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ABSTRACT

Institutional regulations by way of licensing and capacity restrictions have often been considered as barriers to competition in Indian industry. As most of these regulations have given way for market signals an increase in the number of entrants and alterations in the conditions of entry, mainly the barriers to entry are expected. In this paper I attempt to analyse the extent of barriers to entry in Indian manufacturing by empirically quantifying the height of these barriers. Econometric estimation of the height of the barriers for 1991 and 1996 shows that the height of barriers increased in 1996 at the aggregate level. An examination at the disaggregate level reveals that in almost all the industries examined from a sample of firms drawn from the CMIE the height of the barriers have increased in 1996 compared to 1991. The dilution and dismantling of commands and controls intended to ease entry have thus paved the way for the erection and strengthening of market barriers which have grown over time.

JEL Classification : L1, L11, L13

Key words :   economic reforms, entry barriers, height of barriers,
                market barriers

Introduction

As spelt out in the industrial policy statements one of the major components of the economic reforms package in India has been the deregulation and delicensing in the manufacturing sector. The rationale provided often hinges on the argument of inducing competition, which in turn is expected to enhance the efficiency and competitiveness of the manufacturing sector. Lack of competition due to entry restrictions also paves the way for the existence of market power resulting in welfare loss. Institutional regulations by way of licensing and capacity restrictions are often considered as barriers to competition in Indian industry. As most of these regulations have given way for market signals an increase in the number of entrants and alterations in the conditions of entry, mainly the barriers to entry are expected. In this paper I attempt to analyse the extent of barriers to entry in Indian manufacturing by empirically quantifying the height of these barriers. The analysis is carried out for two time points in accordance with the launching of economic reforms to delineate the possible impact of changes in the policy regime.

I confine to some of the measurement issues of entry barriers. The method followed, on the lines of Geroski (1991), can be described as 'consilience of induction', an attempt to weave together wide range of

disparate results from different sources[1] . This is done due to the lack of unanimity regarding the measurement of entry and its barriers, as these are the outcome of a complex process of strategic interaction among firms.

Entry: its importance and actual practice

Entry is often considered as an 'error correction mechanism' to keep markets in (or near) equilibrium. Thus even the threat of entry is considered as an effective source of market discipline. This characterization has led to the development of models of strategic entry deterrence on lines of a contest between 'insiders and outsiders'. It is this element of market discipline due to entry that has been emphasized in its portrayal as a selection process in which market chooses between established and entrant firms as well as between different types of entrants. Entry of new competitors is generally viewed to have beneficial effects. It is considered as a source of competitive discipline bidding prices down thus eliminating excess profits. Entry also changes the structure of the market and can upset the traditional patterns of market conduct. Quite often new entrants de-throne dominant firms, introduce new technology and fresh approaches to product design and marketing leading to more competitive prices. Viewed from this perspective entry reduces x-inefficiency and stimulates innovation and technical progressivity[2] . However, in actual practice the situation might be different.

There exists considerable controversy on the impact of entry. Direct entry is considered to have a small effect. Biggadike (1976) examined 40 entry attempts by 20 large US firms and observed that less than 40per

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1   See Gould 1989, p.282.

2   See Geroski (1991).

cent of these entrants achieved a penetration of at least 10per cent within two years. Masson and Shaanan (1982) found that over the period 1950-66 for 37 US industries the average market share penetration by entrants was 4.5per cent over 6-8 years implying a gain of less than 1per cent per year while, Yip (1982) for 59 entrants found a median gain of 6per cent, with entry via acquisition achieving a penetration roughly 3 times that achieved by direct entrants. Hause and DE Reitz (1984) investigated entry in Sweden over 15-year period and found that the new entrants only managed 1.7per cent market penetration on average that period. This international evidence point to the fact that, in reality the impact of new entrant by penetrating into the market seems to be little.

Even though, the entrants manage only modest market penetration the actual number of entrants are very large. Dunne and Roberts (1986) examined about 400 four-digit industries in US for 1967, 72, 77 and 82 and observed 285, 347, 418 and 425 entrants on average per industry respectively. Interestingly, there exist a close relationship between entry and exit. Geroski (1988) found that on an average 130 firms exited per industry in UK during early eighties. So there could be situations in which entry appears to be easy, but post-entry market penetration and survival seems to be difficult. An explanation offered for this phenomenon is in terms of the existence of high barriers to entry.

What are mobility barriers?[3]

As a prelude to the analysis a precise definition of mobility barriers is warranted. One of the well-known definitions is that of Bain (1956). Bain argues that barriers to new competition depends on the condition

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3   Following Caves and Porter (1977) we depart from the early literature on barriers which focussed on impediments to the entry of new capital into the market and adopt a more general perspective arguing that hindrances exist even for the movement of resources into, out of, or within an existing industry. This leads us to use the term mobility barriers.

of entry which is "determined by the advantages of established sellers in an industry over potential entrant sellers"[4] . According to him a barrier to entry exists if the new entrant is unable to achieve the profit levels after entry that the incumbent enjoyed prior to its arrival. To Elaborate, let $\pi_i(x_i^*,....,x_n^*)$ be incumbent i's profit in a situation where incumbent firms i = 1,....,n operate at the pre-entry outputs x_i^*, and let $\Pi_e(x_i^{**},....,x_n^{**},x_e^{**})$ be the profit of an entrant at post entry output x_i^{**} and x_e^{**}. Entry is deterred if $\Pi_e < 0$. According to Bain the height of barriers to entry for this industry is measured as Π_i - *max*$[\Pi_e,0]$, that is, the level of profits that can be sustained against entry in perpetuity. Condition of entry is primarily a structural situation according to Bain, "which describes the circumstances in which the potentiality of competition will or will not become actual"[5].

Stigler's (1968) definition broadly termed as the Chicago School's definition defines a barrier to entry "as a cost of producing (at some or every rate of output) which must be borne by firms which seek to enter an industry but is not borne by firms already in the industry"[6] . According to Stigler a barrier to entry would exist if the new firm has to overcome more consumer resistance than did the established firm and the height of an entry barrier would be the additional cost an entrant would have to bear in order to produce the same revenue as an established firm. Stigler considers an entry barrier to exist only if the conditions of entry were less difficult for established firms than for new entrants. Stigler compares the entrant and incumbent post entry, that is, a barrier exists if the two are not equally efficient after the costs of entering the industry are taken into account. While Bain's emphasis is on the conditions of entry that

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4 Bain, (1956, P.3)

5 Bain, (1956, pp.17-18).

6 Stigler (1968, p.67).

permit an established firm to raise price above the minimum average cost of the potential entrants.

The definitions of Bain and Stigler are considered as positive definitions of barriers and do not address the welfare consequences of entry. The emphasis is more on the characterization of the conditions that impede entry. Weizsacker (1980) provides what is termed as a 'normative definition' of the barriers to entry which is a qualification of the definition proposed by Stigler. He defines barriers to entry as a "cost of producing (at some or every rate of output) which must be borne by firms which seek to enter an industry but is not borne by firms already in the industry, and which implies a distortion in the use of economic resource from the social point of view"[7] . Demsetz (1982) further extends this approach, by supporting an efficient allocation of resources, argues that, in many cases, what is called an entry barrier is an endogenous response to consumer preferences. The major strength as well as the weakness of this approach is its explicit focus on the normative consequences of entry. So a comprehensive way to asses entry would be to add normative complexities to the measures of barriers to entry defined by Stigler and Bain. Thus the ideal way to evaluate barriers is in two explicit steps : first, measure their height, and then, evaluate their consequences for welfare.

According to Gilbert (1989) mobility barriers exists if a firm earns rents as a consequence of incumbency. This approach has no relation to the consequence of entry or exit for economic welfare and concentrates solely on the advantages that accrue to established firm with emphasis on the role of history and how that affects relative profits. An exit barrier exists if an incumbent firm could earn more if it could leave the industry

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7   Weizsacker, (1980, p.400).

and an entry barrier exists if a firm earns a premium by virtue of its being established in the industry.

The above views on what forms an entry barrier points to the considerable controversy over its definition and how it could be measured. These differences can be resolved if one can show how the factors affecting entry depend critically on the behaviour of the incumbent firms even without attempting to perform a welfare analysis of the barriers. Thus the determinants of entry become crucial to understand the extent of barriers and their consequences.

