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THE ROLE OF POTENTIAL COMPETITION
IN INDUSTRIAL ORGANIZATION

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Abstract

This paper surveys alternative theories of potential competition and contrasts the testable implications of these theories with evidence on industry performance. The theories of potential competition include static and dynamic limit pricing, perfectly contestable markets, and the "Chicago School" where market share differences are attributed to differential efficiency. While available data are not conclusive, the data do not offer much support for either static limit pricing or perfectly contestable markets as general theories of industry behavior. Most of the industry evidence can be interpreted as consistent with either dynamic limit pricing or the differential efficiency hypothesis.

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The Role of Potential Competition in Industrial Organization

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I. Introduction

The economics literature has recognized potential competition as a mechanism to control the exploitation of monopoly power at least since the work of J.B. Clark [1902]. Joe Bain [1956], Paolo Sylos-Labini [1962, originally published in Italian in 1956], and Franco Modigliani [1958] refocused attention on the importance of potential competition in the performance of industrial economies. This research in the then nascent field of industrial organization led to the "structure-conduct-performance" approach to the analysis of industrial markets. The emphasis in this work was primarily on the classification of structural features of markets that could be identified as the primary determinants of industry organization.

Bain identified the "conditions of entry" as structural features of markets that are key to the exercise of market power and identified (i) economies of scale, (ii) absolute cost advantages, and (iii) product differentiation as the primary determinants of entry barriers. While Bain considered these barriers to be largely exogenous, they are clearly affected by the actions of the firms in the market. Product differentiation depends on investments in advertising and marketing. Absolute cost advantages can be the consequence of investments in new technology, or the acquisition of scarce and particularly desirable factors of production, such as a choice location or superior ore deposits. The importance of

¹ This paper relies in part on joint work with Paul Geroski and Alexis Jacquemin, reported in Geroski, Gilbert and Jacquemin [1988]. I am grateful for their collaboration, and to Giacomo Bonanno and Pierre Regibeau for helpful discussions.

entrant scale economies can be affected by the behavior of incumbent firms through the choice of production technology or by actions that influence entrants' optimal capital intensity.

Bain's taxonomy of entry barriers compound many aspects of industrial markets that can affect the conditions of entry and his identification of certain structural characteristics as barriers to entry has been disputed. Stigler [1968] argued that scale economies need not be a barrier to entry. He proposed that an entry barrier be limited to "a cost of producing (at some or every rate of output) which must be borne by firms seeking to enter an industry but is not borne by firms already in the industry". According to Stigler's definition, if both new and old firms have access to the same technology, the extent of scale economies is not a barrier to entry, as it affects the costs of both firms. Thus even if scale economies are such that only one firm can operate profitably, that is not a barrier to entry according to Stigler. In his words, "Some economists will say that economies of scale are a barrier to entry, meaning that economies explain why no additional firms enter. It would be equally possible to say that inadequate demand is a barrier to entry" (Stigler [1968], p. 67).

Bain's structuralist view of scale economies is in sharp contrast with Stigler's rejection of the importance of scale economies as an entry barrier. Yet these disparate conclusions can be reconciled if one introduces firm behavior as an element in theory of entry barriers. The model of limit pricing developed by Bain [1956], Sylos-Labini [1962], and Modigliani [1958] (which I will refer to as the BSM model) concludes that scale economies can be a barrier to entry because the operations of existing firms constrain the demand available to a new entrant, and the constrained demand may be insufficient to allow profitable entry. But if conduct in the industry were such that a new entrant could be assured that established firms would accommodate its entry by pricing high enough that the firm would have adequate demand to operate at (or near) minimum cost, then the existence

of scale economies would not pose an asymmetric burden on newcomers to the industry.

Recent literature on potential competition has followed two distinct paths: "contestability theory" and the theory of dynamic games. Contestability theory, championed by Baumol, Panzar and Willig [1982] (BPW), does not rely on a description of firm behavior and the consequent equilibrium performance of the market. Rather, it chooses as its origin a statement which serves to define the outcome of a contestable market. The essential definition is that of a "sustainable" vector of industry prices and outputs. A vector of prices and outputs (p, y) is sustainable if taking p as given, no firm (using the same technology as incumbent firms) can choose a price $\hat{p} < p$ and operate profitably at any level of output $y \leq D(\hat{p})$, where $D(\hat{p})$ is the vector of industry demands at prices \hat{p} . Building on the definition of a sustainable price-quantity vector, BPW define a contestable market as any market for which a necessary condition that the market be in equilibrium is that the market price-quantity vector be sustainable. A market that satisfies the assumptions of contestability theory is said to be a Perfectly Contestable Market (PCM).

The definition, although not related to a particular description of a competitive process, is nonetheless elegant. If a market is contestable and if a contestable equilibrium exists, total revenue must be equal to total cost, and if two or more firms operate in the industry, the price for each product that is sold must be equal to marginal cost.

Contestability theory embodies Stigler's criticism of the structuralist view that scale economies constitute a barrier to entry. Implicit in the definition of a sustainable market is the assumption that established firms will not cut prices in response to the entry of a new competitor. If an entrant prices slightly below the price set by an established firm, the entrant can choose to satisfy the entire market demand at a price arbitrarily close to the pre-entry price. The demand available to the entrant is not constrained by the existence of established firms. Thus the entrant can operate to take full advantage of scale economies,

without concern about the impact of its production on the market price.

With the favorable assumptions toward entry that are implicit in contestability theory, it is not surprising that a PCM would be effective in policing market performance. A PCM assures that prices will be held to levels that assure no excess profits and that the structure of the market will be the cost-minimizing structure for the outputs and the products that are produced.² If the market is a natural monopoly, in the sense that the combined cost of serving the market demand with two or more firms always exceed the cost of serving the market with one firm, a single firm will operate in a PCM, but price will just be sufficient to cover average cost. In such a situation, contestability amounts to an almost perfect surrogate for price regulation under the constraint that the regulated firm must break even on its operations. When two or more firms coexist in a PCM, price must be equal to marginal cost.

Criticism of contestability theory, of which there has not been short supply, naturally has focused on the extent to which sustainability is a feasible and necessary condition of market equilibria. It is not difficult to construct examples of markets in which sustainable price-quantity pairs do not exist and familiar models of imperfect competition, such as the Nash-Cournot model, generate equilibria that do not satisfy the conditions of sustainability.

