of contestable markets states is as follows: If there are no sunk costs, and if there exists at least one potential entrant who could produce exactly the same products as the incumbent, and if the equilibrium concept is such that the entrant can undercut the incumbent for long enough to enable the entrant to sell his desired output, then we have what is known as a perfectly contestable market CBaumol 1982]. The core of the theory states that even if there are substantial economies of scale and/or economies of scope, or other traditional market deficiencies - provided there are no sunk costs - there can be no exploitation of monopoly power as pricing in excess of average cost would result in under-cutting entry. It is the ability to withdraw costlessly that encourages entry and ensures that incumbents act competitively in the first place.

A perfectly contestable market is therefore an illustration of a market without barriers to entry or exit. There is no product differentiation and no cost advantages. There is no uncertainty and no switching costs, and learning economies are non-existent. Production may exhibit increasing returns to scale,
but firms do not incur any costs that are not perfectly reversible in the event of exit from the market i.e. absence of sunk costs. The entry conditions in such a market are:

(a) Free and without limit,
(b) Absolute, and
(c) Perfectly reversible [see Shepherd 1980:573].

Baumol and Willig, the proponents of contestability theory define an entry barrier as "anything that requires an expenditure by a new entrant into an industry, but that imposes no equivalent cost upon an incumbent" [Baumol & Willig 1981:408, cited in Gilbert 1989a:476]. And, in a contestable market of costless entry and exit, there are no entry barriers. Since sunk costs are the crux of determining whether or not a market is contestable, competitive conditions can exist in any industry where sunk costs are zero. This definition precludes all other barriers to entry including scale economies.

For the contestability theorists the absence of sunk costs is important on two counts. Firstly in a contestable market without sunk costs, the entry option can be exercised at no cost. A potential rival can consider a hit and run entry without concern about irreversible investments. It pays a potential rival to enter the market if he anticipated any positive profits. Secondly, with no sunk costs and with identical technologies, the incumbent firm and a potential entrant bear the same cost at each level of output. There is no strategic asymmetry between an entrant and an established firm because each faces exactly the same cost and revenue functions.

The absence of barriers to entry and exit therefore provides a convenient benchmark to ascertain the consequences of barriers to competition. Baumol, Panzar and Willig show that if a market is perfectly contestable and if an equilibrium exists, then price equals marginal cost for any product produced in positive amounts by two or more firms. If only one firm exists in a perfectly contestable equilibrium, total revenues will exactly equal total production costs.
Contestability theorists make two controversial claims:

(a) That their notion of contestability avoids ex post-oligopolistic interactions compared to earlier studies in IO theory, and

that perfect contestability theory yields a useful benchmark even when the conditions for perfect contestability are not satisfied.

Brock contests the robustness of these claims and says that the rules of the game are not specified and therefore such claims have to be viewed with caution [Brock 1983].

When sunk costs are zero, the potential entrant enforces competitive conditions, regardless of industrial structure including monopolies. But the higher the sunk costs, the greater the risk assumed by entrants. Entry is less attractive because the entry barrier too is high. This notion of potential competition being a market disciplinarian hinges upon the absence of sunk costs. As Dasgupta & Stiglitz point out "...if there are even small sunk costs, potential competition may not be effective in ensuring either that profits go to zero or that efficient outcomes obtain" [1988:571].

A contestable market characterised by 'ultra free' entry, as Shepherd [1984:572] terms it, provides efficient outcomes in all markets i.e. markets with varying degrees of imperfection. These firms are efficient in that they make zero profits, offer Ramsey optimal prices, create an efficient production and market structure, and avoid cross subsidies in pricing. Shepherd [1984] not only questions the semantics of the term contestability, but is sharply critical of the realism of the assumptions about the nature of competition and chary of the empirical issues in measuring and testing ultra free entry.

A contestable market allows for scale economies as long as they are not sunk. The greater the proportion of costs that is non-recoverable on exit, the quicker and more aggressively is the incumbent able to respond. And the greater is the premium over
cost that the incumbent can earn before the potential entrant is willing to risk entry [Davies et al. 1988:38]. Therefore contestable market theory targets potential entry as a primary determinant of market structure and performance.

The contestability theory which took-off from the Chicago School was one of the two developments in Industrial Organisation theory. The other was the 'new' Industrial Organisation which broadly recognised the Bainian barriers to entry as important, but was increasingly dissatisfied with the empirical work and empirically driven theory of the 'old' industrial organisation. And that inter-industry analysis had outlived its usefulness in analysing industries. The 'new' IO economists began the use of game theoretic tools to explain firm strategies in clearly defined industries.

The New Industrial Organisation and Entry Barriers

Competition and entry barriers continue to be the recurring theme of Industrial Organisation. These concepts were however analysed in a more rigorous fashion that allowed for game theoretic tools to analyse strategic firm behaviour in models of imperfect competition. This is reflected from the 1970s, when a growing volume of work in industrial organisation was done by mathematically trained economists who were interested in the theoretical problems of industrial organisation but not necessarily in the specification of econometric work. Davies et al. [1988] call this strand of work the 'New Industrial Organisation' and defend this distinction on the ground that "the rigour of the New Industrial Organisation compared with the Catholicism of earlier years is sufficiently different in emphasis to warrant some sort of distinctive label". The roots of the New Industrial Organisation lie in the works of Cournot, Bertrand, von Stackelberg and Schelling.

The distinction between the old and new IO was essentially that of methodology. The methodology of the new IO primarily involves defining the basic initial conditions and the problem,
determining the equilibrium strategy followed by the players in the game (Cournot, Bertrand or Nash) and then working out long or short-term strategies [see Figure 1.43.

Source: Davies et al [1988:7].

In contrast to Fig. 1.2, Fig. 1.4 clearly illustrates that the conduct of firms is specified through an equilibrium concept where both the initial conditions and mode of conduct are exogenous and there is no feedback. And market structure is treated as more centrally endogenous.