Factors affecting the conditions of entry

A barrier, which gives major advantages for the incumbents, is the realization of the economies of scale. Scale economies act as a barrier for the entrants in two ways, via, a 'percentage effect' and an 'absolute capital requirement effect'[8]. The 'percentage effect' depends on the size of the minimum efficient scale plant relative to the extent of the market. This occurs for large minimum efficient plants (MEP) and if the entrant is to enter at efficient scale, the '...addition to going industry output.... will result in a reduction of industry selling prices'[9]. The entrant will face a cost penalty depending on the slope of the cost curve at sub MEP scales if entry occurs at less than efficient scale. Implicit in the above is the prescription that incumbent firms will not accommodate entry by scaling back their own production by an amount equal to the production offered by new entrants. The expectation of the potential entrants regarding the actions of the incumbents to hold on to their market share turns out to be the key issue here.

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8   Bain (1956, p.55).

9   Bain (1956 p.53).

Absolute capital requirements effect arises from the large investment outlays necessary to build an appropriate sized plant. The size of the disadvantage so created depends on the absolute size of MEP. The imperfections in capital markets, which affect the availability of finances for investments, add to the disadvantage of the entrants. The magnitude of this barrier increases as new entrants often encounter difficulties in raising capital, locating and training a qualified work force and developing the inventories and distribution channels needed for entry at MES as all these induces differential cost effects which are substantial.

Even though at the conceptual level the manifestation of scale economies as a barrier is unambiguous, at an empirical plane the estimation is often confronted with difficulties. The pre requisite for the estimation of scale-related entry barriers is the generation of estimates of the cost per unit that could be achieved at different output levels by the most advantages entrant. The most advantaged entrant is usually defined as the one using the best possible organization of production currently available and minimizing factor expenditures. It needs no mention that the so called ' best possible' is often difficult to observe and what can be easily be observed are the actual unit costs of incumbent firms. So inferences on 'what ought to be' can be made only from what is observed with the assumption that at the best an entrant can only replicate the actions of one or more existing firm which is efficient. The other alternative is direct measurement of MEP. Here one works out from the basic engineering principles what would be the optimal plant size, given current technology, factor prices and so on, for an entrant to aspire to and how large the various cost penalties associated with the non optimal scale are.

Dixit (1981) discusses the use of investment as an entry barrier. This materializes when capital expenditures once made, become

irreversible or 'sunk' in the next period. Then an established firm might be able to commit to producing an output that it could not sustain at equilibrium if its first period expenditure were irreversible. Sunk expenditure lowers the incumbent's marginal cost for any output below the full capacity level, which, in turn discourages the firm from cutting output in response to entry. Dixit also shows that potential entry may encourage an incumbent firm to invest more in irreversible capital which has the effect of increasing the incumbent's post entry equilibrium output, while lowering the entrant's post entry equilibrium output and price. Sunk costs are a barrier that permits the incumbents to act strategically and forces the entrant to operate at a large scale in order to make profits. Capital investment can be an effective entry deterrent in the above model even if the potential entrant has the same cost function as the incumbent or even if the entrant has lower cost. This is because the extent to which costs are sunk plays an important strategic role in permitting the established firm to commit to a level of output that it would maintain if entry were to occur. The established firm's technology with its sunk capital cost is a mechanism by which the firm can sustain the aggressive market share. The Dixit model is thus a theoretical construction that supports Bain's structural view of economies of scale as a barrier to entry and contradicts Stigler's definition of a barrier to entry, which relies on symmetries in the pre-entry costs of established and new firms. The fact is that entry prevention can be achieved in the Dixit model even if the entrant and established firms share the same technology.

Another set of advantages for the incumbents arise from absolute cost advantages. These exist for the incumbent firm" ...if the prospective unit costs of production of potential entrant firms are generally, and more or less at any scale of operations, higher than those of the established

firms....."[10] . Bain defined the absence of absolute cost advantages of an established firm by the following conditions " ...for a given product, potential entrant firms should be able to secure just as low a minimal average cost of production after entry as established firm had prior to this entry. This in turn implies that (a) established firms should have no price or other advantages over entrants in purchasing or securing any productive factor including investible funds, (b) the entry of an added firm should have no perceptible effect on the going level of any factor price; and (c) established firms have no preferred access to productive techniques "[11].

Not all apparent cost advantages qualify as entry barriers. An advantage relative to less efficient potential entrants that is common knowledge to all might not constitute a barrier to entry. Absolute cost disadvantages thus refer to at base, to some factor of production that is denied to the potential entrant, who but for this omitted factor would have been as efficient as established firms. A typical example for this is access to natural resources or key patents[12]. Much of the empirical literature is not concerned with whether absolute cost advantages are truly barriers or not but have focused as to whether they allow incumbent firms to earn super-normal profits. This depends on whether the assets, which are the source of these cost advantages, are carried on the accounting books at their historical costs or at their market values[13]. Thus whether or not absolute cost advantages allow firms to earn persistent above normal profits will depend on, at least in part, in the accounting practices of those firms.

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10   Bain (1956, p.144).

11   Bain (1956, p.12).

12   Bain and Mann discusses the first in detail and Demsetz (1982) discusses the later.

13   For a discussion of this in relation to the use of accounting profits to infer the existence of such barriers see Edwards et.al (1987)

Relying on strategies focusing on product differentiation and advertising incumbents erect important set of barriers. Barriers created by product differentiation refer to " ... buyers' preferences for one of the same variety of very similar substitute products ... and also to the fact that different buyers have different product allegiances or preference patterns so that the preferences in question do not result in some universally agreed upon system of grading or rating of the competing products" and such effects can be propagated by differences in design, quality or sales promotion with the effect that each "... individual seller gains some jurisdiction over his price"[14]. It is unlikely that entrants will be able to reap post entry the price and price-cost margins enjoyed by the incumbents with out expending resources to develop their own consumer loyalties, as there exist a preference for established products. Thus the late coming entrants are forced to incur costs in their efforts to achieve market penetration.

The entrants will have to persuade consumers already settled in their ways to collect information, compare products with different specifications and then re-evaluate their purchasing habits and the incumbent might avoid such costs because it was first on to the market. Farrell (1986) provides evidence to show that new entrants may have a tougher time convincing customers that they will deliver comparable quality. The empirical method to identify the source of product differentiation advantages examines the experience of pioneering brands in markets that experience subsequent entry. Urban *et al* (1984) examined 129 frequently purchased consumer brands in 12 US markets and related the share of the nth mover relative to first movers to the order of entry, entry lags, relative advertising and brand positioning. The order of entry was positively correlated with relative shares. The second brand in the

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14   Bain (1956, p.114)

market had a share less than 75per cent of the pioneer on average, the 3rd about 60per cent, 4th 50per cent and so on all for the same given levels of advertising. Numerous case studies also suggest that early movers are able to sustain their market position against later entrants[15].

As advertising is often identified as the principal cause of product differentiation barriers, attempts to measure product differentiation barriers often equate barriers due to product differentiation with that of advertising. Comanor and Wilson are the most prominent advocates of this approach. According to them advertising expenditures " are both a symptom and a source of differentiation"[16] . They identified absolute cost, economies of scale and capital requirements as sources of entry barriers due to advertising. At the empirical level they used advertising-sale ratio to measure absolute cost advantages and advertising per firm to pick up economies of scale and capital requirements effects. The finding of positive correlation between advertising and profitability has been replicated in many other studies and has been interpreted as establishing the importance of this source of barrier.

Advertising is just not a structural characteristic of the market, so equating product differentiation with advertising and to think that advertising expenditures may measure the height of barriers associated with product differentiation could be unreasonable. Advertising is one of the methods by which incumbents compete against each other. The source of product differentiation barrier lies in the basic structural determinants of the choice of advertising levels such as consumer preferences, consumer informativeness and the technology of production and of information transmission.

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15   Geroski et al., (1990) provides a review of some of these studies.

16   Comanor and Wilson (1967, p.473).

It emerges that there are a wide range of factors, which can serve as barriers to entry, although, the various structural factors do not always necessarily give rise to barriers. However much depend on the way that the barriers have been measured in practice. Most of the empirical work have tried to follow Bain's painstaking measurement exercise which in practice has often amounted to comparing actually observed entrants with incumbents, or has involved simple counter-factual constructions based on observations of incumbent's activities. This creates an upward bias in measuring barriers as there is the implicit or explicit use of incumbent's current activities as the ' best possible under circumstances', which ignores the opportunity that entrants may have to do better than incumbents. This is more pronounced in the case of product differentiation as the definition of a product is very elastic and there exists the possibility that subtle changes in the product can successfully engineer a leap into the markets.

Thus the issue boils down to the interpretation of the evidence. It is ubiquitous that the various structural conditions can give rise to barriers but one always runs the risk of overstating its importance. Apart from the measurement problems the extent to which structural factors are strategically exploited by the incumbents to deter entry is also important. Scale economies per se might not block entry, unless it is accompanied by the threat of large price cuts attendant upon attempted entry at MEP scale. Similarly, in the case of advertising the issue is the cost of advertising and the calculations based on the advertising response of incumbents. Thus one ought to explore the incidence of various types of strategic entry behaviour in evaluating the various structural determinants of entry.

