

WHAT IS A BARRIER TO ENTRY?

By R. Preston McAfee, Hugo M. Mialon, and Michael A. Williams¹

June 6, 2003

ABSTRACT. We expose the conflicts between eight definitions of a barrier to entry that have been proposed in the economics literature. To resolve the conflicts, we introduce four new concepts, namely economic, antitrust, standalone, and ancillary barriers to entry. We then employ these concepts to classify a set of well-known structural characteristics of markets and competitive tactics by incumbents.

In the Papers and Proceedings of the Forty-eighth Annual Meeting of the American Economic Association, published in March 1936, Donald H. Wallace explains that the key principles of public policy that emerged from the literature on monopolistic competition, initiated by Chamberlin (1935), are that "Competitive measures which did not truly measure efficiency should be eliminated; and, by implication at least, any other barriers to free entry except those inherent in differing personal qualities or ability to obtain capital should be removed" (p. 79). This is the first occurrence of the term "barrier to entry" in an academic article published in an economics journal.

Wallace goes on to lament the neglect in the existing literature of other important barriers to entry: "Public policy seems to have overlooked such important barriers to free entry as control of scarce resources of raw materials, ... and the impressive formidability of size and length or purse supplemented by industrial and financial affiliations" (p.80). He expresses his belief, which would be shared by many economists after him, that large capital requirements are also an important barrier to entry that warrants the scrutiny of antitrust authorities. Wallace concludes his article with a research program that would prove to be visionary: "The nature and extent of barriers to free entry needs thorough

¹ Preston McAfee and Hugo Mialon, Department of Economics, University of Texas at Austin, Austin, Texas, 78712 (mcafee@eco.utexas.edu and mialon@eco.utexas.edu), Michael Williams, Analysis Group, Inc., PM KeyPoint LLC, 2200 Powell Street, Suite 1080, Emeryville, CA 94608 (mwilliams@pmkeypoint.com).

study" (p.83). Fifteen years later, Joe S. Bain would publish a series of articles culminating in a book that would constitute the first thorough study of barriers to entry.

In this book, Bain (1956) defined a barrier to entry as anything that allows incumbent firms to earn above-normal profits without the threat of entry. Bain argued that large scale economies are a barrier to entry, according to this definition. Stigler (1968) later rejected the basic notion that scale economies are a barrier to entry. He defined a barrier to entry as a cost that must be borne by a firm that seeks to enter an industry but is not borne by firms already in the industry. With equal access to technology, economies of scale are not a barrier to entry according to Stigler.

Capital requirements are not a barrier to entry either, according to Stigler, unless the incumbent never paid them; but they are a barrier to entry according to Bain, for they seem to be positively correlated with high profits. With respect to scale economies and capital costs, the definitions of Bain and Stigler are at variance, which has resulted in controversy among economists and antitrust lawyers, both over the definition of a barrier to entry, and over the question of whether scale economies and capital costs each constitute a barrier to entry.

The present article is a humble attempt to resolve these controversies. We begin by presenting, in chronological order, the eight principle definitions of a barrier to entry that have been proposed in the economics literature, emphasizing the ways in which they clash. We then introduce four concepts, namely economic, antitrust, standalone, and ancillary barriers to entry, to clear up some of the confusion. An economic barrier to entry is a cost that entrants have to bear but incumbents do not, or have not had, to bear (an adaptation of Stigler's definition), while an antitrust barrier to entry is a cost that retards entry in a way that reduces social welfare. A standalone barrier to entry is a cost that constitutes a barrier to entry even in the absence of other barriers to entry, while an ancillary barrier to entry is a cost that does not constitute a barrier to entry on its own, but reinforces other barriers to entry if they are present.

We argue that scale economies and capital costs are ancillary, antitrust, but not economic, barriers to entry. We then briefly discuss how the new concepts can be employed to classify the barriers to entry posed by other well-known structural characteristics of industries and competitive tactics by incumbents.

I. HISTORY OF THE CONCEPT

Bain (1954) argued that large scale economies are a barrier to entry. Suppose a firm must add significantly to industry output in order to be efficient, and incumbent firms are committed to maintain their output levels in the event of entry. If a firm enters this market at less than the efficient scale, it enters at a significant cost disadvantage relative to incumbent firms. If the firm enters at or above the efficient scale, then the combined industry output would exceed industry demand causing the industry selling price to fall and dissipating all profits for the entrant. Therefore, firms in industries where the efficient scale is large relative to the market may be able to earn considerable profits without inducing entry.

Bain called this effect of scale economies on barriers to entry the "percentage effect," because it reflects the importance of the proportion of industry output supplied by a firm of efficient scale. He suggested that this is only one of two effects of scale economies on barriers to entry. Scale economies may be important to entry also because large absolute amounts of capital are required for efficiency. That is, absolute capital requirements may be so large that relatively few entrepreneurs could secure the required capital, or that entrants could secure it only at interest rates that placed them at an important cost disadvantage relative to incumbents.

