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ADVERTISING, SUNK COSTS, AND BARRIERS TO ENTRY

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I. Introduction

The present analysis is designed to test hypotheses about the entry-deterring effects of advertising in the context of a simple model of entry behavior. Despite the considerable attention this question has received in the industrial organization literature, we note the lack of consensus and a continuing controversy. We attribute this, at least partly, to the absence of an underlying theoretical structure with sufficient empirical content. A formal selection among competing hypotheses requires such structure and this paper will attempt to provide it, albeit in a simplified form.

The original impetus for work in this area stemmed from the suspicion that advertising and competition are incompatible. More specifically, the proposition was advanced that high levels of advertising lead to increased monopoly power and ultimately to sustained supra-normal profits.[1] This proposition was based on the theoretical arguments that advertising erects barriers to entry because: (a) it lowers the cross-price elasticity of demand between brands by enhancing consumer brand loyalty, and therefore renders more difficult any attempt by new entrants to induce brand switching, and (b) it is subject to economies of scale, making small scale entry inefficient while large scale entry would significantly depress price and perhaps induce a retaliatory response from the incumbents.[2]

The claim that advertising creates entry barriers received support largely from an indirect test. A number of empirical studies reported a significantly positive coefficient in an equation explaining profitability.[3] However, there is some controversy about the appropriate interpretation of the observed positive correlation in the cross-section and whether such correlation would persist once the investment-like characteristics of advertising were taken into account.[4]

A contrary hypothesis was later proposed according to which advertising not only does not lead to monopoly power but actually promotes competition.[5] This alternative model maintains that advertising, by providing information about the existence of alternative products and their price-quality characteristics, reduces the search costs faced by consumers, thereby decreasing their loyalty and inertia. Some support is provided for this view by the empirical finding that the prices for selected consumer products (e.g. eyeglasses) are lower in states where their advertising is permitted than where it is prohibited.

This paper attempts to clarify the mechanism through which advertising affects entry. We construct a model of entry behavior which isolates three separate effects of advertising: the effect on the measured rates of profit, the effect on the irreversible costs of entry, and the effect on the risk of entry as perceived by potential entrants.

A key point of our analysis is the high degree of sunkness characterizing investments in advertising. The need to sink money into advertising imposes an asymmetry between the incremental cost and incremental risk faced by a potential entrant and those faced by the incumbent firms.[6] This asymmetry can be further exploited by the incumbents through strategic commitments in advertising to deter entry.

Of critical importance, too, is how the observed advertising intensity in a given market affects the entrant's perceived likelihood of successful penetration of that market. Thus, we present the main arguments put forth by the two major schools of thought concerning the relationship between advertising and competition and examine their implications for our somewhat narrower question of how advertising affects the risk of entry.[7]

II. The Model

The present analysis of the entry process is based on a set of strong assumptions. However, when compared to the more sophisticated analytic models available,[8] it has the compensating advantages that: i) it is amenable to an operational specification, ii) it highlights the critical effect of sunk costs, which have been viewed recently as the principle barrier to entry,[9] and iii) it permits the test of hypotheses concerning the threat of retaliatory responses by the incumbents as perceived by the potential entrant.

The model deals with an industry in which n_e-1 firms have entered since time zero. The focus is on the entry decision of the n_eth prospective entrant. If the entrant acts on the assumption that the incumbents will maintain their output and if there is no growth in demand for the industry's product, then the price the n_eth entrant should expect will be given by:

$$p_e = p(Q_o + Q_e + \tilde{q}_e) \simeq p(Q_o) + (Q_e + \tilde{q}_e)\cdot \frac{\partial p}{\partial q}\Big|_{q=Q_o} \qquad \text{(II.1)}$$

$$\simeq p_o[1 - \frac{Q_e + \tilde{q}_e}{Q_o}\varepsilon] = p_o[1 - n_e\cdot\frac{q_e}{Q_o}\cdot\varepsilon]$$

where $p_o = p(Q_o)$, $\varepsilon = -\frac{Q_o}{p_o}\frac{\partial p}{\partial q}\Big|_{q=Q_o}$, Q_o is the pre-entry industry output, Q_e is the output supplied by the n_e-1 firms which entered since time zero, $\tilde{q}_e$ is the output of the n_eth entrant, and q_e/Q_o is the mean scale of entry to be defined later. Equation (II.1) indicates that the amount by which price falls following entry depends on the excess of the post-entry over the pre-entry output and the relevant elasticity of demand.