Discussions in the Indian context

As we know for many years firms trying to enter an industry had to clear the hurdle of getting permission from the government in the form

of licenses. These licensing requirements created effective entry barriers in many markets and assured the sheltered life of those firms that managed to get licenses. However, after the abolition of licensing, except for a few industries, it has become imperative for firms to formulate entry strategies based on more market-oriented considerations.

There have been some studies on the barriers to entry in Indian manufacturing. Some of recent ones are examined here. Mani (1992) discusses the issue of barriers to entry in light of the industrial policy statement of 1991. According to him the dismantling of the capacity restrictions through licensing in many industries intended to reduce the height of barriers to entry might not work favourably as the earlier policy of fixing minimum efficient scales of operation (MES 1985-86) has erected capital barriers to entry. Citing tyre industry as an example he argues that the capital barriers to entry by MES is very high. However, empirical examination of the height of the barriers is not attempted.

Siddarthan and Pandit (1992) examines the impact the policy changes introduced in 1985 on the structure conduct and performance of the manufacturing sector. Using stepwise discriminant analysis they scanned for the variables that acted as principle discriminant for the period pre and post 1985. They found labour productivity, size of units, skill and import intensity, rate of entry, rate of investments, growth of output and borrowings as statistically significant indicating a positive impact of the liberalisation package. However, the study fails to take into account the further doses of policy changes.

Emphasising more on the welfare issues in the event of entry by foreign firms, Jenson and Krishna (1996) examine entry policy in an open economy. They demonstrate that allowing foreign firms in the industry can directly alter the direction of entry bias by shifting profits

away from the home country. According to them, as the number of firms were kept low in India by licensing, liberalizing entry was likely to be beneficial to begin with. However citing the example of Australia which experimented liberal entry but restrictive trade policy prior to the '80s they sound a word of caution that the industry could experience a dissipation in profits and high prices due to large fixed costs and small production runs. This study also does not address the measurement issues of barriers to entry.

Using CMIE firm level data for 31 industries for a period of 1989-93, Saikia (1997) tries to explain the process of entry in Indian manufacturing. Specifying a model of entry on lines of Orr (1974) he estimates entry as a function of past industry profit rate, sunk costs measured by machinery intensity, product differentiation proxied by intensity of advertising, industry size, concentration, growth and risk. He finds that entry is positively associated with market size and growth and deterred in a concentrated market. After adjusting for simultaneity problem he finds profits to be one of the significant determinants of entry. The sunk cost variable turns out to be insignificant along with product differentiation, which he attributes to small sample size. The height of barriers to entry does not find a place in his empirical analysis as well.

Four types of entry (1) setting up of a new firm in the industry (2) buying i.e., purchasing an existing firm (through mergers, amalgamation or friendly takeover) (3) acquire control through hostile takeovers and (4) enter via joint venture route are surveyed in Sen (1997). The strategies are identified using game theoretic frame work of Tirole and Fudenberg (1991). However he does not present any empirical evidence from the Indian context.

Studies in the Indian context, eventhough have discussed the various entry strategies and barriers, have omitted empirical quantification of these barriers. The present study, for the first time, addresses this issue in light of the policy changes. I start with the specification of a model to capture the height of these barriers.

Measuring the height of overall barriers to entry

As is clear from the theoretical literature, incumbent firms use a variety of barriers to thwart competition in order to enhance and sustain their profits. These barriers are used individually and in combination but in most of the cases derive strength from interactive effects. To elaborate, even modest advertising can be effective in the presence of a vigorous after sales service. True is the case with scale economies as it helps to reap benefits from absolute cost advantages as well, and a combination of advertising and product differentiation proves to be more effective than focusing on product differentiation alone. The point to be stressed is that it is misleading to consider the effects of these various barriers separately as there exists the possibilities of synergies arising out of the joint effect of all the types of barriers taken together. This prompts an examination of the overall barriers.

Inferences on the magnitude of the overall barriers are drawn by computing the height of barriers. We compute the height of the overall barriers at the aggregate and disaggregate level to discern the extent of barriers and its changes over time. In order to measure the height of overall barriers two approaches are followed in the literature[17] . First, is the method followed by Bain, which relies on the judgement of the researcher to convert the ranking of industries by each source of barrier

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17   A third method followed in our disaggregate analysis is that of Geroski (1991). This as elaborated in the subsequent section is a further modification of the second approach.

into a discontinuous overall scale. This of course involves an element of subjectivity, which could influence the results. The second approach put forth by Orr (1974), which is used here is free from this bias.

Most of the econometric investigations of entry barriers have been indirect tests. They have regressed profit rates, rather than entry, on those structural characteristics considered to be barriers to entry, Unfortunately this specification does not permit reliable conclusions regarding the effectiveness of those variables in deterring entry. There are theoretical reasons for questioning the often-assumed strong positive relationship between entry barriers and the true profit rate. Additionally of course there is a gap between true and measured profits.

Attempts to model entry began only after the work of Dale Orr in 1974. In his pioneering work Orr put forth a model of entry, which draws parallels from the work of Bain (1949) and Sylos (1958) on limit pricing which describe entry-limiting price as the maximum to which price can be raised above the competitive level with out attracting entry. This forms the starting point for Orr. According to him the price-cost margin determined by the limit price implies a certain rate of return on sales, which is directly related to the rate of return on capital for the firms of particular industry where the best practice technology requires a specific capital output ratio. Entry limit price thus implies an entry limit profit rate on capital and in the absence of entry barriers entry will take place till the marginal rates of return on capital across industries becomes equal. The incumbent firms, which attempt to block the entry, will raise the profits until the expected post entry profit rates of an entrant equals the entrant's opportunity cost of capital. Thus entry continues until the industry profit rate reaches a point where the entrant's expected rate of return on capital is equal to the opportunity cost of capital. It can thus

be noticed that entry will be a positive function of the difference between observed and entry limiting profit rates and in rapidly growing industries entry limiting strategies are more difficult providing more opportunities to enter. So we expect entry to be a positive function of the expected rate of growth of industry output.

From the above theoretical basis Orr (1974)[18] formulates a general model which is specified below and arrive at the magnitude of entry barriers by constructing an index of overall level of entry barriers.

$$E = \beta_0 \, e^{\beta_1 \, (\pi_p - \pi^*)} \, e^{\beta_2 Q} . \, S^{\beta_3} \, \mu \tag{1}$$

Where,

$$\pi^* = f(K, A, R, r, C) \tag{2}$$

And,

E = the rate of entry,

π_p = past rate of profit,

$Q.$ = past rate of growth of industry output,

K = capital requirements,

A = advertising intensity,

R = research and development intensity,

r= risk , the standard deviation of industry profit rates,

C = concentration,

S = industry size (industry sales).

Entry is specified, as a function of the gap between the observed profit rate and some entry limiting profit rate, observed growth of the industry output and industry size. π_p captures the extent of economic rents enjoyed by the incumbent firms, which is the incentive for new

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18   There has been several studies which have followed the basic methodology of Orr. Gorecki (1975,1976), Hamilton (1985), MacDonald (1986), Mason and Shanan(1986), Schwalbach (1987) and Shapiro(1983) are among these.

firms to enter as their expectations are based on this. Another incentive is the rate of growth of industry output as the expectations are based on past growth. This variable in effect supplements the first variable, as the growth of the industry is an incentive to enter and provides opportunities for enhancing profitability. Capital requirement is well known as a major entry barrier[19] and is defined as the cost of fixed capital required to establish a plant of minimally effective size. The variable on advertising intensity is intended to capture the barriers erected through advertising[20] as well as the effect of product differentiation[21] as firms use advertising as a method of product differentiation. Research and development acts as a barrier in two ways, "The chief component of these barriers is the extent of economies of scale in the R&D process. The second major factor contributing to R&D entry barriers is the accumulation of patents and know-how on the part of incumbent firms."[22]

As the new entrants could be risk averters, we expect that the incentive to enter decreases when risk as measured by the standard deviation of profit increases. This provides ample justification for the inclusion of this variable in our specification. In addition to the above variables an indicator of the level of concentration is also included, as there exists the possibility of collusion among incumbents to thwart entry in concentrated industries. This is captured by a dummy with the value one for highly concentrated industries and zero otherwise[23] . From

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19   See Scherer (1970) for further discussions

20   As elaborated in Comanor and Wilson (1967).

21   Bain (1956) notes product differentiation as a significant barrier to entry in United States manufacturing industries

22   Mueller and Tilton (1969, p.578).

23   Apart from the above-mentioned variables there could be other variables like factor prices and industry demand elasticities which could have an influence on entry. As noted by Orr these factors are difficult to quantify and are not included in the specification.

the specification we expect that the signs of π_p , Q. and S to be positive as these variables are expected to provide incentives for entry. Barriers like K, A, R, r and C are expected to yield negative sign as they hamper entry.