In the process of defending his view that scale economies and capital requirements pose important barriers to entry, Bain formulated the first general definition of a barrier to entry, which he offered in the introductory chapter of his 1956 book, "Barriers to New Competition."

Definition 1 (Bain, 1956, p. 3). A barrier to entry is an advantage of established sellers in an industry over potential entrant sellers, which is reflected in the extent to which established sellers can persistently raise their prices above competitive levels without attracting new firms to enter the industry.

Prices would settle down to their competitive levels if new firms were free to enter the industry. At their competitive levels, prices are equal to marginal cost. According to Bain, a barrier to entry is anything that allows incumbents to raise prices above marginal cost, which usually entails above-normal profits, without inducing entry of new firms. As Viscusi et al. (1992) point out, a problem with this definition is that it is tautological. Bain defines a barrier to entry in terms of its outcome, the extent to which incumbents price above marginal cost or earn above-normal profits without inducing entry, which he called the "condition of entry." The definition is true by virtue of the meaning of the condition of entry alone, without reference to external fact, and its denial results in self-contradiction.

Although not theoretically sound, this definition might have been fashioned for the purpose of identifying barriers to entry empirically. If the condition of entry were observable, then Bain might have been able to identify the extent of barriers to entry across industries. However, Bain could find no immediate observable proxy for the condition of entry. So he simply measured, for a cross-section of twenty industries, the size and importance of the market characteristics that he believed to have an important effect on the condition of entry: economies of scale, capital requirements, absolute cost advantages, and differentiation advantages.

Relative to other industries, Bain found that capital requirements were high in the steel and cigarette industries, and economies of scale were average in the steel industry, and low in the cigarette industry (Table 14, p. 169). Whether scale economies and capital requirements actually had an effect on the condition of entry in the cigarette, steel, and other industries, and hence whether they actually were barriers to entry, Bain answered only in theory.

While admiring Bain's important empirical contributions, Nobel laureate George S. Stigler rejected Bain's basic contention that scale economies and capital requirements are barriers to entry, and developed a more useful definition to defend his point of view.

Definition 2 (Stigler, 1968, p. 67). A barrier to entry is a cost of producing (at some or every rate of output) which must be borne by firms which seek to enter an industry but is not borne by firms already in the industry.

Stigler's definition avoids tautology by identifying a barrier to entry in terms of its fundamental characteristics, emphasizing the differential costs between incumbents and entrants. However, the present tense "is" in the definition is cause for confusion. Suppose entrants have to bear a cost that incumbents do not have to bear today, but had to bear in the past (when they entered). Is this cost a barrier to entry? Perhaps Stigler meant to define a barrier to entry as a cost that entrants have to bear, but incumbents *have not had to* bear.

According to Stigler's definition, a barrier to entry exists only if the potential entrant's long-run costs after entry are greater than those of the incumbent. Stigler's definition is narrower than Bain's definition, that is, some things are barriers to entry according to Bain, and not according to Stigler; but nothing is a barrier to entry according to Stigler, and not according to Bain. In any given industry, entrants and incumbents enjoy the same scale economies as they expand their output. With equal access to technology, economies of scale are not a barrier to entry according to Stigler; but they are a barrier to entry according to Bain (via their percentage effects). Absolute capital requirements are not a barrier to entry either, according to Stigler, unless the incumbent never paid them; but they are a barrier to entry according to Bain, for they seem to be positively correlated with high profits.

The spirit of Bain's definition did not fade after Stigler proposed an alternative definition. Ferguson (1974), who was mainly concerned with the question of whether

advertising is a barrier to entry, proposed a definition that follows Bain's, but with the additional requirement that incumbents earn monopoly profits.

Definition 3 (Ferguson, 1974, p.10). A barrier to entry is a factor that makes entry unprofitable while permitting established firms to set prices above marginal cost, and to persistently earn monopoly return.

Ferguson pointed out that pricing above marginal cost in the long run is not sufficient for incumbent firms to persistently earn above-normal profits. Incumbents only earn above-normal profits if prices exceeds average cost. Prices may not exceed average cost even though they exceed marginal cost because of price or non-price competition among existing firms.

For example, existing firms might compete through advertising. Then potential entrants might be required to pay large fixed advertising costs to enter the industry. However, incumbents also pay these fixed advertising costs to compete in the industry. These costs increase the average cost curves of incumbents, as well as entrants (without affecting their marginal cost curves). As long as they are not a source of scale economies, even if they allow incumbents to set prices above marginal cost, they are not a barrier to entry according to Ferguson's definition, because they increase incumbents' average cost, thereby dissipating their above-normal profits, and hence reducing the incentives of potential entrants to enter the industry. In contrast, they are a barrier to entry according to Bain simply because they allow incumbents to price above marginal cost without inducing entry.

