WHAT IS A BARRIER TO ENTRY?

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

In the Papers and Proceedings of the Forty-eighth Meeting of the American Economic Association, published in March 1936, Donald H. Wallace proposed a research program that proved visionary: "The nature and extent of barriers to free entry needs thorough study" (p. 83). Fifteen years later, Joe S. Bain published a book that was the first thorough study of entry barriers.

In this book, Bain (1956) defined an entry barrier as anything that allows incumbents to earn above-normal profits without inducing entry. He believed that economies of scale and capital requirements meet his definition because they seem to be positively correlated with high profits. George J. Stigler (1968) later defined an entry barrier as a cost advantage of incumbents over entrants. With equal access to technology, scale economies are not an entry barrier according to this definition, and neither are capital requirements, unless incumbents never paid them.

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 an entry barrier, and the question of whether scale economies and capital costs each constitute one.

*Preston McAfee, Department of Economics, University of Texas at Austin, Austin, TX, 78712 (preston@mcafee.cc), Hugo mialon, Department of Economics, Emory University, Atlanta, GA 30322 (hmialon@emory.edu), Michael Williams, KeyPoint LLC, 2200 Powell Street, Suite 1080, Emeryville, CA 94608 (mwilliams@keypointconsulting.com). We are grateful to Sue Mialon for comments.

The present article is an attempt to resolve these controversies. We begin by contrasting the definitions of an entry barrier proposed in the economics literature. We then introduce a classification system to clear up the existing confusion, and we employ it to assess the nature of the barriers posed by scale economies and sunk costs.

I. HISTORY OF THE CONCEPT

In chronological order, the seven principal definitions of an entry barrier proposed in the economics literature are:

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.

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

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.

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

Definition 5 (Von Weizsacker, 1980, p. 400). A barrier to entry is a cost of producing that must be borne by a firm seeking 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.

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

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 necessarily incurred by a new entrant that incumbents do not (or have not had to) bear.

Bain's definition is flawed in that it builds the consequences of the definition into the definition itself. Moreover, one can imagine an industry with competitive pricing due to the presence of many incumbents but with no possibility of entry (e.g. by government fiat); such an industry has no entry barriers according to Bain's definition.

Stigler's definition avoids tautology by identifying an entry barrier in terms of its fundamental characteristics, emphasizing the differential costs between incumbents and entrants. However, the present tense "is" in the definition is confusing. Literally, the definition implies that a cost that only entrants (not incumbents) have to bear today is not an entry barrier, even if incumbents had to bear it in the past (when they entered the market).

Stigler's definition is narrower than Bain's, that is, some costs are barriers according to Bain and not according to Stigler; but all Stiglerian barriers meet Bain's definition.

Ferguson's definition follows Bain's, but with the additional requirement that incumbents earn monopoly profits. Pricing above marginal cost is not sufficient for incumbents 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 quality competition among incumbents.

Fisher's definition follows those of Bain and Ferguson, but is normative rather than positive. For Fisher, an entry barrier is socially harmful only if potential entrants make a calculation that is different from the one that society would want them to make in deciding whether to enter an industry that possesses the barrier in question.

Von Weizsacker's definition is also normative, but follows Stigler's definition. He argues that a cost differential is an entry barrier only if it reduces welfare. His point is that the number of firms in a Cournot industry can be greater than the socially optimal number. In this case, entry barriers serve a socially desirable purpose.

Gilbert's definition focuses on the advantages of incumbents rather than the disadvantages of entrants. According to him, an entry barrier is the additional profit that firms can earn as a sole consequence of being established in the industry. This definition has an immediate problem in that a profit is not a barrier.

Carlton and Perloff offer two definitions. They argue that the first is not practical because it implies that any capital requirement is an entry barrier, and that any industry in which entry takes time has an entry barrier. 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.

Unfortunately, they avoid the timing issue by considering only entry barriers

in the long run. They argue that a firm can only earn profits in the long-run if it has an advantage over potential entrants, which leads them to adopt a moderm version of Stigler's definition. Notice that their version clears up the confusion about the present tense "is" in Stigler's definition.

Scale economies and capital requirements are entry barriers according to Bain's definition because they seem to be positively correlated with profits. Scale economies are not an entry barrier according to Stigler's definition provided entrants and incumbents have equal access to technology. Capital requirements are not Stiglerian entry barriers either, unless the incumbent never paid them.