Given the above specification the task is to justify an appropriate functional form to estimate the equation 1. This involves several assumptions. As the barriers have an influence on entry apart the influence on industry profit rates we substitute equation 2 in equation 1 for arriving π^*. The log form of the dependent variable entry E is used as we expect the response to a change in the barrier or incentive to be less in industries with lower entry. Capital requirements are also in log values as the percent differences rather the absolute differences to be linearly related to entry. Thus the relationship between entry and the independent variable is either by definition in percentage terms or converted into percentage terms by taken the log values. So equation 2 can be written as

$$\pi^* = \alpha_0 + \alpha_1 \mathbf{logK} + \alpha_2 \mathbf{A} + \alpha_3 \mathbf{R} + \alpha_4 \mathbf{r} + \alpha_5 \mathbf{C} \qquad (3)$$

From the above as entry is the difference between π_p and π^* equation 1 can be expressed as

$$\mathbf{E} = \beta_0 \, e^{\,\beta1 \, (\pi p \, - \pi^*)} \, \mathbf{e}^{\beta 2 Q.} \, \mu_1 \qquad (4)$$

Where μ1 is a log normal error term. As entry is correlated with industry size and A and R are standardized to industry size the coefficients could be biased. So to test the impact of A and R industry size an additional variable industry sales (*S*) is included. To arrive at the final estimable equation we multiply equation 4 by *S* ß$_3$ and substitute (3) into (4) and take logs. This yields the following equation, which is estimated.

$$\mathbf{logE} = \mathbf{log}\,\beta_0 + \beta_1\pi_p\,\beta_1\alpha_0 - \beta_1\alpha_1\mathbf{logK} - \beta_1\alpha_2\,\mathbf{A} - \beta_1\alpha_3\,\mathbf{R} - \beta_1\alpha_4\,\mathbf{r} - \beta_1\alpha_5\,\mathbf{C} +$$
$$\beta_2\mathbf{Q.} + \beta_3\,\mathbf{logS} + \mu_2 \tag{5}$$

Empirical evidence

The daunting task here is the issue of tracing entry. Entry can generally be measured in four different ways; (a) by counting the number of new firms, this expressed as the percentage of the existing stock of incumbents gives the measure of incidence of entry; (b) by weighing each entrant by its size relative to the market which gives a measure of market penetration when summed over all entrants; (c) net entry rates which are adjusted to exit and finally (d) by considering only those firms which survive the initial period. We consider the first measure, that is, counting the number of new firms, for want of reliable information like market penetration, exit and survival as consistent data are not available for these on variables. The procedure followed is outlined below.

At a macro level a crude picture of entry into the industrial sector can be understood by examining the variations in the number of non-government companies limited by shares registered during a period. This information is available in the annual report on the working and administration of the Companies Act, 1956, published by the ministry of law justice and company affairs, Government of India. The report provides information on the companies at work as well the registration of new companies during a year apart from additional information on state wise and industry-wise break-up of companies and liquidation. Information is provided on Government and non-Government companies indicating the growth of corporate sector. Industry wise distribution of the non- Government companies registered during 1995/96 the terminal year of analysis is provided in table 1.

Table 1: Non-Govt. Companies by shares registered during 1995/96

Industrial Classification	No.of Companies	Percent to Total
Agricultural & Allied Activities	4055	7.02
Mining & Quarrying	568	1.01
Processing & Manufacturing of		
(a) Food Stuffs, Textiles,		
Wood Pdts, Leather	4777	8.42
(b) Metals & Chemicals & thereof	10703	19.01
(c) Electricity Gas & Water	295	0.52
Constructions	3239	5.75
Wholesale & Retail Trade &		
Restaurants & Hotels	10172	18.06
Transport Storage & Communication	1577	2.80
Finance, Insurance, Real Estate		
& Business Services	19667	34.92
Community &Personal Services	1295	2.30
Total	56315	100

Source : Dept. of Company Affairs, 40th Annual Report on the Working & Administration of the Companies Act 1956, 1996.

As the issue of interest for us is the entry of private sector companies we limit to non-government companies. It emerges from the above table that for the year 1995/96 entry, defined as the registration of new companies, was mainly in the finance, insurance, real estate and business sector followed by wholesale and retail trade. As these activities do not come under the purview of manufacturing it does not figure in our analysis. Within manufacturing we notice entry in metals and chemicals industries. In order to understand the rate of entry we find the year-to-year variations in the registration of companies.

It is evident from Table 2 that the growth of newly registered companies witnessed fluctuations in the nine years considered. We can discern three distinct phases. In the first phase, which is the three-year period prior to the launching of economic reforms, entry as defined

above grew at a rate of around 6.4 percent per annum. This accelerated soon after the initiation of the reforms after 1991which can be termed as the second phase. The registration of new companies grew at a rate of around 25 percent in this phase and in manufacturing activities it grew in the range of 16 to 20 percent. The relaxing of norms for entry and other restrictions after 1991 induced further new entry in this phase.

However, the trend reversed in the third phase and the rate of entry declined drastically in this phase. Compared to the earlier two periods the aggregate growth of entry becomes negative in this phase. This however, does not mean there is exit. The growth in the addition of new firms have fallen pointing to the growth of barriers in this phase. This as can be seen in the subsequent section is taken up for closer scrutiny.

Another way to infer the behaviour of entry at the aggregate level is by examining the letters of Intent (LOIs) and Industrial Entrepreneurs Memorandum (IEMs). These point to the potential entry rather than actual. The data shown in Table 3 reveals that the growth in number of LOIs and IEMs filed have fallen sharply in the phase after the initial years of reform. A comparison with the period prior to 1991 is not possible as the system of IEM replaced the earlier registration system in 1991. From the table it clearly emerges that there has been a deceleration in the LOIs and IEMs filed corroborating the earlier evidence from the registration of non-Government companies. The available evidence on entry at the macro level points to a pattern, that is, a period of slow growth in number of new entrants prior to the changes in the economic policy followed by a surge in entry immediately after the launching of the reforms in 1991 and a deceleration in the growth of new entrants after the initial three years. This points to the existence of hindrances to the process of entry even after the changes in economic policy. These could be market barriers erected by the firms. We try to capture whether these market barriers have increased or not in the subsequent analysis.

Table 2: Growth of newly registered companies

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	AVGI	AVGII	AVGIII
Agriculture & Allied Activities	37.15	-13.47	22.17	40.17	33.79	74.08	72.04	-42.05	-12.85	15.28	49.35	5.71
Mining & Quarrying	25.63	-1.15	6.40	-17.49	-16.89	80.88	25.11	-28.35	-19.41	10.29	15.50	-7.55
Processing and Manufacturing of												
(a) Food stuffs and Textiles	-9.31	4.70	1.50	-13.76	35.53	20.55	2.05	-21.39	2.93	-1.04	14.11	-5.47
(b) Metals, Chemicals & thereof	-5.30	-6.67	5.08	-10.60	6.57	31.80	22.32	-11.29	-9.64	-2.30	9.25	0.47
© Electricity, Gas & Steam	-12.90	-40.74	53.13	6.12	63.46	124.71	54.45	-16.95	-21.22	-0.17	64.76	5.43
Constructions	-9.76	-11.66	12.96	-18.32	16.23	56.98	54.90	-5.28	-17.37	-2.82	18.30	10.75
Wholesale & Retail Trade, Restaurants & Hotels	1.09	26.64	47.03	3.04	39.07	61.16	-2.30	-31.27	-31.10	24.92	34.42	-21.55
Transport, Storage & Communications	-4.66	-4.73	3.31	27.24	37.28	14.40	26.46	-0.25	7.63	-2.03	26.31	11.28
Finance, Insurance, Real Estate & Business Services	8.59	11.46	27.46	3.47	7.87	95.20	17.66	-31.08	-35.91	15.84	35.51	-16.44
Community, Social & Personal Services	-17.73	30.33	-3.27	2.58	19.38	65.91	26.71	-14.83	6.80	3.11	29.29	6.23
TOTAL	-1.31	3.46	17.09	-2.44	18.72	58.29	17.52	-24.46	-20.26	6.41	24.86	-9.06

Note :   AVGI refers to the annual average growth for period I, that is, 1989-90 to 1991-92, AVGII for 1992-93 to 1994-95 and A VGIII for 1995-96 to 1997-98.