Fisher (1979) proposed another definition, which is in the spirit of Bain's and Ferguson's definition, but is normative rather than positive.

Definition 4 (Fisher, 1979, p. 23) A barrier to entry is anything that prevents entry when entry is socially beneficial.

According to Fisher, a barrier to entry exists if incumbents earn profits that are unnecessarily high, in the sense that society would be better off if they were competed away, but firms do not enter to do this. To determine whether a potential barrier to entry causes profits to be unnecessarily high, Fisher asks whether potential entrants make a calculation that is any different from the one that society would want them to make in order to decide whether to enter a market, given this barrier to entry.

Consider, for example, an industry that firms can only enter if they make a large capital expenditure. A firm will not enter if the profits that it anticipates in the long run will not be sufficient to justify the initial capital requirement. But this is exactly the calculation that society would want the potential entrant to make. The capital expenditure would be socially wasteful if it did not guarantee a rate of return that exceeded the rate of return that it could earn if it were invested elsewhere. Therefore, according to Fisher's definition, an initial capital requirement, no matter how large, is not a barrier to entry. It is not a barrier to entry according to Stigler's definition either, but only because incumbents and entrants both had to pay it in the same amount, which is an entirely different reason.

Von Weizsacker (1980, 1) proposed a second normative definition, which is based on Stigler's rather than Bain's definition, in that it focuses on the differential costs between incumbents and entrants, rather than on the profits of incumbents.

Definition 5 (Von Weizsacker, 1980, p. 400). A barrier to entry is a cost of producing that must be borne by a firm which seeks to enter an industry but is not borne by firms already in the industry and that implies a distortion in the allocation of resources from the social point of view.

Von Weizsacker argues that a cost differential is a barrier to entry only if it results in a decrease in welfare. His point is that the number of firms in a Cournot industry can be greater than the socially optimal number of firms. To prove his point, he develops a model of an industry with economies of scale, and shows that the number of active firms

in the Cournot equilibrium with free entry, defined as the largest number of firms such that the Cournot equilibrium is still profitable, exceeds the number of active firms that would maximize social surplus, defined as the sum of consumer surplus and market profit at the level of total industry output that arises when all firms set price equal to marginal cost. In this model, economies of scale are not a sufficient barrier to entry. Welfare would increase if the number of firms were limited to less than the free entry number. The cost savings that arise with fewer firms from taking advantage of economies of scale more than compensate for the reduction in total output from having fewer firms. In such an industry, additional barriers to entry could enhance welfare, by reducing the number of firms to their socially optimal level. However, industries where the number of firms is greater than the socially optimal number of firms are generally difficult to identify.

The definitions of Stigler and von Weizsacker focus on the cost disadvantages of entrants relative to incumbents. Gilbert (1989) argues that such definitions are unnecessarily confining, and proposes a new definition that focuses on the advantages of incumbents rather than the disadvantages of entrants.

Definition 6 (Gilbert, 1989, p. 478). An entry barrier is a rent that is derived from incumbency.

According to Gilbert, a barrier to entry is the additional profit that a firm can earn as a sole consequence of being established in the industry. An incumbent may be able to earn profit and exclude entry not only because of cost advantages over entrants. Suppose the incumbent can commit itself to producing the monopoly output, and this being the case, no other firm can enter at a profit.² Then entry is excluded in this market even though the incumbent has no cost advantage over a new entrant, since both had to pay the sunk costs. Sunk costs are a barrier to exit for the incumbent, which allows it to commit to a level of output, which in turn deters entry, earning the incumbent a rent. Thus, exit barriers for incumbents create entry barriers for entrants.

² In this case, Bain's assumption that entrants expect incumbents to maintain their pre-entry output levels even after entry has occurred is valid.

Moreover, incumbents can use strategic behavior to exploit sunk costs to their advantage. Sunk costs increase the entrant's loss in the event that entry fails, which makes the incumbent's threats of strategic entry deterrence more effective. Thus, exit barriers for entrants create entry barriers for entrants. In these ways, sunk costs provide a rent to incumbents, and hence are a barrier to entry according to Gilbert's definition. The legal restriction that drivers must buy an official medallion from city authorities before supplying taxi services may be a barrier to entry according to Gilbert's definition for the same reason, while it is not a barrier to entry according to the definitions of Bain, Stigler, Ferguson, Fisher, or von Weizsacker.

Disagreement over the definition of a barrier to entry has persisted. Authors of modern textbooks in industrial organization openly document the lack of consensus (see for example, Viscusi et al, 2000, p. 159-163, and Church and Ware, 1999, p. 513-518). In a popular textbook, Carlton and Perloff (1994) propose a literal definition of a barrier to entry.

