

**A SELECT REVIEW OF THE LITERATURE ON
BARRIERS TO NEW COMPETITION**

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**BY
RAJENDRA R. VAIDYA**

**GOKHALE INSTITUTE OF POLITICS AND ECONOMICS
PUNE-411 004**

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Gokhale Institute of
Politics and Economics,
Pune-411 004

Rajendra R. Vaidya

CONTENTS

	<u>Page</u>
ACKNOWLEDGEMENTS	(i)
LIST OF TABLES AND FIGURES	(iii)
INTRODUCTION	(iv)
<u>Chapter</u>	
1 THE EARLY DEVELOPMENTS	1
2 ON PRICE COMPETITION	42
3 ON NON-PRICE COMPETITION	80
4 CONCLUSION	108
BIBLIOGRAPHY	116

LIST OF TABLES AND FIGURES

<u>Table No.</u>		<u>Page</u>
1.1	A Summary of Prof. Bain's Predictions	17
1.2	Costs and Profits of Three Types of Firm	27
<u>Figure No.</u>		
1.1	Diagrammatic Representation of Prof. Bain's First Model	6
2.1	The Undiscounted Income Stream of the Initial Monopolist	45
2.2	Probability of Entry and the Limit Price	55
2.3	Reaction Functions of the Established Firm and Potential Entrant	60
2.4	The Discontinuity in the Established Firm's Reaction Function	72
2.5	Reaction Functions of the Established Firm and Potential Entrant	73
3.1	The Limit Price-Selling Expenses Locus	84
3.2	Isoquants and the Limit Price-Selling Expenses Locus	87
3.3	Diagrammatic Representation of the Possible Equilibria in Williamson's Model	89

INTRODUCTION

"The ownership of exclusive facilities for production or trade in the modern world does not always suggest to a man of sound judgement that he should pursue a severely monopolistic price policy. On the contrary he will keep a watchful eye on the sources of possible competition; direct or indirect. If it appears that those sources are likely to prove large and strong, and the pace at which competitive supply runs is likely to become considerable before long then he will not make full use of his power, but will adjust his prices to obtaining a firm hold on the market before he can be caught by competitive supply following quickly at his heels." [Alfred Marshall, *Industry and Trade*, 1919.]

The effect of potential competition (as distinct from actual competition) as a factor likely to influence determination of price and output in concentrated (such as, oligopolistic) industries had been neglected for over thirty years after these words were written. In the last thirty years or so this neglect has been substantially repaired. The process of this repair was begun in a big way by Prof. J.S. Bain and it is continuing to this day. This M.Phil. dissertation outlines these repairs and depicts where this repairing has led to.

Prior to these efforts, the theory of oligopoly was in a fluid state. Theorists were talking in terms of the

need for a case by case approach, which was a proof of the unsatisfactory theoretical situation. A large number of alternative solutions (from Cournot to Stackelberg) had been suggested, each involving a different set of assumptions. It is in this context that Prof. Sylos Labini makes the following comment: "... there is no stopping on the path of conjectural variations. Solutions can be proliferated to infinity on the manufacture of such hypotheses and solutions can become a sort of a profession. It is all remarkably like working out the chess problems in a weekly magazine (white to play and mate in three moves) or, on a higher plane, like writing a manual on chess strategy. The analogy is not formal only, nor we hope - is it disrespectful. A good chess player is much to be admired."¹

The traditional oligopoly theory was founded on two assumptions: (i) each firm maximizes its profits, and (ii) each firm concerns itself with the repercussions of its actions on the behaviour of other firms already in the market. The first assumption was common to the analysis of all market structures; the second was considered to be the hallmark of oligopoly theory. Once the importance of potential competition was recognized, this shift in focus made it necessary to re-examine both these assumptions. Profit maximization was re-interpreted to mean that each firm would maximize its profits (duly discounted) over the long period, taking into account the repercussions on entry and hence on future profitability of any price policy pursued in the short period. Detailed analysis of various conjectural variations pertaining

to existing firms in an industry had led to nowhere; hence the focus was shifted to potential competition.

In this work, we essentially confine to a discussion of large scale potential entrants. The main focus is on the theoretical implications that follow, once the importance of potential entry is recognized. Some empirical investigations have also been covered. The welfare aspects have not been touched upon at all and the policy implications have been discussed only marginally. We consider situations where there is high concentration on the sellers side, assuming always that there is a large number of buyers. The criticisms that have been levelled at this approach have not been considered in detail. Exit barriers are also left out of the discussion.

The chapter scheme is as follows. The first chapter attempts to summarize the literature from 1949 till about 1960. The second chapter is devoted to reporting the analysis developed on the price-competition from 1960 onwards. The third chapter deals with the literature pertaining to non-price competition that has grown since 1960. The fourth chapter deals with the main conclusions arrived at.

Notes and References

1. Sylos Labini, Paulo. Oligopoly and Technical Progress. Harvard University Press, Cambridge, Massachusetts, 1969, p. 20.

CHAPTER 1

THE EARLY DEVELOPMENTS

In this chapter, we shall attempt a review of the new developments in oligopoly theory since 1949 till about 1960. The main focus would be on the works of Prof. J.S. Bain, Prof. Paulo Sylos Labini and Prof. F. Modigliani, in that order.

In several empirical studies on firm behaviour, it had been observed that some industries hold prices, for a long period, within a range where the industry demand curve was inelastic. This implies that the corresponding marginal revenue is negative and thus necessarily below long-run marginal cost. This meant that prices were held, over long periods, below the level that would maximize profits, which apparently contradicts the predictions of the theory of monopoly (or collusive) pricing.

Prof. Bain attempts to resolve this contradiction in the following manner: "Established sellers persistently or in the long run forego prices high enough to maximize industry profit for fear of thereby attracting new entry to the industry and thus reducing demands for their outputs and their own profits."¹ This method implies that the industry demand curve employed in the analysis must explicitly reflect the effect of the phenomenon in question (i.e. entry by new firms).

Even a monopoly, especially if it is a very profitable one, may be faced with real threats of entry. "The monopolist (collusive oligopolists) might therefore be viewed as setting each an indefinite succession of current prices or profits with an eye to their effect in attracting entry into the industry and thus in reducing the demand for output of established firm(s)."²

Now, there are two possible ways in which the established firm may behave. (i) It may be ignorant of the threat of entry, or feel that entry, if it occurs, would not adversely affect its profits. Thus it may continue to be a short run profit maximizer. (ii) Alternatively, it may be aware of the threat of entry and its effect (if it materializes) on its profits. It will thus attempt to keep short run prices (and long run average prices) at a lower level (than what short run profit maximization implies) in order to discourage entry.

There are two assumptions which are vital to all further analysis. First, we assume that the established firm(s) is aware of any real threat of entry and this awareness will prompt it to behave in such a way as to enhance its own (as distinguished from industry's) profits. Secondly, we assume that potential entrants base their decisions pertaining to entry on the prices charged and profits currently earned by the established firm(s).

A potential entrant into an oligopolistic (or monopoly) industry, who plans to enter with a substantial scale, may

expect the post-entry price to be different from the pre-entry price and may also expect certain reactions from existing firms. If such an interdependence between the potential entrant and the existing firm(s) exists and is recognized by the former, it is not immediately clear as to why the potential entrant would or should base his entry decision on pre-entry prices. If the potential entrant feels that existing firms are trying to bluff him away from the industry, he would disregard existing prices altogether. In such a situation the potential entrant would be concerned with the post-entry reaction of existing firms. If he knows the industry demand curve with a fair amount of certainty and also the conditions of rivalry after his entry he may well disregard the pre-entry price (which may be the limit price, defined later) set by established firms in deciding to enter or not. We thus have some reasons to doubt the efficacy of our second assumption.

However, our confidence with respect to the second assumption is somewhat strengthened if we recognize that industry demands are never known with certainty. Thus, if existing firms are making moderate profits, sufficient uncertainty concerning the elasticity of demand curve at higher prices may be created in the mind of the potential entrant, which may discourage him from entering. We may, thus, at least provisionally, accept the second assumption.

We may give here a loose definition of "limit price" which can be improved upon later. Limit price is the price

established firms believe they can charge without attracting at least one entrant. The level of the limit price depends on (a) cost functions which entrants are expected to have, (b) their estimates of industry demand, and (c) estimates of the market share which established firms think the entrants can capture. It should be recognized that the limit price may be ineffective if it is considered to be a bluff by potential entrants.

If the established firms formulate estimates of limit price (as defined above) on the basis of the position and character of the demand curve for their output after entry, these estimates can be recognized on an anticipated demand curve for their outputs and a formal solution can be developed. Two alternative models are constructed by Prof. Bain. One model assumes that established firms anticipate rivalry with the new entrant while the other assumes that established firms anticipate collusion with the entrant.

Model 1

Assumptions:

(a) There exists a determinate long run demand curve for industry output, which is unaffected by price adjustments or by entry.

(b) The industry is occupied, initially, by a single firm or a group of effectively collusive pure oligopolists.

(c) The established firms estimate a limit price, above which they expect a lump of entry to be attracted.

(d) There exists considerable uncertainty on the part of established firms concerning conditions of demands for their outputs if entry occurs.

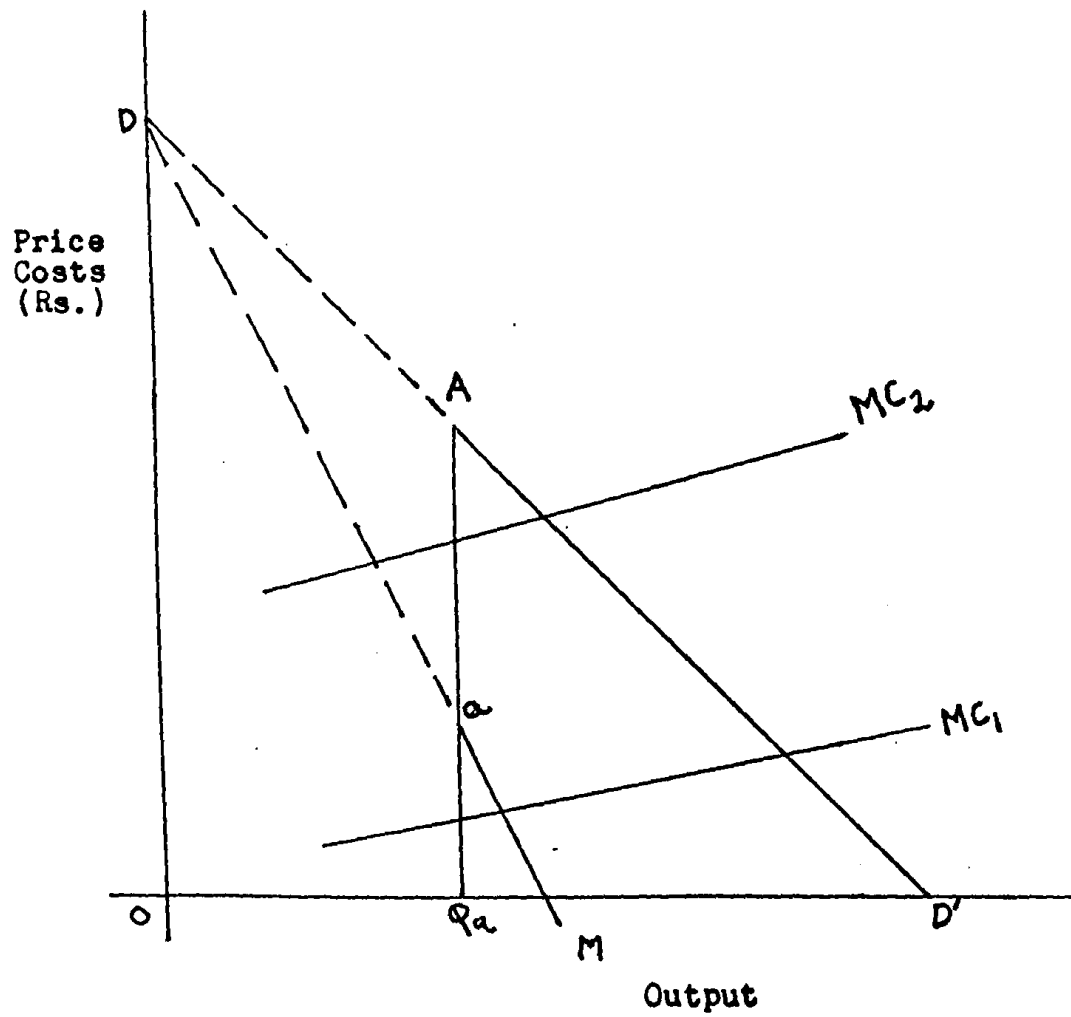
(e) The established firms are uncertain of the sort of rivalry which will develop after entry occurs. (Fig. 1.1.)

The lines DAD' and DaM are the long run industry demand curve and the marginal revenue curve respectively. Suppose the limit price calculated by established firms is QaA . Due to the uncertain effects of entry, the established firms expect to experience some unspecified loss in sales above the limit price. They thus have only the truncated demand curve AD' to exploit exclusively. On the other hand, they have an indeterminate demand for their output once they charge a price above QaA . The possibility of effective private rationing or price discrimination by established firms, which might enable them to produce less than OQa and still hold the price at QaA is excluded.

In such a scenario, the two alternatives open to established firms are: (i) to charge a price less than or equal to QaA and prevent entry, and (ii) to charge a price above QaA and attract entry. The price policy that would be chosen will depend on the established firm's view of the long run profits under the two alternative policies. The possible equilibrium situations may be outlined here.

(a) If the marginal cost curve of the established firm is, say, MC_1 , the conventional profit maximizing-price would be below QaA . Thus, by charging the profit maximizing

Figure 1.1 : Diagrammatic Representation of Prof. Bain's First Model



price, established firms would be able to prevent entry. In such a situation, entry is said to be blockaded. (We may also conceive a situation where the limit price QaA coincides with the profit-maximizing price.)

(b) The marginal cost curve of the established firms may be MC_2 . In this case, the profit maximizing-price will be charged only if the uncertain higher profit that profit maximization implies is preferable to the lower but certain profits if the limit price (or anything below it) is charged.

We have till now implicitly assumed that price would be greater than average costs of established firms. If this assumption is not satisfied, the above conclusions would not hold good. In order to make the diagram less complicated the average cost curves are not drawn in Fig. 1.1.

Prof. Bain also develops a second model where assumption 'e' of model-1 is replaced by the assumption that established firms contemplate collusion with the entrant. As the conclusions are not essentially different from those of model-1, it is not considered here.

In the argument developed so far, all that has been said is that the threat of potential entry may force the long run equilibrium price of the established firms to lie below the price which conventional profit maximization implies. It must be remembered that the above argument refers to homogeneous oligopolies only.

In the article "Conditions of Entry and Emergence of

Monopoly" [in Monopoly, Competition and Their Regulation, ed. E.H. Chamberlain, 1954] and the book Barriers to New Competition (1956), Prof. Bain has tried to develop the above model in a much more detailed and sophisticated way.

The question that is of paramount importance is: What are the strategic tendencies of enterprise behaviour? According to Prof. Bain the tendencies in enterprise behaviour outlined below are relevant to the present discussion.

(i) There is always a tendency for established firms in a concentrated industry to strive for joint profit maximization via mergers, and cartels or express or tacit collusive agreements made by them with respect to outputs and prices.

(ii) There is also a counter tendency for rivalry among established firms. This may prevent the fulfilment of the first tendency. Obviously, the relative force of these two tendencies is important if any prediction of their outcome is to be made.

(iii) The third tendency relates to potential entrants. Potential entrants would enter an industry (unless arbitrarily restrained) whenever they anticipate profits in the post-entry situation. The amount of profit anticipated by potential entrants is likely to vary from industry to industry and, correspondingly, the margin by which established firms can raise their prices above the

competitive level without inducing entry may substantially differ from industry to industry.

The interaction of these three tendencies would ultimately determine what would happen to industry performance and structure in the long run.

In the discussion that follows the following definition of monopoly would be employed: "Monopoly would be found in an industry - defined strictly as a group of close substitute products to buyers - where:

(i) a high proportion of industry output is supplied by very few firms (or other effective control units), or where

(ii) there is a tendency in the long run or on the average through time, towards a level of output at which price substantially exceeds long run marginal costs and probably also exceeds long run average costs."³

By so defining monopoly, the focus is placed on concentration which must be high enough to make effective (express or tacit) collusion among established firms easy and lead to the sort of price results indicated in (ii) above. Prof. Bain suggests, on the basis of extensive empirical observation, that the lower limit of high seller concentration may be found where 70 per cent of the output is supplied by eight firms, given typical dispersion of firms.

The most important concept developed by Prof. Bain

is the "condition of entry". It refers to the state of potential competition from possible new firms. We can quantitatively evaluate the condition of entry by calculating the percentage by which established firms can persistently raise price above the competitive level without attracting entry into the industry. This percentage is likely to vary from zero to a very high figure from industry to industry, depending on the advantages that established firms have over potential entrants. As the difficulty of entry (which is reflected in the value of the condition of entry) increases, some systematic variations in the behaviour and performance of existing firms may be anticipated.

Entry of a new firm refers to the combination of two events: (i) the establishment of an independent legal entity new to the industry and (ii) the introduction by the new firm of physical production capacity that was not used for production in the industry before the establishment of the new firm. We thus exclude the following events from the concept of entry: (i) take overs, or (ii) expansion of capacity by already established firms.

The concept of the condition of entry can be refined to take account of (i) differences among established firms in an industry, and (ii) differences among potential entrants. Differences among established firms may arise due to two reasons: (a) product differentiation, and (b) difference in minimum costs used to arrive at competitive prices. In

such a scenario, the condition of entry can be evaluated by considering the maximum difference between price and minimum costs at which entry can be forestalled for the most favoured established firm(s) in the industry, assuming concurrent price elevation by all established firms. (The most favoured firm may be identified as that with largest difference between price and minimum cost,)

To take care of the differences among potential entrants, the following assumptions are made: (i) the potential entrant firms may differ as to the profits which would induce them to enter, and (ii) any specific entry-inducing profits induces only a finite number of firms to enter. In such a scenario, the condition of entry in any industry is measured by a succession of progressively higher entry-inducing price-cost gaps that will attract successive firms or groups of firms to enter.

The concept of the condition of entry can be further refined. The 'immediate condition of entry' refers to the obstacles to entry faced by those potential entrants that can be most easily induced to enter (i.e. most favoured potential entrants) in a given situation. This is measured by the gap between long run price and minimum cost (for the most favoured established firm(s)) which prevents entry of the most favoured potential entrant(s). The 'general condition of entry' refers to a succession of values of the immediate condition of entry over time.