As Stigler [1968] emphasized, the theory of potential competition is limited by the absence of a robust theory of oligopoly. We would expect the effectiveness of potential competition to depend on the number of firms that are established in the industry and the number of firms that might qualify as potential competitors, as well as on the conduct of the

² A perfectly contestable market does not assure that the selection of products that are offered for sale maximize total economic surplus subject to the break-even constraint. Suppose a product set Ω_1 yields higher surplus than a set Ω_2 . A PCM may exist with the set Ω_2 and taking prices as given, an entrant firm may not be able to introduce the set Ω_1 without making losses. This would not happen if firms were able to perfectly price discriminate, but contestability theory assumes that firms are restricted to linear prices.

firms that compete in the industry. There is, however, almost no discussion of the importance of these factors in the early literature on the theory of potential competition, and only scant attention is paid to analyzing entry in the more general context of oligopoly theory in the more recent literature. None of the prevailing theories of potential competition, from the BSM model to contestability or extensive form dynamic games, solves the problem of determining how the complex interactions of firm behavior will result in a unique outcome. According to Stigler, the theory of potential competition solves the oligopoly problem "by murder".

II. Entry Hypotheses

One can argue at length about the theoretical merits and shortcomings of the alternative models of entry deterrence. My goal in this paper is to assemble some empirical evidence that can be brought to bear on the question of which theory, if any, is consistent with the available evidence. I will consider several alternative hypotheses that are intended to reflect prevailing theoretical views about the process and consequences of entry. I have intended these hypotheses to conform to prevailing theoretical models, although given the fact that little of the theory of entry prevention has been developed with the intention of providing empirically testable results, I regret that the correspondence between my proposed hypotheses and specific models of entry prevention may be less than exact.

H1 Markets are perfectly contestable

Perfect contestability has strong implications for market performance, some of the more important of which I summarize below:

H.1a Firms will not earn profits that exceed or fall short of normal levels.

- H.1b Industry structure and prices will be efficient subject to the constraint that revenues are sufficient to cover costs.
- H.1c Incumbent firms will not make investments that are inefficient at chosen levels of output, but are intended to deter entrants.
- H.1d In the event of entry (or exit), incumbent prices will not change.
- H.1e There is no benefit that is derived from incumbency.

H.1a and b follow directly from the definition of a sustainable market. H.1c must hold because only efficient cost structures are sustainable. H.1d is implied by the definition of sustainability, in which entrant firms take incumbent prices as fixed, which also implies that potential entry should have the same consequences for industry pricing as actual entry. H.1e follows from the assumption that an entrant can do as well as an established firm. I will refer collectively to this set of hypotheses as the PCM hypothesis.

H.2 Markets behave according to the BSM model of limit pricing

The BSM limit pricing model was developed originally to explain dominant firm pricing with economies of scale. Expectations of post-entry competition are clearly crucial to any model and entry expectations are a primary delimiter of alternative models. The standard assumption in the conventional theory of limit pricing has come to be known as the "Sylos postulate", which states that the incumbent firm can commit to a post-entry output equal to its output before entry occurs. The limit output, Y , is the smallest incumbent output with the property that $\pi_1(x_1+Y) < 0$, which requires that

$$P(x_1+Y) < AC(x_1) \text{ for all } x_1.$$

Corresponding to Y is $P(Y)$, the limit price. These quantities are illustrated in Figure 1.

The ability to commit to the output Y after entry occurs is clearly crucial to the theory of limit pricing. Dixit [1981] shows that sunk costs may offer a mechanism by which output commitment may be feasible. To the extent that an established firm has sunk investment expenditures and excess capacity, its marginal cost of production is lower than that of a new firm with the same technology (for which expenditures are not yet sunk). Thus sunk costs can make operation at capacity profitable for an established firm challenged by new competition, even if competition lowers its marginal revenue.

The extent to which limit pricing is both desirable and feasible must depend on the behavioral characteristics of the firms in the market and on the relationship between actions that occur prior to entry and equilibrium conditions after entry occurs. If equilibrium in the post-entry game is unaffected by pre-entry behavior, there is no scope for limit pricing and entry will be prevented only if the market cannot sustain an additional firm when established firms act without regard to the effects of their behavior on entry. (Bain would say that entry is "blockaded" in this case.) In contrast, if established firms can commit to actions that will make entry less profitable, they may choose to do so, provided the cost of these commitments does not exceed the profits that would be lost if entry occurs. Behavior may be adapted to entry opportunities to the extent that potential entrants may still rely on pre-entry market conditions as signals of post-entry profitability. For example, if potential competitors use pre-entry price as a signal of post-entry profitability, incumbent firms may be forced to lower prices to prevent rivals from inferring that their markets are unduly profitable (see Salop [1979] and Milgrom and Roberts [1982]).

There are as many variants of the limit pricing model as there are forms of post-entry behavior and strategic opportunities to affect and signal post-entry market conditions. For my purpose, I will focus on several aspects which I believe are crucial to

the conventional (BSM) limit pricing theory and distinguish the theory from alternative entry models.

H.2a Dominant firms will earn profits that persist above normal levels. There are permanent gains from incumbency.

H.2b Entry will be followed by price competition and incumbent firms will attempt to maintain their pre-entry outputs.

H.2c Firms will engage in strategic behavior designed to deter entry.

Implicit in Bain's theory of the conditions of entry is the presumption that entry barriers are structural features of markets that can lead to persistent advantages for established firms, hence H.2a. Although limit pricing theory does not require the Syslos postulate, H.2b reflects the spirit of limit pricing, which is that established firms are able to make life difficult for prospective competitors. Strategic behavior prior to entry is the essence of limit pricing, and this is H.2c.

H.3 Markets conform to the dynamic limit pricing model

Dynamic limit pricing is a variant of the BSM pricing model. For example, as formulated by Gaskins [1971], a dominant firm chooses a price path (p_t) to maximize

$$\Pi(t_0) = \int_{t_0}^T (p_t - c)[D(p_t) - x_t] dt$$

where $D(p_t)$ is total demand at price p_t , x_t is the total supply from competing firms, and c is the dominant firm's average cost of production (taken to be constant). It is assumed that the

rate of change of x_t is an increasing function of the price set by the dominant firm.

There are obvious problems with the specification of dynamic limit pricing. The behavioral assumptions of potential competitors are not specified and it is not clear why the dominant firm should be a price leader, particularly after its share of the market has been significantly eroded by entry. Several refinements of the dynamic limit pricing model have been made (e.g. Kamien and Schwartz [1971], Friedman [1979], Judd and Peterson [1986] and others), and one could add strategic instruments, such as advertising, that could have the affect of limiting the rate of entry. Whatever the embellishments, the important empirical implication of the dynamic limit pricing model is:

H.3a Dominant firms will earn supra-normal profits, but these profits will be eroded gradually over time with entry. There are gains from incumbency, but these gains are transient.