Definition 7 (Carlton and Perloff, 1994, p. 110). A barrier to entry is anything that prevents an entrepreneur from instantaneously creating a new firm in a market. A long-run barrier to entry is a cost that must be incurred by a new entrant that incumbents do not (or have not had to) bear.

The authors argue that the first definition is rarely useful in practice, for it implies that any capital requirement is a barrier to entry and that any industry in which entry takes time has a barrier to entry. They note that the term "barrier to entry" is often used to refer to both costs of entering and the time required to enter. However, to our knowledge, they are the first to propose a definition that explicitly includes a time dimension.³ Unfortunately, they avoid the timing issue thereafter by considering only barriers to entry in the long run. Entry erodes profits in the long run. Therefore, if a firm earns profits in

³ Shephard (1997) also distinguishes between the extent and speed of entry (p. 209), but does not explicitly incorporate speed into a definition of an entry barrier.

the long run, the industry must have long run barriers to entry. The authors argue that a firm can only earn profits in the long run if they have an advantage over potential entrants, which leads them to adopt a modern version of Stigler's definition. Notice that their version clears up the confusion about the present tense "is" in Stigler's original definition.

In another popular textbook, Church and Ware (1999) distinguish between structural and strategic barriers to entry, reserving the term "barrier to entry" only for the former.

Definition 8 (Church and Ware, 1999, p. 487). An entry barrier is a structural characteristic of a market that protects the market power of incumbents by making entry unprofitable.

Most definitions before this one were implicitly intended to apply mainly to structural market characteristics anyway. That is not to say that these definitions could not, in principle, be applied to strategic behavior also. However, most strategic behavior involves sacrifice by incumbents in order to inflict losses on entrants. Thus strategic behavior is never a barrier to entry according to any definition that is inspired from Stigler's.

We have seen that the concept of a barrier to entry has a rich heritage in economics. In attempting to define the term, economists have made at least seven fruitful distinctions: (1) incumbents earning high profits versus entrants having greater costs than incumbents, (2) incumbents pricing above marginal cost versus incumbents earning profits that are above normal, (3) entry being deterred versus social welfare being reduced, (4) advantages of incumbents versus disadvantages of entrants, (5) barriers to entry versus barriers to exit, (6) speed of entry versus extent of entry, and (7) structural versus strategic barriers to entry.

II. ECONOMIC ANALYSIS

To clear up some of the confusion surrounding the definition of a barrier to entry, we introduce four concepts, namely economic, antitrust, standalone, and ancillary barriers to entry. The following section defines these concepts and discusses several of their general properties.

II.A. STANDALONE OR ANCILLARY

A patent is a sizeable barrier to entry into any market, regardless of whether the market has any other barrier to entry. This suggests that some barriers deter entry autonomously.

Definition 9. A standalone barrier to entry is a cost that constitutes a barrier to entry by itself.

By definition, a standalone barrier to entry is a barrier to entry even if no other barrier to entry is present. On the other hand, a large sunk cost does not seem to constitute a barrier to entry by itself, although it increases the entrant's loss in the event that entry fails, which makes the incumbent's threats of strategic entry deterrence more effective. This suggests that some barriers only deter entry if other barriers to entry are present.

Definition 10. An ancillary barrier to entry is a cost that does not constitute a barrier to entry by itself, but reinforces other barriers to entry if they are present.

A group of small standalone barriers to entry may constitute a significant barrier to entry. A group of small ancillary barriers to entry cannot constitute a significant barrier to entry unless other standalone barriers to entry are also present. A particular ancillary barrier to entry may reinforce only a restricted class of other barriers to entry. If a market possesses no barrier to entry from this class, then the ancillary barrier does not deter entry. Ancillary barriers can also reinforce other ancillary barriers, which in turn reinforce standalone barriers if they are present.

II.B. ECONOMIC OR ANTITRUST

The dominant definition of a barrier to entry to emerge from the economics literature is Stigler's definition.

Definition 11. An economic barrier to entry is a cost that must be incurred by a new entrant and that incumbents have not had to incur, or a cost-time tradeoff that must be faced by a new entrant and that is less favorable to the new entrant than it was to incumbents when they entered the market.

Generally, the time it takes to enter a market is endogenous. A barrier to entry is not economic only if incumbents faced the same cost-time tradeoff as entrants. However, now that the incumbents are in the market, an entrant might choose a slower entry path, or the same time path and that takes an appreciable amount of time. In this case, the barrier to entry is economic. Even though a cost is not an economic barrier to entry, it may nevertheless reduce social welfare simply because it delays entry.

Definition 12. An antitrust barrier to entry is a cost that delays entry, and thereby reduces social welfare relative to immediate but equally costly entry.