The lag period (i.e. the time interval between when a new firm has taken more or less irrevocable steps to

establish and use new capacity in an industry and when the firm has established all production and other facilities necessary to permit it to produce its planned rate of output) may vary greatly from industry to industry. The longer the lag period, the less influence any given threat of entry will be likely to have on established firms.

What are the factors that determine the value of the condition of entry in any industry? In conventional price theory we generally talk of easy entry. Easy entry is taken to imply that there are no impediments to the entry of new firms (the value of the condition of entry in this case would be zero). If the value of the condition of entry is to depart from zero, it must be due to at least one of the following reasons: (i) Established firms have absolute cost advantages over potential entrants; (ii) Established firms have product differentiation advantages; and (iii) There are significant economies of large scale in the industry. It is due to one or more of these three reasons that barriers to entry can occur.

Typical circumstances which would give rise to an absolute cost advantage to established firms are: (i) control of production techniques by established firms, via either patents or secrecy, (ii) imperfections in factor markets which allow lower buying prices for established firms or ownership or control of strategic factor supplies by established firms, (iii) a highly inelastic supply curve for a certain factor of production, and (iv) money market

conditions imposing higher interest rates on potential entrants than on established firms.

The following circumstances would give rise to product differentiation advantages to established firms:

- (i) Cumulative preference of buyers for established brand names and company reputations, (ii) Control of superior product designs by established firms through patents, and (iii) Ownership or contractual control by established firms of distributive outlets.

Circumstances discouraging entry by sustaining significant economies of large scale firm are: (i) Real economies; (ii) Strictly pecuniary economies; and (iii) Real or pecuniary economies of large scale advertising or other sales promotion.

Prof. Bain assumes, on the basis of empirical observation, that the condition of entry and its determinants are usually stable and are not generally susceptible to alteration by potential entrants into various industries. The condition of entry, thus, may be viewed as a long term structural determinant of firm behaviour.

There are three factors that are important in determining the effect of the condition of entry on the behaviour (with respect to price and output) of established firms. They are: (i) the value of the condition of entry, (ii) the degree of concentration among established sellers in the market and the corresponding existence or non-existence of a recognized interdependence or of express or tacit collusion

among them, and (iii) the source of departure from easy entry, particularly whether or not the departure involves the existence of significant scale economies.

As regards the value of the immediate condition of entry, a few more terms need to be defined.

(a) Ineffectively impeded entry: where pricing to forestall entry is less profitable than pricing to maximize short run profits and allowing entry.

(b) Effectively impeded entry: where charging a limit price (which lies below the short run profit-maximizing price) is more profitable in the long run than charging the short run profit-maximizing price.

(c) Blockaded Entry: where the limit price is irrelevant as it lies above the profit-maximizing price.

Prof. Bain suggests a six-fold classification of the general condition of entry, which, without loss of generality can be represented by the following five classes.

- (i) Constantly easy entry.
- (ii) Continual ineffectively impeded entry.
- (iii) Initial effectively impeded entry,
followed by either effectively impeded
or blockaded entry.
- (iv) Initial ineffectively impeded entry
followed by effectively impeded entry.
- (v) Continually blockaded entry.

The higher the concentration among established firms in an industry, the more likely is some sort of collective action by established firms to forestall entry. This does

not necessarily imply an open collusion; it only implies some sort of understanding among established firms for some collective action against potential entrants. There are a large number of reasons why an open collusion may not materialize in concentrated industries, for example, (i) fear of legal action, (ii) unwillingness on the part of firms to surrender their freedom to a higher authority, (iii) difficulty in finding agreeable terms, etc.

The analysis that follows is based on the assumption that high concentration among established firms would lead to some sort of collective action against potential entrants. One possibility is that there may be an agreement on price but not on the level of product differentiation and selling outlays. Another possible case is price leadership. It is also possible that there is no conscious collective action but each firm independently takes the necessary action to forestall entry.

Two things need to be noted about the significance of the economies of large scale firm. Firstly, the existence of significant scale economies (such that a firm of optimal scale will supply an appreciable fraction of industry output and smaller firms will have distinctly higher costs) leads to progressively higher entry barriers as progressive entry occurs. Secondly, the existence of significant scale economies will ordinarily tend to be associated with moderate to high concentration among established firms.

Before discussing the possible effects of the condition of entry on market performance, it would be useful to

go over the assumptions involved. They are: (i) collective action by established firms against potential entrants, (ii) firms are generally correct in their appraisals of what will attract and forestall entry, and (iii) diseconomies of large scale firm are generally negligible or absent. We restrict ourselves to only those cases where the concentration among established firms is high.

Table 1.1 summarizes the predictions on the basis of a priori theory. Columns 1 and 2 are what we consider as given and columns 3, 4, 5 and 6 show the predictions relating to prices, profits, stability of market structure and excess capacity respectively.

We now turn to the discussion of each of the three sources of barriers to entry mentioned earlier.

Economies of Scale as Barriers to Entry

Significant economies of scale to the plant or firm can be said to exist if (i) its output at minimum optimal scale is a significant fraction of the total capacity of the industry, and (ii) if unit costs are significantly higher at scales less than minimum optimum scale. If significant scale economies exist, then: (i) an addition of output of a minimum optimal plant to industry output by a new entrant would result in a significantly lower post-entry price, or (ii) if established sellers want to maintain the pre-entry price in the post-entry situation, they would have to contract their outputs.

Table 1.1 : A Summary of Prof. Bain's Predictions

Condition of Entry (1)	Concentration (2)	Price level (3)	Profit (4)	Stability of market structure (5)	Excess capacity (6)
1) Initially effectively impeded and thereafter the same or blockaded	High	Limit price will be charged	Appreciable long run profits will be earned	Stable	Nil if scale economies are negligible. If scale economies are present some excess capacity will be observed.
2) Initially ineffectively impeded progressing to effectively impeded entry as entry occurs	High	Initially profit maximizing price will be charged followed by the limit price	-do-	Initially unstable but stable after some entry	-do-
3) Continuously ineffectively impeded	High	Price would be equal to average cost but it would be greater than minimum average cost	No appreciable long run profits	Unstable	Chronic excess capacity, especially if scale economies are present.
4) Continuously Blockaded	High	Profit maximizing price will be charged	Appreciable long run profits will be earned	Stable	Nil if scale economies are negligible. If scale economies are present some excess capacity will be observed.

Significant scale economies would create a barrier to entry for prospective entrants because: (i) the entrants would anticipate higher than minimum attainable average costs, or (ii) of a lower price in the post-entry situation. It would thus be possible for established firms to charge a limit price (which is greater than minimum attainable average costs) and deter entry. This barrier to entry (and thus the limit price) would be greater as both (a) the minimum optimal scale becomes a greater proportion of total industry output, and (b) the average cost curve becomes steeper as scale is reduced below the minimum optimal scale.

The potential entrant who contemplates entry with a large scale would have to make predictions about the reactions of established firms. His decision whether to enter or not would be largely dependent on the expected behaviour of established firms in the post-entry situation. It was suggested earlier that going price policies of established firms would be read by potential entrants in order to decide whether or not the post-entry price would offer them any profits. If the limit price charged by established firms is to be successful in preventing entry, it must be successful in indicating to the potential entrant that there are no profits to be had if he enters.

In order to be able to determine the maximum entry-preventing price, alternative conjectures made by potential entrants (concerning established firms reactions to entry) have to be considered. Prof. Bain distinguishes the

following six possible categories of conjectures by potential entrants.

(i) The potential entrant may decide to enter at a very small scale and thus expect his entry to go unnoticed by established firms.

(ii) The potential entrant may predict that established firms would react to entry (at a scale large enough to affect the market) by maintaining pre-entry prices.

(iii) The potential entrant may predict that established firms would react to his entry (at a scale sufficient to affect the market) by maintaining pre-entry levels of output.

(iv) The potential entrant may predict that the established firms' reaction to entry (at a scale sufficient to affect the market) would lie between conjectures (ii) and (iii), i.e., established firms would be expected to reduce output by less than what is required for maintaining pre-entry price in the post-entry situation and thus allow the entrant to get a market share at a price below the pre-entry level but above the post-entry price anticipated in (iii).

(v) The potential entrant may predict retaliation by established firms i.e. established firms would be expected to increase output above pre-entry levels resulting in a greater lowering of prices than in (iii).

(vi) The potential entrant may expect the established firms to raise prices above the pre-entry level, allowing the entrant to secure a market share at the higher level of prices.

Prof. Bain is of the opinion that conjecture (iv) is the most likely and realistic one. To be able to understand the implications of conjecture (iv) we have to examine its limiting cases, viz, conjectures (ii) and (iii). For simplicity, the following two assumptions are made.

(a) The product is homogeneous.

(b) The industry under consideration is characterized by an L shaped long run average cost curve. This assumption is made after consideration of a host of studies on cost curves most of which show that cost curves in the American Manufacturing industry were L shaped.

Let us first consider conjecture (iii). Under it "established firms can restrict market output below that at which price will equal minimal costs by an amount equal to the output of an entrant firm of minimal optimal scale, provided that the entrant can enter only at that scale."⁴ The limit price that such a strategy implies would necessarily mean that price would fall below minimum attainable costs if entry occurs. The price-minimum cost difference that such an output restriction policy implies would be directly related to the minimum optimal size of plant and the pre-existing number of firms in the industry and inversely related to the output under pure competition and the price elasticity of demand. These conclusions follow from simple diagrammatic analysis which need not be gone into here.

Under conjecture (ii), there are three questions that have to be answered. What share of the market will an entrant gain at the going level of prices set and maintained by

established firms? As we have assumed a homogeneous product this implies that the entrant would obtain a market share proportionate to the number of firms in the industry. By how much will the total industry demand be reduced as established sellers try successively higher alternative prices? This obviously depends on the price elasticity of demand for industry output.

What would be the best entry-excluding price the established firms can charge? This would depend on the height of the entry barrier due to scale economies. There would be no barrier as long as the entrant's minimum average costs are equal to the established firms' minimum average cost and if the entrant is able to capture a market share at least equal to his minimum efficient scale output (at price equal to minimum average cost). If the entrant's market share at price equal to minimum average cost is smaller than his optimal scale output, established firms will be able to elevate price above minimum average cost without attracting entry. This limit price is directly related to (a) number of firms in the industry, (b) steepness of the long run average cost curve at sub-optimal scales, (c) price elasticity of industry demand curve, and inversely related to (d) share of the entrant relative to output at minimum efficient scale. These conclusions follow from simple diagrammatic analysis which is not necessary to reproduce here.

In the case of conjectures (ii) and (iii), the height

of the price-minimal cost gap which forestalls entry is directly related to the number of firms in the industry. The height of the entry-forestalling price-minimum cost gap is directly related to the elasticity of the industry demand curve under conjecture (ii) and inversely related to it under conjecture (iii). The other determinants of the height of the entry-forestalling price-minimum cost gap are different in the two cases. As such, only one statement can be made with confidence about conjecture (iv): this gap will be directly related to the pre-existing number of firms. What its relation will be to elasticity of industry demand curve is not immediately clear. Everything would depend on how close conjectures (ii) and (iii) are to conjecture (iv).

Product Differentiation Advantages of
Established Firms as Barriers to Entry

"Product Differentiation is propagated by differences in the design or physical quality of competing products by efforts of sellers to distinguish their products through packaging, branding, offering auxiliary services to buyers and by advertising and sales promotional efforts designed to win allegiance and custom from the potential buyer."⁵

The most important consequence of product differentiation is that the individual seller gains some control over his price which he would not have if the competing products were homogeneous. Product differentiation enables a firm to raise the price of its product above those of its rivals and still retain some (not all) of its customers.

There, thus, would not be a single price but a vector of prices in the industry. If buyer preferences for particular products are vulnerable to price differences, the firms may prefer to charge very similar prices and concentrate on non-price competition. In such cases, product preferences by buyers will be evidenced more in the disparity of market shares than in the disparity of prices.

Due to product differentiation by established firms, buyers may prefer established and known products to new and relatively unknown ones. Such a tendency on the part of buyers would place the potential entrant at a disadvantage vis-a-vis established firms in the industry. To overcome this disadvantage, the entrant may be forced to sell his product at a price lower than that of established firms and/or he may have to incur higher selling costs per unit in order to secure a reasonable market share. The duration of the product differentiation disadvantage (to the potential entrant) is also very important. If the duration is substantial, this would mean a rise in absolute capital requirements in the form of money which the entrant must invest even at a loss over the period of years during which he is trying to establish his product.

The established sellers, due to their advantage, will be able to elevate their long run price above minimum average costs by some amount without attracting entry. It should be recognized that the product differentiation barrier may not be simply additive to barriers resulting from scale

economies. Existence of either economies or diseconomies of large scale sales promotion in an industry may effect the entrant's decision as to the best scale for entry.

It is very possible that, in some cases, product differentiation may not pose a barrier at all. In fact it may facilitate entry. If an industry is plagued by sub-standard quality products, a new firm may be able to enter with a product of superior quality. It should be recognized that such cases would be exceptions. The general rule is that product differentiation would present a barrier to entry for new firms.

Absolute Cost Advantages of Established Firms as Barriers to Entry

An absolute cost advantage can be said to exist if the expected unit costs of the entrant firm are higher than those of established firms at all relevant levels of output. In other words, if the long run average cost curve of the potential entrant lies at a higher level than the long run average cost curve of the established firms for all relevant ranges of output, then the established firms can be said to have an absolute cost advantage. By virtue of this advantage established firms would be able to raise price above minimum cost in the long run without attracting entry.

Prof. Bain's path-breaking book Barriers to New Competition was published in 1956. During the same year (July 1956), Prof. Paulo Sylos Labini published a book titled Oligopoly and Technical Progress in which he presents a model on limit pricing which is in some respects similar to Prof. Bain's model.

According to Prof. Sylos Labini, the theory of the kinky demand curve, put forward almost simultaneously by R.L. Hall and C.J. Hitch, and P.M. Sweezy, is a welcome deviation from the chess-like problems set up and solved by earlier theorists. The problem with the kinky demand curve theory is that it does not say why the price is what it is. It only says that once the price is fixed (in whatever manner) it would tend to be stable and would change only if the cost conditions change uniformly for all the firms in the industry. In the kinky demand curve hypothesis the price and the structure of the industry are taken as given. Prof. Sylos Labini tries to explain how and why a particular price and industry structure comes about in the first place. He makes the following assumptions.

(i) The market demand curve is given and has unitary price elasticity.

(ii) The product of the industry is homogeneous and is sold at a unique price.

(iii) There exist technological discontinuities. The technology consists of three types of plant: a small plant with a capacity of 100 units of output, a medium sized plant with a capacity of 1000 units of output and a large plant with a capacity of 8000 units of output.

(iv) Each firm can expand by multiples of its initial plant size only.

(v) The cost curve for each plant is L shaped and there exist economies of scale i.e. unit cost decreases as the size of plant increases.

(vi) The price is set by a price leader who is the largest firm and also has the lowest cost of production.

(vii) The price leader charges the limit price and thus tries to forestall entry by new firms.

(viii) In the face of entry, existing firms maintain their pre-entry output levels.

(ix) The new firms are induced to enter the industry only if, in the long run, they anticipate a profit rate at least equal to a certain minimum (in the numerical example discussed subsequently, this profit rate is assumed to be 5 per cent).

(x) The structure of the industry is as given below.

Number and size of firms	Output per firm	Output of the group
20 small	100	2000
2 medium	1000	2000
1 large	8000	8000

Table 1.2 summarizes the conditions prevailing in the market.

Let the initial price be Rs. 20. The price corresponding to the minimum profit rate for a firm (P_m) is given by the formula $P_m = [(k/x) + (v)] [1 + r_m]$ where, k is the total fixed cost, x is output, v is the average direct cost, and r_m the minimum profit rate. For each of the three types of firms, P_m is (assuming r_m is 5 per cent):

Small firms	: $P_m = \text{Rs. } 19.4$
Medium firms	: $P_m = \text{Rs. } 18.9$
Large firms	: $P_m = \text{Rs. } 17.8$

Table 1.2 : Costs and Profits of Three Types of Firm

Output x	Fixed Cost (Rs.)		Average direct cost (Rs.) v	Price (Rs.) P	Total Revenue (Rs.) Px	Total Cost (Rs.) T = k + vx	Profit (Rs.)		
	Total k	Average k/x					Total G = Px - T	Per unit g	Profit Rate S = G/T
100	100	1	17.5	20	2,000	1,850	150	1.5	8.1
				19.5	1,950		100	1	5.4
				19.4	1,940		90	0.9	5.0
1000	2,000	2	16	20	20,000	18,000	2,000	2	11.1
				19.5	195,000		1,500	1.5	8.3
				19.4	194,000		1,400	1.4	7.8
				19.2	19,200		1,200	1.2	6.7
8000	24,000	3	14	20	160,000	136,000	24,000	3	17.6
				19.5	156,000		20,000	2.5	14.7
				19.4	155,200		19,200	2.4	14.1
				19.2	153,600		17,600	2.2	12.9
6385	24,000	3.76	14	18.8	120,040	113,400	6,640	1.04	5.8

The entry preventing price, P_L , with respect to firms in each group lies immediately below the respective P_m . In such a scenario the following conclusions hold.

(i) No new large firm can enter the industry. If it did, the price would fall to Rs. 12 and this is lower than the price corresponding to the minimum profit rate (Rs.17.8). In fact, this post-entry price would be even lower than the average direct costs of the large firm (Rs. 14).

(ii) No medium-sized firm can enter the industry. If it did, the price would fall to Rs.18.4, which is less than P_m for medium-sized firms (i.e. Rs.18.9).

(iii) Upto three small firms can enter the market. This would cause price to fall to Rs.19.5, which exceeds the price corresponding to the minimum profit rate for small firms (Rs. 19.4).

(iv) The initial price of Rs.20 is not an equilibrium price. After the entry of three small firms the price established would be Rs. 19.5. At this price, if a fourth small firm enters, the price would fall below Rs.19.4 and entry is thus precluded. We can, therefore, regard Rs. 19.5 as the equilibrium price.

(v) The price leader will surely not raise price above Rs. 20, as it is possible that by doing so he invites entry, maybe of even a medium or large firm.

(vi) It is not profitable for the large firm to eliminate the small firms. To do so, it would have to charge a price of Rs.17.4. The space thus vacated (by small

firms) corresponds to sales of 2000 units. If the large firm duplicates its plant (after pushing out the small firms), the output would rise to 18,000 units and the price would fall to Rs.13.3 which is less than the large firm's P_m and v .

(vii) For similar reasons, it is not profitable for the large firm to eliminate both medium and small firms.

The equilibrium price is thus Rs.19.5 and at this price the structure of industry is as given below.