H.4 Market share and profit are explained by efficiency differences

H.4 is an expression of the "Chicago School" of industrial organization. Dominant firms owe their position to superior performance, not to strategic behavior or the history of entry into the industry, and profits are simply the rents that accrue to superior technology (see Stigler [1968], Ch.7 and Demsetz [1973]). Dominant firms have large market shares because they are low cost producers. Given differences in production efficiency, a positive correlation between market share and profitability would be implied by "innocent" models of price or quantity-taking behavior (e.g. static Nash-Bertrand or Nash-Cournot models), in which firms ignore the consequences of their actions on actual or potential competitors. Thus according to the Chicago School, it would be mistaken to "explain" profitability by measures of market share or concentration. This would obscure the underlying connection

between market share and profitability, which is the differential efficiency of firms. Some specific implications of the Chicago School are:

- H.4a There should be no gains from incumbency *per se*.
- H.4b Market concentration should not be a determinant of prices. Prices and market shares are determined by the cost characteristics of the firms.
- H.4c Incumbent firms will not make investments that are inefficient at chosen levels of output, but are designed to deter entrants.

Firms that prosper are those that are most efficient, not those that happen to be established in the industry. This is the basis for H.4a. Concentration and price are consequences of the cost characteristics of the firms, and there is no causal connection between concentration and price in the Chicago School; hence H.4b. As efficiency reigns in the Chicago School, there is no scope for strategic activity. H.4c is identical to H.1c in the PCM hypothesis.³ I will abbreviate H.4a–c by CS, for the "Chicago School".

Note that the CS hypotheses are a subset of the PCM hypotheses. If a market is perfectly contestable, there is no gain from incumbency. In a PCM, market concentration is a consequence of efficient production and not a determinant of price. The Chicago School set of hypotheses is weaker than perfect contestability in that a PCM implies that markets behave in accordance with the Chicago School, but the opposite is not true.

In principle, contestability could be generalized to make it more similar to the

³ H.4c (and H.1c) should not exclude strategic behavior that has positive efficiency consequences (see von Weizsacker [1980] and Demsetz [1982]). For example, advertising informs consumers of product characteristics and therefore has positive efficiency consequences. However, activities that sacrifice profits solely to deter entry and that do not provide compensating benefits for consumers should not occur if behavior is motivated entirely by efficiency consequences.

predictions of the Chicago School. Suppose firms had access to different technologies. Then the contestability result might imply that established firms are winners of a second price auction, in which the market price is determined by the next most efficient firm. Although a model with these properties has been described by Grossman [1981], there has been little attempt to apply this theory to actual markets. Thus I will confine the search for empirical validation to the hypotheses described above.

Proponents of the theory of contestable markets have argued that perfect contestability is not a realistic objective, but the theory should be applied to markets that are "imperfectly contestable", so that entry or exit is not free. With one exception, the doctrine of perfect contestability has little predictive power. If barriers to entry or exit as defined by Bain are absent, most theories of oligopoly behavior would predict that incumbent firms would make profits that are indistinguishable from normal levels. Consider a simple Nash–Cournot model. Suppose there is only one homogeneous good that can be produced with the technology $C = vx + F$, where F is a fixed cost which is sunk once production begins. Both potential entrants and incumbent firms have the same technology. Demand is linear, with the inverse demand function $P(X) = a - bX$. In a symmetric Cournot–Nash equilibrium with N firms, each firm earns

$$\Pi^*(N) = \frac{1}{b} \left[\frac{a-v}{N+1} \right]^2 - F$$

and entry will occur until $\Pi^*(N) > 0$ but $\Pi^*(N+1) < 0$. As $F \rightarrow 0$, both market price and profits approach competitive levels.

The predictions of the Nash–Cournot model in this case are not identical to that of perfect contestability. For any $F > 0$, the efficient market structure is a single firm, not N competing firms. However, if an established firm could commit to an output level with full

information about potential entrants, then as $F \rightarrow 0$ and if N is sufficiently large, the optimal output of the established firm approaches the competitive level (see Omari and Yarrow [1982] and Gilbert [1986]). In theory, contestability would require only one potential entrant to keep prices near competitive levels, while the number of potential entrants would have to be large to make limit pricing an attractive strategy. But even contestable markets could be subject to collusive tendencies with only a small number of potential entrants.

When fixed (and sunk) costs are low, conventional models of oligopoly produce results that are near competitive levels, so what does contestability theory offer? One feature of the contestable market model that is not matched by other oligopoly models is the ability to sustain industry outcomes with no excess profits when production exhibits substantial increasing returns to scale. To obtain this result in the context of the theory of a PCM, it is necessary to distinguish between costs that are fixed (and hence contribute to increasing returns to scale) and costs that are sunk (and hence contribute to entry or exit costs). Thus empirical questions that are relevant to the scope of contestability theory are the extent to which sunk costs can be ignored and the extent to which entry and exit costs can be moderate in economies with substantial sunk costs.

Entrants' expectations are at the heart of contestability theory and, for that matter, any theory of market competition. In contestability theory, a potential entrant effectively conjectures that established firms will not react to entry by lowering their prices. Customers are assumed to have full information about alternative prices and costlessly shop for the firm with the lowest price. Contrast the contestability expectations assumption with that of the limit pricing model proposed by Bain, Syslos–Modigliani, and others. In the limit pricing model, potential entrants conjecture that incumbent firms will do whatever is necessary to maintain their post–entry outputs at their pre–entry levels. As a result, established firms may be able to earn profits and withstand entry because potential rivals do

not expect to have a large enough market share to operate profitably.

Both contestability theory and the limit pricing model make strong and empirically untested assumptions about the behavior of firms. The expectation assumptions in contestability theory are favorable to entry. By maintaining prices at their pre-entry levels, entrants are free to serve all of the available demand below the pre-entry market price. The expectations assumption in the limit pricing model implies that incumbent firms would cut prices in order to maintain their pre-entry output levels. These assumptions are polar, but not extreme. Incumbent firms could threaten to increase outputs if entry occurs, as suggested by Spence [1977]. Spence allows incumbent firms to represent to potential entrants that they will act as competitive, price-taking firms in the event that entry should occur. This would result in incumbents' post-entry outputs that are equal to the inverse of the their marginal costs evaluated at the post-entry price and would generally imply a large post-entry production increase. For example, suppose both established firms and potential entrants have access to the technology described by $C(x) = vx + F$. Under the Spence conjecture, if entry occurs the price will fall to the marginal cost, v , and entry would be unprofitable for any $F > 0$.