Models of entry deterrence in the new IO formulate post-entry strategies and moves in order to trace back the implications for entry deterrence. (In contrast, the theory of perfectly contestable markets finds post-entry conditions irrelevant and strategic entry deterrence impossible.) While the Old Industrial Organisation picked up causal strands in the S-C-P paradigm and tested them using econometric techniques, the new IO builds mathematical models of firm behaviour which are as yet, not amenable to testing using firm or industry specific data. However, the new IO uses many of the concepts of the old IO and injects a measure of analytical rigour into them.
Economists of the new IO use game theoretic approaches for analysing situations in contrast to the econometric analysis of the earlier theorists working in the old IO. Their analysis involves chalking out and comparing the equilibrium strategies followed by firms in the pre and post-entry period based on the information available about the industry. The equilibrium conditions could be Cournot, Bertrand or Nash. These equilibria are:

Cournot Equilibrium: The output rates chosen by the firms constitute an equilibrium if, given the outputs chosen by rivals, no firm can improve its profits by altering its output.

Bertrand Equilibrium: The prices chosen by firms constitute a Bertrand Equilibrium if, given the prices chosen by rivals, no firm can improve its profits by altering its prices.

Nash Equilibrium: Each firm optimises its profits given the strategy of rivals.

Depending on the specificities of the model, the notion of Stackelberg leadership could be imposed to analyse the post-entry game. In a Stackelberg equilibrium, one firm (the leader) moves first, and the second firm (the follower) moves next. The follower chooses a strategy, taking the leader's choice as given. However, the Stackelberg leader anticipates the follower's choice and take this into account when making a decision.

After setting out the problem in this way, the long-run and short-run strategies of the firms are worked out. The greatest advantage of this method is perhaps, the systematic way the problem is set out and analysed. As Schmalensee puts it, "Perhaps the greatest merit of the game theoretic approach is that it disciplines theoretical discussion by, in effect, forcing theorists to specify and then abide by the rules of the games they analyse" [Schmalensee 1988:646].

Entry deterrence literature in the new industrial organisation can be categorised in terms of the following three attributes to entry:

(a) When information is asymmetrical,
(b) When incumbents make commitments (usually of capacity) in advance of entry, and
(c) When entrants are uncertain about an incumbent’s objectives

Models based on industry specific characteristics are then built, the underlying premise being information asymmetry, commitment or uncertainty. Some models also superimpose a behavioural condition of reputation-building on the part of the incumbent. An incumbent may behave aggressively (and thereby irrationally); the incumbent’s predatory actions are designed to eliminate entrants when they appear; by building a reputation for such credible threats, the incumbent could serve to deter the more sophisticated entrants.

Analysis of this sort led to a variety of two-period entry deterrence models with a single established firm (a monopoly) and a potential entrant. If there were more than one incumbent, the models would assume some sort of a collusive behaviour which liken the collusive oligopoly to a monopoly. This would enable the players to act in a duopoly game (in case of entry) which is amenable to detailed analysis. This basic framework of analysis enabled economists to examine the entry-deterring strategies of incumbents who used various entry barriers such as high cost of entry, excess capacity, concentration, vertical integration etc. to deter potential entrants. The following is typically reduced form of two-stage game between an incumbent monopolist and a prospective entrant.

Figure 1.5
The Entry Game

Source: Dixit [1982:3]
In the first stage, the entrant has to make the entry decision. If he stays out, the incumbent earns monopoly profits ($\Pi_m$). If entry occurs, the incumbent decides whether to fight a price war resulting in $\Pi_v$ to each player or share the market with $\Pi_d$ to each duopolist. In Figure 1.5, each end-node represents a pay-off, the first component being the incumbents. It is assumed that $\Pi_m > \Pi_d > 0 > \Pi_v$. i.e. a duopoly is profitable but not as much as a monopoly while a price war is mutually destructive. Most entry games are modifications of the above model suited to the specificity of the study. The basic entry-deterring model works out post and pre-entry conditions, compares the two and makes conjectures about the entry-deterring strategy of the incumbent. And many modifications can be made to the above basic model depending on industry-specific basic conditions and the specificities of the game to be researched.

There is extensive literature analysing how an incumbent monopolist might invest pre-emptively in order to deter all future entry. We discuss those papers where firms invest (a) to expand capacity for the same product and (b) create capacity in a neighbouring product i.e. to integrate vertically. These two forms of capacity commitments are relevant for the Indian petrochemical industry.

Studies of capacity expansions and entry deterrence are based on the basic idea that a firm's capital investment is inflexible downwards, so that by investing pre-emptively, the incumbent monopolist commits himself to a higher capital stock and thus to a lower (short-run) marginal cost function, at least over an ascribed output range. The lowered marginal cost makes the incumbent a tougher competitor in any future interaction, thereby reducing expected profits from entry. Studies by Spence [1977], Dixit [1979, 1980], Eaton & Lipsey [1980, 1981], and Gilbert & Harris [1984] are representative of this genre of writing. The new IO uses many of the concepts of the old IO and presents them in a rigorous analytical manner. Dixit's work [1979 & 1980]
provides a fine example as he translates Bain's categorisation of entry barriers into the vocabulary of the new IO. We will develop in detail Dixit's work, not only because it provides for alternative approaches but is seminal for understanding increasing to scales industries such as the petrochemical industry. Before doing so we shall briefly survey one of the earliest studies in the new IO, examining entry deterrent possibilities of excess capacity, by Spence [1977]. He argues that entry is deterred in an industry when existing firms have enough capacity to make entry unprofitable. The resulting excess capacity is an effective entry deterrent partly because it is irreversible and represents pre-emptive commitments to the industry. Of course the presence of excess capacity, given output levels, results in higher costs than are necessary. It also results in higher prices and lower levels of output than those implied by various forms of the limit price model. The post-entry game, therefore, involves leadership by the established firm. The incumbent's threat of producing at a level equal to the pre-entry capacity is believed by the prospective entrant and entry is thereby deterred.

In the Spence model, existing firms choose capacity in a strategic way designed to discourage entry. “This strategic purpose is realised by holding ‘excess’ capacity in the pre-entry period. This excess capacity permits existing firms to expand output and reduce price when entry is threatened, thereby reducing the prospective profits of the new entrant who operates on the residual demand curve to zero. Given that capacity is selected in this entry forestalling manner, existing firms choose pre-entry price and quantity so as to maximise profits” [1977:534-35].