Fisher also claims that capital requirements are not entry barriers according to his definition. Consider, as Fisher does, 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 cost. But, argues Fisher, 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 that which it could earn elsewhere. Fisher therefore concludes that, according to his definition, capital requirements, no matter how large, are not entry barriers.

But Fisher's argument ignores consumer surplus, which enters into society's calculation, but not into the potential entrant's calculation. The addition of another firm to the industry could increase competition, and hence consumer surplus, enough to compensate for the entrant's profit loss in society's calculation. Governments have operated

firms on this theory, to create price competition where there would otherwise be a natural monopoly.

Capital requirements or scale economies may not constitute entry barriers according to Von Weizsacker's definition. To prove this, Von Weizsacker models an industry with scale economies, and shows that the number of active firms in the Cournot equilibrium with free entry exceeds the number of active firms that would maximize social surplus. The cost savings that arise with fewer firms from taking advantage of scale economies more than compensate for the reduction in total output from having fewer firms. In such an industry, additional entry barriers enhance welfare.

Capital requirements can be entry barriers according to Gilbert's definition, especially if a significant proportion of them are sunk. Sunk costs generate earnings that would be lost if a firm exits the market; in this sense, sunk costs are exit barriers. Exit barriers can affect entry by influencing the incentives of incumbents. If incumbents cannot exit without considerable losses, then their threats of aggressive post-entry behavior are more credible, which deters entry and earns them higher profit. Thus, exit barriers for incumbents create entry barriers.

Moreover, sunk costs increase an entrant's losses in the event that entry fails, which makes the incumbent's threats of aggressive post-entry behavior more frightening. Thus, exit barriers for entrants create entry barriers. In these ways, sunk costs provide rents to incumbents, and hence are entry barriers according to Gilbert's definition, while they are not according to Stiglerian definitions, since all entrants must bear them equally.

II. ECONOMIC ANALYSIS

As we have seen, the concept of an entry barrier has a rich and confused heritage in economics. To clear up the confusion, we offer a new classification of entry barriers:

Definition 8. An economic barrier to entry is a cost that must be incurred by a new entrant and that incumbents have not had to incur.

Definition 9. An antitrust barrier to entry is a cost that delays entry, and thereby reduces social welfare relative to immediate but equally costly entry.

Most economic entry barriers are antitrust entry barriers. However, many antitrust entry barriers are not economic entry barriers. Antitrust is a larger category than economic.

When free entry leads to the efficient number of firms, if a market has no antitrust entry barriers, then it is efficient. If it has no economic entry barriers, then it is eventually efficient. An antitrust entry barrier in a market that is otherwise efficient reduces welfare relative to what it would have been in the absence of that barrier.

The presence of an antitrust entry barrier does not necessarily mean that 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 means that welfare would be higher if that barrier did not exist.

In our analysis, we also find it useful to distinguish between direct and reinforcing barriers:

Definition 10. A primary barrier to entry is a cost that constitutes a barrier to entry on its own.

Definition 11. 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 primary barriers may constitute a significant entry barrier. A group of small ancillary barriers do not commonly constitute a significant entry barrier unless other primary barriers are also present. However, in some cases, large ancillary barriers can combine, and reinforce each other, to form a large primary entry barrier.

A particular ancillary barrier may produce a primary entry barrier only when combined with a restricted class of other ancillary barriers, or reinforce only a restricted class of other primary entry barriers. If a market possesses no entry barrier from either class, the ancillary barrier in question does not deter entry.

III. SCALE ECONOMIES

Bain argued that scale economies are an entry barrier. Incumbents may have already built plants of efficient scale. If the added output of the entrant's efficient plant is large relative to industry demand and existing output, price could fall below the entrant's per unit cost, and entry could be unprofitable.

This argument assumes that the entrant 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 to prevent its profits from falling to zero. But then the entrant's profits might also be prevented

from falling to zero, and entry might be *ex ante* profitable.

However, the incumbent's output reduction would prevent the potential entrant's post-entry profits from falling to zero only if it caused some fraction of customers to switch from the incumbent to the entrant. Customers may be loyal to an existing brand because continuing to buy it involves less risk than trying a new one. Therefore, scale economies deter entry only if customers are sufficiently loyal to the incumbent's brand. Hence, scale economies are ancillary entry barriers that reinforce primary entry barriers such as brand loyalty.