At the other extreme of the Spence conjecture, potential entrants could expect that incumbent firms will react to entry by conspiring to achieve a post-entry monopoly price. This would make entry even more attractive than under the assumptions implicit in contestability theory, although potential competition would not be effective in maintaining productive efficiency. If entrants conjecture that post entry prices will remain at monopoly levels, entry would continue until excess costs dissipate monopoly profits.

From a purely theoretical perspective, it is appropriate to confine competitive conjectures to those actions that could be credibly sustained if entry were to occur. Dixit describes a way to make the BSM assumption credible, by assuming that established firms

have sunk costs that lower their marginal costs for production below installed capacity. The PCM theory is silent about how the price conjectures that are implicit in theory could be made credible actions in the event that entry should occur. One possibility is that incumbent firms might have pricing agreements with "most favored nation" clauses that discourage cutting prices to meet competition. (But equilibria of markets with such pricing agreements need not be sustainable as defined by BPW. See the example in Aghion and Bolton [1987].)

If the costs of entry are not large, one might argue that the assumptions of contestability theory are more appropriate because it takes only one rival who expects that incumbents' prices will not respond to its actions to upset the limit pricing model. This is not an argument based on principles of equilibrium theory. It is instead a behavioral theory. In essence, potential entrants are different, and the more there are, the more likely it is that at least one will have optimistic conjectures of pricing behavior (or profitability) in the post-entry game.

One can construct a model of industry behavior that is consistent with each of alternative descriptions of entry described in hypotheses H.1–H.4 above. Contestability theory can be modeled as a game in which established firms move first and commit to prices which potential entrants take as given in evaluating their entry decisions. Such a model would generate results close to those of a PCM if the cost of entry and exit is very low and if prices move slowly relative to the flow of capital into and out of the industry (see Baumol, Panzar and Willig [1986] and Schwartz [1986] for examples of extensive game forms that reflect the PCM hypothesis). There is no scarcity of reasonable theories of entry behavior, indeed there are too many. The theory cannot answer the question of which of the many alternative models is the best predictor of entry behavior. We must turn to the empirical evidence.

III. Empirical Results

As Stigler said, there can be no theory of potential entry without a predictive theory of oligopoly, and no such theory presently exists (or rather no theory exists that allows us to choose from the many alternative models). Which model of potential competition most accurately represents industry behavior is ultimately an empirical question. There are several ways by which the accuracy of alternative theories of potential competition may be tested, all of which are necessarily imperfect as predictors of behavior in specific markets. These include observations of entry in actual markets, simulation studies, and interviews with industry managers. I will attempt to interpret the available evidence in light of the hypotheses that are attached to the alternative theories of entry behavior in Section II. Experimental economics provides a controlled environment in which to study alternative hypotheses, and as such provide a useful beginning. The following discussion parallels that in Schwartz [1986].

III.1 Simulation Studies of Entry

Simulation experiments provide a test of the validity of alternative behavioral theories complete with the advantages and shortcomings of experimental settings. The performance of the "contestable markets hypothesis" in simulation experiments has been mixed. Harrison [1986] performed experiments in which the rules of the game were structured to show contestability in its most favorable light. Sellers designated as incumbents were instructed to make public price offers which could not be changed in the subsequent period. Thus the institutional design in the Harrison experiment imposed a structure in which the incumbent firm had a first-mover advantage and the natural strategy of potential competitors was to behave as Nash price-takers. Moreover, potential competitors faced no costs of entry and demand was simulated by computer, which

removed any scope for strategic play by consumers.

The outcome of the Harrison game was generally supportive of contestability. In most cases prices converged to Ramsey-optimal prices. (In these experiments, the competitive and Ramsey-optimal prices were identical. Whether the results extend to situations in which this is not the case is open to question.). Convergence to Ramsey prices did take some time and at least one case witnessed a successful attempt to maintain collusive prices, although this collusion was subsequently thwarted by introducing an additional seller.

On balance the Harrison results are strongly supportive of the PCM hypothesis, but it should be stressed that these experiments were intentionally designed to conform to the behavioral assumptions of contestability theory, without regard for the validity of these assumptions. Market experiments that allowed for sunk entry costs and imposed symmetry on sellers' price offers showed much weaker support for the contestability hypothesis. In Coursey *et al* [1984a], the effectiveness of potential competition was diminished in the presence of sunk entry costs. Importantly, the presence of sunk costs did not significantly reduce entry, although entry was clearly inefficient in their simulated market (and inconsistent with the operation of a PCM). Coursey *et al* [1984b] and Harrison and McKee [1985] simulated markets with potential competition, but no sunk costs, and found that potential competition produced outcomes that were closer to competitive than to monopoly levels. However, despite the absence of sunk costs, in neither experimental design were prices identical to Ramsey-optimal prices, and Harrison and McKee [1985] concluded that a system of franchise regulation was superior in most cases to potential entry in limiting profits. These experiments underscore the importance of the behavioral assumptions in the formulation of contestable markets. If incumbents can commit to post-entry prices, contestability appears to have substantial predictive power, but this ability cannot be

assumed and in its absence potential competition may be only partially effective in policing monopoly behavior.

Although simulation experiments can serve to sharpen our understanding of how alternative theories might translate into actual behavior, we have to turn to the real world to test the ultimate validity of our models. In what follows I will draw on industry studies with regard to aspects of competitive behavior and market performance that bear on tests of the hypotheses that correspond to alternative theories of entry.

III.2 The Existence and Persistence of Industry Profits

The work of Joe Bain [1956] was the first systematic attempt to uncover a correlation between measures of market concentration, the conditions of entry, and monopoly profits. Bain identified a positive correlation between profits and both concentration and estimates of the height of barriers to entry, categorized as scale economies, absolute cost advantages, and product differentiation. In the absence of substantial barriers to entry, the correlation between profits and market concentration was weak, an observation which lends some support to the contestable market hypothesis. But at best, one can conclude from Bain's investigations that his measures of the height of entry barriers are an index of the strength of potential competition.