Source: Dept. of Company Affairs, 40th Annual Report on the Working & Administration of the Companies Act 1956, Various issue

Table 3: Industrial investment intentions filed through IEMs and LOIs

Years	IEM	LOI
1991	3084	195
1992	4860	620
1993	4456	528
1994	4664	546
1995	6502	355
1996	4825	522
1997	3873	321
1998	2889	145
Growth Rate In period I	17.98	68.84
Growth Rate In Period II	-7.88	-20.32

Note: Annual average growth rates.

Source: Economic survey, various issues.

As is evident from the above the rate of growth of entry has been declining in the recent years after a period of fast growth soon after 1991. A caveat needs to be added on the above inference. Actual entry might be even lower than both these pieces of evidence. This is because registration does not necessarily mean that the firm actually enters the market. Same is the case with IEMs and LOIs as these are proposals and not actual investments. Thus these figures might not reflect the true entry rates. In order to get a magnitude of the actual rate of entry we examine a sample of firms from the CMIE's electronic database PROWESS. CMIE provides information on the background of firms[24] in

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24   This is defined as the background report, which is provided for each firm.

which both the year of incorporation of the firm as well as the year of commencement of production is given. We consider the year of commencement of production as the year of entry as the firm actually enters the market from that year onwards. Thus from the sample of firms, by examining the year of commencement of production of each firm, we trace the number of entrants in each industrial group.

The econometric investigation is done at two stages. First, using the methodology suggested by Orr (1974) we compute the height of barriers for the entire set of new firms. This macro analysis is intended to examine the barriers at an aggregate level for the industrial sector as a whole. To understand inter-industry variations and identify the industries, which have increased the barriers, an industry level analysis is carried out as suggested by Geroski (1991) in the next section.

Before I proceed on to the econometric estimation of equation (5) a brief description of the data and variables. As noted earlier the whole exercise is based on the data drawn from the Prowess. In Table 4 are presented the number of new entrants and their distribution across industrial groups used for the estimation. As the number of entrants varies from year to year and our further econometric estimation is based on panel data we consider the entrants for the period 1988 to 1991 as the entrants for 1991 and 1992 to 1996 for the year 1996. Correspondingly the averages of other variables are used for estimations. Due to the non-availability of consistent data for the second period the analysis is restricted to only 202 firms even though the actual number of entrants are higher in this period. Average of rates of profit for the industry for the previous three years is used for past profit rates. These are actual profits realized by the firms after taxation as is reported in the balance sheets. Growth of industrial output for the last three years is used to capture Q.

Arriving at capital requirements involves stringent assumptions. First the minimum effective size (MES) of a firm[25] is computed from a distribution of firms of several class intervals for 1989. This is done by first identifying the fraction of firms reporting tax losses in the year (t) and multiplying this by the number of firms in the industry in the year (f). Then MES is the size of the plant which is (t*f)+1 from the bottom of the plant size distribution. The fixed capital of the firms is defined as the minimum capital required. Advertising and R&D intensity is defined as the values of these variables divided by the industry sales. To assess the extent of risk, the standard deviation of the industry profit for the previous years are used and to denote whether the industry is highly concentrated or not a dummy is used. Inferences regarding concentration are drawn from the CMIE publication on markets and markets shares. All variables are collected at the industry level and summed up to arrive at the figures at the aggregate level.

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25   Ideally one should be using the size of the plant. But data constraints do not permit us to use plant level information

Table 4: New entrants according to industrial groups

Industrial Group	1991	1996
Food Products	42	50
Bevearges & Tobacco	3	4
Cotton & Blended textiles	14	11
Textile processing	5	8
Synthetic Yarn	4	2
Inorganic Chemicals	5	3
Drugs & Pharmaceuticals	16	17
Organic Chemicals	8	5
Paints, Varnishes etc.	5	5
Soaps, Detergents etc.	2	3
Tyres & Tubes	3	3
Non-metallic minerals	25	15
Iron & Steel	16	11
Metal products	5	5
Non-Ferrous Metals	5	4
Non-Electrical Machinery	9	6
Electrical Machinery	7	9
Electronics	20	20
Transport Equipment	4	3
Wood & paper products	9	9
Leather	5	5
Miscellaneous	3	4
Total	215	202

Source: CMIE, Prowess.

Table 5: Determinants of Entry: Econometric Estimates

Year	Constant	πp	Q.	Log K	A	R	R	C	S	R2
1991	-1.18 (-2.23)	0.14 (2.75)	0.18 (1.98)	-0.44 (-2.17)	-0.38- (1.99)	-0.18 (-2.77)	-0.14 (-3.21)	-0.27 (-3.65)	0.49 (2.32)	0.51
1996	-1.38 (-3.14)	0.20 (1.99)	0.19 (2.18)	-0.85 (-4.21)	-0.43 (3.47)	-0.21 (-1.98)	-0.16 (-2.71)	-0.32 (-2.66)	0.55 (3.67)	0.59

Note: Estimates of equation (5). t ratios in parenthesis

Results of the estimation of equation (5) are reported in Table 5. As the intention is to make comparisons over two time points we estimate the equation for 1991 and 1996. All variables are significant at five percent level of significance and maintain the expected signs. From the above results the following inferences can be made which are consistent with a priori expectations. Capital requirements, advertising and concentration are significant barriers to entry and industry size has a positive impact on entry. Research and development and risk are moderate barriers to entry in Indian manufacturing and firms are yet to indulge in erecting barriers on the basis of these. Both past profit rates and industry growth have positive impact on entry. Thus it can be concluded that capital requirements, advertising intensity and high concentration are the strong barriers to entry and research and development intensity appears to be a moderate barrier considering the low levels of R&D intensity of the firms.

As our interest here is to compute the height of the overall barriers, an index of barriers is constructed from the empirically determined propensities of capital requirements, advertisement intensity, R&D

intensity, risk and high concentration to deter entrants *ceteris paribus.* An index (I) is constructed simply by weighting the value of each entry barrier by the regression coefficients estimated, as reported in Table 5. Higher value of the index indicates higher barriers and vice versa. This index according to Orr (1974) is insensitive to units of measurement, continuous and the weight of each individual barrier is empirically determined[26] .

Figure 1 portrays the index thus constructed for the aggregate sample for two time points 1991 and 1996.

Index of overall barriers

Manufacturing Total
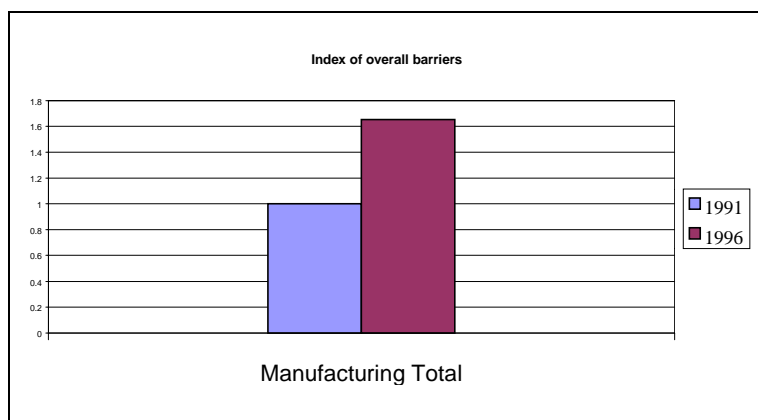
1991
1996

It is evident from the figure that in 1996 the height of overall market barriers have increased compared to 1991. This, it should be noted is after the relaxing of the norms of entry and other procedures pointing to the strategy of firms to erect market barriers based on advertising, R&D and capital. These did not acquire significance in the pre-reform era as the firms were already protected under the umbrella of licenses. The relaxation of the curbs on entry thus on the contrary has

26   See Orr (1974) for properties of this index.

increased the height of the barriers rather than reducing them. The above results confirm the low levels of entry in the phase after the economic reforms (from 1996 onwards) as entry was blocked by the incumbents by increasing the height of the barriers. The picture will be even clearer when the analysis is carried at the industry level.

Entry barriers: An industry level examination

Even though the above methodology provides us reasonably good estimates of the height of the overall barriers to entry it suffers from inaccuracies introduced by the use of the kinds of variables that proxy barriers. Moreover, the data available for cross section examination by itself is capable of inducing biases in the measure. Thus it can only be considered as a first step in analysing the extent of barriers. Added to this is the possibility of inter-industry variations in erecting barriers. As entry is discrete and involves a time lag to respond to incentives, which differ across industries, a more suitable method will be to examine a panel of firms across industry groups. In this section we examine the height of entry barriers using a panel of firms at the individual industry level. For the task in hand a more appropriate methodology is that of Geroski (1991) as it suits the panel data analysis and minimizes the inaccuracies in measurements.