Entry barriers in Spence’s model are a "combination of structural and technological factors on the one hand, and obstacles that are put in place by the existing industry on the other" [1977:543]. He stresses on the latter which involves the irreversibility of investment which is important on two counts: (a) that such a commitment would constitute a credible threat and
(b) there is no need to set sub-optimally a relatively flexible instrument like the price, since that can be adjusted within the time horizon required for entry to take place. He discards the view that the mere threat of entry is a resource-improving measure.

Detailed studies on competition and entry barriers in the new IO framework is that of Dixit. Dixit [1979 & 1980] draws attention to the critical roles of expected post-entry competition in deciding the extent to which economies of scale and excess capacities can be a barrier to entry. (Ironically, it appears that the more competitive the post-entry game is expected to be, the greater will be the entry barrier.) Dixit formulates three scenarios. If entry takes place:

(a) The incumbent firm acts as a Stackelberg leader and the entrant is the follower CDixit 1979];

(b) Both the firms act as Nash players CDixit 1980]; and

(c) The entrant becomes a Stackelberg leader and the incumbent is the follower CDixit 1980.

Whereas in Dixit C19793 the incumbent firm has a clear first mover advantage, Dixit [1980] explores the possibilities of limited leadership.

Dixit [1979] analyses a model of duopoly where scale economies are introduced into the model via fixed costs. Leadership by one "established" firm may yield an outcome in which the second is inactive, but entry prevention is not a prior constraint. Dixit discusses a case where the incumbent firm's strategy is to threaten a sufficiently large output in the event of entry while maintaining enough capacity to make that threat credible. He uses linear demand and cost functions and assumes Cournot competition.** While demand functions are the usual ones, cost functions are defined as follows:

\[ C_i = f_i + \omega x_i + r_i k_i \]

where \( x_i = \) output

\( k_i = \) capacity &

\( \omega_i + r_i = v_i = \) marginal cost of expanding output and capacity together.
The incumbent firm $<1)$ can threaten a post-entry output of $h_i$ while producing $x_i$ ($\leq h_i$) so long as entry does not occur. For firm $2$, the relevant quantity is $h_i$: it will stay out if $h_i > B_i$ where $B_i$ is the incumbent's limit output at which entry can be prevented because the entrant has a certain fixed cost. Dixit then defines the four possible outcomes in terms of Bainian entry barriers and shows how the strategy of excess capacity can enlarge the zone where entry is effectively impeded at the expense of the zone where it is allowed to occur. Allowing excess capacity to be held introduces a second way of barring entry that is preferable over a portion of the range.

Dixit [1980] analysis the entry game in a case where the incumbent incurs a sunk cost. There is one incumbent, one potential competitor and two periods: before and after entry. Entry occurs only in the second period. If entry occurs, the two firms behave as Cournot competitors. The entire game rests on the premise the 'Strategic entry deterrence requires an inter temporal linkage between actions that the incumbent may take prior to entry and the probability or extent of subsequent entry.' [Gilbert 1989a: 4883]
In Dixit's model, the inter-linkage is achieved by allowing for capital expenditures that, once made, become irreversible or sunk in the next period. This enables the incumbent firm to commit to an output it cannot otherwise sustain as an equilibrium if its first-period expenditure were reversible. The incumbent is able to turn a liability (irreversibility of capital investment) into a key asset that makes entry deterrence feasible.

In an extension of the above model, Dixit considers a possibility where the entrant acquires the role of quantity leadership i.e. Firm E chooses a point on Firm I's reaction function to maximise its own profit. But Firm I, by its initial capacity commitment, can decide on a reaction function to present to the entrant.

In the models of Dixit credible entry deterrence is an example of the indirect effects of a barrier to exit where sunk costs affect the behaviour of established firms. With Cournot competition, sunk costs make an incumbent firm more aggressive. If capital investments were recoverable, the opportunity cost of capital would be an additional component of the firm's marginal cost function and the firm's reaction function would shift to the left. The firm would produce less at every level of rival output and perhaps exit the market, making entry more profitable.

The Dixit's models were the forerunner of many models of that genre. Fudenberg and Tirole [1983] analyse how an early entrant in a market can exploit his headstart by strategic investment. They study the investment game in the no-discounting case and arrive at an equilibrium which shows that the follower firm is forever deterred from investing. Capital is sunk only to the extent that it is embodied in a durable investment. Eaton and Lipsey [1980] argue that the entry deterrence property of capital depends critically on its durability and this aspect of capital has been largely ignored. They charge that the works of Dixit [1979, 1980] & Spence [1977] amongst others of that genre deal with, what they call, the atemporal aspect of capital as a barrier to entry. A monopolist strategically commits a quantity of
capital which is sufficient to produce a negative flow of profits to a new entrant. The durability of capital is a constraint on a firm's ability to exploit a sunk cost barrier to entry. When capital wears out, an established firm and an entrant are on a level playing field (provided all of the firm's capital wears out at the same time, which seems rather unlikely).

Strategic decisions with respect to capital durability are examined by Eaton and Lipsey [1980] in two models. In the first model capital decays exponentially, and in the second model, capital decays only with use. Specific capital is a natural vehicle for commitment to the market and commitment is valuable to the firm since it inhibits entry. Accordingly, a profit maximising firm will choose the specifications of capital, so that marginal cost is equal to a positive marginal value in inhibiting entry. This choice will often result in specific capital that is 'too durable' or 'too soon replaced' or 'too well maintained' relative to the unconstrained cost-minimising solution.

Markets with increasing returns to scale in investment where competition occurs over both the amount and the timing of new capital construction are examined in Gilbert and Harris [1984]. They develop a theory of competition in markets with indivisible and irreversible investments. The consequences of competition depend on the strategies and information available to the competitors. If firms act as Nash competitors with binding contracts, revenues will exceed costs for any number of firms, and otherwise identical firms will earn different profits. In the absence of binding contracts, competition over the timing of investment can completely dissipate profits in a sub game perfect equilibrium with two or more firms.

The underlying assumption of many capacity commitment models is what Malueg & Schwartz [1991] term the mimicking principle. The mimicking option implies that the incumbent makes the same investment decision that an entrant would make and thereby deter entry. For example, if the entrant was planning to enter with capacity $k$, the incumbent could hope to deter entry by expanding
by capacity $k$. In Eaton & Lipsey [1980] the incumbent deters entry by building a new plant sufficiently in advance before the old one needs to be replaced. The mimicking option exists in their model because, by assumption, the market cannot support two independently operated plants. Thus, by adding the plant the entrant would have added, the incumbent deters entry. In Gilbert & Harris [1984] the mimicking option arises because the incumbent and the entrant would use the added plant identically (i.e. to capacity) in any subsequent output interaction. So if allowing one entrant suffices to deter further entry, duplicating that entrant's investment will suffice to deter it.