Bain's studies were highly influential and his correlations have withstood many repeated observations, in particular the importance of product differentiation in consumer products industries (see Comanor and Wilson [1967], among others). But Bain's investigations suffered from important deficiencies. The measurement of entry barriers was necessarily subjective and vulnerable to the criticism of circularity: barriers are high in industries that have persistent profits. Profitability itself is difficult to measure. Accounting profits differ from economic profits (for instance in the choice of depreciation schedules

and in the recording of asset values at historical rather than replacement values.)

Orr [1974] and Masson and Shaanon [1986] use statistical observations on the response of aggregate entry and exit to industry profitability as a means to infer estimates of the importance of barriers to entry. They found that entry barriers were consistent with the hypothesis that in some industries, profits had to exceed normal levels by a substantial margin to induce significant entry. These estimated "hurdle profit rates" can be equated to empirical estimates of the height of entry barriers.

Mueller [1986], (see also Mueller [1977]), takes a somewhat different approach to the measurement of the conditions of entry by estimating the persistence of firm profits. His sample included 600 of the largest U.S. manufacturing corporations whose profitability was measured over the period 1950–72. (These 600 were the surviving firms from a larger data set, and thus raise questions about selection bias – see Pakes [1987].) Mueller found that profit levels showed a strong tendency to revert over time to the sample mean, but the process was anything but instantaneous. Estimated long run profits for the 100 companies with the highest profit levels in 1950 was more than 30 percent above the sample average.

Mueller's results contain the usual set of suspects. Profits are those reported in company accounts and may differ systematically from economic profits. The data are at the five–digit SIC level. In most industries the five–digit level aggregates several lines of business and therefore provides an imperfect picture of product line costs, market share and profitability. Thus Mueller's approach may account for firm characteristics that imply persistent profits, but they do not reflect the process of competition (and in particular entry and exit) at the line of business level.

With these caveats in mind, Mueller's findings and those of Orr and Masson and Shaanon offer little support for the PCM hypothesis. Whatever is the cause of interfirm profitability differences, these differences should be corrected quickly under the PCM

hypothesis. These findings would be consistent with the PCM hypothesis only if the observed profitability figures were accounting artifacts.

But neither do these results offer strong support for the classical BSM model of limit pricing. Excess profits do not last indefinitely in Mueller's sample, although the decay rate is quite long. Whatever is the cause of these profits, competitive forces tend to eliminate them over time. Thus Mueller's results do not point to entry barriers that are permanent structural features of industries. If entry is impeded by structural barriers, these barriers are eventually worn down and overcome.

Although Mueller's results and those of Orr and Masson and Shaanon do not provide much empirical support for the classic BSM model, they are generally consistent with the theory of dynamic limit pricing. In these models, entry takes time. Dominant firms can exploit the constraints on the rate of entry and price at levels that are above competitive prices, although they will generally price below the monopoly price in order to retard the advance of potential competitors. Models such as Judd and Peterson [1986], in which entry must be financed by cash flow, derive certain conditions under which prices never converge to competitive levels. Mueller found evidence that would allow him to predict positive profits for some firms if he were to extrapolate forward, and this is not inconsistent with dynamic limit pricing, provided entry is constrained by cash flow or other reasons. All of the limit pricing models imply some degree of imperfect information or other competitive constraint on the part of potential competitors and in this sense they are theoretically lacking. Yet as empirical descriptions of the process of entry, they appear to be not without some explanatory power, at least for industries with dominant firms as in Mueller's sample.

Another aspect of Mueller's findings is much more troublesome for those who believe in structural impediments to competition and a causal link between concentration and profits. When Mueller includes market share effects in a differentiated oligopoly model

with advertising and research and development expenditures, he finds that industry concentration is not positively correlated with firm profitability. If anything, he finds that including advertising and R&D as exogenous variables, concentration and profits are negatively correlated. Note that these results do not necessarily contradict the dynamic limit pricing model, because in the standard model of dynamic limit pricing price is determined by the level of entry, not by the degree of collusion among firms.

Mueller's findings are generally consistent with the Chicago School, in which profitability is determined by efficiency, not concentration. Even the time pattern of profitability of dominant firms can be explained by expertise that erodes slowly over time. But Mueller's conclusions as to the profits–concentration relationship stretch the data to the breaking point. His econometric estimates confound measures of demand elasticity, marginal cost, the degree of substitution between products, and the extent of cooperation between firms. The difficulty of empirically identifying these separate parameters was emphasized in Clarke *et al* [1984] in their study using British data that also sought to clarify the concentration–profits debate. In addition, advertising and R&D expenditures and profitability is not exogeneous, but simultaneously determined with market share and profitability.

These statistical studies are determined attempts to uncover the relationships between concentration, profits and entry. Nonetheless, the findings do not allow rejection of any of the hypothesized models of entry with a high degree of confidence. If we accept the underlying data as being accurate measures of profitability, Mueller's results do reject both the PCM (contestability) and the BSM (limit pricing) models. Yet there is probably ample latitude for proponents of these models to disagree with the accuracy of the data. Mueller's results are consistent with both the dynamic limit pricing hypothesis and the Chicago School, but they do not offer a clear means to choose one over the other.

III.3 Strategic Behavior

Do firms that are established in an industry engage in activities that are designed to protect their markets against entry? There is an enormous economics literature that studies the scope for strategic entry—deterrence, but the size of the literature is not a reliable index of the magnitude of strategic behavior in actual markets. Corporate strategy, which includes lessons in entry deterrence, has become a standard component of business school curricula. The business trade press cites product development and marketing strategies that are designed to improve the security of competitive niches, and courts overflow with cases alleging anticompetitive abuses toward frustrated entrants. But again, these do not constitute proof that strategic entry deterrence is attempted and that it works.

The empirical literature gives mixed signals on the importance of strategic entry deterrence. While Gilbert and Lieberman [1987] found that firms in concentrated chemical product industries could preempt the expansion of rival firms by investing in new capacity, Lieberman [1987] did not find evidence to support preemptive capacity expansion designed to deter rival entry. A possible explanation for Lieberman's results is the difficulty of committing to entry—detering investment. Gilbert [1986] found that the technological characteristics of most industries are such that a single established firm could not commit to a production level that prevented entry, even if it had the desire to do so. But other strategies are available that could be more successful in deterring entry. Brand proliferation is commonly cited as an instrument to deter entry. Schmalensee [1978] and Bonanno [1987] describe models of brand proliferation, but Judd [1985] offers reasons why such strategies may fail to deter entry. (See Gilbert and Matutes [1988] for an attempt to reconcile the two.) A related strategy is spatial preemption. West [1981] examines the pattern of store location by competing supermarkets and concludes that deterrence is a factor in location choice.