Geroski (1991) modifies the basic empirical model of Orr. It is as follows. Consider entry as an 'error correction mechanism' which is attracted by excess profits. Entry in this sense will occur whenever profits differ from their long run levels. With the above hypothesis, observations of actual entry rates and current profits can be used to make inferences about the unobservable - the long run profits. Entry E_{jt} in an industry j at time t is hypothesized to occur whenever expected post entry profits π^e_{jt} exceed level of profits protected in the long run by entry barriers b_j, that is,

$$E_{ijt} = \gamma(\pi^{e_{jt}} - b_j) + \mu_{jt} \qquad 1$$

The level of profits that can be sustained in perpetuity without attracting entry is clearly *bj* and these "limit profits" are a natural measure of the height of barriers to entry. In other words the flow of entry that would have occurred if there were no entry barriers is $\gamma\pi ejt$ and the difference between this and the actual flow *Ejt* is on average equal to γbj, which clearly depends on the height of barriers to entry.

To discuss the micro economic foundations of equation (1) more explicitly. Suppose that a firm i chooses output x_i and that industry output is $x \equiv \Sigma x_i$. Assume that the output is homogenous and the demand be $p = p(x)$ and the marginal costs be constant at a level of c_i per unit. Thus the current period profits net of fixed cost are

$$\pi_i = x_i [p(x) - c_i] \qquad 2$$

The choice of x_i by firm i in period t is affected by two constraints. First, rivals are likely to respond to any attempt by i to expand and this response is likely to occur over time. Using conjectural variations we suppose that firm *i* expects an initial aggregate response,

$dx_i/dx_{it} \equiv \theta_0$ by all rivals and a subsequent response

$dx_{t+1}/dx_{it} \equiv \theta_1$ to any output change that it makes in period t.

Since $dx/dx_i = (1 + \Sigma dx_j/dx_i)$, $j \neq i$ then $\theta_0 = \theta_1 = 0$ describes a situation in which price is expected to remain constant when xi changes. Thus the larger are θ_0 and θ_1 the less accommodating are rivals and so is the price decline consequent on increasing x_i.

Second the choice of x_i in t may involve firm i substantial short run adjustment costs if $x_{it} \neq x_{it-1}$[27]

These adjustment cost $Ajt = A(x_{it}, xi_t - 1)$ are assumed for the sake of simplicity to be proportional to increase in market share implied by the choice of x_{it} given x_{it-1}. That is if

$S_{it} \equiv x_{it}/x_t$ then marginal costs are assumed to be $dA_{it}/dx_{it} \equiv d_t(S_{it} - S_{it-1})$. Finally we assume that $d_t/p_t \equiv \delta$ which is constant over time.

Given these assumptions choice in t by firm i have future effect and a rational decision maker will maximize the expected present discount value of profits.

$$V_t = E_t(\sum_{\tau=0}^{\alpha} \rho^\tau (x_{t+\tau}[\rho(x_{t+\tau})-C])- A_{t+\tau})$$

3

Where p is the discount factor, $E_t(.)$ denotes the expectation at time t of the quantity in parenthesis. We have suppressed subscript i to simplify the notation.

The sequence of x_{it} which maximizes (3) satisfies [28]

$$P_{t+\tau}-C+X-it+\tau P'(X_{t+\tau}\theta_0 -\delta_t(S_{it}-S_{it-1}$$
$$+\rho E_t(X_{it+\tau+1}P'(X_{t+\tau+1})\theta_1 -\delta_{t+1}(S_{it+1}-S_{it})]\; = \; 0$$

4

Rearranging and simplifying (4) gives

$$m_{t+\tau}+S_{t+\tau}(\frac{\theta_0}{\eta})-\delta(S_{t+\tau}-S_{t+\tau-1})$$
$$+S^e_{t+\tau+1}(\frac{\lambda\theta_1}{\eta})-\lambda\delta(S^e_{t+\tau+1}-S_{t+\tau})=0$$

5

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27   Penrose discusses this type of costs like managerial costs.

28   See Sargent (1979) for details.

Where $E_t(S_{t+1}) \equiv S^e_{(t+1)}$, $\lambda \equiv \rho P_t / P_{(t+1)}$ and is assumed to be constant and η is the elasticity of demand ($\eta < 0$). Collecting terms and suppressing τ, we obtain

$$\gamma_0 m_t + \gamma_1 S^e_{t+1} + \gamma_2 S_t + S_{t-1} = 0 \qquad\qquad 6$$

where $m_t \equiv (p_t - c)/p_t, i's\ price\cdot costmargin, \gamma_0 = \delta^{-1}$,
$$\gamma_1 = [(\lambda\theta_1/\eta) - \rho\delta]\gamma_0,$$
$$\gamma_2 = [(\theta_0/\eta) - \delta + \lambda\delta]\gamma_0$$

Under reasonable restrictions on the parameters the solution to (6) is

$$S_t = \eta_1 S_{t-1} + \eta_1 \gamma_0 \sum_{\tau=0}^{\infty} (\frac{1}{\eta_2})^\tau m^e_{t+\tau} \qquad\qquad 7$$

Where $\eta 1$ and $\eta 2$ are such that $0 < \eta 1 < 1/\gamma 1 < \eta_2$.

They are the roots of (6) and so are implicitly defined by the two equations $\eta_1 + \eta_2 = -\gamma_2/\gamma_1$, and $\eta_1\eta_2 = 1/\gamma_1$

It can be shown that increases in θ_0, θ_1 and δ all raise η_1 and lower η_2. Finally defining

$$S^*\text{-}t \equiv \frac{\gamma_0 \eta_1}{1 - \eta_1} \sum_{\tau=0}^{\infty} (\frac{1}{\eta_2})^\tau m^e_{t+\tau} \qquad\qquad 8$$

We can write (7) as

$$\Delta S_t = (1 - \eta_1)(S^*_t - S_{t-1}) \qquad\qquad 9$$

Whether written as (6), (7) or (9) the model has reasonable interpretation. Two observations help to bring this out. First if q1 = d = 0, then the current choice of xit has no effect on pi(t+1) and (5) simplifies to

$$m_t = \frac{-\theta_0}{\eta} s_t \qquad\qquad 10$$

which is standard Cowling-Waterson model of market structure and price-cost margins. Eq 5 then says that a firm choosing S_t given $S_t > S_{t-1}$ and expecting $S_{t+1} > S_t$ will earn less than $-\theta_0 S_t/\eta$, i.e., an expansion programme generate short run costs of adjustment.

Secondly equation 9 is a way of relating the model to the standard dynamic models used in applied work. If $S^*_t = S^*$ then Eq 9 describes a partial adjustment to a fixed target. In practice the target S^* will not be constant over time and equation 8 makes plain not only that it does depend on the entire future stream of profit but also that it is a target which depends on the expectation of these profits. It is therefore likely to be a moving target, being updated continuously with the arrival of new information. When the adjustment costs are high then adjustment is slower and even slower when there are adverse price consequences of rivals' reactions.

For an entrant in its year of entry $S_{t-1} = 0$, then Eq.9 simplifies to

$$E_t = (1 - \eta_1) S^*_t \qquad\qquad 11$$

E_t = entrant's market penetration.

From equation 11 it is clear that entry will occur if the appropriately discounted present value of stream of expected post entry margins is positive and that entrants will respond more quickly to t given S^*_t. The more benign the response of incumbents the smaller are adjustment costs. But this is an incomplete model of entry due to two problems. Firstly, entrants may have to pay a fixed entry cost (F) to enter and secondly, the level of cost c_i that the entrant i incurs in producing output x_i is not observable. The observable variable is the price-cost margin of

the incumbents. Entry costs imply that marginal cost does not equal to average cost and absolute cost disadvantages imply that incumbents and entrants operate along different marginal cost schedules. With fixed costs what is germane are price average cost margins. Thus if $(p-a_i)/p$ is the price- average cost margin of the incumbents then that of entrants is

$$\frac{p - a_I}{p} + \frac{a_I - a_E}{p} \qquad\qquad 12$$

The difference between average unit costs between entrant and incumbent depend on both F and the difference in MC between them.