Firms	Output (in units)
23 small	2300
2 medium	2000
1 large	8000

Obviously, this result depends on the initial structure of the industry and on the assumptions made. The factors affecting price determination are the following:
 (a) absolute size of the market, (b) elasticity of demand, (c) technology, (d) prices of variable factors and capital goods which, along with the technology determine the firm's average cost.

There are striking similarities between Prof. Bain's and Prof. Sylos Labini's analyses. Prof. Bain's conjectural variation number three (when we considered economies of large scale as barriers to entry) and Prof. Sylos Labini's assumption number eight (as listed earlier) are identical. The point to be noted is that Prof. Bain's analysis involves less restrictive assumptions than that of Prof. Sylos Lanini's.

Prof. Bain's analysis is richer, primarily due to the

fact that he has developed the concept of the condition of entry fully which is implicit in Prof. Sylos Labini's analysis. The latter analysis is confined to the homogeneous product case. Though Prof. Sylos Labini has some comments to offer on product differentiation he does not have much to say on how the analysis would be affected if product differentiation occurs. Moreover, Prof. Sylos Labini's analysis is based on a numerical example, permitting no generalizations.

Prof. Sylos Labini very neatly integrates two theories; they are: (i) the kinky demand curve theory, and (ii) the price leadership model. By using the Price Leadership model, Prof. Sylos Labini explains why a certain price comes about to be fixed. The price leader in this case has to fix a price such that entry will be discouraged. Once the price is thus fixed, the kinky demand curve would explain why price fixed by the leader is unlikely to change. If the price leader has reason to believe that his price rises are unlikely to be followed but his price cuts are likely to be followed, he has little interest in changing the price. The price changes we are talking about are not those which are caused by industry-wide uniform cost changes, but those which are followed in order to get higher profits. The fact that the product is assumed to be homogeneous strengthens the above argument. This integration is certainly a merit of Prof. Sylos Labini's analysis.

Prof. F. Modigliani (1958)⁶ attempts to explain Prof.

Sylos Labini's model in the framework of conventional price theory by making the following assumptions.

(i) The technology is the same for all firms in the industry.

(ii) The long run average cost curve is L shaped. Thus, there is a minimum optimal plant size (\bar{x}) at which the economies of scale are fully reaped and after which the average cost curve becomes a straight line.

(iii) Entry occurs with the minimum optimum scale plant.

(iv) The product is homogeneous and the market demand curve for it is known.

(v) The price is set by the largest firm in the industry at such a level that prevents entry of new firms.

(vi) The firms behave according to what Prof. Modigliani calls the Sylos Postulate, which implies: (a) the existing firms expect the entrant to enter with at least a plant of minimum optimal scale (\bar{x}) and that he (i.e. the entrant) will not enter if he expects the post-entry price to fall below the flat segment of the long run average cost curve, and (b) the entrant expects that the established firms will keep output at the pre-entry level if confronted with actual entry.

Let $X = D(P)$ be the market demand curve for the product and P' be the pre-entry price. The output level corresponding to P' is $X' = D(P')$. "Under Sylos' postulate the prospective entrant is confronted not by an infinitely

elastic demand at price P' but by a sloping demand curve which is simply the segment of the demand curve to the right of P' .⁷ The entry-preventing price will have to be such that the demand curve to the right of it is everywhere below the long run average cost curve. Let P_0 be the highest entry preventing price, and the corresponding output be $X_0 = D(P_0)$. If the output corresponding to the minimum optimal scale (\bar{x}) is a non-negligible fraction of the industry output, then the extent to which P_0 will exceed the minimum cost will depend on the nature of the demand and long run average cost function.

Let P_c be the perfectly competitive equilibrium price and $X_c = D(P_c)$ the corresponding output. Let us define the size of the market, S , as the ratio of competitive output to the minimum efficient scale output ($S = X_c/\bar{x}$). If the entrant is expected to enter with at least the minimum optimal scale, then the entry-preventing output of established firms, X_0 , is:

$$\begin{aligned} X_0 &= X_c - \bar{x} = X_c \left[1 - \frac{\bar{x}}{X_c} \right], \\ X_0 &= X_c \left[1 - \frac{1}{S} \right]. \end{aligned} \quad \dots (1)$$

The price corresponding to X_0 is $P_0 = D(X_0)$.

What is the relationship between the competitive equilibrium price, P_c , and the entry preventing price, P_0 ? The formula for the price elasticity of demand is:

$$e = dX/X \div dP/P.$$

This can be expressed approximately in finite differences as follows:

$$e = \Delta X / X \div \Delta P / P.$$

Under the Sylos postulate, all increments in demand (due to a fall in price) will accrue to the entrant so that:

$$\Delta X = X_c - X_L / X_c = \bar{x}.$$

The change in price is: $P = P_L - P_c$. Thus at the neighbourhood of P_L the elasticity is:

$$e = \frac{\bar{x}}{X_c} \div \frac{P_L - P_c}{P_L}.$$

Solving for P_L , we get

$$P_L = P_c \left[1 + \frac{\bar{x}}{X_c \cdot e} \right]. \quad \dots (2)$$

From equation 2, the following conclusions can be drawn.

(a) The entry-preventing price varies directly with the minimum optimal scale, \bar{x} , and the competitive price, P_c .

(b) The entry-preventing price is inversely related with the price elasticity of demand and the perfectly competitive output.

Let us now turn to the empirical work that has been done in this field in the period under consideration.

In an earlier study, Prof. Bain (1951)⁸ arrives at the following conclusions. (i) There is no linear relationship between profit rates and industry concentration. (ii) There is a significant difference in the average profit rates of those industries with an eight-firm concentration ratio of above seventy per cent and those industries with an eight-firm concentration ratio below seventy per cent. Those industries with higher concentration (i.e. above 70

per cent) had significantly higher average profits compared to those industries with low concentration (i.e. below 70 per cent).

Prof. Bain undertook a comprehensive empirical investigation in his book Barriers to New Competition. He considered a sample of 20 manufacturing industries in the U.S.A. The period considered was 1947-52. Prof. Bain used data from Census of Manufacturers and data collected on his own through questionnaires. The empirical investigation was done in a very detailed and rigorous manner. We shall summarize his major findings and not go into the methodological aspects of his empirical investigation.

Prof. Bain found that scale economies as barriers to entry were very important in two industries (i.e. automobiles and typewriters). They were moderately important in five industries and unimportant in ten industries. The rest of the industries could not be classified due to insufficient data.

Product differentiation as barriers to entry was very important in six industries, viz, tractors and large farm machinery, typewriters, cigarettes, liquor, fountain pens (high priced) and automobiles. They were moderately important in seven industries and unimportant in the rest.

Absolute cost advantages of established firms (arising from large initial capital requirements) as barriers to entry were significant in five industries (steel, automobiles, petroleum refining, tractors and cigarettes). They were

moderately important in eleven industries and unimportant~~ly~~ in the rest.

Considering all the three barriers together, very high entry barriers were found in six industries (automobiles, cigarettes, fountain pens, liquor, tractors, and typewriters). Six industries had moderate entry barriers and in the rest barriers were negligible.

It was also found that high entry barriers were more frequently attributable to product differentiation than to scale economies in production and distribution. The sources of product differentiation as barriers to entry, which were found to be important, were as given below.

(i) Durability and complexity of the product which lead to poor ability on the part of the consumers to appraise the quality of the product.

(ii) Integration of retail dealer service organizations by manufacturers.

(iii) Importance of "conspicuous" consumption motives on the part of consumers.

(iv) Large advertising outlays.

Prof. Bain's findings regarding the relation of profit rate to industry concentration during the period 1947-51 were similar to those during 1936-40 which have been summarized earlier (see p. 33).

His investigation into the relation of profit rate to the condition of entry yielded the following results.

(i) There was a significant difference in the

average profit rate of industries with very high entry barriers when compared with industries having moderate to low entry barriers. The former had significantly higher profits than the latter.

(ii) There was no significant difference in the average profit rates of industries with substantial entry barriers when compared with those having moderate to low entry barriers. This finding is compatible with the earlier analysis of Prof. Bain if we recognize that when entry barriers are moderate or low, entry is likely to be ineffectively impeded. "This would lead at least periodically to profit rates in this latter category (i.e. industries with moderate to low entry barriers) roughly as high as those resulting from the entry-forestalling limit prices anticipated in industries with substantial entry barriers, although profits in the 'moderate to low' barriers category would then be expected to be associated with structural instability and recurrent excess capacity."⁹

H. Michael Mann (1966)¹⁰ in a study for a ten year period 1950-1960, obtains results similar to Prof. Bain's. He observes: "... the monopoly problem appears to exist most noticeably in those industries which are highly concentrated and have high barriers to entry. If public policy seeks to improve resource allocation, industries with these structural characteristics seem to be a good place to start."¹¹

John T. Wenders (1967)¹² tries to show how strong Prof. Bain's empirical results are. Wenders argues that,

given the estimates of entry barriers and elasticities of demand, monopoly pricing is impossible even where effective collusions are in existence (i.e. the case of blockaded entry can never occur).

Let us now turn to some criticisms made against the Limit Price Hypothesis. R.B. Heflebower (1957)¹³ argues that established firm entry (i.e. a firm already established in another industry) and new firm entry merit separate analysis, as the barrier to entry would be definitely lower in the former case. This criticism was elaborated by Howard H. Hines (1957)¹⁴ who argues that barriers to entry would be lower for already established firms because of the reasons given below.

(i) Already established firms are likely to have more information about opportunities for profitable entry than new firms.

(ii) Already established firms are likely to have easier access to productive resources.

(iii) Already established firms are more likely to be able to face rivalry from existing sellers after entry than a new firm entrant. What is implied is that the condition of entry is likely to have a lower value when potential entry from already established firms is taken into account, though its empirical implications are not immediately clear. This is so primarily because the theory of entry barriers has not been re-oriented formally in this direction. The later commentators on the subject seem to have disregarded

this line of argument almost completely. The reasons may be twofold.

(i) The distinction between a new firm entrant and an already established firm entrant (as emphasized by Hines) is considered to be less important because entry barriers arising out of scale economies and product differentiation may be identical for both types of entrants.

(ii) The body of theory that has been developed without explicitly or implicitly recognizing this difference between potential entrants, has derived certain empirically testable hypotheses that have received widespread support.

Dale K. Osborne (1964)¹⁵ was of the opinion that the theory of limit pricing is not important from the standpoint of price but of concentration. It, thus, is not a theory of price but a proposition in welfare economics. This conclusion was arrived at because Osborne analysed the problem with Chamberlinian tools and got results which showed that limit price theory implied only higher concentration. Michael Mann, Paul Hass and John Walgreen (1965)¹⁶ argued that Osborne had completely misunderstood the Limit Price Hypothesis which Osborne (1965)¹⁷ accepted. He says: "Of the several errors in the article, for example, a confusing diagram, an invalid reference to Chamberlin's tangency solution, a sloppy statement of Sylos' Postulate, the worst resides in my statement that the limit theory is not a price theory."¹⁸

Let us now outline the main hypotheses that emerge from the foregoing discussion.

(i) With ineffectively impeded entry there is a high probability that price policies would lead to structural instability and chronic or quasi-chronic excess capacity, provided that for some reason or another seller concentration becomes fairly high and competition among established sellers can become significantly restricted.

(ii) To the extent that seller concentration is sufficient to bring about some sort of collective action by established sellers to forestall entry, the gap between price and long run minimum average cost will tend to be greatest where blockaded entry is encountered and less where effectively impeded entry is observed. The degree of seller concentration would also influence the price-minimum average cost margin. Some complex relationship of at least three variables - profit rates, degree of seller concentration, and condition of entry - is of such a character that some net positive association between barriers to entry and profit rate is expected.

(iii) Product differentiation is a very important source of entry barriers.

(iv) Public policy should attempt at removing high barriers to entry, wherever feasible. Scale economies should not (and probably cannot) be removed because of adverse effects on efficiency of such removal. Removing the product differentiation barrier is likely to be an impossible task. Any policy aimed at shortening the entry lags would be desirable.

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CHAPTER 2

ON PRICE COMPETITION

In this chapter, we concentrate on the limit price hypothesis. Keeping in mind Prof. Bain's exposition, we look into the more recent and analytically more rigorous treatments of the hypothesis.

The analysis of Prof. Bain, Prof. Sylos Labini and Prof. Modigliani leaves the following question unanswered: When should and when should not the monopoly price be reduced to the limit price to block entry? B. Peter Pashigan (1968)¹ attempted to provide an answer. He considered a case where initially the industry is occupied by a monopolist (or collusive oligopolists) and the minimum efficient scale represents a non-negligible share of the industry output.

If the potential entrant's decision to enter or not is based on expected profits in the post-entry situation, then, what prevents the monopolist from initially charging the monopoly price and blocking entry by threatening to lower price if entry is attempted? Pashigan provides three reasons why this policy is unlikely. Firstly, to achieve the output flexibility needed to enforce such a strategy, the monopolist would have to sacrifice some plant efficiency or carry higher inventories which would imply higher costs. Secondly, in the face of such a policy pursued by the monopolist, the entrant may be able to gain a cost advantage by choosing an appro-

priate plant size. Thirdly, if costs are a function of the rate of output and also the rate of change of output, then, the monopolist will incur even higher costs if he attempts to block entry by expanding output.

Pashigan defines the limit price as that price which causes the entrant to suffer a larger present value of losses than the monopolist would suffer if entry did occur.

Pashigan assumes that the industry under consideration is characterized by a L-shaped cost curve. Once demand and cost conditions are specified, monopoly profits (π_m) and limit profits (π_L) of the industry can be determined. Let $S(t)$ denote the market share of the monopolist at time 't' with $S(0) = 1$. Let 'r' be the discount rate.

If the monopolist initially charges the monopoly price, which is higher than the limit price, then entrants are attracted into the industry causing both the market share and the profits of the monopolist to decline. As entry continues, at some point in time it would become profitable for the monopolist to lower price to the limit price and block entry. At the limit price, the initial monopolist obtains a certain share of the limit profits of the industry. As demand and cost conditions are assumed to be stationary, the market share of the initial monopolist remains constant thereafter.

To determine an optimal price policy for the monopolist, the determinants of the market share of the monopolist need to be specified. Pashigan assumes that the rate

of entry is a function of the elapsed time during which the price has been above the limit price.

In Fig. 2.1, the undiscounted income stream of the initial monopolist is drawn, assuming that monopoly price is lowered to the limit price at time $t = T$. [Income stream is ABCP in Fig. 2.1.] If price is lowered to the limit price at $t = V = T + dT$, then, the income stream becomes ABEGH, because the monopoly price is maintained for an interval dT , during which both the market share and the monopoly profits continue to decline till $t = V$. Thus, the monopolist's share of limit profits will be lower if the limit price is charged at $t = T + dT$.

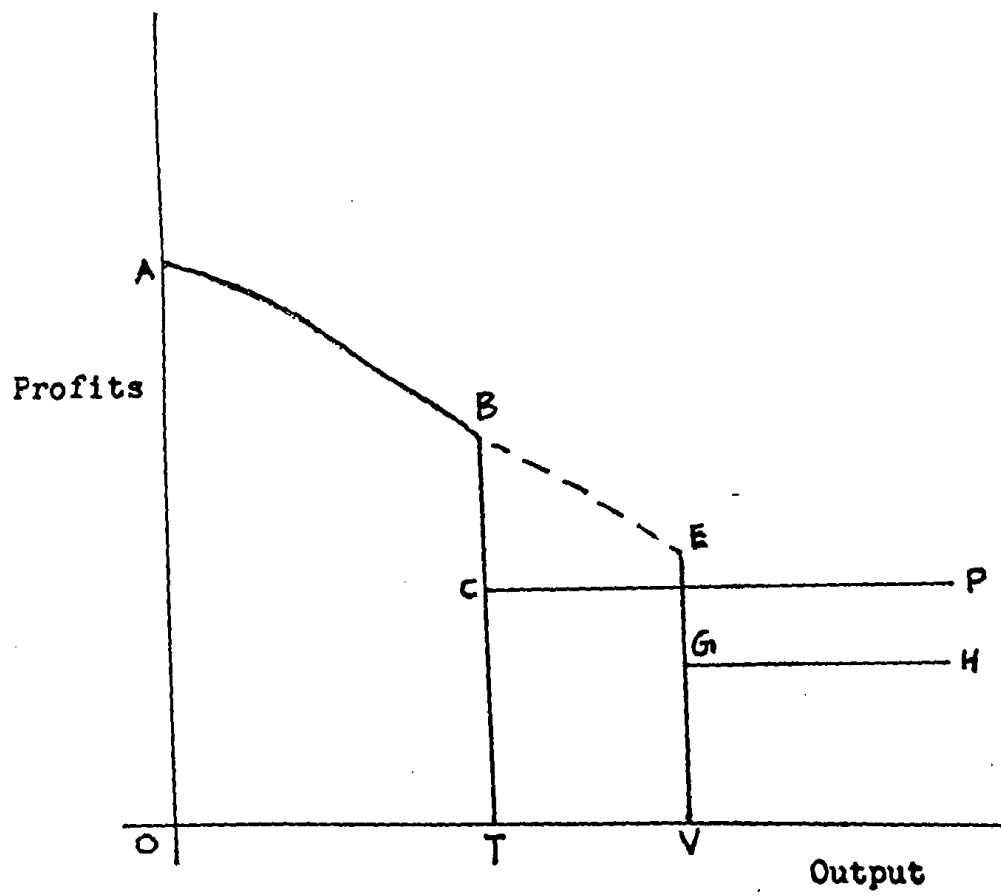
To find the optimal price policy for the monopolist, Pashigan proceeds to specify the present value of the monopolist's income stream as

$$PV(T) = \int_{t=0}^T \pi_m S(t) e^{-rt} dt + \int_{t=T}^{\infty} \pi_L S(T) e^{-rt} dt. \quad \dots (1)$$

When $0 < t < T$ the monopoly price is charged and the market share of the monopolist declines. The first integral on the RHS of (1) represents the discounted value of the monopolist's profits when $0 < t < T$. The second integral represents the discounted value of the monopolist's share of limit profits when $t > T$ i.e. when the limit price is charged. Differentiating equation 1 with respect to T and re-arranging terms we get the following first order condition for the maximum [of $PV(T)$].

$$\pi_m [S(T)] = \pi_L S(T) - \pi_L \frac{dS}{dT} \frac{1}{r}. \quad \dots (2)$$

Figure 2.1 : The Undiscounted Income Stream
of the Initial Monopolist



The second order condition is :

$$\frac{d^2(PV)}{dT^2} = [(\pi_m - \pi_L) \frac{dS(T)}{dT} + \pi_L \frac{d^2S}{dT^2} - \frac{1}{r}] e^{-rt} < 0. \quad \dots (3)$$

We can use Fig. 2.1 to interpret equation (2). If the monopoly price is charged over the interval dT , the monopolist's share of monopoly profits is $\pi_m S(T)$ [area BEVT]. In so doing the monopolist sacrifices (a) his interim share of limit profits $\pi_L S(T)$ [area CFVT] and (b) the present value of the income stream lost due to the decline in market share during dT [i.e. $\frac{dS}{dT} \cdot \frac{1}{r}$, shown by the area FPHG]. Thus, when LHS of equation 2 is greater than RHS, the monopolist would not lower price to the limit price. It follows, that the optimal time at which to lower the price to the limit price is when the condition given by equation 2 is satisfied.