Another aspect of barriers to entry that came into prominence was of vertical integration through capacity creation in neighbouring products. Vertical integration has long been known to provide integrating firms with greater profits. Schmalensee [1973] investigates the implications of vertical integration by successive monopolists for costs, prices and welfare in the case of a monopolist who produces an intermediate good and integrates forwards into the competitive customer industry. He assumes that the intermediate-good monopolist must sell his output of final products at a price equal to the average cost of the producers he does not control. Since the monopolist has an incentive to acquire these independent producers, he may well not want to sell at this price. Under some conditions, it would be in the monopolist's interest to engage in a price squeeze, whereby he charges the independent producer $q$ and sells his own production for less than $M(q)$, in order to purchase the fixed assets of the independent producers on favourable terms.

In his vertical integration model Schmalensee [1973] investigates the case of a monopolist in an intermediate industry who integrates forwards. He assumes forward integration of firms "...from concentrated markets to unconcentrated industries because it is generally profitable." C1973:4493 On the other hand, given the presence of monopoly power in the market for the intermediate good involved, such an integration, he says, is not necessarily a
bad thing. Complete integration will lower the average social cost of producing the final product, and it may well lower its price also. Even if the price of the final product rises because of integration, the Marshallian measure of welfare too may increase.

The vertical integration of successive oligopolists has been demonstrated by Greenhut and Ohta [1979] as mutually profitable, since industry output increases and product price is lower. This implies in general to oligopolistic industries in which fixed proportions apply to successive stages of production. The welfare gain stemming from vertical integration is further shown to hold not only in the case of a Cournot oligopoly but also a Stackelberg oligopoly. Greenhut & Ohta therefore recommend that industries characterised by oligopoly and fixed proportions in successive stages should be allowed to integrate without concern over 'arbitrary' concentration ratios.

The view that a monopolist producing an intermediate product and selling to a competitive industry has a profit incentive to integrate forward, has also been supported by Vernon and Graham [1971]. They say this is not true only in a special case when production in the customer industry is characterized by fixed coefficients. They show graphically and verbally that attempting to capture monopoly profits by pricing an intermediate good above cost leads to substitute away from it and, thus, to inefficient production at the next stage. A monopolist can avoid this inefficiency and thus increase his profit by integrating forward.

This review of literature on the entry, deterrence possibilities of investment by incumbent firms has dealt with two strands in IO theory: first, the question of how the creation of excess capacity by incumbent firms can deter entry; and second, how vertical integration is an entry barrier.

In the 1980s, the models of the new IO attracted trade theorists which resulted in a synthesis of trade and industrial organisation theory. The concept of the firm was replaced by the
nation to overcome the geographical restrictions of the domestic market. Once the stage was set, domestic and foreign firms could play the 'industry game' using the rules of the new industrial organisation, with the added complexities of trade. This branch of economics came to be known as the New International Trade Theory (ITT) and gained currency predominantly through the works of Krugman [1979, 1990], Helpman [1984], Caves [1980], and Ethier [1982].

THE NEW INTERNATIONAL TRADE THEORY

The theory of comparative advantage enunciated by Ricardo in 1817 has been the fundamental underpinning of economists' argument of the gains from trade for nearly 200 years. His theory gave rise to the traditional constant returns and perfect competition models of international trade. These models sought to explain differences in export performance in terms of factor endowments - the most popular being the Heckscher-Ohlin theory and its numerous variations. The only exception to the traditional gains from trade theory was the infant industry argument for protection; in fact, the only case where a departure from the free trade norm was grudgingly accepted by trade theorists.

A major departure came in the late 1970s with the possibility that trade might arise for reasons other than exogenous differences in factor endowments, technology, or tastes. These theories arose from a desire to provide a satisfactory explanation for intra-industry trade that was globally prevalent. The New International Trade (ITT) pointed out that economies of scale that characterised imperfect competition could generate international trade and that too in the absence of cost differences. In other words, trade was simply a way of extending the market and exploiting scale economies [Krugman 1979:4793].

Trade theory and industrial organisation theory were increasingly combined to offer explanations of cases where economies of scale had led to arbitrary specialisation in products that were produced in monopolistically competitive conditions.
This major departure from mainstream trade theory sought to provide a theoretical justification for government intervention in trade on two counts: a) for strategic reasons and b) on account of externalities. As a result of which, while "free trade is not passé, it is an idea that has irretrievably lost its innocence" (Krugman 1987:313).

The crux of the new IT theory is its incorporation of scale economies to formal models. Traditional trade theory avoided the problem of scale economies because firstly, it was incompatible with the perfect competition assumption of the early trade models and secondly, it was awkward to model. It was the revolution in industrial organisation theory, particularly the use of game theoretic oligopoly models which were incorporated by trade theorists that helped to overcome this problem. In fact, international trade theory was remoulded into the image of industrial organisation by superimposing government interactions onto the firm strategies. Therefore international trade theory became not so much competition amongst nations, but competition amongst firms where governments were interested players and makers of trade policies [see Dixit 1987:313].

It was recognised very early that scale economies were not 'compatible' with traditional trade models which propagated free trade. Frank Graham argued that economies of scale in production provided a rationale for protection on the grounds that protection raises the sales of domestic firms and thus allows them to slide down their average cost curves. [The new trade theorists in fact point out that it is economies of scale that leads to specialisation which drives trade in the modern world. In an increasing returns industry, one can envisage a scenario whereby a few efficient manufacturers are adequate to cater to the world market. In such a case, an individual country that protects such an industry can raise the scale of that industry (domestically) sufficiently to reap a net benefit and even lower prices to domestic consumers. Regarding such a situation, there is much debate in the new IT about 'optimal' trade policy. Although the
case for free trade appears stronger, evidence shows that an individual country acting alone may have reasons not to adopt free trade. Trade models, in the new 77\" show that it is possible that export subsidies and tariffs may in fact favour the protecting nation.