The PCM and CS hypotheses imply that the choice of production technology is determined solely by efficiency considerations. To the extent that established firms choose products, locations, outputs, advertising, R&D or other competitive actions that are motivated primarily by their consequences for entry, this behavior contradicts both the PCM and the CS hypotheses. Entry deterrence is an activity that intentionally compromises productive efficiency in order to protect an established market. Of course it is possible that entry prevention results in outcomes that are more efficient than when entry is accommodated by established firms, and actions that are economically efficient may have incidental deterrence effects (see von Weizsacker [1980] and Demsetz [1982]). Thus evidence of strategic behavior designed to discourage entry requires careful scrutiny before it can be used to reject the PCM and CS hypotheses.

III.4 Industry Responses to Entry

Implicit in contestability theory is the assumption that industry prices move slowly relative to the flow of capital into or out of the industry and this assumption can be tested using available data on industries where entry has occurred. Of course our job could not be this easy. One can argue that contestability is an equilibrium theory, and in equilibrium entry will never occur because incumbent firms are pricing at average cost. Yet one can introduce a stochastic term in firms' observations on prices and/or costs. This would result in entry whenever the perceived price was above the perceived average cost, and exit when the opposite holds. This version of the contestability model predicts large flows of capital into the industry by new firms and frequent exits by once established firms, a pattern of entry and exit that is rarely observed in actual industries. Furthermore, with the exception of prices that are fixed by regulation, there is no reason for potential entrants to believe that prices will remain constant in response to entry unless such behavior was observed in past

entry attempts. Thus, even if observations of entry attempts correspond to disequilibrium phenomena, they provide valuable lessons for firms contemplating entry.

What then is the experience we observe in actual entry attempts? Yip [1982] surveyed managers in markets that experienced entry over the period 1972–79. Out of 69 instances of entry, Yip selected 36 which he judged to be most successful. These included 21 by direct investment and 15 by acquisition. Managers in the industries that were challenged by these entrants reported that only 29 percent of the entries were viewed as "serious" threats when they occurred. Only 30 percent reported that they responded to entry with a competitive price, and then only in the case of direct entry.⁴ The failure to respond in price is not inconsistent with contestability theory, and in a PCM, incumbents would not be expected to take entrants seriously because entry would not be viable. But these data should be interpreted with caution. They pertain only to the most successful entrants, and their success could be a direct consequence of the reluctance of the managers of incumbent firms to take the entrants seriously when they first entered the industry. Yip's data are subjective, and the meaning of a "competitive response" is not well-defined. Furthermore, managers might be reluctant to describe their competitive strategies in much detail given the risks of an anticompetitive challenge under the antitrust laws.

Lieberman [1987] examined the behavior in response to entry of incumbent firms in 39 chemical product industries by statistically estimating equations specifying investment rates for established firms and new entrants. He found that entry into industries characterized by relatively high concentration levels was typically followed by an expansion of capacity by the incumbent firms. Incumbent firms in concentrated industries did not respond positively to expansion by other incumbents, and incumbents in relatively

4. None of our alternative theories predict the consequences for industry performance of a change in management in the absence of a change in industry concentration. This is an important deficiency given the prevalence of entry by acquisition of existing assets.

unconcentrated industries did not increase their investment activity in response to new entry.

Lieberman's results are consistent with Caves and Porter's [1977] theory of "mobility deterrence". Incumbent firms (in the relatively concentrated industries in Lieberman's sample) invest to retard the rate of growth of new entrants, but they do not necessarily invest to prevent entry. In an economy with stationary technology and demand these observations are inconsistent with the PCM and CS hypotheses. In an otherwise stationary environment, entry should coincide with exit of an incumbent firm. These observations are also inconsistent with common formulations of dynamic limit pricing, in which established firms accommodate entry by reducing their own output in response to production increases by competitive "fringe" firms. Also rejected is the Sylos postulate that established firms will maintain their pre-entry outputs, but note that an increase in output by established firms is not inconsistent with credible limit pricing (see Bulow *et al* [1985] on Dixit's [1981] limit pricing model).

Lieberman's results fail to identify why it is that firms enter new markets and this can be crucial to the conclusions. One might expect entry to coincide with advancements in technology or with new information that leads to optimistic expectations of demand growth. In either case one would expect that incumbent firms would also react positively to these developments, so that there would be a positive correlation between entrant and incumbent capacity expansion. It is, however, curious that Lieberman does not identify a positive correlation in industries with relatively low concentration levels.

Bresnahan and Reiss [1987] take a different approach to the measurement of incumbent responses to entry. They restrict the set of observations to markets (primarily services in rural areas) that can support no more than a few firms. This allows them to isolate the competitive effects of a discrete entry decision. By comparing a cross-section

of markets with no firms to those that have only a single firm they are able to estimate a critical market density, S_1 , at which monopoly profits are just sufficient to cover the cost of entry. In the same way, they estimate a critical market density, S_2 , that can just support two firms in the same market. Bresnahan and Reiss argue that if $S_2 = 2S_1$, and if the second firm is not more efficient than the first, then entry is not associated with aggressive competition. Their empirical estimates range from about 2 for auto dealers to about 4 in the case of veterinarians. The results suggest that at least in some markets, entry results in a substantial increase in competition, and this can be a deterrent to potential entrants.

The Bresnahan and Reiss approach is novel and it strikes to the essence of the competitive process that is crucial to an understanding of entry dynamics. Unfortunately, the estimates of market densities provide an unreliable index of competitive intensity. The reason is that firms should enter when the present value of future profits is large enough to allow profitable operation. Bresnahan and Reiss measure only current market size, not present value profits. The relationship between the two can be tenuous.

III.5 Benefits to Incumbency

Much of the preceding discussion was targeted to the question of whether firms that are established in an industry earn profits that are above normal levels. The ability to earn persistent profits was Bain's main concern in his study of the relative performance of markets and evidence on profitability was the basis for his theory of the determinants of the conditions of entry. A related, yet distinct, approach to the characterization of barriers to entry (or, more generally, barriers to capital mobility) is based on the existence of rents that are derived from incumbency. For example, some industries may experience high rates of growth in demand or technological progress that contribute to sustained profits above normal levels. Yet there need not be any significant difference in the profits attained by

established firms and by recent entrants. In this case, it would be difficult to assign rents that are derived from incumbency.

Urban *et al* [1984] examined 129 frequently purchased consumer brands in 12 U.S. markets. They found that market shares were a decreasing function of the order of the entry of the brand. Early entrants enjoyed larger market shares, all else equal. Larger market shares do not imply higher profitability, but they at least suggest an asymmetry that depends on the history of entry into an industry.