It is possible that the optimal value for T is $T = 0$, in which case the limit price is immediately charged. Pashigan opines that this is unlikely because: (a) initially, the market share will decline slowly as the potential entrants would take time to judge the profitability in the industry and thus be hesitant to enter, and (b) it will take time to develop substitutes and demand may be sufficiently inelastic in the initial period so that profits at the monopoly price will be much higher than profits at the limit price. Pashigan expects that the limit price will be charged after some entry has occurred.

The model suggests that the limit price will be charged at one time or another in every concentrated industry

where the assumed type of cost conditions exist.

Associated with the earlier outlined optimal price policy is the terminal market share of the temporary monopolist. For a given market demand, Pashigan argues, the terminal market share of the temporary monopolist will be larger, the larger the minimum efficient scale plant. This is so, as the terminal market share depends on the ratio π_m/π_L , which will be smaller the larger is the minimum efficient scale plant.

If T is defined as the optimal time at which to lower price to the limit price, then a change in r (discount rate) causes T to change in the following way:

$$\frac{dT}{dr} = - \frac{\left[\frac{d\pi_m}{dr} \cdot S(T) - \frac{d\pi_L}{dr} \cdot S(T) + \frac{dS}{dT} \cdot \frac{d\pi_L}{dr} - \frac{dS}{dT} \cdot \frac{1}{r^2} \right]}{\left[(\pi_m - \pi_L) \frac{dS}{dT} + \frac{\pi_L}{r} \cdot \frac{d^2S}{dT^2} \right]}$$

The sign of dT/dr cannot be predicted from a priori considerations alone as, an increase in the discount rate lowers both monopoly profits and limit profits but not necessarily in the same proportion. Thus, nothing can be said about how changes in r will affect T .

The exact manner in which the market share of the temporary monopolist declines gets reflected in the "decay rates".* The variables which affect the decay rate are not

* Decay rate is defined as the rate at which the market share of the temporary monopolist shrinks as entry occurs.

easily identified. Some variables like price and advertising outlays, which are under the firm's control do certainly affect the decay rate. But apart from this, it is an area in which not much is known.

Pashigan concludes that "to be useful, the limit price hypothesis must become a systematic analysis of the terminal market share of the leading firm(s). Thus modified it explains why and when entry occurs given profit maximising."²

Pashigan fails to appreciate the significance and usefulness of the concept of the condition of entry. Bain has listed six possible ways in which the condition of entry may move over time. Pashigan concentrates on only one of the six alternatives. He considers the situation where initially entry is ineffectively impeded and, as entry occurs over time entry becomes effectively impeded. The only prediction that follows from Pashigan's analysis is that ultimately the market structure would be stable. Pashigan is silent on what would happen to profits (they depend on the nature of the market share function) and utilization of capacity in the industry. For such a movement of the condition of entry, Prof. Bain predicts that firms in the industry would earn appreciable long run profits, initial instability in the market structure would disappear as entry occurs and, if scale economies are present, some excess capacity can be expected.

We are therefore afraid that Pashigan is unable to improve upon Prof. Bain's model, though he has obtained

certain useful results with respect to a particular case of the general conditions of entry.

Prof. Andrews had suggested (as discussed by Bhagwati, J., 1970, see reference 3, p. 302) that some premium in the form of a profit margin in excess of normal profits can be secured by established firms if entry is not easy. According to him, entry may be difficult due to the fact that demand that accrues to the entrant may be smaller than the minimum efficient scale plant of the entrant. Further, Andrews assumes that the established firms and entrants expect (a) the established firms to follow the entrant firm's price cuts, and (b) customers of existing firms will not switch over to the entrant unless the entrant offers a cheaper product. In such a scenario, the market share that the entrant would be able to secure would be some fraction of the marginal increment in the industry's demand when the post-entry price falls below the pre-entry level. If the entrant's demand curve lies below the range of outputs at which minimum average cost is reached, entry would be unprofitable. The existing firms will then be able to raise price above minimum cost and prevent entry.

Prof. Bhagwati (1970)³ develops Andrews' arguments further. He derives the relationship between the limit price (P_L) under the Andrews strategy and the price under perfect competition (P_C).

Let \bar{x} denote the output at which minimum average costs are reached, X_C denote the industry demand at price P_C , N denote

the number of firms, ρ denote the price elasticity of demand at price P_c and E denote the elasticity of demand with respect to change in price of current buyers' transfer of custom to the entrant. Under the assumption that the increment in industry demand is equally shared by established firms and the entrant, E will be zero. If it is assumed that the entrant is able to steal some customers from established firms, E will be non-zero.

Bhatwati derives the following relationship between P_L and P_c :

$$P_L = P_c \left[1 + \frac{\bar{x}}{X_c \left(\frac{\rho}{N+1} + E \right)} \right].$$

It follows that the premium obtainable by established firms while deterring entry will vary directly with (i) the minimum efficient size of plant (\bar{x}), and (ii) number of established firms (N) and, inversely with (i) output under perfect competition, (ii) price elasticity of industry demand, and (iii) the extent to which existing buyers will transfer custom to the entrant in the post-entry situation.

In the present framework, it is possible to incorporate the effects of growing demand into the analysis. Suppose, the market demand increases by an amount λ and, out of this, k per cent accrues to the entrant. The limit price in this situation is:

$$P_L = P_c \left[1 + \frac{\bar{x} - k\lambda}{X_c \left(\frac{\rho}{N+1} + E \right)} \right].$$

It is obvious that in a situation where demand is growing, the limit price would be lower than in a situation

where demand is stationary (i.e. $\lambda = 0$). Also, the higher the increase in demand the lower will be P_L .

The above formula leads to a rather surprising result. Suppose $\bar{x} < k\lambda$. In this case, the limit price lies below P_c , so entry prevention becomes impossible for existing firms. Viewed from the angle of existing firms, their market share, when demand increases by λ , is likely to decline if $\bar{x} < k\lambda$. In such a situation, the most that existing firms can do is to try to appropriate as much of the growing demand to themselves as possible. Entry prevention thus becomes unimportant and formal analysis of the non-price factors which determine the market share of the existing firms in a growing market becomes important. The non-price aspects of entry deterrence are discussed in Chapter III.

How would the analysis of the limit price change if two or more potential entrants contemplate entry into a concentrated industry? This question is gone into in detail by R. Sherman and T.D. Willet (1967).⁴

If there are two or more potential entrants, the problem becomes slightly complicated because the outcome of such potential entrant's action depends on what the other potential entrants do. Thus, the profits of each potential entrant in the post-entry situation depend on (i) the reaction of existing firms to entry and (ii) whether or not other potential entrants also enter.

The following simplifying assumptions are made.

(i) There are two potential entrants A and B who have access to the same cost function as existing firms.

(ii) The market situation is such that one firm may profitably enter while two cannot and this is recognized by the potential entrants and established firms.

(iii) We consider a homogeneous oligopoly with effectively impeded entry.

(iv) The existing firms behave according to the Sylos postulate.

(v) Utility is a linear function of profits.

(vi) Collusion among potential entrants is ruled out.

Suppose the profit rate in the post-entry situation is denoted by $f(P - P_1, n)$, where P is the pre-entry price, P_1 is the limit price that would forestall entry by a single potential entrant and 'n' is the number of potential entrants who actually enter. If $P > P_1$ then $f(P - P_1, 1) > 0$ i.e. if a single potential entrant actually enters, he would make positive excess profits in the post-entry situation. Let P_2 be a price high enough for two potential entrants to enter and break even. Then for $P < P_2$, we have $f(P - P_2, 2) < 0$. The payoff matrix can be represented as follows.

		B's strategy choice	
		Enter	Do not Enter
A's strategy choice	Enter	$f(P - P_1, 2),$ $f(P - P_1, 2)$	$f(P - P_1, 1), 0$
	Do not Enter	$0, f(P - P_1, 1)$	$0, 0$

The pay off matrix shows no dominance with respect to either firm's choice. If the potential entrants disregard each other's presence and follow a maximax strategy, and if $f(P - P_1, 1) > 0$ then both of them would enter. Under the maximax strategy of potential entrants, they can be prevented from entering by the same limit price, P_1 , that will keep out one potential entrant. Thus, in this case, the number of potential entrants will not affect the entry forestalling price that can be charged by existing firms.

If the potential entrants adopt the maximin decision rule, then, the limit price would be affected. Under this rule, each of the potential entrants would seek a best response to the other potential entrant's most harmful action. In such a situation, none of the two potential entrants would enter as each of them would prefer a zero profit to a loss. Thus the established firms would be able to deter entry at a higher price than was possible with a single potential entrant. The entry-forestalling price would lie just below P_2 . If the number of maximin type potential entrants was more than two, then they would all refuse to enter unless the pre-entry price was so high that all could enter and earn profits in the post-entry situation. Thus, the entry-forestalling price would be a monotonically increasing function of the number of potential entrants.

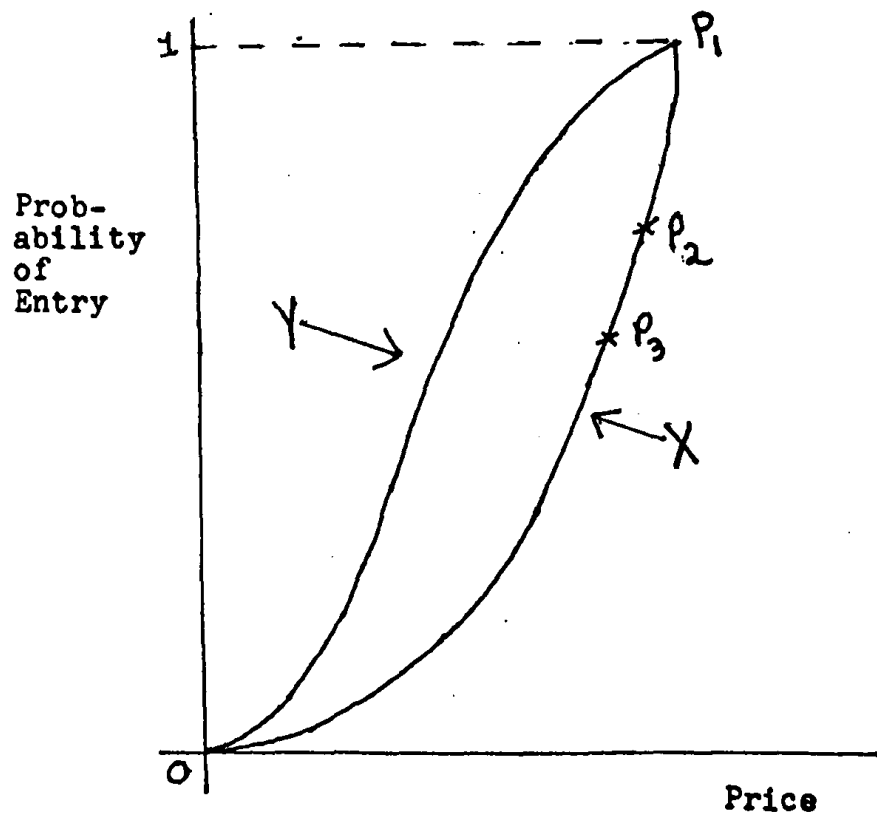
The same result can be obtained with a decision rule less extreme than either maximax or maximin, namely an expected utility maximizing strategy, based on subjective probabilities.

Victor Goldberg and Sharon Moirav (1973)⁵ argue that an increase in the number of potential entrants causes the probability of at least one firm entering to increase and thus causing the limit price to fall. They argue that this result can be obtained by replacing the either/or assumption (i.e. the assumption that firms either maximize short run profit or charge the price that will forestall entry) with a subjective probability estimate made by the established firms of the likelihood of entry at given prices. Consider Fig. 2.2.

Suppose the probabilities of entry at prices P_1 , P_2 and P_3 are 1, 0.7 and 0.2 respectively (plotted on curve X). These, of course, are subjective probabilities. Another set of subjective probabilities is shown by curve Y. At any price, the probability of entry along curve Y is at least as large as in X (in fact it is distinctly larger except at prices 0 and P_1). Thus, the entry barriers implied by curve Y are lower than those implied by curve X. Goldberg and Moirav contend that increasing the number of potential entrants will cause the limit price-probability curve to shift from X to Y. When subjective probabilities are used, there is no single limit price. There are a set of prices that will prevent entry with different probabilities. A lowering of the limit price can be depicted as an upward shift of the curve X.

Assume that there are two potential entrants, A and B. Let $P(A/B) = R$ and $P(A/\sim B) = E$ be the respective probabilities that firm A will enter, given that firm B will and will

Figure 2.2 : Probability of Entry and the Limit Price



not enter. E will also be equal to the probability of entry, given that a single potential entrant exists. Assume complete symmetry in these relationships such that $P(A/B) = P(B/A)$; $P(A/\sim B) = P(B/\sim A)$, $P(A) = P(B)$, etc.

By definition: $P(A) = P(A/\sim B) \cdot P(\sim B) + P(A/B) \cdot P(B)$.
 $= E[1 - P(A)] + R P(A)$.

$$P(A) = \frac{E}{1 + E - R}.$$

$P(A)$ shows the probability of entry by a single firm. So long as $R < E$, $P(A)$ will be less than $P(A/\sim B) = E$.

The probability that at least one firm enters, $P(A \cup B)$, is the probability of entry with which the existing firms would be concerned. It can be easily shown that

$$P(A \cup B) = \frac{E(2 - R)}{1 - R + E}.$$

If increasing the number of potential entrants is to decrease the limit price, then

$$E < E\left(\frac{2 - R}{1 - R + E}\right), \text{ or}$$

$$E - E\left(\frac{2 - R}{1 - R + E}\right) < 0.$$

For $E = 1$ and $E = 0$, the expression equals zero. If $0 < E < 1$, then, the inequality holds. Thus, an increase in the number of potential entrants from one to two causes the probability of at least one firm entering to rise except when $E = 0$ (i.e. no potential entrants exist) and $E = 1$ (entry by a single potential entrant is certain).

We thus have two models with diametrically opposite results. The conclusion that, if the number of potential

entrants change, the limit price will change is obvious. But, there is very little we can say about the direction of change of the limit price.

Morton I. Kamien and Nancy L. Schwartz (1971)⁶ consider a market in which the existing firm is aware that its price policy will affect the probability of entry. The authors assume that (i) the conditional probability of entry is a non-decreasing function of product price and an increasing function of market growth, and (ii) the objective of firms is maximization of the present value of expected future returns over the indefinite future. Then, limit pricing aimed at precluding entry appears to be optimal in very special cases. The existing firm will optimally set its price somewhere below the monopoly price (unless entry is blockaded). In other words, existing firms would set price somewhere between the monopoly price and the limit price when demand for the product is growing. This optimal pre-entry price tends to fall as the discount rate drops, the market growth rate rises or certain non-price barriers to entry decline.

David P. Baron (1973)⁷ investigates into the effects of potential entry on price and profitability. He represents potential entry in a probabilistic framework with the probability of entry being dependent on price charged by established firms and on the number of firms already in the industry.

Baron shows that, in such a framework, the limit price would lie between the monopoly price and the perfectly competitive price. As an entry forestalling strategy has something

to do with the uncertain nature of profits, the question of how risk preferences affect the limit price becomes important. Baron demonstrates that the higher the risk aversion (of existing firms) the lower the limit price will be, given that a lower limit price implies a lower probability of entry. The barriers to entry (their height and nature) will be reflected in the assessed probability of entry. Higher barriers to entry cause the expected utility (of existing firms) to increase and the hazard rate (of entry) to fall; thus, the optimal limit price would rise.

Raymond R. De Bondt (1976)⁸ explores the implications, for the existing firm's price policy, of an entry lag between a potential entrant's decision to enter and his appearance as an entrant. The conclusions that he comes to are identical to those of Prof. Bain.

De Bondt's analysis (like Prof. Bain's) suggests that, due to entry lags, existing firms may be able to charge the monopoly price as the threat of entry is not immediate. The short run profits of established firms depend on the length of the lag. Such behaviour on the part of established firms is shown to be consistent with maximizing discounted future profits.

Avinash Dixit (1979)⁹ considers a case of potential duopoly with one established firm and one potential entrant. He makes the Sylos postulate central to his analysis thus making the problem simple as it can be discussed in terms of a quantity-setting duopoly. In this context, firm 1 is

assumed to be the established firm and firm 2 the potential entrant.