The point that government interventions could raise national welfare by shifting oligopoly rents from foreign to domestic firms was first formalised in a model by Brander and Spencer [1983]. They said that in principle, government policies such as export subsidies can serve the same purpose as investment in excess capacity in the IO literature on entry deterrence.

While one strand of trade theorists have held that protection increases domestic market power, there has been a second proposition that protection, by initially generating monopoly rents, generates excessive entry and thus leads to inefficiently small scale production [see Dixit & Norman 1980]. However, an increase in competition through entry may leave firms unable to charge a markup on marginal cost sufficient to cover average cost. The result will be exit and more market power.

The ideas of entry deterrence in the new IO are assimilated in the New IT in Dixit & Kyle [1985]. If a firm commits itself into producing, by making an irreversible investment i.e. sunk costs, it would be socially optimal to provide an export subsidy. And with this subsidy, the firm will find its entry justified. In other words, firms can make strategic moves designed to affect government decisions; if the firm moves first, the government has to provide a subsidy. Yet, if the government commits itself not to provide a subsidy, entry would be deterred. The point is that while export subsidy, given entry, increases welfare it would be optimal to deter entry.

Government policies might serve the ‘strategic’ purpose of altering the subsequent incentives to firms, and act as a deterrent to foreign competition. Clearly a tariff can give domestic firms a strategic advantage in the domestic market the
same way export subsidies give them an advantage in foreign markets. Krugman classifies four themes on the implications of new international trade literature on trade policy Csee Krugman 1990: chap.143:

(a) The relation between trade policy and the market power of domestic firms,

(b) Role of price discrimination and dumping in international markets,

(c) The possibility that government action can serve a ‘strategic’ role in giving domestic firms an advantage in oligopolistic competition, and

(d) Whether IO theory gives new arguments in favour of protection.

It stands to reason that scale economies are likely to be most important in the manufacture of intermediate goods since the scope for product differentiation of products is very low in intermediate goods when compared to consumer goods Csee Ethier 1979, 1982b]. In such a situation, scale economies can cause a concentration of the industry in a country when such a good is non-tradable Csee Helpman & Krugman 1985]. The presence of scale economies also offers a great incentive to dump.

In the new international trade dumping is viewed as an asymmetric modal in which a domestic monopolist confronts price-taking foreign firms; the assumption is that the domestic market is somehow closed to imports while allowing the domestic firm to export. This is the underlying condition of Grander and Spencer's model of dumping [1983]. Their results are pivotal on transport costs: if transport costs are high, but not high enough to prevent trade, trade based solely on dumping leads to losses. If they are low, trade is beneficial. Of course there are many other reasons for which firms dump. Ethier [1982c] points out that dumping can arise out of sluggish adjustments of the key determinants of trade.

The new international trade theory is relevant to our study on two counts: (a) it deals with economies of scale and <b>the
Traditional trade liberalisation advocates an elimination or drastic reduction of government-imposed restrictions on trade to make way for 'free' trade. But in the light of the New IT, governments are viewed as key players in international trade in their roles as formulators of strategic trade policy. The new IT theory thereby offers a novel perspective on trade liberalisation: strategic trade interventions can be justified on the grounds of domestic and foreign market imperfections. And to the extent trade is propelled by oligopolies and further, by the exploitation of scale economies, trade theory is inextricably intertwined with industrial organisation.

Having reviewed the literature on entry barriers and entry deterrence in the new IO and trade literature, we outline the methodology of our study in the following section.

A NOTE ON METHODOLOGY

This study is set in mainstream industrial organisation. While our notion of entry barriers is derived from the old IO, we have used the analytical tools of the new IO to study the effectiveness of entry barriers in deterring the entry of new firms in the Indian petrochemical industry. Both the Chicago School and the Contestable Market paradigms are ruled out because of their stringent conditions pertaining to entry. Their narrow definition of entry barriers do not include the factors that we consider entry deterring; they are after all the outcome of profit maximisation behaviour!

The government has liberalised the petrochemical industry in the aim of enhancing competition and obtaining efficient outcomes. The earlier regulatory regime had resulted in a highly oligopolistic industrial structure. The study commences on the premise that entry barriers do exist in high fixed-cost industries.
with scale economies such as the petrochemical industry in India. The structure of the industry itself is dependent upon the nature and extent of these entry barriers - both artificial and natural.

An examination of India's liberal industrial and trade policies in the petrochemical industry indicate that they have eliminated artificial entry barriers. But natural entry barriers not only persist but are accentuated. We then proceed to analyse the implications of these natural entry barriers on the entry deterring strategies of firms in the petrochemical industry.

Bain's work [1956] and many other subsequent studies, as the review of literature illustrates, define barriers to entry as one of the determinants of structure amongst others like concentration, scale economies, high fixed costs etc. In our study, barriers to entry are not determinants of structure but each of the structural determinants of the industry have entry-deterring properties. For example, if concentration, the existence of excess capacities and vertical integration are determinants of industrial structure as they are in the Indian petrochemical industry, each one of them constitute an entry barrier.

An analysis of the petrochemical industry in India reveals that it continues to be concentrated thus forming an oligopoly. The two other factors that support the oligopolistic nature of the industry are vertical integration and excess capacities.

Concentration is measured both by four-firm concentration ratios and the Herfindahl index (CD-I-index). The Herfindahl index is used as the most appropriate for our sample of firms in the petrochemical industry. The index reflects both the number of firms and their relative size. It is based on easily observable variables and is easy to calculate. The \(H\) index is calculated as follows:

\[
H = \sum_{i} S_{i}^{2}
\]

where \(S_{i}\) is the market share of the \(v\)th firm.
We have however used market share in terms of output and not sales. The market share based on output in fact reflects the share based on sales in an intermediate goods industry. The four firm ratios and an analysis of dominant firms are used to make up for the deficiencies of the DH-Index.

Concentration ratios indicate the market power held by an interdependent group of firms. When the ratio is high, a few firms dominate the market and, with some degree of collusion, can raise prices and perform other conventional monopoly actions. Higher concentration makes effective collusion more probable. The market power that these oligopolists exert can be as great as if the firms were unified into one dominant firm. Therefore concentration is an indicator of diluted monopoly power.