We now argue that scale economies are antitrust, not economic, entry barriers. Bain's notion, that entry may be deterred because the industry only has room for a fraction of the efficiently-scaled plant, is generally a short-run phenomenon that doesn't persist as existing plants are replaced. Moreover, in an industry experiencing growth, the fractional issue is clearly temporary. Thus, scale economies are not economic, but may be antitrust, entry barriers if they delay entry and thereby reduce social welfare.

In a technical appendix to this paper, we have constructed model in which new firms face Cournot competition with incumbents if they choose to enter, and in which (1) scale economies do not delay entry on their own, (2) brand loyalty delays entry on its own, and (3) brand loyalty delays entry even longer in the presence of scale economies. Thus, according to the model, scale economies are ancillary barriers that exacerbate the entry delay caused by brand loyalty.

But does the additional delay caused by scale economies necessarily reduce social welfare? For an important class of

demand functions (including linear demand), 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, scale economies are ancillary antitrust entry barriers, since they delay entry by reinforcing the entry deterrent effects of brand loyalty, and thereby reduce social welfare.

IV. SUNK COSTS

Many firms are capable of paying large capital costs if entry is worthwhile. If capital markets are efficient, raising capital is no more difficult for profitable large-scale projects than for profitable small-scale ones. And even if capital markets are inefficient, perhaps because of asymmetric information about industry prospects, they do not necessarily fail in larger measure with large-scale projects than with small-scale ones.

While prospective entrants may not be able to finance the large capital costs associated with entry even if entry is worthwhile, incumbents may not be able to finance the large capital 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 an industry. Microsoft entering the internet browser business is an instance where the entrant was larger than the largest incumbent. In industries where the primary, potential entrants are large diversified firms, large capital costs are not entry barriers.

Nevertheless, capital costs can indirectly discourage entry. Instead of being entry barriers in their own right, they often reinforce other entry barriers, 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 frightening is the threat of aggressive behavior. By magnifying risks, capital requirements reinforce other entry barriers. Therefore, capital requirements are ancillary barriers, especially if a significant proportion of them are sunk.

Capital requirements are not economic entry barriers, since incumbents had to bear capital costs in the past similar in size to those that entrants have to bear today. However, they may nevertheless be antitrust entry barriers. 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 delayed relative to a static world.

In the technical appendix to this paper, we argue formally that sunk costs, like scale economies, are ancillary antitrust entry barriers. We present a model in which (1) sunk costs do not delay entry in the absence of uncertainty, (2) uncertainty does not delay entry in the absence of sunk costs, but (3) uncertainty and sunk costs combine to delay entry until the realization of

uncertainty. For an important class of demand functions, efficient entry is in advance of the realization of uncertainty. In these cases, sunk costs and uncertainty are ancillary antitrust entry barriers that combine, and reinforce each other, to produce a primary antitrust entry barrier.

V. CONCLUSION

The presence of entry barriers is the central subject of contention in numerous antitrust lawsuits.[1] Usually, a merger in a particular industry cannot permanently reduce competition if new firms can easily enter the industry. Therefore, to prove that mergers are socially harmful, antitrust authorities must usually, at the very least, demonstrate the presence of entry barriers. To do so, they must rely on a definition, and for this, they have often turned to economists.

Unfortunately, economists have not yet been able to reach broad consensus over the definition of an entry barrier, and this has probably hindered the development of efficient antitrust policy. In the hope of facilitating consensus, we have illuminated two other aspects of entry: (1) the effect of alleged entry barriers on the timing of entry, and (2) the effect on the timing of entry of the interaction between different alleged entry barriers.

[1] See, for instance, American Tobacco Co. v. United States, 328 U.S. 781 (1946), FTC v. Procter & Gamble, 386 U.S. 568 (1967), General Foods v. FTC, 391 U.S. 919 (1968), Southern Pac. Communications Co. v. AT&T, 556 F. Supp. 825 (1985), Ball Memorial Hosp., Inc. v. Mutual Hosp. Ins., Inc., 784 F.2d 1325 (1986), and California v. American Stores Co, 872 F.2d 837 (1989).

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TECHNICAL APPENDIX

First, we argue formally that scale economies are ancillary, antitrust barriers to entry. To do so, we present a simple model in which (1) scale economies do not delay entry on their own, (2) brand loyalty delays entry on its

own, and (3) brand loyalty delays entry even longer in the presence of scale economies.