Let us assume now that the n_eth entrant anticipates a growth in demand given by g, i.e.

$$q = (1+g)\cdot f(p) \qquad \text{(II.2)}$$

where $Q_o = f(p_o)$ represents the demand for the industry's product at $t = 0$. Then it is easy to calculate the price change Δp due to the additional output Δq supplied to the market:

$$\Delta q = q - Q_o = (1+g)\cdot f(p) - f(p_o) = (1+g)\cdot[f(p_o) + \Delta p \left.\frac{\partial f}{\partial p}\right|_{p=p_o}] - Q_o$$

$$\Delta p = \frac{\Delta q - g\cdot Q_o}{(1+g)\cdot \left.\frac{\partial f}{\partial p}\right|_{p=p_o}} = p_o \cdot \frac{n_e \cdot \frac{q_e}{Q_o} - g}{(1+g)\cdot(-\varepsilon_p)} \qquad \text{(II.3)}$$

where $\varepsilon_p = -\frac{p_o}{Q_o}\cdot\left.\frac{\partial f}{\partial p}\right|_{p=p_o}$ is the price elasticity of demand for the industry's product.

We proceed further by relaxing the assumption that the incumbents maintain their pre-entry output. If we assume that the incumbents will expand by $\tilde{g}$ (on a percentage basis), then the expression in (II.3) is modified as follows:

$$\Delta p = p_o \cdot \frac{n_e\cdot\frac{q_e}{Q_o} - (g - \tilde{g})}{(1+g)\cdot(-\varepsilon_p)}. \qquad \text{(II.4)}$$

The price the n_eth entrant should expect is therefore given by:

$$p_e = p_o\cdot[1 - \frac{n_e\cdot\frac{q_e}{Q_o} - (g - \tilde{g})}{(1+g)\cdot\varepsilon_p}]. \qquad \text{(II.5)}$$

The expected profit of the n_eth entrant will be given by:[10]

$$E(\Pi_e) = \alpha\,\{p_o\cdot[1 - \frac{n_e\cdot\frac{q_e}{Q_o} - (g - \tilde{g})}{(1+g)\cdot\varepsilon_p}] - AC^T\}\,\tilde{q}_e\,\gamma \qquad \text{(II.6)}$$

$$- (1-\alpha)\cdot[(1-S_K)\,K_e + (1-S_A)\,A_e]$$

where α is the probability the entrant perceives of having a successful entry; AC^T is the average cost of production including capital costs; $\gamma = \int_o^T e^{-rt}\,dt$, r being the discount rate and T the expected lifetime of the entrant in the industry; K_e and A_e are the entry investments in capital and advertising, respectively; and $1-S_K$, $1-S_A$ represent the unrecoverable portion of the entry investment in capital and advertising, respectively, in the event of exit.

Under the assumption that entry into a given industry continues until the expected entry profit is driven to zero, we obtain the following expression for the number of new entrants:

$$n_e = \frac{g - \tilde{g}}{q_e/Q_o} + \frac{(1+g)\cdot\varepsilon_p}{q_e/Q_o}\, \Pi_o \cdot \{1 - \frac{1}{\gamma\Pi_o} \cdot \frac{1-\alpha}{\alpha} [\frac{(1-S_K)\ K_e + (1-S_A)\ A_e}{S_e}]\} \quad \text{(II.7)}$$

where $\Pi_o = \frac{(p_o - AC^T)\cdot Q_o}{p_o \cdot Q_o}$ is the pre-entry price-cost margin of the incumbents and $S_e = p_o \cdot \tilde{q}_e$. Note that the first term $\frac{g - \tilde{g}}{q_e/Q_o}$ in the above equation indicates the number of new firms that could fit in the industry due to demand growth without depressing the price or capturing sales away from the incumbents. The (1+g) factor in the second term expresses the fact that, again because of growth in demand, the additional output supplied to the market will depress price at a slower rate.