The pattern of vertical integration was determined by tracing the diversification in a sample of firms in the petrochemical industry. Vertical integration takes place when a firm diversifies into neighbouring products in the production process.

Excess capacities was determined by the capacity utilisation rates of firms at present, and the anticipated excess capacities. Future excess capacities are estimated by comparing the capacities created by plants that are being built and estimated demand in the economy. However, petrochemical firms have to expand capacity in a discrete or lumpy manner. This gives rise to an excess of unutilised capacities in a periodic fashion: a non-strategic or innocent entry-barrier. It is however not possible to separate excess capacities into those that are innocent and those that are built to serve a strategic purpose. We can only determine whether excess capacity in a firm is entry deterring or not regardless of the firm's intention.

We then offer three models in the theoretical framework of the new JO to examine the entry deterring possibilities in an industry with high fixed costs (and scale economies). The three models analyse how the structural factors of excess capacity
(through scale economies), vertical integration and concentration provide opportunities for incumbent firms to deter entry. The **models** are:

Model 1: Excess Capacities, Step-wise Capacity Function and Entry Deterrence.

Model 2: Vertical Integration and Entry Deterrence

Model 3: Imperfect Competition, Prices and Tariffs

The **models** assume that the incumbents are monopolists in the first period. The assumption of monopoly is not stringent and is in fact only a **simplification** since firms in an oligopoly situation can collude and simulate a monopoly situation. Entry is postulated in the second period and the two firms become Cournot duopolists. We have assumed Cournot competition on the following grounds:

(a) Once large capacities have been established, firms can vary their output in **infinitesimal** quantities. This implies that the existence of scale economies, lumpy investments wherein once fixed costs are sunk, the **firm** can vary its output strategically.

(b) Prices are not flexible enough to enable Bertrand competition.

The Cournot model we have followed **is** briefly as follows: In game theoretic terms, the Cournot model is a one-period game in which N firms (N > 2), **simultaneously** choose output levels of identical products. If Q is total output and P(Q) is the market inverse demand function (which is assumed to be common knowledge), sellers' payoffs are given by their profit function:

\[ \Pi_i = q_i P(q_i + q_-) - C_i(q_i) \quad (i = 1, 2, ..., N) \quad \ldots (1.1) \]

where \( q \) is firm \( i \)'s output and \( q_- = Q - q \) is the total output of its rivals. The first order necessary conditions for each \( q \) to be a best response to the corresponding \( q_- \) are as follows:

\[ \frac{\partial \Pi_i}{\partial q_i} = P(Q) + q_i P'(Q) - mc \quad (q > =0 \quad i = 1, 2, ..., N) \quad \ldots (1.2) \]
where \( mc_i \) is firm \( i \)'s marginal cost \( \frac{\partial C}{\partial q} \) and \( P'(Q) = \frac{dP(Q)}{dQ} \). A Nash equilibrium in pure strategies provides a solution to (1.2) [see Schmalensee 1988:645].

Licensed capacities of petrochemical firms are far below efficient scales in the pre-liberalisation period. Liberalisation policies stipulated a Minimum Efficient Scale of operation, as one measure to increase competition in the industry. First-mover firms who expanded capacities (to take advantage of scale economies) could build excess capacities. Model 1 illustrates how incumbent firms build excess capacities and deter the entry of new firms and pre-empt capacity expansions of other firms thereby accentuating their market power.

Delicensing was another important component of liberalisation. Delicensing enabled firms in the petrochemical industry to vertically integrate. Model 2 shows how firm behaviour of vertical integration can preclude further entry (both in the input and product market) thereby accentuating the dominant power of the incumbent.

Our analysis of industry structure indicates that the petrochemical industry was highly concentrated in the pre-liberalisation phase. Liberalisation policies facilitated firms to hold excess capacities and integrate vertically. Therefore, the industry continues to maintain its oligopolistic character. Model 3 examines the implications of liberal trade policies for the concentrated petrochemical industry in India.

The entry deterring effects of concentration, vertical integration and excess capacities in the Indian petrochemical industry leads us to suggest different forms of government intervention.
NOTES

The terms state and government are used interchangeably.

Privatisation as used in Western economies, particularly the U.K. connotes divestiture i.e. a partial or total sale of the state owned enterprise. In the Indian context, the term privatisation has a much broader connotation.

In June 1966 the rupee was devalued by 57.5\% against the sterling. The effective devaluation was, however, estimated at 21.6\% for exports and 42.3\% for imports [Bhagwati & Srinivasan 1975:92]. The currency devaluation was expected to boost exports, restrict imports and channelise resources into more productive and efficiency areas. This was the first step towards rectifying the distortions that had crept into the economy through controls.

There is a consensus amongst economists that Indian industry underwent a prolonged stagnation between the mid-1960s and mid-1980s Csee Shetty [1978], Ahluwalia [1985] etc.]. However, there has been an extensive debate regarding the reasons for this stagnation between those who prescribe to supply-side and demand factors. Liberalisation policies attempt to tackle the supply-side bottlenecks in the hope that demand constraints will consequently be taken care of.

Appendix A companies manufacture goods reserved for the public sector under Schedule-A to the IPR [1956] or for production in the small scale sector.


This assumption is made in Mani [1992], where entry automatically implies greater competition.

Economies of scale the unit cost of producing an output (single or composite) under a given technology (with no technical change). There are economies of scale in some interval of output if the average cost is decreasing there.

A related idea is that of returns to scale: here both the output and input proportions are kept fixed, and one compares the amount of (the simple or composite) output \( f(x) \) produced by a given input vector \( x \) with the amount produced by vector \( \lambda x \), for \( \lambda > 1 \). Increasing returns to scale are said to prevail if \( f(\lambda x) \) is greater than \( Xf(x) \). Under some conditions increasing returns to scale are equivalent to economies of scale. [The New Palgrave: A Dictionary of Economics, Vol.2.]
There are two ways in which MES is calculated:

(a) Engineering estimates obtained by analysing technical data.
(b) By examining the distribution of plant sizes:
   - The survivor-technique attempts to identify the size class of a plant which is seen to be expanding relative to others over a period of time and argues that the lower bound (or average size) of this class represents MES.
   - By observing plant sizes where firms operate more than one plant, on the premise that the plant must have reached output rates of at least MES. Csee Davies et al 1988:53-41.