Consider a one-shot entry game. A potential entrant first chooses whether or not to enter a market. If it chooses not to enter, the sole incumbent acts as a monopolist. If it chooses to enter, the entrant and incumbent play a Cournot duopoly game. The entrant and incumbent both have the same cost function $C(q) = cq + f$, where c is marginal cost, and f is fixed cost (the simplest expression of scale economies). Note that incumbent and entrant both have to bear the fixed cost f. Therefore, f is certainly not an economic barrier to entry in this model. The incumbent's inverse demand function is given by $P(q) = 1 - Q$, where Q is the total quantity produced by the industry, that is, $Q = q_I + q_E$ if the potential entrant chooses to enter the market, and $Q = q_I$ otherwise, where q_I and q_E are the incumbent's and entrant's quantity choices, respectively. The potential entrant's inverse demand function, if it chooses to enter the market, is given by $P(q) = 1 - Q - \lambda$, where λ is a measure of consumers' loyalty to the incumbent's brand. Note that if λ deters entry, then it is an economic barrier to entry, since in this model it is a cost to the entrant but not to the incumbent.

Case 1. $\lambda = 0$ and $f > 0$

In the subgame that follows entry, the incumbent and entrant's maximization problem is

(1) $\max_{q_i} (1 - Q)q_i - cq_i - f$

The equilibrium quantity choices of the incumbent and entrant are

(2) $q_I = q_E = \frac{1-c}{3}$

Therefore, the incumbent and entrant's equilibrium profits are given by

(3) $\pi_I = \pi_E = \frac{(1-c)^2}{9} - f$

Hence, the potential entrant chooses to enter if and only if

(4) $f \le \frac{(1-c)^2}{9}$

Note that if the marginal and fixed costs are small enough, inequality (4) is satisfied, so that the fixed cost never deters entry, in the absence of brand loyalty. In other words, for the parameter ranges defined by (4), scale economies are not primary barriers to entry.

Case 2. $\lambda > 0$ and $f = 0$

In this case, the entrant's maximization problem is

(5) $\max_{q_E} (1-Q-\lambda)q_E - cq_E$

The first order condition yields

(6) $q_E = \frac{1-q_I-c-\lambda}{2}$

The incumbent's maximization problem is

(7) $\max_{q_E} (1-Q)q_E - cq_E$

Here, the first order condition yields

(8) $q_I = \frac{1-q_E-c}{2}$

Solving (7) and (8) simultaneously yields

(9) $q_I = \frac{1-c+\lambda}{3}$ and

$q_E = \frac{1-c-2\lambda}{3}$

Therefore, the potential entrant's profits, if it chooses to enter the market, are given by

(10) $\pi_E = \frac{(1-c-2\lambda)^2}{9}$

The equation $\pi_E = 0$ has the following root:

(11) $\lambda_1 = \frac{1-c}{2}$

Therefore, the potential entrant chooses to enter if and only if

(12) $\lambda < \frac{1-c}{2}$

where the quantity on the right hand side is the monopoly output. When brand loyalty is large enough, inequality (12) is not satisfied, and so entry is deterred, even in the absence of scale economies. In this case, brand loyalty is a primary, economic barrier to entry.

Case 3. $\lambda > 0$ and $f > 0$

In this case, the entrant' maximization problem is

(13) $\max_{q_E}(1-Q-\lambda)q_E - cq_E - f$

And the incumbent's maximization problem is

(14) $\max_{q_E}(1-Q)q_E - cq_E - f$

The solutions to (13) and (14) are the same as the solutions to (5) and (7):

(15) $q_I = \frac{1-c+\lambda}{3}$ and $q_E = \frac{1-c-2\lambda}{3}$

Therefore, the potential entrant's profits, if it chooses to enter the market, are given by

(16) $\pi_E = \frac{(1-c-2\lambda)^2}{9} - f$

The equation $\pi_E = 0$ now has the following two roots:

(17) $\tilde{\lambda}_{1,2} = \frac{1-c\pm 3\sqrt{f}}{2}$

Therefore, the potential entrant chooses to enter if and only if

(18) $\lambda < \frac{1-c-3\sqrt{f}}{2} < \frac{1-c}{2}$

Hence brand loyalty deters entry for a larger range of parameters with scale economies than without them.