A main prediction of contestability theory is that there are no rents that are derived from incumbency. An incumbent firm can protect a natural monopoly, but it cannot earn rents as a result. In addition, the sequence of entry into a market should not, by itself, account for differences in profits or market shares, as all firms are presumed to have access to the same technology. The empirical evidence by Urban *et al* is not inconsistent with the weaker hypothesis of the Chicago School, if it happens that earlier entrants tend to be better able to satisfy consumer demands and therefore have higher market shares.

III.6 Entry in Deregulated Markets

The airlines are an industry in which sunk costs are small relative to total expenditures. Alfred Kahn once characterized the airlines as "marginal costs on wings". The capital costs of entry into the industry are relatively low and the main component of fixed plant, the aircraft, is extraordinarily mobile and can be put to use in alternative markets in response to changing market conditions. Thus many expected that the deregulated U.S. airline industry would become the classic example of the effectiveness of the contestability thesis, with industry performance determined more by the threat of entry than by actual competitive circumstances.

This sanguine view was expressed by Bailey and Panzar (1981) shortly after the

passage of the Airline Deregulation Act of 1978. They concluded, based on the limited available evidence in the post-deregulation period, that potential competition from the major trunk carriers was sufficient to police monopoly pricing behavior in long haul local markets (greater than 400 miles), but not in local markets of shorter distances where specialized equipment requirements make them less vulnerable to entry. They also concluded that equipment availability limited the effectiveness of potential competition in controlling pricing by trunk carriers.

There is little disagreement that potential competition is important in the U.S. airline industry. Moreover, most economists would consider the outcome of deregulation at least a qualified success. However the airlines have not been a model of contestability theory. Several observations since deregulation suggest flaws in the cloak of contestability theory.

- (1) Airline route prices are sensitive to actual market concentration levels and prices have responded rapidly to entry and exit.
- (2) "Hub and spoke" networks have become the dominant form of industry organization, and entry into occupied hubs appears to be difficult.
- (3) There is widespread price discrimination for apparently similar services.

Call and Keeler [1985] found that incumbent carriers price aggressively in response to entry, which contradicts the implicit assumption in contestability theory that prices move slowly relative to capital. Incumbent carriers typically responded to the entry of aggressive carriers such as World and Capital Airways by selectively cutting prices on those routes which were challenged (see Kahn [1988]). The industry went through periods of price-cutting that, in the opinion of Alfred Kahn, were not sustainable. Industry profitability experienced wide swings, a result that is inconsistent with free entry and exit. The industry has experienced a massive restructuring since deregulation in 1978. Entry occurred on a large scale, followed by bankruptcies and mergers.

Bailey, Graham and Kaplan (1985) found that average fares in markets served by newly certified carriers were 20 percent lower than in similar markets that did not experience entry of new carriers. Established carriers did not cut fares to deter entry, but instead waited for entry to occur before responding competitively. In a statistical study of fare determination, a simple regression showed that fare levels were positively correlated with the degree of concentration in markets. This alone, is not inconsistent with contestability theory because concentration can reflect cost conditions that differ across markets. Indeed, when the authors allowed concentration to be an endogenous factor in their statistical model, the correlation between price and structure disappeared, but statistical tests did not support this specification of the model.

While much of the experience of airline deregulation is not consistent with the operation of a perfectly contestable market, the evidence is not sufficient to reject contestability theory. When deregulation occurred the structure of the industry was far from efficient. Wages were inflated by protective regulation, firms had little experience in pricing and marketing, and the industry had not fully exploited the hub and spoke system that governed its evolution in the 1980s. With its highly inefficient cost structure, it is not surprising that the industry experienced a turbulent period of entry, exit and restructuring. This was true even at the level of the established trunk carriers, which were also changing the structure of their routes and services. When the industry settles into a more stable configuration, the time will be right to pose the question of whether airlines are a contestable market. It would appear that access to ground support facilities (which have not been priced at market clearing levels) will continue to be important "absolute cost advantage" barriers to entry in the airlines, and the pattern of competitive responses to entry and exit is not likely to come to a quick end. The outlook for the airlines as the model of a perfectly contestable market is not good, but it is still too early to tell.

IV. A Summing Up

What does the evidence, in total, allow us to conclude? Unresolved questions about measurement errors and the lack of formal statistical confidence tests preclude an objective assessment of our alternative entry hypotheses, and despite a large body of data we are led to necessarily subjective opinions. Simulation studies provide an opportunity to test alternative theories in controlled settings. Such studies show that when the assumptions of contestability theory are satisfied, the PCM hypothesis has considerable explanatory power. When they are not satisfied, the simulation studies show that potential competition is important as a control on monopoly pricing, but market performance does not correspond to the predictions of contestability theory. Neither do these studies show much support for the BSM limit pricing model. Although "incumbent" firms respond to entry by lowering price, potential entrants often succeed in penetrating the market and price takes some time to fall to levels that make further entry unattractive. These observations are closer to the predictions of dynamic limit pricing models. To my knowledge there have been no comprehensive experimental tests of the Chicago School theory, which attributes market structure to relative efficiency, with no role for strategic behavior.

Allegations of strategic behavior abound (consider the volumes of antitrust complaints alleging anticompetitive behavior toward entrants, but also note the incentives for these allegation). To the extent that there is truth in numbers, the sheer amount of these allegations undermine the credibility of both the PCM and CS hypotheses of entry behavior. But statistical tests of strategic behavior have been inconclusive. We are led, perhaps based too much on anecdotal evidence, to suspect that strategic behavior is important in certain industries, but the scope of strategic behavior may be less than the abundance of theories of oligopolistic interactions would lead us to believe.

Several studies show that profits persist in some industries and that there are rents to

incumbency. Profits persist, but not to the extent that would be implied by the "pure" BSM limit pricing model. Profitability that erodes over time is consistent with the dynamic limit pricing model, but it is also consistent with the efficiency hypothesis. Profits persist because some firms are more efficient than others. It is not surprising that relative efficiency advantages change over time or that relative efficiency should have a tendency to exhibit regression to the mean. Thus observations on profitability alone are not sufficient to reject the CS hypothesis.