Writing $\pi \equiv (p - a_I)/p, b \equiv (a_E - a_I)/p, \gamma \equiv (1 - \eta_I)$

We can write EQ 10 entirely in terms of observable as

$$E_{it} = \gamma (\pi^e_{it} - b_i) \qquad\qquad 13$$

Equation 1 is the basic empirical model of entry. Equation 2 to 12 provides interpretation of γ, π^e and b. The speed of response γ of entrants to excess profits depends upon the elasticity of demand, cost of adjustment and no future reaction by incumbents to current entry. When there are future reactions to entry and the adjustment costs are high then rational entrants will respond to more than just current profits. In the long run however entry barriers may leave entrants permanently disadvantaged, facing higher unit costs than those faced by the incumbents. This is captured by b.

Specifying an empirical entry equation

To turn equation 1 into a regression equation to measure γ and the height of entry barriers we need to express in terms of observables. The problem is that neither π^e_{jt} nor b_j is directly observable. One is expectational variable and the other unobserved outcomes. The usual procedure is to assume that entrants use lagged actual profits π_{jt-1} to

proxy expected post entry profits and to model b_j as being determined by a series of observable features of current market structure.

$$b_j = \beta_0 + \beta_1 X_j \qquad\qquad 14$$

For the ease of exposition we have assumed that only one observable measure of entry barriers X_j is used. These two assumptions transform equation 1 into a regression model

$$E_{jt} = \alpha_0 + \alpha_1 \pi_{jt-1} + \alpha_2 X_j + \mu_{ij}$$
$$where \quad \alpha_0 = \gamma \beta_0 , \alpha_1 = \gamma , \alpha_2 = \gamma \beta_1 \qquad 15$$

Neglecting purely random transitory factors, $E_{jt}=0$ in the long run and using this condition to solve equation 15 for the level of limit profits πj_j^*

$$\pi_j^* = \frac{\alpha_0 + \alpha_1 X_j}{\alpha_1} \qquad\qquad 16$$

If the entrants expect no higher profits than π_j^*, then they will not be able to cover their entry costs, so will not enjoy a positive return post entry.

There are three conceptual problems, which make equations 15 a little tentative. Firstly, the use of observed profits prior to entry π_{jt-1} to predict expected post entry profits π_{jt}^e presumes that entrants have naive expectations. In assuming that outcomes will be the same post entry as they were pre-entry, naive entrants neglect the effect that their entry will have on profits. But it is hard to accept the proposition that entrants will be naive. As the expectations that any but the most naive entrants are likely to hold are unlikely to be based on pre-entry observables, we should mimic the kind of expectations formation process that entrants might use if we are to proxy π_{jt}^e properly. The second problem is that it is often difficult to obtain good cross section estimates of particular types of barriers to entry. For example it is difficult to construct a variable that reflects the strategic control of incumbents on scarce natural resource.

So it is prudent to regard X_j as being measured with error, more over, there is a possibility that certain types of barriers are likely to be omitted from most of the regression equations. Thus the estimates could be inefficient estimates. Thirdly, the equation assumes that entrants respond at the same speed to profit opportunities in all the industries, which is usually made purely for the convenience of estimation. But the basic model we have constructed is shaped by the decisions we have made with respect to each of the three points. So we dwell with these three issues separately.

First, π^e_{jt} is the level of profit expected by the entrant post entry which is not observable prior. However an entrant who forms rational expectations will make use of all the information available to it at the time it make the decisions. This information comes in two forms (1) observed data reflecting past market outcomes and (2) a prior knowledge of how market processes operate. The two types of information complement each other because knowledge of market operations enables the entrant to establish a causal link between the different observables in its information set. So we combine the two types of information in a simple econometric model which enables the entrant to predict profits.

Given the observed data on profits π_{jt-1} and other variables Z_j we can model the interaction between entry and profitability by expressing each as a distributed lag function of the other plus exogenous variables. Solving the model by eliminating the entry variables yields an auto regression in profits

$$\pi_{jt} = \lambda(L)\pi_{jt-1} + \Phi Z_{jt} + \varepsilon_{jt} \qquad 17$$

Where $\lambda(L)$ is a polynomial in the lag operator L. The assumption of rational expectations implies that expectations are unbiased and will differ from realized values only randomly.

We can use the predictions from equation 17 in place of unobservable latent variable π^e_{jt} if entrants' expectations are rational. Doing this insures that the information available to entrant in t-1 will be used to make predictions of π_{jt} and this in turn implies that E_{jt} will be a regression error with classical properties. We shall assume that entrants make their decisions rationally, using the predicted value of π_{jt} to proxy the latent variable π^e_{jt} to model the signal that attracts entry[29]. Measuring entry barriers poses the second problem. The solution of this problem is the observation that height of barriers to entry ought to be fixed in the short to medium run in most of the industries. They take specific value in each industry. As a practical matter then, we can measure the height of barriers to entry as

$$b_j = \beta_j + \beta_1 X_j \qquad\qquad 18$$

where the fixed effects β_j are objects of estimation along with β_1 and X_j is an observable determinant of barriers. Substituting equation 18 in equation 1 generates an equation like 15 the difference being that a_0 takes different value for each industry. The amended model becomes an equation with fixed effects and cannot be estimated using single cross section data. It can only be estimated using panel data. The third conceptual problem is the assumption that g the speed of response by entrants is the same in all industries. Although we wish to model the determinants of variations in the response rates of entrants, our data are too limited to do this job.

To sum up, we propose estimation of equation 15 using a rational expectations estimator for π^e_{jt}. As the model includes fixed effect to capture unobserved entry barriers we wish to work with two years of

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29   See Wallis (1980) and Wickens (1982) for the standard procedure to estimate rational expectation models and Pagan (1984, 1986) on the properties of two stage estimators.

data. Two separate panels are estimated to compare barriers overtime the first panel uses data for 1991 and 1992 and the second one for 1996 and 1997. The observable variables are industry size and industry growth. All observable are assumed exogenous. These decisions leaves us with an entry equation

$$E^d_{jt} = \gamma^d \pi^e_{jt} + \alpha^d_0 \, SIZE_{jt-1}$$
$$+ \alpha^d_1 GROW_{jt-1} + f^d_j + \mu^d_{jt} \qquad\qquad 19$$

First step in the estimation of equation (19) is to generate proxy values for π^e_{jt}. The estimates of the reduced form estimates of equation (17) used to generate the proxy values are given below.

$\pi_t = \ -0.31\pi_{t-1} \quad -0.12\pi_{t-2} \quad -0.002\pi_{t-3} \quad -0.04 \ SIZE_{t-1} \quad +0.01GROW_{t-1} \quad -0.002 \ EXP_{t-1}$
$\qquad\quad (-3.21) \qquad (-2.34) \qquad (-1.03) \qquad\quad (-2.84) \qquad\qquad (2.11) \qquad\qquad (-1.24)$

$R^2 = 0.92$

$\pi t = \ -0.28\pi_{t-1} \quad -0.14\pi_{t-2} \quad -0.003\pi_{t-3} \quad -0.02 \ SIZE_{t-1} \quad +0.01GROW_{t-1} \quad -0.001 \ EXP_{t-1}$
$\qquad\quad (-3.37) \qquad (-3.11) \qquad (-.96) \qquad\quad (-2.41) \qquad\qquad (2.02) \qquad\qquad (-0.87)$

$R^2 = 0.89$

The first set of estimates corresponds to the panel for 1991 and 1992 and the second set of estimates for 1996 and 1997. EXP denotes export intensity and t statistics are denoted in the parenthesis. The high explanatory power of the models is due to the inclusion of the lagged profits as explanatory variables. This points to the fact that current profits are affected to a great extent by the past profits while export intensity does not seem to affect the observed current profits. Another notable feature is that there exists significant fixed effects and that the between variations in the data dominates the within variations. This also implies that the differences in profit margins between industries are larger than the margins within an industrial group.

Having generated the proxy values for expected profits we estimate equation (19) along with the fixed effects and results are reported in Table 6.

Table 6: Regressions explaining entry

	Panel I	Panel II
πe_{jt}	1.42	0.81
	(3.11)	(2.27)
$Size_{t-1}$	0.02	0.02
	(1.01)	(0.78)
$GROW_{t-1}$	-0.13	-0.19
	(-1.36)	(-1.07)
R^2	0.46	0.41

Note: Panel I refers to 1991,1992 and panel II refers to 1996,1997. t statistics are given in the parenthesis. π^e_{jt} expected profits measured as the predicted value from π_{jt} from equation (17). $Size_{t-1}$ is the lagged log of total output and $GROW_{t-1}$ is the lagged rate of growth of output. E_{jt} is the gross entry.