Can this imply that brand loyalty delays entry longer with scale economies than without them? The model does not have an explicit time dimension, but we can nevertheless address the issue of entry delay indirectly by considering how the model's parameters might change over time. Suppose that technological innovation in input markets will continuously reduce the industry's marginal cost c for all of its participants. Then, entry would eventually take place, all else approximately constant, for as c decreases, the inequalities in (18) are more likely to be satisfied. But entry would take place later with scale economies than without them, since the

first inequality in (18) is stricter than the second.

Does the additional delay in entry occasioned by scale economies necessarily reduce social welfare? For an important class of demand functions (including linear demand), 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, scale economies are ancillary, antitrust barriers to entry, since they delay entry by reinforcing the entry deterrent effects of brand loyalty, and thereby reduce social welfare.

Second, we argue formally that sunk costs are ancillary, antitrust barriers to entry also. To do so, we present a simple model in which (1) sunk costs do not delay entry in the absence of uncertainty, (2) uncertainty does not delay entry in the absence of sunk costs, but (3) uncertainty and sunk costs combine to delay entry.

Consider a two-period entry deterrence model in which a prospective entrant is uncertain about the incumbent's type. The incumbent is either aggressive, with probability α, or weak, with probability $1-\alpha$. 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 $0+\delta\pi^m$, where δ is the discount factor, and the entrant's payoff is $-\sigma$, where σ 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, π^c, in each of the two periods, for a total payoff of $(1+\delta)\pi^c$.

If the potential entrant does not enter in period 1, it chooses 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 either period, its payoff is 0, and the incumbent's payoff is $\pi^m(1+\delta)$, where π^m is the monopoly profit. If the incumbent does not accommodate in period 2, then its payoff is π^m and the entrant's payoff is $-\delta\sigma$. If the weak incumbent accommodates in period 2, then its payoff is $\pi^m + \pi^c\delta$ and the entrant's payoff is $\pi^c\delta$. Notice that if $\delta\pi^m < (1+\delta)\pi^c$, the incumbent never accommodates, and hence the potential entrant never enters if it has to incur any positive sunk entry cost. Henceforth, we assume that $\delta\pi^m < (1+\delta)\pi^c$.

Case 1. $\alpha \in \{0,1\}$ and $\sigma > 0$

Suppose $\alpha = 0$. By backwards induction, the incumbent accommodates in both periods, and hence the entrant enters in period 1, regardless of σ. Now suppose $\alpha = 1$. In this case, the entrant knows that the incumbent never accommodates, and therefore it never enters, whether σ is small or large. Thus, large sunk costs do not delay entry, or do not cause additional entry delay, in the absence of uncertainty. In other words, sunk costs are not primary barriers to entry.

Case 2. $\alpha \in (0,1)$ and $\sigma = 0$

By backwards induction, 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 does not enter if it has learned that the incumbent is aggressive. Now, the potential entrant's expected payoff from not entering in period 1 is $(1-\alpha)\delta\pi^c$ (which is a measure of the lost option value of entering), while its expected payoff from entering in period 1 is $(1-\alpha)(1+\delta)\pi^c$. Thus, the potential entrant always enters in period 1. Thus, uncertainty never deters entry, in the absence of sunk entry costs. In other words, uncertainty is not a primary barrier to entry either.

Case 3. $\alpha \in (0,1)$ and $\sigma > 0$

By backward induction, we find, once again, that the weak incumbent accommodates in both periods, and therefore, the potential entrant enters in period 2 if it learns that the incumbent is weak, but does not enter if it learns that the incumbent is aggressive. The potential entrant's expected payoff from not entering in period 1 is still $(1-\alpha)\delta\pi^c$, but now its expected payoff from entering in period 1 is $\alpha(-\sigma)+(1-\alpha)(1+\delta)\pi^c$. Therefore, the potential entrant does not enter in period 1 if and only if

$$\sigma > \frac{1-\alpha}{\alpha}\pi^c \qquad (19)$$

Thus, large sunk costs (high σ) and uncertainty (α not too small) can combine to delay entry until the realization of uncertainty. For an important class of demand functions, efficient entry is in advance of the realization of uncertainty. Hence, sunk costs and uncertainty are ancillary,

antitrust barriers to entry that combine, and reinforce each other, to produce a primary, antitrust barrier to entry.