The quantities produced are x_1 , x_2 and prices charged P_1 , P_2 of firm 1 and firm 2 respectively. There is a competitive numeraire sector whose output is x_0 . The demands are assumed to arise from the utility function:

$$u = U(x_1, x_2) + x_0 \quad \dots (1)$$

Since this utility function has a zero income effect on the duopoly industry, we can consider it in isolation. The inverse demand functions are the partial derivatives of the utility function. They are:

$$P_i = u_i(x_1, x_2), \quad \text{for } i = 1, 2. \quad \dots (2)$$

The profits of the firms are:

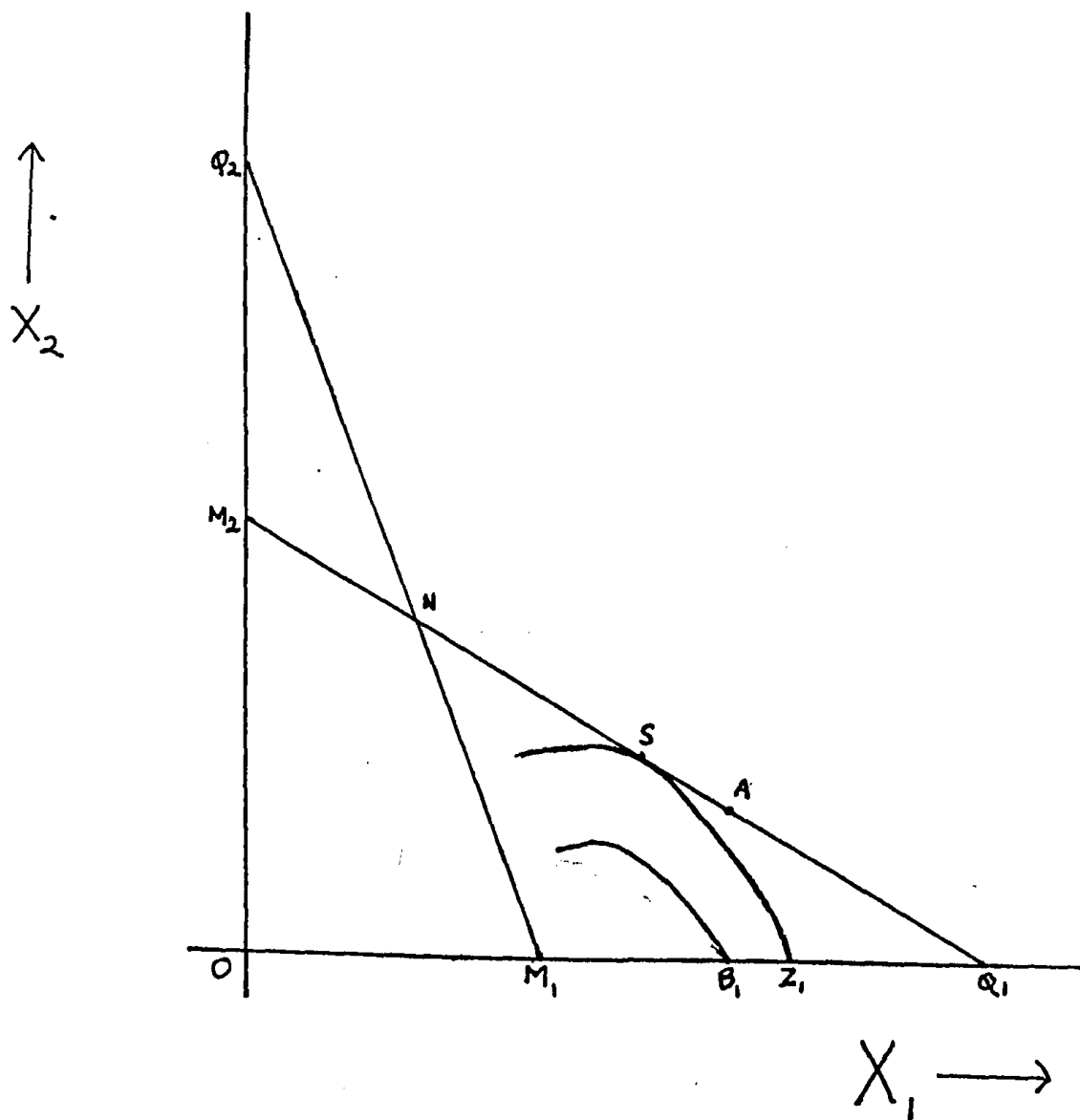
$$\pi_i(x_1, x_2) = x_i U_i(x_1, x_2) - C_i(x_i), \quad i = 1, 2 \quad \dots (3)$$

where, $C_i(x_i)$ for $i = 1, 2$ are the total cost functions.

To be able to posit the problem in terms of reaction functions (in x_1, x_2 space), Dixit makes the assumptions that would yield downward sloping reaction functions with a stable equilibrium. Consider Fig. 2.3.

Firm 2's reaction function is M_2Q_1 and firm 1's reaction function is M_1Q_2 . Suppose there exist scale economies in the form of fixed costs. The isoprofit curves (used to derive the reaction functions) are unaffected in shape, but each one corresponds to a lower level of profit compared to the situation where no fixed cost exist. Due to the presence of fixed costs, the profits of firm 2 (π_2) becomes zero at some point before Q_1 , say A_1 . Let B_1 which lies vertically

Figure 2.3 : Reaction Functions of the Established Firm and Potential Entrant



below A_1 be the point on the X_1 axis. If the established firm maintains an output level greater than or equal to A_1 in the pre-entry situation, then the optimum response for firm 2 is to stay out. Thus, due to presence of fixed costs the reaction function of firm 2 is now made up of two segments M_2A_1 and B_1Q_1 . The exact point of discontinuity on firm 2's reaction curve would depend on the level of firm 2's fixed costs. A similar discontinuity will exist even on the reaction curve of firm 1.

In the pre-entry situation, firm 1 has first move advantages. It can behave like a Stackelberg leader in the pre-entry situation. Whether firm 1 can use this first move advantage and successfully deter entry would depend on the position of the discontinuity on firm 2's reaction curve.

In Fig. 2.3, ZZ_1 is firm 1's isoprofit curve which is tangent to firm 2's reaction curve at point S. Z_1 is the point where the isoprofit curve ZZ_1 meets the X_1 axis. If firm 2's fixed costs are small enough so that the point of discontinuity (B_1) lies to the right of Z_1 , then the best choice for firm 1 remains at S and it becomes optimal for firm 1 to allow entry. If the point of discontinuity (B_1), due to large fixed costs, lies to the left of M_1 , then, firm 1 can ignore firm 2 and behave like a monopolist who is not faced by the threat of potential entry. The case where the point of discontinuity lies between M_1 and Z_1 (as shown in Fig. 2.3) is more interesting. In this situation, firm 1 would be able to prevent entry by setting its output just

above the B_1 level in the pre-entry situation. If it sets its output at B_1 , then firm 2 would be indifferent between entering and not entering. If we take B_1 to be the limit output, then, there is a corresponding limit price $P_1 = U_1(B_1, 0)$. In this case, firm 1 finds it profitable to prevent entry but does not enjoy unrestrained monopoly power.

Following Prof. Bain's terminology, the above-mentioned cases can be classified as under.

- (i) $B_1 < M_1$: Entry is blockaded. Firm 1 has pure monopoly at $x_1 = M_1$.
- (ii) $M_1 < B_1 < Z_1$: Entry is effectively impeded by limit pricing and $x_1 = B_1$.
- (iii) $Z_1 < B_1$: Entry is ineffectively impeded, yielding the conventional Stackelberg solution.

This particular classification of the immediate condition of entry was formulated and emphasized by Prof. Bain without laying down the conditions under which each would occur. Dixit formulates the conditions under which entry would be blockaded, effectively impeded and ineffectively impeded.

R. Schmalensee (1981)¹⁰ shows that entry deterrence involves charging the exact limit price in the pre-entry situation. In other words, entry can be deterred, if established firms choose to produce the limit output in the pre-entry situation and threaten to behave according to the Sylos Postulate if entry is attempted. The question that is

crucial is whether this threat is credible. Schmalensee argues that, if significant economies of scale exist, the threat becomes credible, as any output reduction would imply higher costs to the established firm. Thus, the entrant would see that an output reduction is non-optimal from the existing firms point of view. If the established firm in the pre-entry period has already chosen the limit output, then, an addition of output corresponding to minimum efficient scale plant by the entrant would drive the industry price below the competitive level in the post-entry period unless the established firm reduces its output. As reduction of output would be non-optimal for the established firm, such a reaction would not be expected by the entrant. So, if scale economies are present, the optimal entry deterrence strategy for established firms would be to produce the limit output (and install appropriate capacity) and charge the limit price and threaten to maintain this output level if entry is attempted.

Schmalensee is of the opinion that unnecessary importance has been given to scale economies in theoretical treatments of entry deterrence, as they have been found to have little empirical significance.

What role does information play in the models that analyse entry prevention by established firms? J. Friedman is of the opinion (as discussed by Milgrom, P. and Roberts, J., 1982, p. 444) that if both the established and the potential entrant are completely informed about the demand and cost

conditions and post-entry profits when the entry decision (by the potential entrant) is made, then, the logic of equilibrium requires that the entry decision be independent of the pre-entry price. This implies that any attempt by established firms to prevent entry by limit pricing will be futile and the established firm would unnecessarily squander pre-entry profits if it attempts to prevent entry.

Paul Milgrom and John Roberts (March 1982)¹¹ model the problem of entry-deterrence as a game under incomplete information. In this game, Prof. Bain's argument that the potential entrant may regard the pre-entry price as an indicator of post-entry profitability is found to be valid.

The Excess Capacity Hypothesis

Let us now turn to the so-called "excess capacity hypothesis". According to this hypothesis, established firms would hold excess capacity in the pre-entry situation while charging monopoly price, threatening to expand output if entry occurs. Prof. Bain's limit price hypothesis predicts the emergence of excess capacity in certain cases (see Chapter 1). Here capacity is not used as a strategic weapon by established firms, but excess capacity emerges as an outcome due to entry. The use of excess capacity as a strategic weapon is ruled out both by Bain and Pashigan.

John T. Wenders (November 1971)¹² argues that excess capacity might be profitably used by established sellers to invalidate Sylos Postulate by threatening to increase output if an entrant appeared. Wenders is of the opinion that

maintaining excess capacity, though involving higher costs, would not be unprofitable. Excess capacity would be used only upto that point where the incremental future benefits are matched by incremental future costs.

Wenders may have a valid point but he fails to develop it in a convincing manner. Eaton B. Curtis and Richard G. Lipsey (1976)¹³ consider a spatial market in which demand is growing and demonstrate that, if growth of demand is foreseen, it will always pay existing firms to pre-empt the market by establishing new plants before the time when it would be profitable for new firms to enter. They argue that in such markets, monopolies and oligopolies will persist and due to the early building of new capacity, excess capacity would result. Curtis and Lipsey also show that if the existing firms do not pre-empt or are prevented from pre-empting the market, competition among potential entrants will lead to the establishment of capacity at virtually the same time when it would have been established by the existing firms. Thus, capacity will be installed well before it is needed in such markets, because more profits can be extracted from the market by locating plants at joint profit-maximizing locations and charging joint profit maximizing prices.

In the spaceless models, incentive to pre-empt the market arises only from the first move advantages enjoyed by established firms. In the spatial model considered by Curtis and Lipsey, the established firms have an added incentive to pre-empt the market since they can increase the

total profit that can be extracted from the market by choosing joint profit maximizing locations as well as prices. In this model price has no role in entry-deterrence. An aggressive investment policy is what deters entry. Earlier B.L. Johns (1962)¹⁴ had argued on similar lines, though he had no comments to make on excess capacity.

A. Michael Spence (1977)¹⁵ argues that entry is deterred in an industry when existing firms install enough capacity in the pre-entry situation to make new entry unprofitable. The existing firms choose capacity in a strategic way designed to discourage entry. Holding excess capacity in the pre-entry period permits existing firms to threaten to expand output if entry is attempted. Given that capacity is selected so as to forestall entry, existing firms choose pre-entry price and quantity so as to maximize profits.

Capacity is measured in output units, say k . Let the annual cost of capacity be r (interest on debt, or opportunity cost if funds are raised internally). Variable costs are $c(x, k)$ and $C_{xk} = 0$ (i.e. capacity has no effect on marginal costs). The inverse industry demand function is $P(x)$ and quantity is denoted by x . The total revenue is $R(x) = xP(x)$. Profits denoted by $\pi(x, k)$ are:

$$\pi(x, k) = R(x) - C(x) - rk$$

Average total costs are denoted by $a(x, k)$

$$= \left[\frac{C(x)}{x} + \frac{rk}{x} \right].$$

When $x = k$, the firm can be said to be efficient (i.e. costs are minimized). In such a situation, $a(x, x) = \frac{C(x)}{x} + r$.

Suppose the established firms in an industry choose a pre-entry capacity of k . If entry occurs, they can expand output to k and thus lower price to $P(k)$. It is assumed that the existing firms can hold output at $x = k$ in the post-entry period. In such a case, the demand left over for entrant (residual demand) can be arrived at as follows. Suppose the entrant supplies an amount y , the total industry output would be $k + y$. The price in the post-entry situation would be $P(k + y)$, and this can be regarded as a function of y , which would in effect be the inverse demand function the entrant would face. If for all ' y ', the profits the entrant would earn in the post-entry situation are non-positive, then entry would be deterred, i.e.

$$P(k + y) < a(y, y) = \frac{C(y)}{y} + r. \quad \dots (1)$$

Obviously, as k increases, $P(k + y)$ falls for each y . If k is large enough, the residual demand would be reduced to zero. We can thus determine a minimum level of capacity, say \bar{k} , for which equation 1 holds. If the existing firms in the industry maintain a capacity of \bar{k} in the pre-entry period, entry is deterred.

The existing firms in the industry maximize profits with respect to x and k , subject to two constraints:

$$x \leq k \quad \dots (i)$$

which implies that quantity produced cannot exceed installed capacity, and

$$k \geq \bar{k} \quad \dots (ii)$$

which implies that entry is deterred by holding excess capacity.

The Kuhn-Tucker conditions for the problem are (with multipliers λ and μ):

$$R'(x) - C'(x) = \lambda$$

$$r = \lambda + \mu$$

$$\lambda(k - x) = 0, \quad \mu(k - \bar{k}) = 0$$

$$\lambda, \mu \geq 0$$

Case 1 : $\mu = 0$, $\lambda = r$ and $R' = c' + r$

This occurs when the unconstrained profit maximizing automatically implies installation of entry-detering capacity in the pre-entry period.

Case 2 : $\lambda = 0$ and $\mu = r$

- In this case, established firms install capacity at $k = \bar{k}$ and then maximize profits by setting $x < \bar{k}$, and price above $P(\bar{k})$. The constraint $x < k$ is not binding, thus, for the purpose of entry deterrence; capacity is maintained at a higher level than what is required for efficiency in production.

Case 3 : $\lambda \neq 0$, $\mu \neq 0$

In this case, both constraints are binding and capacity is set at \bar{k} to deter entry and output is set equal to \bar{k} to maximize profits.

The excess capacity hypothesis implies that the price set by existing firms may exceed the limit price, and the quantity may be lower than the limit quantity. In some cases, the profit maximizing price, when the industry has sufficient capacity to deter entry, may be the limit price, but it also may not be.

"Entry barriers 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. The latter include more or less irreversible investments in a variety of kinds of capital. In a homogeneous product industry, a natural candidate is capacity, though this does not preclude other factors like a distribution system."¹⁶ The investments used to deter entry must be irreversible so as to be able to make credible threats to potential entrants. Capacity, according to Spence, is an irreversible investment and thus is a credible threat for potential entrants. This is in line with T. Schellings (1960) conclusion that a threat can be made credible only by entering into a binding commitment.

A. Dixit (March 1980)¹⁷ gives a more lucid analysis of the excess capacity hypothesis. The most important aspect of this hypothesis is whether the threat made by established firms by holding excess capacity is considered credible by potential entrants.

Established firms always have certain first move advantages over potential entrants, in the sense that they can take some decisions in the pre-entry situation which would affect the equilibrium of the post-entry situation. The rules of the post-entry game have to be taken as given. For example, a decision to invest in capacity allows the established firms to alter their post-entry marginal cost curves and, thereby, the post-entry equilibrium under any specified post-entry rule.

Dixit assumes away all lags. As in his earlier analysis, there is one established firm (firm 1) and one potential entrant (firm 2). Each firm is assumed to have a variable cost of output and a constant unit cost of capacity expansion, and a set-up cost. Assume firm 1 has capacity k_1 and is producing output x_1 ($x_1 \leq k_1$); its total cost of production per period will be

$$C_1 = f_1 + w_1 x_1 + p_1 k_1 \quad \dots (4)$$

where f_1 is the fixed set-up cost, p_1 is the constant per unit cost of capacity and w_1 the unchanging average variable cost for output. The total revenue per period is denoted as $R^1(x_1, x_2)$.

In the pre-entry period, the established firm chooses a capacity level \bar{K}_1 . If required, this may be further increased in the post-entry period but it cannot be reduced. If the other firm (i.e. firm 2) enters, the two will achieve a duopoly Cournot-Nash equilibrium involving quantity setting by each firm. If there is no entry, firm 1 would obviously continue to be a monopolist.

Suppose that, in the pre-entry period, firm 1 has installed capacity \bar{K}_1 and is producing output x_1 such that $x_1 \leq \bar{K}_1$. Firm 1's total costs are $C_1 = f_1 + p_1 \bar{K}_1 + w_1 x_1$. If it wants to expand output beyond \bar{K}_1 , additional capacity will have to be installed. Thus, if $x_1 > \bar{K}_1$, firm 1's total costs will be $C_1 = f_1 + (w_1 + r_1) x_1$. The marginal cost of firm 1 is w_1 as long as its output does not exceed \bar{K}_1 , and $(w_1 + r_1)$ for output greater than \bar{K}_1 . There is thus a

discontinuity in the marginal cost function of firm 1. Obviously, the choice of \bar{K}_1 affects the position where the discontinuity will occur. This discontinuity in the marginal cost curve will overflow to the firm 1's reaction curve. As firm 2 has no prior capacity commitment, its total cost will be $C_2 = f_2 + (w_2 + r_2) x_2$ and a marginal cost will be $(w_2 + r_2)$. If entry occurs, the resulting duopoly solution depends on \bar{K}_1 and so do the post-entry profits. If firm 2 expects positive profits in the post-entry period, it will enter. Firm 1 will choose that \bar{K}_1 that will maximize his profits, keeping in mind the possibility of firm 2's entry. The important question is whether firm 1's profit maximizing strategy involves entry prevention by installing excess capacity in the pre-entry period.