An increase in standalone antitrust barriers to entry in markets that are otherwise efficient reduces welfare. Indeed, if a market has no antitrust barriers to entry, then it is efficient. If a market has no economic barriers to entry, then it is eventually efficient. Therefore, no markets that have antitrust barriers to entry are otherwise efficient.

An antitrust barrier to entry reduces welfare relative to what it would have been in the absence of that barrier to entry. The presence of an antitrust barrier to entry does not necessarily mean that, for example, a merger should be disallowed. The net change in welfare resulting from the merger could still be positive. Rather, the presence of the antitrust barrier to entry means that welfare would be higher if that barrier did not exist.

Most economic barriers to entry are also antitrust barriers to entry. However, many antitrust barriers to entry are not economic barriers to entry. Antitrust is a larger category than economic. Indeed, the economic definition derives from Stigler's work, which served to complete the edifice of Chicago antitrust thought. The Chicago School has consistently argued against the need for "draconian" measures against monopoly and collusion, such as those in the Sherman and Clayton Acts (see Posner, 1979). No surprise, then, that their definition of a barrier to entry is stricter than those that the legal authorities had in mind when they enacted the draconian measures.

In general, whether an ancillary barrier to entry is economic or antitrust depends only on the standalone barriers to entry that it (eventually) reinforces, not on the nature of the ancillary barrier to entry itself. Thus, if an ancillary barrier only reinforces standalone antitrust barriers, then it is also antitrust. If an ancillary barrier only reinforces standalone economic barriers, then it is both economic and antitrust, for an economic barrier is usually also an antitrust barrier.

We now employ the concepts introduced in this and the previous section to assess the nature of the barriers to entry posed by scale economies, capital requirements, and some of the other usual suspects.

III. SCALE ECONOMIES

With access to credit, an entrant could easily build a plant of minimum efficient scale. The problem is that incumbents have already built plants of minimum efficient scale. If the added output of the entrant's plant of minimum efficient scale is large relative to industry demand and existing output, the product price would fall below the entrant's per unit cost, so that entry would be unprofitable.

However, this argument assumes that the new firm expects the incumbent to maintain its pre-entry output level even after entry has occurred. Once the new firm has entered, the

incumbent may want to reduce its output from its pre-entry level, to prevent its profits from falling to zero. But then the entrant's profits might also be prevented from falling to zero, so that entry might be ex ante profitable. However, this requires some buyers to switch from the incumbent firm to the new entrant. Switching from an IBM computer system to that of a new rival may cause the business buyer to incur added costs for new software or for employee retraining. If such switching costs are high, then entry will not be profitable.

On the other hand, the new firm could enter and slightly undercut the incumbent's price. It would then get all of market demand, and entry would be profitable, provided the new firm can induce all consumers to switch to buying its product by setting a slightly lower price. Consumers may be loyal to existing brands, and for good reason. Rational consumers who have had experience with the existing brand may decide not even to try a new brand introduced at the same price and of equal ex ante attractiveness, for once the brand has been used, continuing to buy it involves less risk than trying the new brand. In order to offset brand loyalty, a new firm would have to offer a considerable price discount to lure consumers away. But at this discount, entry might no longer be profitable.

Therefore, scale economies are ancillary barriers to entry that reinforce other barriers to entry, such as customer switching costs and brand loyalty. Whether scale economies are economic barriers to entry depends on whether switching costs and brand loyalty are economic barriers to entry. The switching costs borne by entrants today are usually comparable to those that were borne by incumbents back when they entered the market, unless these incumbents were the pioneers. Thus, customer switching costs are not usually economic barriers to entry.⁴

⁴ Indeed, if scale economies are low, switching costs may even be entry boosters rather than barriers. Farrell and Shapiro (1988) analyze an overlapping generations model, in which two infinitely lived firms compete over price in the presence of buyer switching costs, and buyers live for two periods. If switching costs are greater than scale economies, the incumbent exploits his locked-in buyers and concedes the new buyers to the entrant (a Fat-Cat effect). Although switching costs make it harder for entrants to

On the other hand, brand loyalty seems to confer a definite advantage to an incumbent over potential entrants, which may lead one to conclude that it is an economic barrier to entry. However, this advantage may have been costly for the incumbent to acquire, or it may be relatively easy for potential entrants to overcome. Brand loyalty is an economic barrier to entry only if it provides the incumbent with an advantage that is more expensive for potential entrants to overcome than it was for the incumbent to acquire. This test is more stringent. Consumers may view purchases of contraceptive pills as particularly risky, so that brand loyalty in contraceptive pills may be particularly difficult for entrants to overcome; but firms' expenditures on advertising may also have to be particularly large in order to acquire brand loyalty in the market for contraceptive pills, so that on the whole brand loyalty in this market may not be an economic barrier to entry.