From the table it follows that 10 percent rise in expected profits increase entry by around 1.5 percent during 1991 and 1992 while the increase in entry falls below one percent for 1996 and 1997. It can also be observed that entry exhibits variations with excess profits and variations in industry size and growth rates appears to have little effect on the barriers and thus on the entry flows. Using the estimated parameters and equation (16) we solve for the level of profits which can be sustained without attracting entry, that is the limit profits, which are a measure of the height of barriers to entry. As the fixed effects could not be reduced to a sample wide constant there exists substantial inter-industry variations in the height of barriers. On an average the height of barriers in 1991 was around 35 percent and this increased to around 40 percent by 1996. This means that firms could maintain prices above 35 percent of costs without attracting entry in1991 and in the 1996 they could maintain above 40 percent. This points to substantial increase in the barriers overtime.

Figure 2

INDEX OF OVERALL BARRIERS 1991 & 1996

Figure 3

INDEX OF OVERALL BARRIERS 1991 & 1996

Figure 4

Index of Overall Barriers 1991&1996

Figure 5

Index of overall barriers 1991 &1996
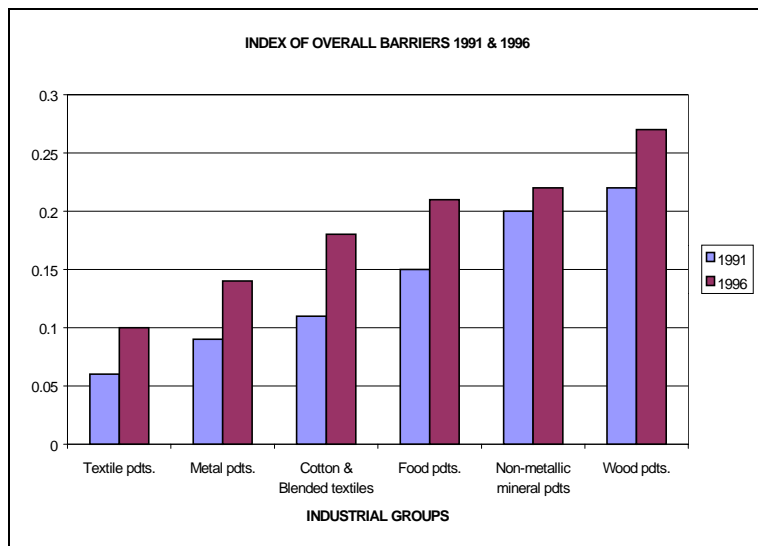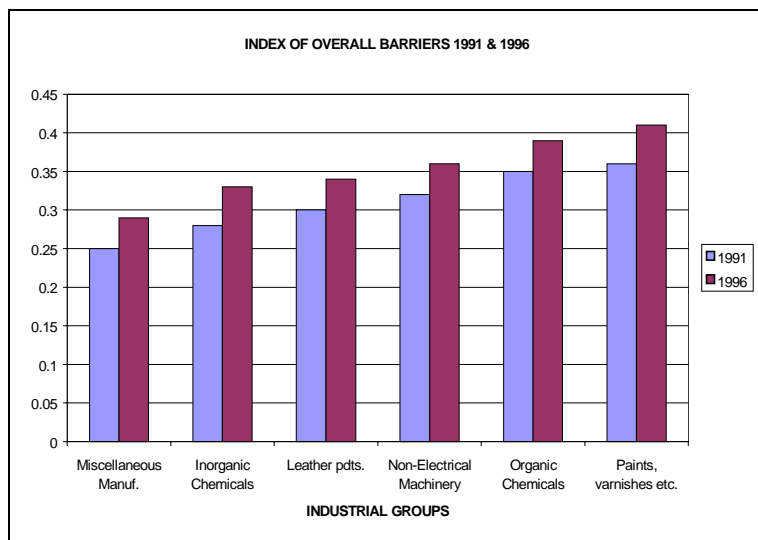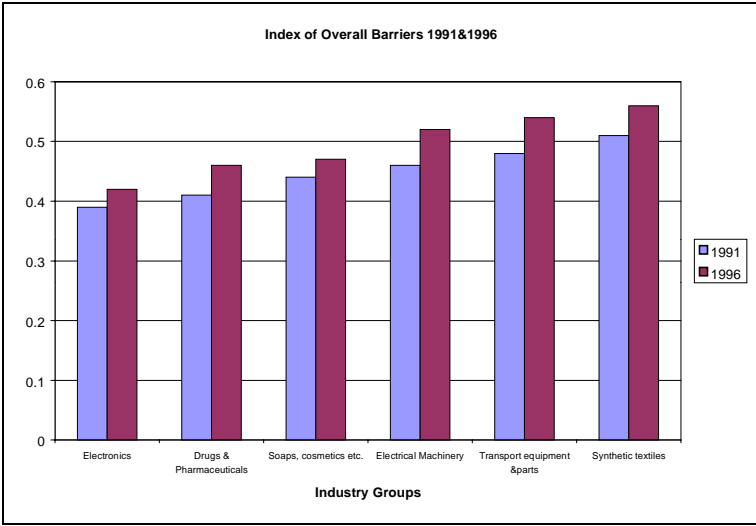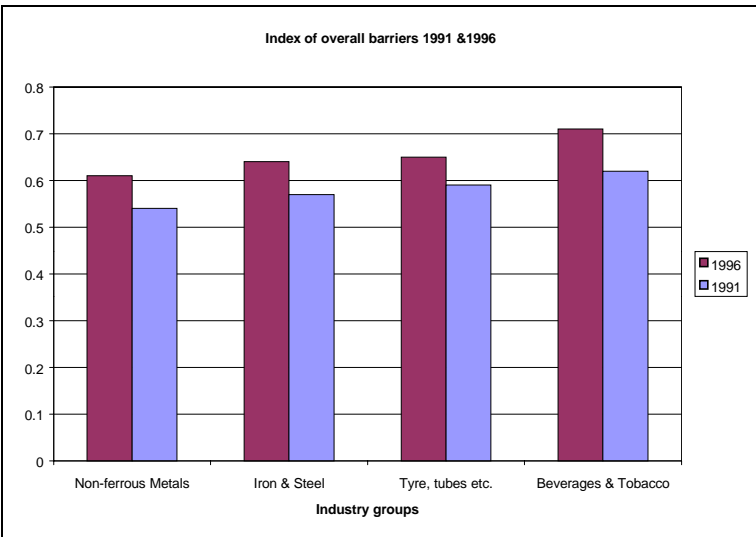
Figures 2 to 5 makes this point more explicit. It can be noticed that in all the industries there has been an increase in the height of overall barrier. Barriers are the highest in synthetic textiles and transport equipment and parts followed by iron and steel products, tyres and tubes and non-ferrous metals and soaps, detergents and cosmetics. Food and food products, leather and leather products and textile products register the lowest barriers. On the whole we observe an increase in barriers in all the industrial groups in 1996 compared to 1991 confirming the results at the aggregate level.

To sum up

In this paper an analysis of the extent of barriers for new entrants in the manufacturing sector has been attempted. As the thrust of the economic policy changes have been on the easing and removal of restrictions in the industrial sector the analysis has been for the period since the onset of the changes in the policies. As a prelude to the analysis the extent of entry is traced. The number of new entrants measured as the gross entry grew at the steady rate in the pre-reform period, accelerated immediately after the reforms and register a declining trend during the last three years. This points to the existence of hindrances even after the removal of institutionalised barriers like licenses. These hindrances are the non-institutionalised market barriers like advertising. The extent of market barriers has been captured by examining the height of these barriers.

Econometric estimation of the height of the barriers for 1991 and 1996 yield that the height of barriers has increased in 1996 at the aggregate level. An examination at the disaggregate level reveals that in almost all the industries examined from a sample of firms drawn from the CMIE the height of the barriers have increased in 1997 compared to 1991. Ever since the doing away of the 'license raj', firms have been able

to indulge in entry blocking strategies fuelled by the working of market forces. The dilution and dismantling of commands and controls intended to ease entry have thus paved the way for the erection and strengthening of market barriers which have grown over time.

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ABSTRACT

Institutional regulations by way of licensing and capacity restrictions have often been considered as barriers to competition in Indian industry. As most of these regulations have given way for market signals an increase in the number of entrants and alterations in the conditions of entry, mainly the barriers to entry are expected. In this paper I attempt to analyse the extent of barriers to entry in Indian manufacturing by empirically quantifying the height of these barriers. Econometric estimation of the height of the barriers for 1991 and 1996 shows that the height of barriers increased in 1996 at the aggregate level. An examination at the disaggregate level reveals that in almost all the industries examined from a sample of firms drawn from the CMIE the height of the barriers have increased in 1996 compared to 1991. The dilution and dismantling of commands and controls intended to ease entry have thus paved the way for the erection and strengthening of market barriers which have grown over time.