In Figs. 2.4 and 2.5, MM' is the reaction curve for firm 1 when capacity expansion costs matter and NN' is the reaction curve for firm 1 when there exists spare capacity. Thus MM' is relevant for outputs above \bar{K}_1 and NN' for outputs below \bar{K}_1 . For a given \bar{K}_1 the reaction function is kinked as shown in Fig. 2.4. Suppose M has co-ordinates $(M_1, 0)$ and N has co-ordinates $(N_1, 0)$. M_1 and N_1 are the profit maximizing quantities for firm 1 given that output of firm 2 is zero. When capacity expansion costs matter, M_1 is the profit maximizing quantity and when they do not it is N_1 . Firm 2's reaction curve is RR' (as shown in Fig. 2.5). It intersects MM' at T and NN' at V. Suppose the co-ordinates of T are (T_1, T_2) and of V are (V_1, V_2) . Both T and V represent

Figure 2.4 : The Discontinuity in the Established Firm's Reaction Function

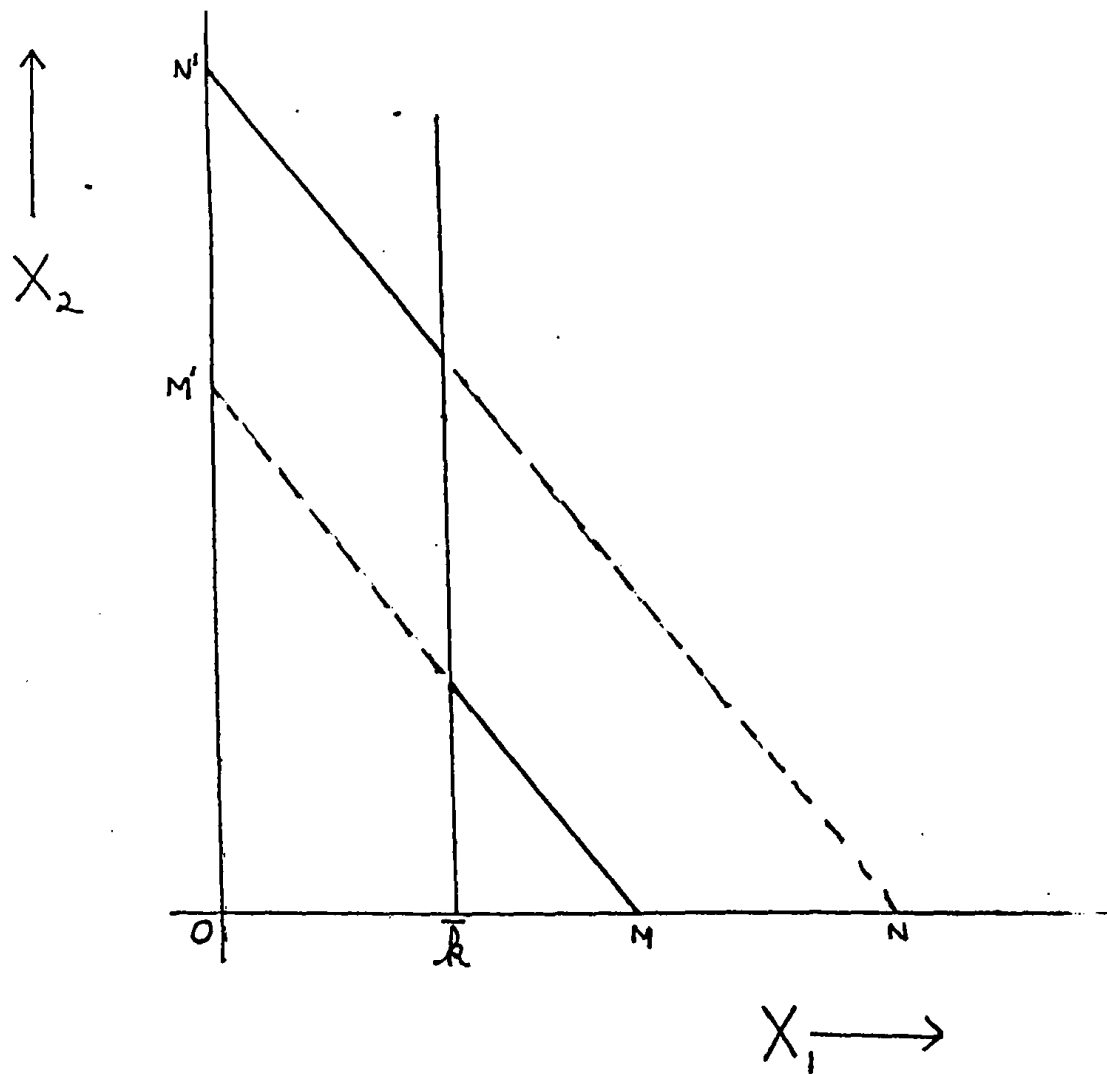
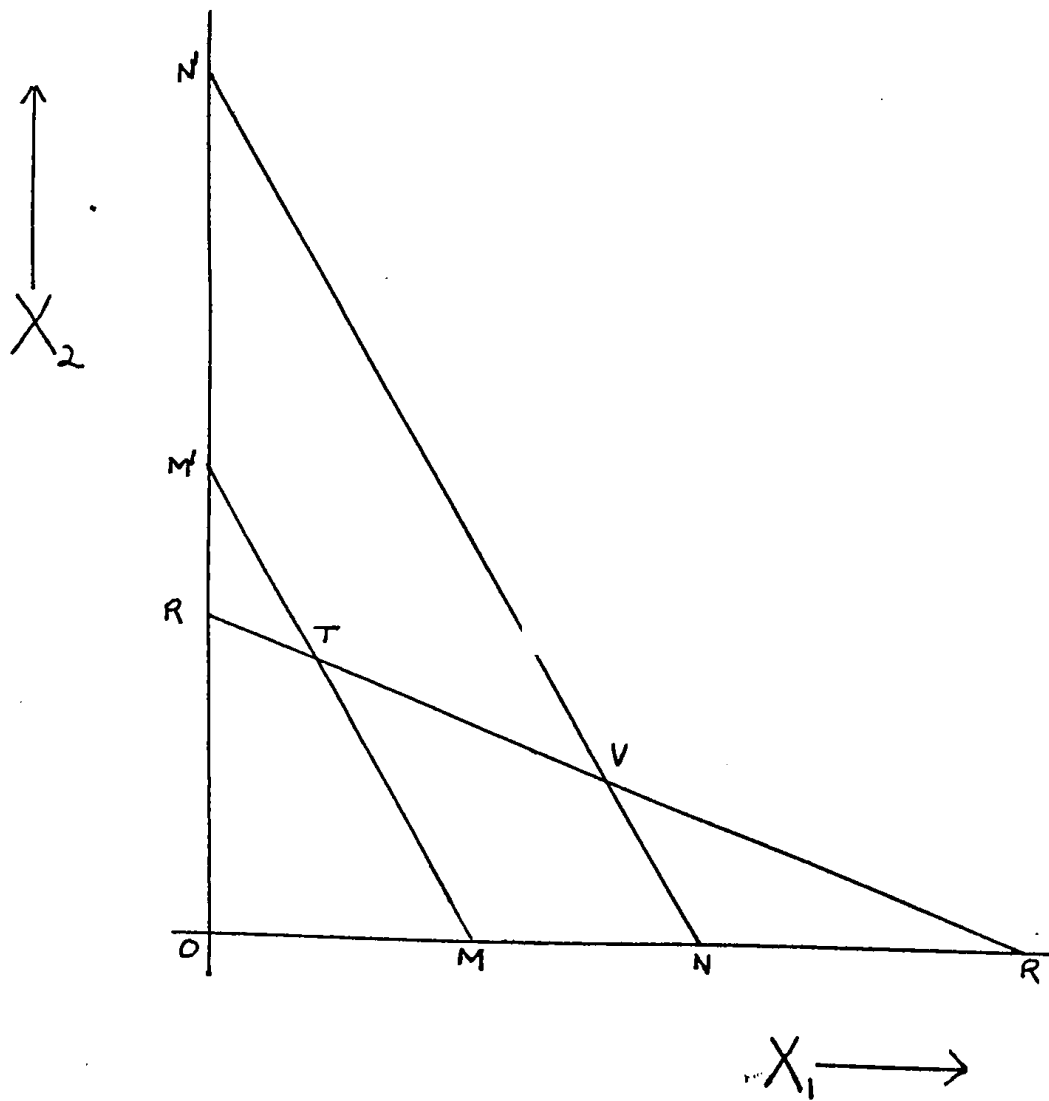


Figure 2.5 : Reaction Functions of the Established Firm and Potential Entrant



Cournot-Nash equilibria under alternative extreme circumstances. If $K_1 \leq T_1$, the post-entry equilibrium will occur at T and if $K_1 \geq V_1$ it will occur at V . If $T_1 \leq K_1 \leq V_1$ then the equilibrium will occur somewhere on the segment TV . In these cases firm 1 would produce output $x_1 = k_1$, and the entrant (firm 2) will produce the same output as a Stackelberg follower faced with x_1 .

If firm 2 is confident that it will be able to sustain a Cournot-Nash equilibrium in the post-entry game, capacity levels above V_1 are not credible threats. Knowing this, firm 1 is unlikely to install capacity above V_1 . The point to be noted is that whatever capacity level that the established firm chooses in the pre-entry situation will always be utilized fully. In other words, the Spence strategy will not be optimal under the assumed post-entry game (i.e. Cournot-Nash equilibrium).

Daniel F. Spulber (1981)¹⁸ is also of the opinion that the excess capacity hypothesis is inconsistent with post-entry Nash-Cournot type of equilibrium. He shows that holding excess capacity to deter entry can be successful only when the established firm is a Stackelberg leader in the post-entry game and the cost of capacity is low relative to net discounted marginal returns at entry-detering output.

Michael Waldman (April 1987)¹⁹ argues that if (i) the existing firms cannot collude on an investment in entry deterrence, (ii) the entry-detering investment serves no other role than the entry deterring one, and (iii) uncertainty

is introduced into the model, then investment in entry deterrence has the properties of a public good in the sense that there would arise a free rider problem and each firm would have an incentive to under-invest. Thus, holding excess capacity to deter entry is unlikely to be actually observed.

Let us now turn to a brief review of a few empirical studies.

Robert T. Masson and Joseph Shaanan (1982)²⁰ try to empirically test the limit price hypothesis. The time period they consider is 1950-1956. The study is made with reference to the manufacturing industries in the U.S. They come to the conclusions given below.

(a) Entry responds to pre-entry profit rates.

(b) The level of entry-forestalling profits rise with the level of entry barriers.

(c) The implications of traditional limit pricing to forestall entry may be rejected.

(d) They find support to the predictions of Kamien and Schwartz (1971) with respect to price (i.e. the price actually charged by established firms will lie somewhere between the monopoly price and the limit price).

John C. Hilke (September 1984)²¹ tries to investigate the role of excess capacity in deterring entry. His results indicate that excess capacity is likely to be related to entry in the predicted way, but, this claim falls short of the usual standard statistical confidence limits.

Marvin B. Lieberman (June 1987)²² in a recent paper examines the role of excess capacity as an entry deterrent in 38 chemical product industries in the U.S. over a period of twenty years. His results suggest that the strategic use of excess capacity to deter entry is not very common. The results do not indicate that excess capacity will never be used to deter entry but that its use is rare and unlikely to be successful.

The following are the major conclusions drawn from the discussion in this chapter.

1) When the demand for the product (in homogeneous product industries) is expected to increase, entry barriers and thus the limit price is lowered.

2) The limit price will be reached at one time or another in every industry with high concentration and a L shaped cost curve. This is so primarily because, if an entry-prevention strategy is not adopted by the initial monopolist, his market share and profits would decline over time.

3) When the demand for the product is growing, non-price competition becomes important.

4) If the number of potential entrants change, the limit price would change, but there is very little we can say about the direction of the change of the limit price.

5) When the demand for the product is growing, the sellers will optimally set their price somewhere below the monopoly price and above the limit price. This price is inversely related to the rate of growth of demand.

6) Excess capacity can be used by established firms to deter entry only under the following conditions: (i) if the market can be viewed as a spatial market, in which demand is growing and this growth is foreseen by established firms, (ii) in a static framework, this strategy becomes optimal if in the post-entry game the established firm is assumed to behave like a Stackelberg leader. If the post-entry game is assumed to be characterized by a Cournot-Nash equilibrium, the threat of excess capacity ceases to be credible.

7) It is possible to put forth conditions under which entry would be blockaded, effectively impeded, and ineffectively impeded.

8) If there is imperfect information, the potential entrant will regard the pre-entry price as an indicator of post-entry profitability.

9) Empirical evidence gives support to conclusion 5 (listed above) but the excess capacity hypothesis does not have satisfactory empirical support.

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CHAPTER 3

ON NON-PRICE COMPETITION

In the previous chapter the question of how price (and output) could be manipulated by established firms in order to prevent entry was discussed. Price is by no means the only variable that the established firms have under their control, and which they can use to prevent entry. Product differentiation and selling expenses are two other variables which can be used by established firms to prevent entry. This had been recognized by Prof. Bain and, in fact, he found that the product differentiation barrier was the most important in the American economy. A large number of other empirical studies have confirmed this finding. In this chapter we summarize the literature on non-price aspects of entry deterrence in an oligopolistic market.

The non-price aspects of entry deterrence become important not only because of their empirical importance, but also because their role has been emphasized by theorists who concentrate on the price (output) aspects of entry deterrence (e.g. Bhagwati).

At this point, it is appropriate to examine the meaning of product differentiation and selling expenses and the relationship between the two. According to Prof. E.H. Chamberlin: "A general class of products is differentiated if any significant basis exists for distinguishing the goods (and services)

of one seller from those of another. Such a basis may be real or fancied, so long as it is of any importance whatever to buyers, and leads to a preference of one variety of the product over another. Where such differentiation exists, even though it may be slight, buyers will be paired with sellers, not by chance and at random (as under pure competition) but according to their preferences."¹ About selling expenditures Prof. Chamberlin says, "... the seller may influence his sales by making expenditures, of which advertising may be taken as typical, which are directed specifically to that purpose. Such expenditures increase both the demand for his product, and his costs; ... gains from this source are possible because of (a) imperfect knowledge on the part of buyers as to the means whereby wants may be most effectively satisfied, and (b) the possibility of altering wants by advertising or selling appeal."²

Furthermore, "advertising increases the demand for the product, that is, it enables the seller at whatever price he decides upon, to dispose of more than he could without it."³

It is difficult to rationalize selling expenses if the buyers view the products of an industry to be homogeneous (i.e. buyers are indifferent between the products sold by different sellers in an industry). Once the buyers view the products produced by different firms in an industry to be differentiated (for whatever reason), selling expenses can be rationalized. Thus, the very existence of selling expenses would confirm that products of an industry are

differentiated. In fact, it would not be grossly wrong to say that, the higher the selling expenditures incurred, the more differentiated the products are within an industry. The assumption underlying the above statement is that the selling expenditures are successful in achieving their objectives (of spreading information and altering wants). If there is reason to believe that this assumption does not hold, then, the relationship that has been suggested between product differentiation and selling expenditures does not hold. Nevertheless, in all that follows we retain the assumption.

Selling Expenses as a Barrier to Entry

A rigorous analysis of selling expenses as a barrier to entry in an oligopolistic market is first provided by O.E. Williamson (1963).⁴ The models discussed earlier (except Prof. Bain's) involved a single decision variable (price or output). The introduction of selling expenses as another decision variable, slightly complicates matters. We can no more talk of a single limit price. There now would exist a certain functional relation between the limit price and selling expenses.

Let us consider, in brief, Williamson's exposition of selling expenses as barriers to entry. The rationale for selling expenses (if successful) is that they provide existing firms with strong and stable preference patterns. In order to alter these preference patterns, an entrant might have to incur very large selling expenses. It is these large selling expenses that an entrant may have to incur which would act

as an entry deterrent. Williamson considers selling expenses to be synonymous with product differentiation. We have had occasion to point out earlier that this may not be necessarily true.

Decisions made by existing firms, regarding the level of selling expenses and the price, are now joint decisions made with a view to maximize profits subject to the condition that entry is prevented. Figure 3.1 gives a diagrammatic representation of the relation that is assumed to exist between the level of selling expenses and the limit price.

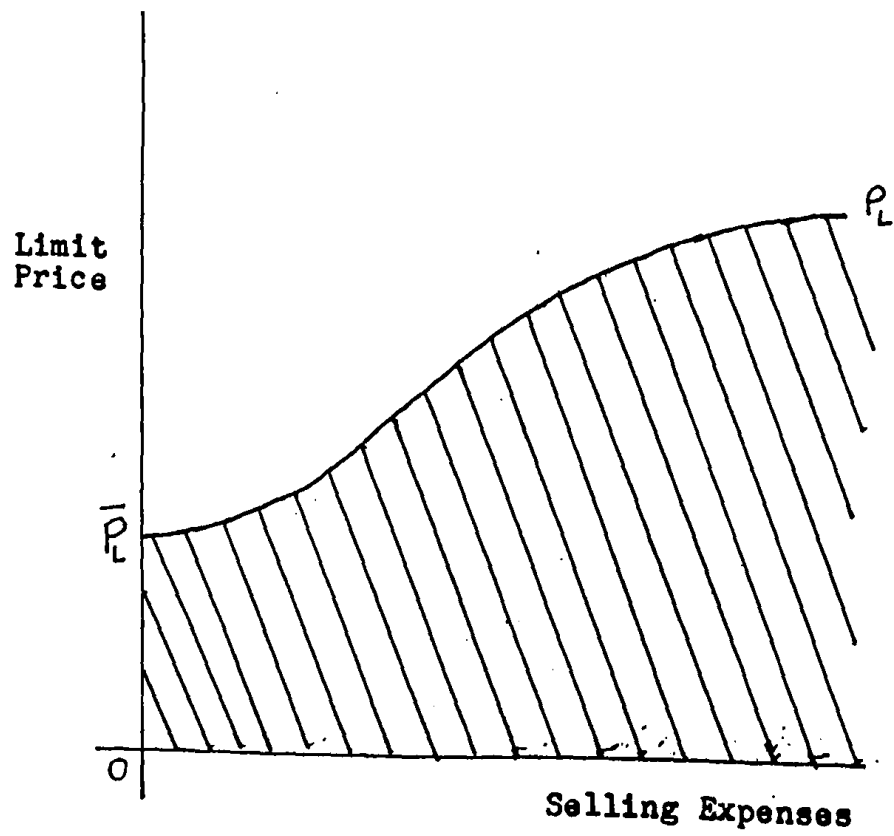
P_L is the limit price when no selling expenses are incurred by established firms. The particular shape of the curve comes about due to the following assumptions made by Williamson.

(i) Small selling expenses do not affect the limit price significantly as they can be easily matched by potential entrants.

(ii) As selling expenses incurred by existing firms rise, they impose an additional burden on the entrant.

(iii) Very large selling expenses incurred by existing firms (i.e. selling expenses which exceed the levels at which all the essential customer services, etc., can be provided) will not appreciably increase the limit price further. In order to prevent entry, the existing firms must choose a limit price-selling expense combination, somewhere in the shaded region of Fig. 3.1. The exact position of the curve would depend on the nature of the product and whether

Figure 3.1 : The Limit Price-Selling Expenses Locus



barriers to entry are high, substantial, or low.

It is assumed that existing firms are profit maximizers who also want to prevent entry and that there exists a price leader or a loose collusion which intends to establish a joint profit maximizing position. So, the existing firms want to maximize $R - C - S$, subject to $P \leq P_L$

where R = total revenue = $P \cdot X$

P = price = $P(X, S)$ with $\frac{\partial P}{\partial X} < 0$ and $\frac{\partial P}{\partial S} > 0$

X = output

C = production costs = $C(X)$

S = selling expenses

P_L P_L = locus of safe prices for each level of selling expense = $P_L(S)$, and $\frac{\partial P_L}{\partial S} \geq 0$.

The constraint can be converted into an equality by introducing a slack variable, say Y^2 i.e. $P + Y^2 = P_L(S)$.