Even if brand loyalty is not more expensive for the incumbent to acquire than for potential entrants to overcome, one might nevertheless argue that brand loyalty is an antitrust barrier to entry if it reduces welfare by delaying entry. Consumer loyalty can reduce consumer welfare only if consumers are ignorant of some underlying bio-equivalence of the various brands in the market. Possibly, buyers may refuse to buy from a new entrant even though its brand is bio-equivalent to the incumbent's brand because they are not informed of this bio-equivalence, which is a market failure that might require intervention by the courts. One way for the courts to inform consumers about the homogeneity of brands is mandatory trademark licensing, since trademarks provide a good deal of information quickly to one who has experience with it. With mandatory trademark licensing, the courts can quickly inform consumers without them knowing it.

attract attached buyers, they actually encourage entry to serve unattached ones. However, if scale economies are greater than switching costs, the incumbent firm keeps the potential entrant out in equilibrium. The switching costs protect the incumbent from the entrant's competition for attached buyers, while the economies of scale make it unattractive for the entrant to enter and serve only the unattached buyers. This suggests that scale economies and switching costs might both be ancillary barriers to entry that reinforce each other, as well as other standalone barriers to entry.

IV. CAPITAL COSTS

The necessity for firms to be large relative to the market in order to attain productive efficiency reinforces barriers to entry such as brand loyalty and customer switching costs. This is the percentage effects of scale economies on barriers to entry. Scale economies may also affect entry because the absolute amount of capital required for efficiency may be so large that relatively few entrepreneurs could secure the required capital, or that entrants could secure it only at interest rates that placed them at an important cost disadvantage relative to incumbents.

However, many firms are capable of paying large capital costs, if the entry is worthwhile. Raising money for large projects is not necessarily more difficult than raising money for small projects. If capital markets work properly, raising capital should be no more difficult for a profitable large-scale project than for a profitable small-scale project. Profitable projects should attract many investors.

If capital markets do not work properly, prospective entrants may not be able to pay the large capital costs associated with entry even if entry is worthwhile, but incumbents may not be able to pay the large costs associated with replacing existing, depreciated capital either. Capital market imperfections favor wealthier and more experienced firms over entrepreneurs without track records, but the former are not necessarily the incumbents. Some entrants are large, diversified firms that build new plants in a new industry.⁵ Microsoft entering the internet browser business, and Sony entering the videogame business, are instances where the entrant was larger than the largest incumbent. In industries where the principle, potential entrants are large diversified firms, large capital costs may be an economic entry booster rather than barrier.

⁵ Although in most industries usually no more than 4 percent of entrants are large diversifying firms, these large entrants are typically the principle engines of industry growth. Baldwin and Gu (2003) find that in Canada almost all the contribution of plant turnover to productivity growth is due to more productive new plants of multi-plant firms displacing existing plants of multiplant firms, suggesting that small independent single-plant firms have had little impact on aggregate productivity.

Nevertheless, large capital requirements can indirectly discourage entry. Instead of being barriers to entry in their own right, capital requirements often reinforce other barriers to entry, by making the risks larger. Thus, when a solid reputation is necessary to enter an industry, large costs make it difficult or impossible to test the market; instead, the entrant must commit large resources to enter. If large sunk costs are associated with entry and entry is unsuccessful, the entrant's losses are large. In such a setting, the threat of aggressive behavior by the incumbent may deter entry. The greater the potential loss, the more potent is the threat of aggressive behavior. By magnifying risks, capital requirements reinforce other barriers to entry. Therefore, capital requirements are ancillary barriers to entry, especially if a significant proportion of them are sunk.

Capital costs are not ancillary, economic barriers to entry, since incumbents had to bear capital costs in the past similar in size to those that entrants have to bear today. Capital costs are analogous to an admission fee, which must be borne by any firm that enters the industry. Although capital costs are not economic barriers to entry, they may nevertheless be antitrust barriers to entry. Sunk costs cause firms to delay entry because of their option value. The option of entering is lost once the firm enters. With uncertainty about market conditions, this option has value. Thus dynamic entry is retarded relative to a static world.

But does this reduce social welfare? The question is whether sunk costs retard entry relative to efficient entry. Consider a simple two-period entry deterrence model in which a prospective entrant is uncertain about the incumbent's type. The incumbent is either aggressive, with probability \mathbf{a} , or weak, with probability $1-\mathbf{a}$. The aggressive incumbent never accommodates. In period 1, the potential entrant chooses whether or not to enter, not knowing the incumbent's type. If the potential entrant enters, the weak incumbent chooses whether or not to accommodate. If the incumbent does not accommodate, its payoff is 0, and the entrant's payoff is $-\mathbf{s}$, where \mathbf{s} is a measure of the extent to which the capital costs of entering the industry are sunk. If the weak incumbent accommodates, the weak incumbent and entrant both get the Cournot payoff, \mathbf{p}^c .