The Herfindahl index in this case is simply ES/Xc.

Total Cost in such an industry is:

\[ TC = MC + F \]
\[ AC = \frac{MC + F}{Q} \]

which is a rectangular hyperbola.

Davies [1988: 933 says that this third argument is particularly difficult to develop formally without some specified model of incumbent behaviour. Any analysis has to take recourse to modeling the oligopoly game and this is what we have done in Chapter 4.

In our study the terms industrial and market structure are used synonymously as is the practice in Industrial Organisation literature and also in our study.

Despite differentiation, low scales and low concentration mean that there is little price discipline as there are few barriers to entry and new entry tends to eliminate abnormal profits.

Shepherd defines entry as follows: "Entry is a process separate from entry barriers, and it is also complex. It has at least three elements: size, speed and probability of occurrence... Only when all three elements are substantial is entry significant." [Shepherd 1984:5813

See J.B. Clark [1887], The Limits of Competition, Political Science Quarterly, Vol. 2, No. 1 pp45-61 cited in Hause and Du Rietz [1984]. Also see Clark [1902], the Control of Trusts cited in Gilbert [1989a].

There are other ways by which entry occurs: entry by acquisition and/or mergers. In the Indian context, entry by investment is more prevalent and therefore the study defines entry in terms of investment.

What is interesting is that Franco Modigliani's paper on "New Developments on the Oligopoly Front" in the Journal of Political Economy [1958] focused on entry as did A.K. Dixit's paper more than 20 years later on "Recent Developments in Oligopoly Theory", American Economic Review, [1982].

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The ‘rival’ and radical approaches in IO theory such as the Austrian and Marxian Schools have been briefly but excellently reviewed in Davies et al [1988].

20This categorisation is followed by Davies et al [1988] and appears to be standard and appropriate.

21To be sure, this presents a need to pick and choose. Roughly, if the issues are ones of price, output, efficient factor proportions and the like, the production function set up applies. If, however, the object is to assess the comparative efficacy of alternative economic and organisational instruments, recourse to the newer theories, which expressly engage the relevant micro-analysis is indicated.

If "the neoclassical theory of the firm treats the firm as a monad, the dyad is the basic relation on which the firm as a nexus of contracts focuses." [Williamson 1990]

Adam Smith recognised the central role of entry in the theory of supply. In An Inquiry into the Nature and Causes of the Wealth of Nations he says "When by an increase in the effectual demand, the market price of some particular commodity happens to rise a good deal above the natural price, those who employ their stocks in supplying that market are generally careful to conceal this change. If it was commonly known, their great profit would tempt so many new rivals to employ their stocks in the same way, that, the effectual demand being fully supplied, the market price would soon be reduced to the natural price, and perhaps for some time even below it. If the market is at a great distance from the residence of those who supply it, they may sometimes be able to keep the secret for several years together, and so long enjoy their extraordinary profits without any new rivals. Secrets of this kind, however, it must be acknowledged, can seldom be long kept; and the extraordinary profit can last very little longer than they are kept." (Smith [1776] 1937 p 60) But it was Bain who formalised the role of entry in an industrial economics framework.

4These definitions are from Tirole [1988:3063.

Sylos postulated that entrants expect that established firms will not accommodate entry by reducing their output. Modigliani’s formulation states that the limit output is the smallest pre-entry output for which entry is not profitable.

The limit pricing model has been treated extensively in the industrial organisation literature. See Tirole [1988], Jacquemin [1987] or any standard textbook.

63All else being equal, the lower the limit price the flatter is the residual demand curve. Also, entry is easier if the entrant's minimum efficient scale is small and if the average cost falls quickly to its lowest level [Gilbert 1989a:482].
The main deficiency of Bain's analysis was that the measurement of entry barriers was necessarily subjective and vulnerable to criticism of circularity. Are barriers high in industries that have persistent profits or vice versa? And since accounting profits can differ widely from economic profits - for example the choice of depreciation rates and the use of historical asset values - profitability itself is difficult to measure.

Comanor and Wilson's paper [1967] offers a typical example of econometric work in the pattern of Bain. They investigated regression equations of the following form:

\[ r = f_{to} + \beta_1(\text{CON}) + \beta_2(\text{BE}_1) + \ldots + \beta_n(\text{BE}_n) \]

where \( r \) = measure of profitability
\( f_{to} \) = unknown coefficients
\( \text{CON} \) = seller concentration
\( \text{BE}_s \) = variables designed to measure the structural determinants of entry barriers

The barriers to entry variables in the above example (as several other studies do in this genre) use any one or more of the four Bainian entry-barriers viz., scale economies, product differentiation, cost advantages and absolute costs of incumbent firms.

Orr's study of 71 Canadian manufacturing industries indicates that capital requirements, advertising intensity and high concentration are the most significant barriers to entry. He used the following model:

\[ E = f_i (\Pi_p - \Pi^* , Q) \]

Instead of using profits, Orr used \( E \) i.e. entry specified as the number of entrants per year as his dependent variable, where

\( \Pi_p \) = past industry profit rate
\( Q \) = past industry rate of growth of output
\( \Pi \) = long run profit rate predicted for the industry on the basis of the level of entry barriers where:

\( \Pi^* = i_z (X, K, A, R, r, c) \)

\( X \) = market share of MS plant
\( K \) = capital requirements
\( A \) = advertising intensity
\( R = R & D \) intensity
\( r \) = risk
\( C \) = high concentration
Their analysis uses econometric tools and is based on a model of industry evolution developed by Boyan Jovanovic. They conclude that:

(a) the long-run effect of a cohort of entrants on market structure in the chemicals industry is very small;

(b) the entrants appear to fare less well in the chemical industries than in the average manufacturing industry;

(c) the relatively high growth rates of the chemical industries, do not have an appreciable effect on entry despite the common association between industry growth and entry in other studies.

Bresnahan and Reiss [1991] propose an empirical framework for measuring the effects of entry in concentrated markets. Building on models of entry in atomistically competitive markets, they show how the number of producers in an oligopolistic market varies with changes in demand and market competition. Their results suggest that competitive conduct changes quickly as the number of incumbents increase. But, they suggest that each industry has an entry threshold — i.e. a measure of the market size required to support a given number of firms. Bresnahan and Reiss use econometric techniques to estimate this entry threshold. Above this entry threshold, an entrant can make a significant increase in industry competition. Below the threshold, an entrant changes it only marginally. What is novel about their approach is their attempt to draw inferences about the effects of entry without the use of the firms’ prices or cost data.