Observations on the persistence of firm profits could be reconciled with contestability theory if one were to impose measurement problems that are correlated with industry structure and that persist over time (e.g., systematic errors in accounting vs. economic depreciation). However, there are two reasons why measurement problems are unlikely to resurrect the PCM hypothesis. The first is that profits show considerable variability in the short run. If markets were perfectly contestable, entry and exit would eliminate even short-run changes in industry profitability. (It is unlikely that measurement error can explain observations of profitability that differ from normal levels both in the short-run and over long periods of time.) The second is that observations of firm profits show considerable serial correlation in market shares over time (even more than the correlation in profits – see Mueller [1986] and Pakes [1987]). If contestability were at work, we would expect to see substantial changes in market shares in response to firm profits (assuming that profit differences are real and not measurement errors).

Similar remarks apply to observations of rents that appear to be associated with incumbency or with the order of entry. If early entrants are better than latecomers, these observations pose no difficulty for the Chicago School. It is not unreasonable to expect that more efficient firms enter an industry before less efficient firms. Efficiency differences pose problems for PCM because the theory assumes that firms have access to the same

technology. But reported profits depend on accounting conventions and standard accounting conventions will tend to overstate profits of early entrants to the extent that the reported costs of factors of production are based on historical rather than replacement values.

The U.S. airline industry was once considered a model of perfectly contestable markets, and has since turned out to perform in ways that appear to contradict contestability theory. But the movement from a regulated to a competitive market in airlines involved large dislocations and a massive restructuring of traffic and service patterns in the industry. With these changes taking place, it is unreasonable to expect that the industry should behave as if it were contestable. Personally, I think it is still too early to tell.

Proponents of the theory of contestable markets should be expected to argue that many of the observations discussed in this paper are irrelevant to contestability theory because the theory is intended to apply only where entry and exit costs are low. Industries with substantial sunk costs, for example, shouldn't be contestable. However, the validity of contestability theory also depends on the assumption that prices move slowly relative to capital, and if this assumption is not satisfied, even industries with rather small entry and exit costs need not behave in a manner consistent with the PCM hypothesis.

Potential competition is important as a mechanism to control market power. This was the observation of Clark, Bain, Syslos-Labini and others. But these scholars considered potential competition to be an imperfect monitor of industry performance. With the theory of perfectly contestable markets, potential competitors were elevated to a status comparable to that of actual competitors. Potential competition in the theory of contestability is an (almost) perfect monitor of monopoly power (the qualification being that price will equal average cost with potential competition, but price will equal marginal cost with actual competition in contestable markets). Our observations suggest, but do not prove, that

potential competition is very good, but it is not as good as the theory of contestable markets implies. The BSM model is not consistent with observed market performance, but its close variant, the dynamic limit pricing model, holds up reasonably well, as does the entirely different hypothesis that performance reflects efficiency differences and has little to do with actual market concentration or potential competition.

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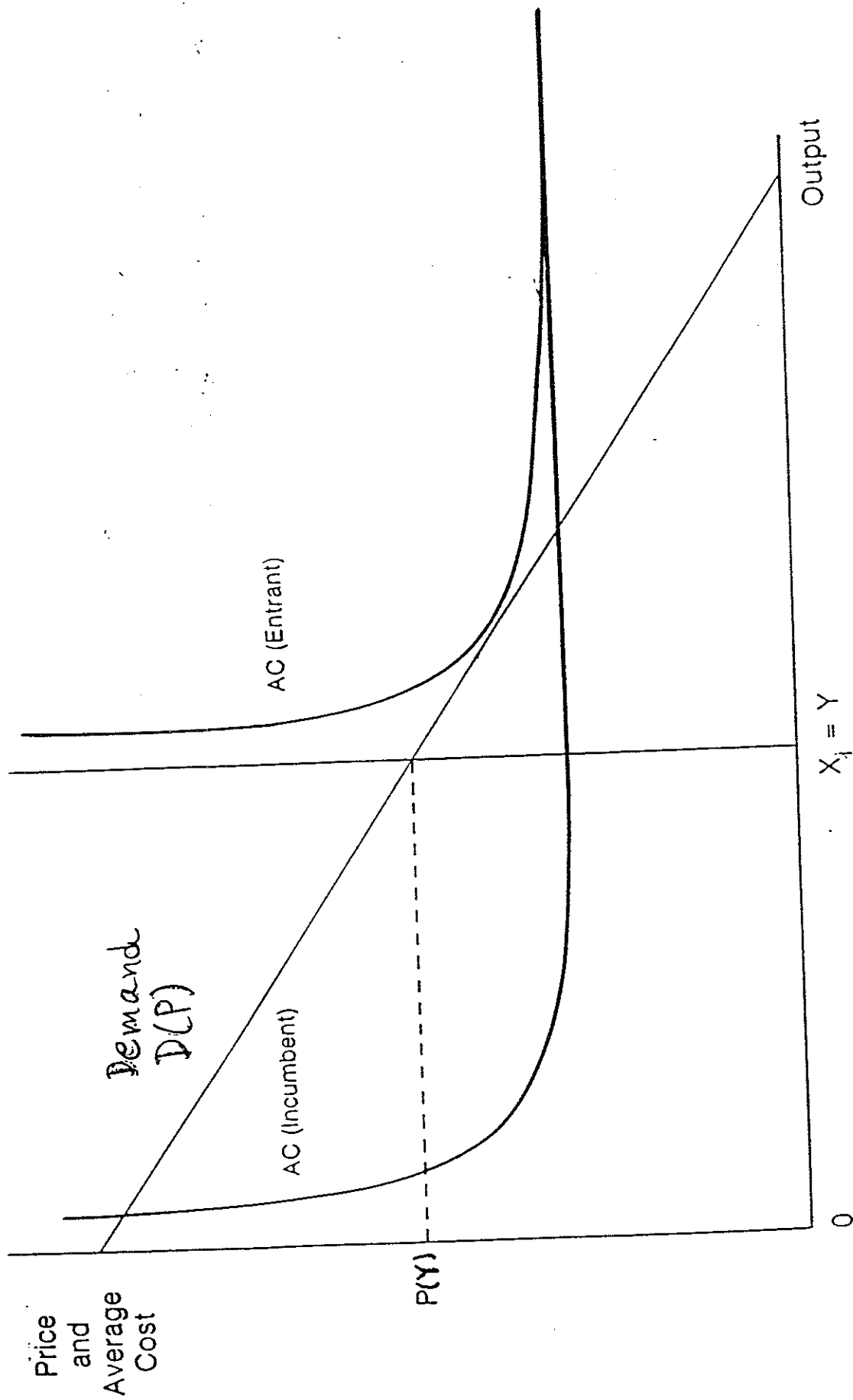


Figure 1. Limit Pricing

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