Even if the potential entrant does not enter in period 1, it can still choose whether or not to enter in period 2. At the end of period 1, just before period 2, the entrant learns the incumbent's type (perhaps because it has had time to observe the incumbent's reaction to other entrants). If the potential entrant does not enter in period 2 either, its payoff is 0, and the incumbent's payoff is $p^m(1+d)$, where d is the discount factor, and p^m is the monopoly profit. If the incumbent does not accommodate in period 2, then its payoff is p^m and the entrant's payoff is $-ds$. If the weak incumbent accommodates in period 2, then its payoff is $p^m + p^c d$ and the entrant's payoff is $p^c d$.

Using backward induction, we find that the weak incumbent accommodates in both periods. Therefore, the potential entrant enters in period 2 if it has learned at the end of period 1 that the incumbent is weak, but it does not enter if it has learned at the end of period 1 that the incumbent is aggressive. The potential entrant's expected payoff from not entering in period 1 is therefore $a(0) + (1-a)dp^c$ (which is a measure of the lost option value of entering), while its expected payoff from entering in period 1 is $a(-s) + (1-a)(1+d)p^c$. Therefore, the potential entrant does not enter in period 1 if and only if

$$(1) \quad s > \frac{1-a}{a} p^c$$

In this model, a relatively large sunk cost of entry results in equilibrium entry waiting for the realization of uncertainty. For an important class of demand functions, social welfare under Cournot competition is higher than social welfare under monopoly, because the profit loss incurred by the incumbent is not large enough to offset the price reduction that benefits consumers. In these cases, efficient entry is in advance of the realization of uncertainty, so that the relatively large sunk cost of entry is an antitrust barrier to entry, since it delays entry and thereby reduces social welfare.

V. OTHER USUAL SUSPECTS

Informational Advantages. The uncertainty about market conditions that incumbents had to bear in the past, when they first entered the industry, might have been similar to the uncertainty that the entrant has to bear today. Moreover, any informational advantage that the incumbent enjoys over the entrant eventually disappears as the entrant spends more time on the market. This may imply a hard patch for the entrant, but if the entrant can hold its ground, it will eventually be no more uncertain about market conditions than the incumbent. Therefore, informational advantages are best classified as ancillary, antitrust, but not economic, barriers to entry.

Indeed, sometimes what appears to be an informational advantage for incumbents actually boosts entry. During the 1940's and 1950's, du Pont gradually perfected a new process for manufacturing titanium dioxide (a whitener used in paint and paper) using ilmenite chloride technology. Copying the process took competitors and potential entrants an estimated ten years of experimentation (see Ghemawat, 1987, for a history of the american TIO₂ industry). It was not that potential entrants could not copy the process, just that it took time. Indeed, knowing Du Pont did it was useful information to potential entrants. Not knowing what an incumbent has done, but knowing that they have done it, raises a potential entrant's expectation of success in related projects, which boosts entry. Thus, what appeared to be an economic entry barrier was rather an economic entry booster, but still a significant antitrust barrier.

Absolute Cost Advantages. Incumbents may have already established their operations in the most favorable locations, so that entrants may have to pay more for scarce raw materials and other crucial inputs, and ship them a greater distance than incumbents. Favorable input access for incumbents over entrants tends to deter entry permanently, let alone delay it, and tends to deter entry into all industries, regardless of whether these

industries have many or few other barriers to entry. Therefore, they are standalone economic, and hence antitrust, barriers to entry.

Incumbents may also have patents on superior production techniques, learned through research and development. A patent is an economic barrier to entry, and may or may not be an antitrust barrier to entry depending on the time required to create intellectual property that avoids the patent in question. Legal literature on "blocking patents." Patents are still antitrust barriers to entry in the sense of limiting entry temporarily even when success at enforcing the patent is uncertain. ***

Table 1: Classification of Structural Barriers to Entry

Structural Barriers to Entry	Economic		Antitrust	
	Standalone	Ancillary	Standalone	Ancillary
Economies of Scale				+
Switching Costs			+	
Brand Loyalty	+		+	
Capital Costs				+
Absolute Cost Advantages	+		+	
Informational Advantages				+
Organizational Advantages		+		+
Asset Specificity		+	+	

Table 2: Classification of Strategic Barriers to Entry

Strategic Barriers to Entry	Economic		Antitrust	
	Standalone	Ancillary	Standalone	Ancillary
Intense advertising			+	
Contracts to block distribution			+	
Excess capacity		+	+	
Price discrimination	+		+	
Leave-only marketing		+	+	
Tying	+		+	
Collective product proliferation				+
Lobbying to raise entrant's cost	+		+	
Exclusive patent cross-licensing		+	+	