Using the Lagrangian Multiplier method we get,

$$\phi(X, S, \lambda, Y) = R - C - S - \lambda[P + Y^2 - P_L(S)].$$

The first order conditions are:

$$(1) \quad \frac{\partial \phi}{\partial X} = \frac{\partial R}{\partial X} - \frac{\partial C}{\partial X} - \lambda \frac{\partial P}{\partial X} = 0,$$

$$(2) \quad \frac{\partial \phi}{\partial \lambda} = P + Y^2 - P_L(S) = 0,$$

$$(3) \quad \frac{\partial \phi}{\partial S} = \frac{\partial R}{\partial S} - 1 - \lambda \left(\frac{\partial P}{\partial S} - \frac{\partial P_L}{\partial S} \right) = 0,$$

$$(4) \quad \frac{\partial \phi}{\partial Y} = -2Y\lambda = 0.$$

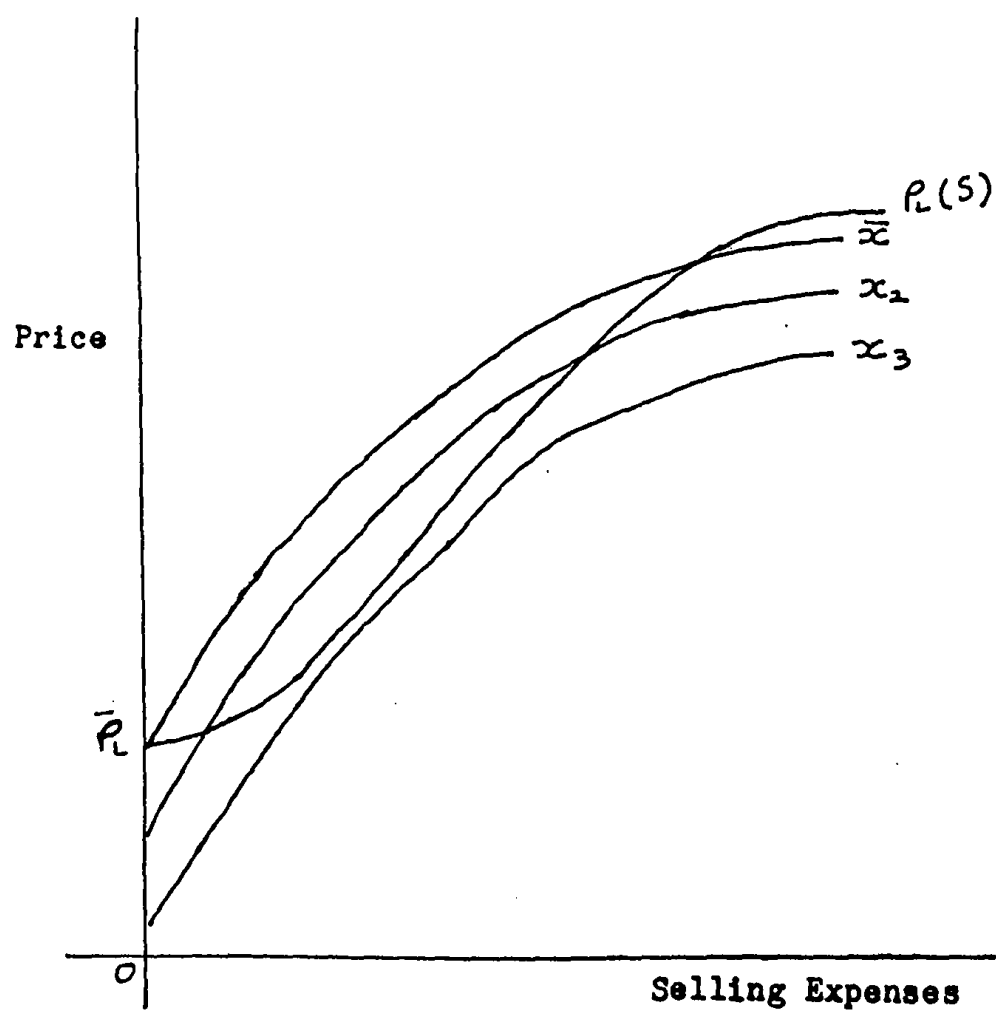
From (4) it is obvious that either $Y = 0$, or $\lambda = 0$, or $Y = \lambda = 0$.

If the constraint is not binding (i.e. $\lambda = 0$), then the existing firms behave like usual unconstrained profit maximizers as the profit maximizing price would lie below the relevant limit price. In Prof. Bain's terminology, this could be classified as a case of blockaded entry. If the constraint is binding (i.e. $\lambda \neq 0$), then the optimum price for existing firms would lie below the conventional monopoly price. Thus, in order to prevent entry, the existing firms must choose a price in the shaded region (in Fig. 3.1).

It is possible to embed isoquants in Figure 3.1 to be able to get a few extra results. The isoquants could be interpreted as follows: for every price-selling expense pair (P, S) , there would be a corresponding output (X) that can be sold. Similarly, for every level of output, there would be a locus of price-selling expense pairs that would be successful in ensuring that the produced output is sold. This locus is referred to as an isoquant (see Fig. 3.2).

A family of such curves would correspond to the conventional isoquant map. $\frac{\partial P}{\partial S}$ measures the slope of an isoquant and $\frac{\partial P_L}{\partial S} = \frac{d P_L}{d S}$ measures the slope of the limit-price-selling expenses locus. If the $P_L(S)$ curve intersects the isoquants from below then $\frac{\partial P_L}{\partial S} > \frac{\partial P}{\partial S}$. This case is shown in Fig. 3.2. If $\frac{\partial P_L}{\partial S} > \frac{\partial P}{\partial S}$ and if the constraint is binding (i.e. $\lambda > 0$), then from equation 2 given earlier, we can say that the firm would operate where $\frac{\partial R}{\partial S} < 1$ (i.e. the firm would over-spend on selling expenses). If the $P_L(S)$ curve intersects the

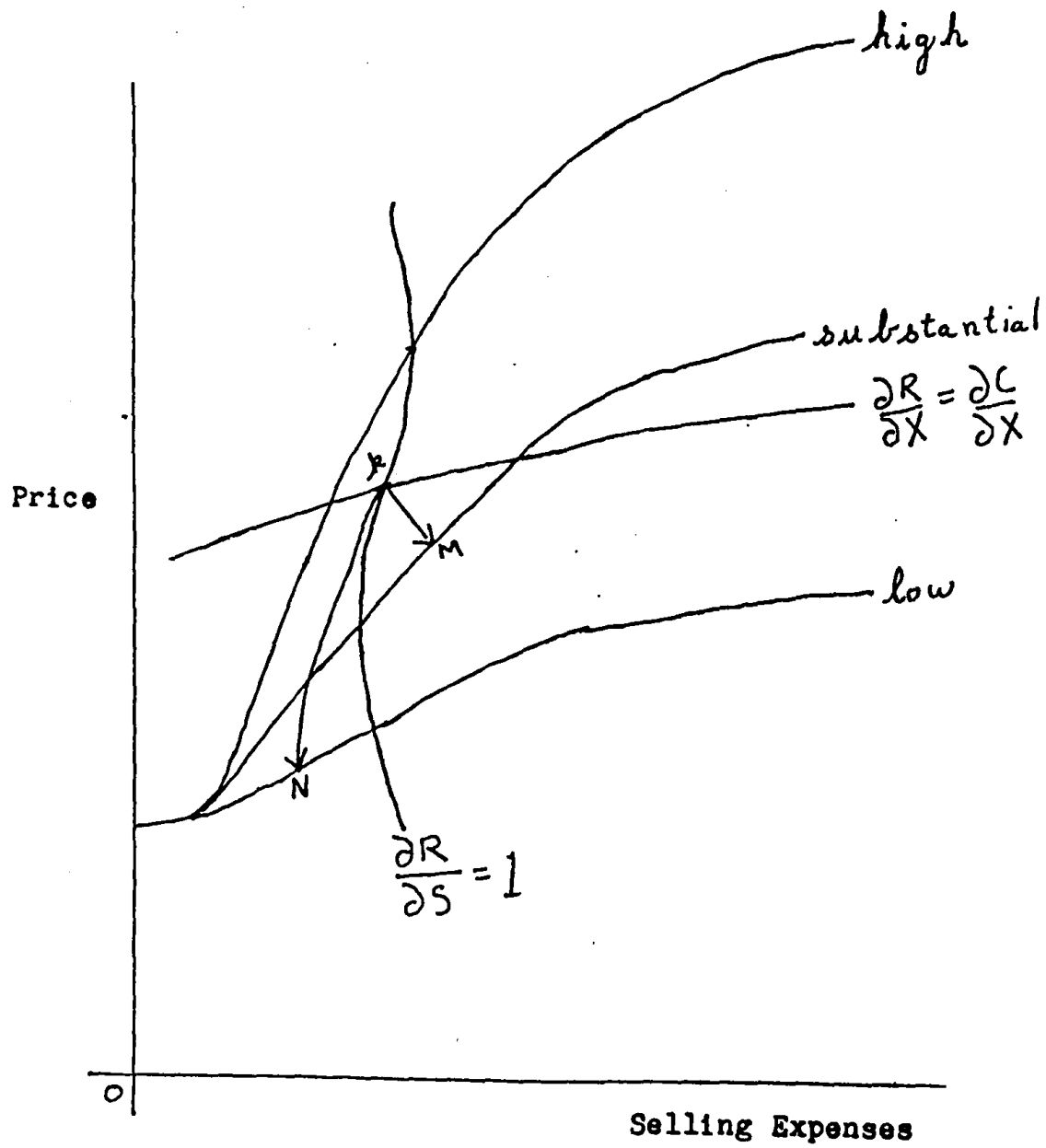
Figure 3.2 : Isoquants and the Limit Price-Selling Expenses Locus



isoquants from above, then $\frac{\partial P_L}{\partial S} < \frac{\partial P}{\partial S}$ and if the constraint is binding (i.e. $\lambda > 0$), then from equation 2 we can say that the firm would operate where $\frac{\partial R}{\partial S} > 1$ (i.e. the firm would under-spend on selling expenses).

When will the limit price-selling expense locus [or $P_L(S)$ curve] be more steeply sloped than the isoquants and when will it be less steeply sloped? To answer this question, Williamson uses Prof. Bain's three categories of high, substantial and low barriers to entry. \bar{P}_L is the limit price which depends on scale and absolute cost barriers only. If scale and absolute cost barriers provide only a moderate barrier to entry, and if the established firms want to prevent entry and at the same time charge a price that is substantially above the competitive price, the established firms would have to incur selling expenses. In other words, the established firms would have to move to an isoquant which lies above isoquant \bar{x} (where \bar{x} is the isoquant through \bar{P}_L as in Fig. 3.2). Thus, if selling expenses along with other barriers are to provide a high or substantial barrier, then the limit price locus would have to be more steeply sloped than the isoquants (i.e. $\frac{\partial P_L}{\partial S}$ must be greater than $\frac{\partial P}{\partial S}$). If the selling expenses provide only a moderate or low barrier to entry and barriers from other sources are also negligible, then, the limit price locus would be less steeply sloped than the isoquants. The limit price loci in the case of substantial, high and moderate barriers to entry are shown in Figure 3.3. The nature and characteristics of the

Figure 3.3 : Diagrammatic Representation of the Possible Equilibria in Williamson's Model



particular product group (industry) under consideration would determine which particular curve is relevant.

To get some additional results, Williamson introduces into the analysis (see Fig. 3.3) the locus where $\frac{\partial R}{\partial S} = 1$ (i.e. along this locus selling expenses are used optimally implying that costs are matched by benefits) and the locus along which $\frac{\partial R}{\partial X} = \frac{\partial C}{\partial X}$ (i.e. along this locus efficiency in production is achieved). The intersection of these two loci occurs at point 'k'. In Fig. 3.3 these loci are drawn in such a way that point k lies below the high $P_L(S)$ curve (i.e. where selling expenses provide a high barrier to entry) and thus the unconstrained optimum point (k) lies within the high $P_L(S)$ boundary and above the substantial $P_L(S)$ boundary. Thus no change in the decision variables is required in order to prevent entry.

If the entry barriers due to selling expenses are substantial, then, a change in the decision variables is required, if entry is to be prevented as the unconstrained optimum point k lies above the substantial $P_L(S)$ locus. In this case (i.e. where selling expenses provide a substantial entry barrier), the constrained optimum will lie somewhere along the substantial $P_L(S)$ curve, where $\frac{\partial R}{\partial S} < 1$ and $\frac{\partial R}{\partial X} < \frac{\partial C}{\partial X}$. As this corresponds to the region between loci $\frac{\partial R}{\partial X} = \frac{\partial C}{\partial X}$ and $\frac{\partial R}{\partial S} = 1$, the existing firms in order to effectively impede entry, must (i) increase selling expenses to a sub-optimal level, (ii) increase output to a sub-optimal level (from the point of view of efficiency in production),

and (iii) they must decrease price. Thus, the existing firms would choose a point, say M (in Fig. 3.3), on the substantial $P_L(S)$ curve.

From the point of view of firms in the low barrier category, a very significant shift in the decision variables from the unconstrained optimum would be required in order to prevent entry (say, from k to point N in Fig. 3.3). The firms may thus feel that the costs involved in forestalling entry far outweigh the benefits and so they may prefer to stay at point 'k' and accept entry. Entry, in such a situation, would be ineffectively impeded.

Williamson's analysis, that has been discussed so far, leads to the conclusion that an optimal limit price strategy usually combines a lower price with a higher selling expense and greater output compared to the unconstrained optimal level.

As long as the existing firms select a price-selling expense pair anywhere below the limit price-selling expense locus, entry will never occur in the framework proposed above. Williamson is of the opinion that "an alternative interpretation of the limit price locus is to treat it as one which with high probability will, effectively impede entry and as the boundary is violated by taking positions further and further above it, entry becomes successively more likely. On the other hand, should the firm move down from the locus, the probability of entry would be reduced. In essence, the limit price curve represents an isoprobability locus; any point on

the boundary is one which will prevent entry with the same high probability and this probability can be reduced by moving below or above the locus respectively."⁵

In such a non-deterministic (or probabilistic) framework, the goal of the firm would be to maximize expected profits. In order to be able to do this, the firm would have to (i) find its unconstrained optimum, (ii) impute a probability of entry to this position, (iii) find the corresponding optima for each of a series of probability levels at which entry could be effectively impeded, and (iv) see which particular price-selling expense pair yields highest expected profits.

An important mechanism through which advertising erects entry barriers is based upon its ability to create loyalty to the products of existing firms and thus have dynamic effects on demand. But does brand loyalty really create a barrier to entry? Richard Schmalensee (1974)⁶ argues that brand loyalty does not pose a barrier to entry if we assume a demand structure characterized by distributive lags. In his model, both the established firms and the potential entrants face a demand structure characterized by a distributed lag and advertising is the only competitive weapon available to both. In this framework, Schmalensee demonstrates that even when established firms have built up loyalty for their brands or sell to inert customers, they cannot use it to deter entry. Nevertheless, if capital markets are imperfect and potential entrants lack assets to

act as collateral, then established firms may be able to deter entry. That is, even though advertising has dynamic effects on demand, it does not necessarily follow that entry barriers are high or even existent in industries with heavy advertising. Undoubtedly Schmalensee's results depend on the particular dynamic structures employed. Schmalensee admits that there may exist plausible models in which the above result does not hold true. Thus, assertions about the impact of advertising on entry barriers via brand loyalty cannot be justified by informal arguments.

Schmalensee agrees that this result does not follow if capital markets are imperfect. At an empirical level, Schmalensee's result is unlikely to find support as capital markets are known to be imperfect. Thus, as long as we have reason to believe that capital markets are imperfect, advertising via creation of brand loyalty is likely to erect entry barriers, though this proposition has yet to be derived at a formal level.

Douglas Needham (1976)⁷ tries to find out the conditions under which advertising can be used by established firms to deter entry. Though much of his analysis is not satisfactory (for example, the very formulation he uses is analytically unsatisfactory) some of his concluding remarks provide valuable insights into the problem.

Needham points out that if established firms want to use advertising to prevent entry, they must somehow influence the potential entrant's expectations regarding

the post-entry behaviour (with respect to advertising) of established firms. Despite its obvious importance, the issue of which factors actually determine the expectations of potential entrants has received little attention. It is due to this neglect that the fundamental question of whether it is possible for established firms to deter entry, even if assymetry in the response of demand to advertisement by entrants and established firms is present, remains unanswered.

How far would a game-theoretic approach help in tackling the problem of entry deterrence? Thomas Schelling (1960)⁸ had demonstrated that in a game-theoretic framework, a threat could be made credible by entering into a prior commitment that made its fulfilment optimal. We have had occasion to point out that established firms have certain first move advantages. So the established firms can commit to make a certain amount of expenditures on advertising in the pre-entry period and thus make clear their intentions of what they intend to do if entry occurs. Whether or not this strategy would be successful is considered below.

Steven Salop (1979)⁹ attempts to use Schelling's result to tackle the problem at hand. According to Salop two classes of entry barriers can be distinguished.† An innocent entry barrier is one that is unintentionally erected as a side effect of innocent profit maximization. A strategic entry barrier, on the other hand, is purposely erected to reduce the possibility of entry. This classification is dubious. We cannot, in this context, talk in terms of a side effect of innocent profit maximization. A certain

strategy is always intentionally selected by firms in order to achieve the goal of profit maximization. Thus in a certain sense all entry barriers are strategic. It must be remembered that in this context we always talk in terms of maximizing discounted future profits and not in terms of conventional short run profit maximization.

Salop assumes that there is a single established firm which is facing a single potential entrant and that information is perfect and its communication is costless. Suppose the monopolist can earn a positive present value of excess profits, V_0 , if there is no entry. Given some rule governing the post-entry interaction, the monopolist and the equally efficient entrant would each earn a lower present value of profits V_1 (i.e. $V_1 < V_0$). If $V_1 > 0$, entry would clearly occur. Suppose the monopolist selects a pre-entry advertisement expenditure level of 'C', that an entrant must match in order to survive. Consider the outcome matrix:

Entrant	Monopolist	
	No Ads	C Ads
Entry (matching ads)	V_1, V_1	$V_1 - C, V_1 - C$
No entry	$0, V_1$	$0, V_0 - C$

If the established firm advertises at a level where $C \geq V_1$, then the entrant is deterred due to the prospect of non-positive profits and the monopolist would be able to maintain a profit of $V_0 - C$. If the established firm does not advertise, then entry occurs and the monopolist as well as the entrant earn V_1 . The minimum amount of expenditure on

advertising that is required to deter entry is $C = V_1$. Such a policy would be profitable only if $V_0 \geq 2V_1$.