Hause and du Rietz make a distinction between entry by new firms and entry through diversification and go on to consider how the rate of entry can be influenced by (a) potential entrants and (b) costs of entry. They cite minimum size of plant required for efficient entry as a significant factor in retarding entry i.e. it is a significant entry barrier.

In Salop’s terminology, excess capacities that deter entry but are created for non-strategic purposes are innocent entry-barriers.
Lieberman's study of excess capacity as a barrier to entry and investment in a sample of 38 chemical product industries in the U.S. showed that incumbents rarely built excess capacities pre-emptively in order to deter entry. Using logit and log-linear models of investment behaviour, his analysis showed that entrants and incumbents exhibited similar investment behaviour, and excess capacities were not created as an entry deterrent. Lieberman's analysis indicated that excess capacities were maintained to accommodate demand variability and investment lumpiness. In fact, in only three cases were incumbents holding excess capacity for entry deterrence purposes and in all the three cases some entry did occur. The only two products in his sample of 38 where excess capacity did offer at least partial success as an entry deterrent, were characterized by slow market growth, high producer concentration and high capacity intensity.

Hilke [1984] regressed entry rates on excess capacity and other variables for a 16-industry sample. The excess capacity coefficient proved negative but insignificant at standard statistical levels.

Vertical 'formation' describes vertical integration at the time the firm is created. Vertical 'expansion' describes vertical integration which occurs as a result of the internal growth of the firm creating its own new subsidiaries in the neighbouring stages. Vertical 'merger' describes vertical integration which occurs through the acquisition by one firm of an existing firm in a neighbouring stage CPerry 1989:1863.

Costs such as those required to establish the reputation of an entrant, including expenditure on technology acquisition and advertising are sunk costs. Once these costs are incurred they cannot be put into alternate use. Sunk costs are distinct from fixed costs in that while sunk costs are irreversible fixed costs can be retrieved.

See Schmalensee [1988:663]. Economies of scale exist when the production of a single product decreases with the number of units produced; economies of scope are cost-saving externalities between product lines (e.g. the production of good A reduces the production cost of good B) CTirole 1988:16].

Ramsey prices maximise total surplus, subject to a break-even constraint [Brock 1983:10563.

The works of these economists are:
The distinction we make here is that predation deals with strategies whose rationality depends on inducing exit and preventing future entry whereas entry deterrence is concerned with the conditions that impede capital mobility.

The resulting outcomes of entry games have been classified by Fudenberg & Tirole [1984]. They provide a taxonomy of behaviour in response to entry that an incumbent may use: the 'top dog', the 'puppy-dog ploy', the 'fat cat', and the lean and hungry look.

(a) The top dog over-invests to deter entry. This is the optimal deterrence strategy in models such as Spence [1977], and Dixit [1981]. Investment makes the incumbent tough and in response, the entrant would cower and produce less. Top dog behaviour is optimal in this case whether or not entry is actually prevented. Even if entry is allowed in the Dixit model, the incumbent will play the top-dog role to increase its post-entry profits.

(b) The fat cat: This is an example where the incumbent's optimal price is an increasing function of investment in advertising because the advertisements lower the elasticity of demand for the product, so that more advertising makes the incumbent soft. By being soft, the fat cat encourages its rival to be less aggressive. This strategy involves over-investment (relative to the case where the strategic interactions are ignored) in order to optimally accommodate entry.

(c) The lean and hungry look: If reaction curves are upward sloping and investment makes the incumbent soft, entry prevention calls for a lean and hungry look. In the advertising example, the incumbent may under-invest (relative to no entry) in order to commit itself to aggressive pricing if entry occurs.

(d) The puppy dog ploy: The puppy dog ploy is under-investment in order to make the incumbent firm appear more friendly to a new entrant. This can be an optimal strategy if the reaction functions are upward sloping, less investment makes the incumbent soft, and the incumbent expects entry to occur (See Gilbert [1989:510]).

See Dixit [1982], Jacquemin [1987], for examples and extensions of the two-stage entry model.

This is contrary to the contestability theorists who claim that potential competition i.e. a mere threat of entry would induce competitive forces in an industry regardless of structure.

Only downward sloping reaction functions allow for entry deterrence through excess capacity hence the assumption of Cournot competition.
Eaton & Lipsey [1980] dub this type-A artificial monopoly. They provide an alternative to type-T natural monopoly to be the one in which cost minimising decisions with respect to durability, replacement and maintenance of capital amply that there is no point in time at which entry is profitable, and a type-T artificial monopoly to be one in which strategic decisions with respect to capital prevent there being any point in time at which entry is profitable.

The desirability of such a strategy depends, of course, on the ease with which the fixed assets of the independent producers can be shifted to other industries. If these assets are to some extent specialised to the production of the final product in question, the monopolist can impose losses on the independents and reduce the market value of their fixed assets, though he must sacrifice some profit to do this. He must weigh this sacrifice against the expected present value of the savings it would yield in asset acquisition cost. If the squeeze strategy is not optimal, the monopolist would presumably acquire the fixed assets he needs at their current market value and then refuse to sell the intermediate good to potential competitors, or sell it only at such a high price that nobody else would find it profitable to produce the final product in question [Schmalensee 1973:448].

The historical underpinning for the case of infant industry protection is outlined in Irwin [1991]. Venables & Smith [1986] offer a cursory account of this departure in trade theory. Also see Caves [1980].

Graham's exposition led to an intense debate between him and Knight. Knight's view was that Graham's analysis of the possible losses from trade was valid if the economies of scale are external to the firms and internal to the industry but not if economies of scale are internal to the firm. See the following articles for a gist of the Knight—Graham debate on tariff protection:


Early literature defines dumping as price discrimination between national markets. Apart from sporadic instances, dumping is thus treated either as profit maximisation by a discriminating monopolist or as an oligopolistic tactic to eliminate competition or to enforce a cartel (predatory dumping).

These demand estimates have been worked out by the Kapur Committee and the Sengupta Committees. Our study draws heavily from these two reports in the determination of future excess capacities.