BIBLIOGRAPHY

- Bain, Joe S. (1949), "A Note on Pricing Monopoly and Oligopoly," *The American Economics Review*, vol. 39, issue 2, 448-464
- Bain, Joe S. (1950), "Workable Competition in Oligopoly: Theoretical Considerations and Some Empirical Evidence," *The American Economics Review*, vol. 40, issue 2, Supplemental Papers and Proceedings of the Sixty-second Annual Meeting of the American Economic Association, 35-47
- Bain, Joe S. (1954), "Economies of Scale, Concentration, and the Condition of Entry in Twenty Manufacturing Industries," *The American Economics Review*, vol. 44, issue 1, 15-39
- Bain, Joe S. (1956), "Barriers to New Competition," Cambridge, MA: Harvard University Press.
- Baldwin, John and Gu, Wulong (2003), "Plant Turnover and Productivity Growth in Canadian Manufacturing," Research Paper Series No. 11F0019MIE 2003193, Analytical Studies Branch. Ottawa: Statistics Canada
- Carlton, Dennis and Perloff, Jeffrey (1994), "Modern Industrial Organization," Reading, New York, NY: HarperCollins College Publishers
- Church, Jeffrey and Ware, Roger (1999), "Industrial Organization: A Strategic Approach," Boston, MA: Irwin McGraw-Hill
- Chamberlin, Edward (1935), "The Theory of Monopolistic Competition," Cambridge
- Demsetz, Harold (1982), "Barriers to Entry," *The American Economic Review*, vol. 72, no. 1, 47-57
- Fisher, Franklin M., "Diagnosing Monopoly," *Quarterly Review of Economics and Business*, Summer 1979, 19, 7-33
- Ferguson, James M. (1974), "Advertising and Competition: Theory, Measurement, Fact," Cambridge: Ballinger.
- Farrell, Joseph, Shapiro, Carl (1988), "Dynamic Competition With Switching Costs, "

- The RAND Journal of Economics, Vol. 19, No. 1, 123-137
- Gilbert, R. (1989), "Mobility Barriers and the Value of Incumbency," Handbook of Industrial Organization. ed. R. Shmalensee and R.D. Willig. Amsterdam: North-Holland, 475-535.
- Greer, Douglas F. (1992), "Industrial Organization and Public Policy," Macmillan Publishing Company, New York
- Ghemawat, Pankaj (1987), "Du Pont In Titanium Dioxide," Mimeo, Harvard Business School
- Hsieh, Chang-Tai, Moretti, Enrico, "Can Free Entry Be Inefficient? Fixed Commissions And Social Waste In The Real Estate Industry," The Journal of Political Economy, Forthcoming
- Klemperer, Paul (1987), "Entry Deterrence In Markets With Consumer Switching Costs," The Economic Journal, Vol. 97, Issue Supplement: Conference Papers, 99-117
- McAfee, R. Preston (2002), "Competitive Solutions: The Strategist's Toolkit," Princeton University Press, New Jersey
- Muhse, Albert C. (1916), "Trade Organization and Trade Control in China," The American Economics Review, vol. 6, issue 2, 309-323
- Pindyck, Robert and Rubinfeld, Daniel (1998), "Microeconomics," Upper Saddle River, NJ: Prentice Hall.
- Posner, Richard H., "The Chicago School of Antitrust Analysis," University of Pennsylvania Law Review, April 1979, 925-948
- Schmalensee, Richard (1979), "On the Use of Economic Models in Antitrust: The ReaLemon Case," University of Pennsylvania Law Review, Vol. 127, 994-1050
- Schmalensee, Richard (1981), "Economies of Scale and Barriers to Entry," The Journal of Political Economy, Vol. 89, No. 6, 1228-1238
- Stigler, George (1968), "The Organization of Industry," Chicago, IL: University of Chicago Press.
- Shepherd, William G. (1997), "The Economics of Industrial Organization," Prentice-Hall, New Jersey
- Shughart II, William E. (1990), "The Organization of Industry," BPI Irwin, Boston
- Tirole, Jean (2000), "The Theory of Industrial Organization," The MIT Press, Cambridge,

- Massachusetts
- von Weizsacker (1980, 1), "A Welfare Analysis of Barriers to Entry," *Bell Journal of Economics*, Vol. 11, No. 2, 399-420.
- von Weizsacker (1980, 2), "Barriers to Entry: A Theoretical Treatment," Germany: Springer-Verlag.
- Viscusi, W. Kip, Vernon, John, and Harrington, Joseph (2000), "Economics of Regulation and Antitrust," Third Ed., Cambridge, MA: MIT Press.
- Williams, E.T. (1912), "Taxation in China," *The Quarterly Journal of Economics*, vol. 26, issue 3, pp. 482-510
- Wallace, Donald H. (1936), "Monopolistic Competition and Public Policy," *The American Economics Review*, vol. 26, issue 1, Supplemental Papers and Proceedings of the Forty-eighth Annual Meeting of the American Economic Association, 77-87