In the above analysis, the necessity of a binding commitment is obvious. If it were possible for the established firm to have control on current expenditures on advertising, then, the potential entrant would rationally forecast that the monopolist will curtail mutually destructive advertisement and accommodate the entrant, once he enters. Thus to be able to deter entry, the established firm will have to make a binding commitment, in the pre-entry period, on the level of advertising expenditure it would incur in subsequent periods. By making a binding commitment, the established firm attempts to make its threat credible. Whether this threat is really credible depends on the nature of the post-entry game that the entrant expects. If the entrant is confident of achieving and maintaining a Cournot-Nash equilibrium in the post-entry situation (for whatever reason), then the threat made by the established firm is not credible.* If the entrant expects that he would have to behave like a Stackelberg follower, in the post-entry situation, then the threat is credible. Thus, whether or not the threat is credible depends on the nature of post-entry game. Unfortunately, no confident

* See also Schmalensee, R. "Advertising and Entry Deterrence: An Exploratory Note," Journal of Political Economy, 91, August 1983, pp. 636-653. Though his model is not cast in a purely game-theoretic framework, he shows that when entry is not blockaded and if post-entry equilibrium is of the Nash-Cournot type, the threat is not credible.

predictions on the nature of the post-entry game can be made. All that can be said is that the established firm would try to behave like a Stackelberg leader in the post-entry situation. His success, of course, is not guaranteed.

Advertising is but one aspect of non-price competition. Though it can be taken as a representative example, the issues involved in analysing phenomena like brand proliferation, and research and development expenditures, (and their effects on entry) are different, and thus merit separate treatment.

Brand Proliferation and Research and Development Expenditures as Barriers to Entry

Richard Schmalensee (1978),¹⁰ in an article acclaimed as a classic one by many commentators, analyses the role of brand proliferation in entry deterrence. He presents an elaborate model of entry deterrence and uses it to analyse the Ready to Eat Breakfast Cereal Industry in the U.S. Here, only a part of his argument, which is relevant for our purpose, is presented.

He makes the following assumptions.

(i) For individual brands, at least at low output levels, the unit cost of production and marketing falls with increase in output. He assumes that the long run total cost of producing and marketing a typical brand is given by

$$C(q) = F + vq \quad \dots (1)$$

where F and v are positive constants and q is the output of the brand.

(ii) It is assumed that rivalry among brands is

localized, so that actions relating to any single brand generally have important effects only on a small number of other brands. A spatial framework is used to indicate the implications of localization.

(iii) It is assumed that brand locations cannot be changed. Replacing this with the assumption of substantial (but finite) repositioning costs would not affect the qualitative aspects of the conclusions.

Let the cost function (1) apply to all established firms and potential entrants. Let the expected or actual average sales per brand, when there are N brands optimally positioned and when all brands are sold at the same price ' P ', be given by $q(P, N) = a(P) b(N)$, where $b(N)$ is decreasing and $N b(N)$ is non-decreasing and concave. The total profits of the established brands are then given by

$$V(P, N) = N\pi(P, N) = A(P) N b(N) - NF,$$

where $A(P) = (P - v) a(P)$ and $P > v$.

Let the values of P and N that maximize this expression be P^m and N^m respectively. A price matching entrant's maximal sales will be $q(P, r N)$, where r is some constant, greater than one, the exact value of which depends on the precise nature of the economic space and distribution of consumers therein (in a situation where buyers are uniformly distributed around a circle of unit circumference r can be shown to be equal to 2). The profits that would be earned by a price-matching entrant brand are then

$$\pi(P, r N) = A(P) b(r N) - F.$$

The existing firms can deter the entry of a price-matching entrant by choosing an appropriate P and N such that $V(P, N)$ is maximized subject to the constraint $\pi(P, rN) \leq 0$. Let such values of P and N be P^d and N^d respectively. It can be shown that, under the assumptions made $P^d = P^m$ and, if the constraint is binding, $N^d > N^m$. Thus, in this model, entry is prevented by following what may be called a brand proliferation strategy. Schmalensee, expands the model slightly to include advertising. His analysis suggests that the optimal entry-deterrence strategy involves high prices, brand proliferation and some degree of over-spending on advertising.

The question whether the threats (made by established firms to potential entrants), implicit in the strategy described above are credible is important. "An expressed threat to surround an entrant with new brands would be a threat to engage in mutually damaging warfare and it thus may lack credibility. But, if established firms can crowd economic space with brands before the threat of entry appears, as we have been assuming, the entry deterring threat is that the brands will not be moved if entry occurs. Since repositioning of brands is assumed to involve substantial costs, such a threat is quite credible."¹¹ This again is an example of a first move advantage enjoyed by existing firms.

Expenditure on Research and Development (R & D) by established firms may also create a barrier to entry. There is no rigorous analysis available on how exactly this would occur. Dennis C. Mueller and John E. Tilton (1969)¹² are

of the opinion that the extent of entry barriers created by R & D expenditures would depend on the age or state of development of an industry.

They view the industry as passing through four separate stages of growth, namely, innovation, imitation, technological competition and standardization. Any breakdown of this type is, without doubt, somewhat arbitrary. Nevertheless, as such a classification simplifies analysis it is used.

Mueller and Tilton argue that in the innovation stage R & D expenditures do not create serious entry barriers. At this stage it is uncertainty that creates very high barriers. The imitation stage also does not provide enough scope for R & D expenditures to lead to high entry barriers. It is at the technological competition stage that R & D expenditures are likely to create high entry barriers. When the standardization stage is reached, the barriers based on initial R & D requirements fall. So, R & D expenditures are expected to create serious entry barriers only at the technological competition stage.

Growth in Demand and Barriers to Entry

So far we have not said anything about how the analysis will be affected if we assume that there is an increase in demand in markets with differentiated products. B. L. Johns (1962)¹³ is of the opinion that if an industry is characterized by differentiated products and if an increase in demand is expected, then this increase in demand is not an increase in demand for a particular commodity, but for products of

particular manufacturers. In such a scenario, the existing firms are likely to proceed with their investment plans regardless of entry. The existing firms will be aware that many buyers will not permanently transfer their brand allegiances to new brands unless there is a continuous shortage of existing brands at current prices. It is thus vital for existing firms to maintain and if possible to improve their market share, which implies not only an aggressive sales policy but also an aggressive investment programme.

Thus, new entrants are unlikely to find prospects of successful entry improved due to the fact that demand is expected to increase. This does not imply that entry is impossible. The main point is that, if product differentiation exists, entrants will often find that entry is no easier when there is secular growth in demand.

Summary of Empirical Studies

Let us now turn to some empirical studies relating to entry barriers primarily created by non-price factors, in order to see whether the theoretical arguments presented earlier find empirical support.

In a study, D. Orr (February 1974)¹⁴ introduces the entry variable (number of entrants per year) and identifies the determinants of entry without relying heavily on measured profit rates. He finds that advertising and profitability are highly correlated across the consumer goods industries. By regressing entry, rather than profits, on entry barriers, Orr is able to demonstrate that advertisement by established

firms has a negative impact on entry. The other main results of his study are summarized below.

1) Capital requirements, advertising intensity and high concentration are strong barriers to entry.

2) The past profit rates and the past rate of growth of industry output are only weak incentives to entry.

D. Orr (September 1974),¹⁵ in a later study constructs an index of entry barriers and investigates into the relevance of such an index in explaining the structure-performance relationship. This study (as the earlier one) uses the data pertaining to the Canadian manufacturing industries (sample size of 71 industries) relating to the period 1963-1967. He regresses the past profit rate (π_p), capital requirements (K), advertising intensity (A), R & D intensity (R), risk measured by standard deviation of profits (r), concentration (C), industry sales (S) and past rate of growth of industry output (\dot{Q}) on the rate of entry (E) into an industry. He gets the following result:

$$\begin{aligned} \text{Log } E = & -1.36 + .03\pi_p + .01\dot{Q} - .24 \log K - .13A - .07R \\ & - .08r - .89C + .51 \log S \end{aligned}$$

$$R^2 = .496 \qquad \bar{R}^2 = .431$$

The coefficients of π_p and \dot{Q} are not found to be statistically significant. The index is constructed from the empirically determined propensities of capital requirements, K, advertising intensity, A, R & D intensity, R, risk, r and concentration, C. An index I could be constructed simply by weighting the value of each entry barrier by the regression coefficients

obtained. That is,

$$I_1 = -.24 \log K_1 - .13A_1 - .07R_1 - .08r_1 - .89 C_1$$

$$I = I_1 \dots I_{71} \text{ industries.}$$

For convenience I_1 can be transformed as follows:

$$B_1 = \lambda - I_1$$

where λ is a constant which will set the mean of B_1 's, i.e. \bar{B} , to be zero. The I_1 's are multiplied by -1 so that high values of the index correspond to high barrier industries. So, industries with $B_1 > 0$ have above average barriers and those with $B_1 < 0$ have below average barriers. It can be shown that this index (B_1) is invariant to the units in which the variables are measured. Orr draws the following two conclusions.

1) The highest barrier group enjoys the highest long run average profits.

2) Industries with average barriers are slightly less profitable than those with lowest entry barriers. No firm conclusion can be drawn in this respect as the difference is not statistically significant.

R.J. Stonebraker (1976)¹⁶ is of the opinion that risk can be thought of as the vehicle through which entry barriers work. The risk of entering an industry would depend upon the height of entry barriers. He estimates the following regression equation.

$$\begin{aligned} ER = & 12.515 + 1.889 \log ADV + 3.783 DRES + 0.820 ES \\ & - 0.289 \log MEP \end{aligned}$$

where ER = the risk of entry into an industry
 ADV = the ratio of average advertising expenditure to total sales
 DRES = average Research and Development expenditure to sales ratio
 ES = measure of economies of scale
 MES = measure of minimum efficient scale plant.

His results suggest that entry risk does depend on the height of entry barriers. The most important entry barriers are those based on advertisement and Research and Development expenditure and entry barriers based on scale economies are not very important.

Let us now outline the major conclusions we have arrived at in this chapter.

- 1) An optimal limit price strategy usually combines a lower price with higher than optimal selling expenses and greater output.
- 2) Assertions about the impact of advertising on entry barriers via creation of brand loyalty cannot be made on the basis of informal arguments.
- 3) Firms wanting to use advertising to prevent entry must somehow influence the potential entrant's expectations regarding the post-entry behaviour (with respect to advertising) of established firms.
- 4) Established firms would try to influence the potential entrant's expectations by making binding commitments in the pre-entry period. Whether or not this policy

is going to be successful would depend on how potential entrants view the post-entry game.

5) An optimal entry-deterrence strategy involves high prices, brand proliferation and some degree of over-spending on advertising.

6) R & D expenditures are expected to create serious entry barriers only if the industry is in the technological competition stage.

7) If an industry is characterized by differentiated products, new entrants are unlikely to find the prospects of successful entry improved even if the demand is expected to increase.

8) The empirical studies considered here suggest that the non-price aspects of entry-deterrence are of vital importance.

Notes and References

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CHAPTER 4

CONCLUSION

The riddle of oligopolistic markets is an intriguing one. Before the importance of potential competition and entry barriers was explicitly recognized, the theory of oligopoly was in a "fluid state". Has the recognition of the importance of potential competition and entry barriers improved the theoretical analysis?

In the first chapter the most important concept introduced was the condition of entry. We outlined various predictions about firm behaviour with respect to different conditions of entry (i.e. blockaded entry, effectively impeded entry and ineffectively impeded entry). The most interesting case, of course, is effectively impeded entry, as it is in this situation that entry prevention becomes an optimal policy for the firm.

In the second chapter we concentrated on price aspects of entry prevention. The literature on limit price hypothesis which was rigorously treated both in a static and dynamic setting was summarized. The question of whether firms would be able to deter entry by holding excess capacity was also discussed. We saw that holding excess capacity to deter entry would be a successful strategy only if the established firm could behave like a Stackelberg leader in the post-entry

situation. Whether he will in reality be able to behave like a Stackelberg leader is a question that is left unanswered.

In the third chapter, non-price aspects of an entry-prevention strategy were discussed. One lacuna in the literature developed till now on non-price aspects of entry prevention, is the absence of a model which treats product differentiation and advertising together and which lays down precise conditions under which an entry-prevention strategy is likely to be successful. Everything depends on the nature of the post-entry game. On the basis of a priori theory, it is not possible to make any predictions on the nature of the post-entry game.

The influence that potential competition and entry barriers have on firm behaviour has been demonstrated in chapters one, two, and three at both theoretical and empirical levels. The influence of potential competition has been treated theoretically, (i) with respect to price competition and (ii) with respect to non-price competition. At a theoretical level, there are certain indications which suggest that the non-price competition aspects are of vital importance. These indications get substantial support from the empirical studies. In fact, scale economies have been found to be less important than variables like advertising and R & D expenditures in regard to creation of entry barriers. Though we have treated the two variables (i.e. price and non-price) separately both for conceptual clarity

and analytical convenience, the fact that, in reality, a firm's decisions with regard to both the variables are taken jointly must not be lost sight of.

In models of oligopolistic markets which do not focus on potential competition and entry barriers (i.e. models formulated by Cournot, Edgeworth, Stackelberg, etc.), short-run profit-maximization strategies adopted by individual firms, automatically lead to long-run profit-maximization. This is so because strategies adopted in one period are not expected to affect the profitability in the subsequent periods, nor do the strategies adopted in the past affect the profitability of the present period. Once the importance of potential competition and entry barriers are recognized, we can no more talk of the long-run being divided into a series of independent short-runs. A strategy followed in one period would influence the profitability of the next period. Once a firm recognizes this, and adopts the goal of maximizing discounted stream of future profits, the short-run strategies that it would follow would have to be consistent with the long-run goal. In attempting to achieve this goal, firms must also try to prevent entry into the market, whenever it is profitable to do so. For example, when entry is effectively impeded, the discounted future stream of profits that an entry-preventing strategy gives rise to is greater than that from a strategy which does not attempt to prevent entry implies. It is for this reason that an entry-prevention strategy is adopted. In this case we have some sort of a

constrained maximizing situation, the constraint being prevention of entry by new firms. Entry can be said to be blockaded when this constraint is not binding. In the case of ineffectively impeded entry it is not optimal to follow an entry-detering strategy.

Thus, conventional profit-maximization can no more be considered to be the firm's goal. The firm's goal now is to maximize its discounted stream of future profits and also try and prevent entry whenever it is optimal to do so.

The literature surveyed in the earlier chapters has vital implications on another aspect of traditional price theory, in which considerable confidence is put on the ability of price to act as a signal. Our discussion throws ample doubt on the capability of price to convey correct signals. There is no doubt that price does act as a signal to potential entrants. (It would not be viewed as a signal by potential entrants if the future was certain and there existed perfect information, which in reality is not the case.) The problem is that established firms have an incentive to manipulate the signalling mechanism to their advantage. Thus, price as signalling mechanism operates in a very unsatisfactory way in oligopolistic markets.

Probabilities have been used in the non-deterministic models to take into account uncertainties that necessarily surround the phenomenon of 'entry' into an industry by a new firm. The question that is frequently asked is: can probabilities (subjective or objective) be used to measure

uncertainty? To answer this question, a clear distinction must be made between risk and uncertainty. Many economists (G.L.S. Shackle, Lord Keynes, J.R. Hicks among others) are of the opinion that uncertainty by its very nature (as a matter of fact, by definition) cannot be measured by probabilities. Shackle feels that the element of surprise every decision-maker faces is suppressed when we use probabilities. Thus, the use of probabilities to measure uncertainty may yield misleading results.

There is little doubt that the theory of oligopoly has received a new direction due to the shift of focus from actual competition to potential competition. Moreover, the predictions with respect to firm behaviour and performance arrived at via this reorientation have received extensive empirical support. Though a large body of empirical work is available in the field, limited attention has been paid to this in the present thesis.

Unfortunately, most of the empirical studies available pertain to advanced countries. In the Indian context there is very little empirical work available. Whatever is available is very sketchy and methodologically unsatisfactory.¹ This field is thus open for further empirical investigation.

An attempt is made to calculate an index of entry barriers for twenty Indian manufacturing industries for the period 1975-1980.² The variables considered are as follows:

E = rate of entry per year

GR = growth rate of output

L = a dummy variable for licensing policy.

L = 0 if licensing policy was strict and

L = 1 if licensing policy was liberal.

EC = excess capacity in 1975

FC = ratio of number of units with foreign collaboration in an industry to total number of units in that industry in 1975

$\frac{MSEP}{TP}$ = ratio of minimum efficient scale plant to total production in 1978 (mid-year of the period under consideration).

The estimated equation is given below.

$$E = 0.6139 + 0.3656 GR + 0.9032 L - 0.3074 EC - 0.4173 FC - 0.4531 \frac{MSEP}{TP}.$$

All the coefficients have the expected sign. Except the coefficient for licensing policy (L), all the other coefficients are not statistically significant at the 0.05 level. Most of the 't' values (except the coefficient of excess capacity, EC) are near about 1 and are not significant at even 0.10 level. The F value is significant at 0.05 level. The R^2 is 0.5902 and \bar{R}^2 is 0.4438.

Licensing turns out to be the most important barrier to entry. This is not a surprising result, as the way the licensing policy is expected to work, it obviously would create serious entry barriers. Though the importance of other explanatory variables is not very large, one encouraging

feature is that they have the predicted sign. Our coefficient of excess capacity is similar (in the sense that it is statistically insignificant) to the coefficient got by Hilke and Liberman.

The expected values of E (entry) are considered to be Index of Entry Barriers (following Dale Orr). The industries with very high entry barriers were: Aluminium Ingots, Dry Battery Cells, Newsprint, Passenger Cars, and Agricultural Tractors. The industries with substantial entry barriers were: Cigarettes, Domestic Refrigerators, Paints and Varnishes, Motorcycles and Scooters, Sewing Machines, GLS Lamps, Typewriters, Sanitaryware, Razor Blades and Room Air-conditioners. The industries with low entry barriers were: Detergents, Cement, Plywood, Nitro-Fertilizers and Glazed Tiles.

The study suffers from the following limitations.

(i) The sample size is small.

(ii) There is incomplete specification as variables like the past profit rate of the industry, standard deviation of the profit rate of the industry (a measure of risk) and the advertising intensity in an industry (a measure of product differentiation) have been omitted due to non-availability of relevant data.

(iii) In some cases we are unable to properly distinguish between entry and expansion as, in the process of expansion, a corporate firm may create a separate legal entity which has been treated as entry.

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See also, Vaidyanathan, R. and Apte, P.G. "Concentration, Controls and Performance in Twenty-Nine Manufacturing Industries in India," Indian Economic Review, Vol. XVII, Nos. 2-4, pp. 241-262.

In this study entry barriers are not properly evaluated. In our empirical study we suggest a method by which entry-barriers can be evaluated in the Indian context. What light this would throw on the Structure-Performance Hypothesis is not gone into here.

2. Data Sources:

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