The Effect of Advertising as a Sunk Cost

Our basic assumption here is that advertising has a long-lasting effect on sales and therefore has to be considered as an investment in a capital asset. For the prospective entrant, the act of entry requires the conversion of liquid assets into advertising capital which is completely non-salvageable if the entrant is forced to exit. This need tc sink money into advertising imposes an asymmetry between the incremental cost and incremental risk faced by a potential entrant and those faced by the incumbent firms (in the same manner as the need to sink money into machines).[11]

The expected incremental cost facing the new entrant includes $(1-S_A)\cdot A_e$, the sunk portion of the investment in advertising. For the incumbents, however, the sunk costs are mostly bygone, for these firms have already introduced their ex ante risky products, which by time zero are largely established. While their further participation in the market is not without risks, it can be reasonably assumed nevertheless that their continued operation with established products exposes them to a smaller peril than the new entrant with an untested product and no consumer experience. In the extreme case, for an incumbent who is beyond the regime of failure (i.e. $\alpha = 1$), advertising enters only in AC^T and is thus a normal cost of doing business.

It is in this sense that advertising constitutes a sunk cost barrier to entry. It is important to note that economies of scale in advertising or the possibility that a new entrant might have to advertise more than the incumbents (per unit of sales) to overcome the consumer inertia are not necessary conditions for advertising to constitute an entry barrier. Even if there were no economies of scale or consumer inertia, advertising would still give rise to an entry barrier because of the above-mentioned asymmetry in the costs and risks to a new entrant and the incumbents. Notwithstanding this, the existence of economies of scale and consumer brand loyalty certainly would accentuate this asymmetry.

The advertising by incumbents may simply reflect profit-maximizing behavior. In such a case a sunk cost entry barrier is unintentionally erected. On the other hand, incumbents who attempt to exploit their leadership role in order to thwart entry might view advertising as an instrument of deterence.[12] For them, advertising represents a binding commitment which the entrant must match, conceivably making his entry unprofitable. The sunk cost effect of advertising could therefore already reflect this strategic choice.

Hypothesis 1

For the potential new entrant, the required investment in advertising leads to an unrecoverable entry cost in the case of failure -- thus, advertising creates a sunk cost barrier to entry.

The Effect of Advertising on the Risk of Entry

The height of the barrier which sunk costs are hypothesized to erect depends on the risk they expose the entrant to -- as the term $\frac{1-\alpha}{\alpha} \cdot \frac{(1-S_K) \cdot K_e + (1-S_A) \cdot A_e}{S_e}$ in Equation (II.7) indicates, where $\frac{1-\alpha}{\alpha}$ is the perceived relative probability of exit.

A major factor contributing to such risk is brand loyalty resulting from the experience of buyers with the established products.[13] We must recognize that sampling normally imposes a certain cost against which the expected benefits from finding a better brand through additional search must be weighed. Such a cost gives rise to buyer inertia. It is therefore important for the entrant to assess the difficulty of altering the existing patterns of loyalty in a given market and of overcoming the associated buyer inertia.

According to the Advertising = Market Power school, advertising is an instrument of persuasion. It increases brand loyalty, reduces the perceived number of product substitutes by enhancing differentiability, and ultimately lowers the cross-price elasticity of demand. Advertising acts as a complement to experience in reinforcing the buyers' valuation of the established brands. As the buyers' uncertainty about this valuation is reduced, their motivation to try different brands is lessened and aggregate brand switching declines. This view seems to suggest that entry into a market characterized by high levels of advertising -- where incumbents are insulated from potential rivals by loyal and persuaded customers -- would pose a high degree of risk of failure for the entrant.

The Advertising = Competition school maintains that advertising is an attention getting device. It informs buyers about the attributes and prices of products, thereby reducing their search costs and decreasing their inertia. It acts as a substitute for experience and thus is a means of overcoming loyalty. It also adds to the perceived number of product substitutes, increases the cross-price elasticity of demand and leads to a higher incidence of brand switching. This view has opposite implications for the process of entry into an industry characterized by intense advertising, which should contain well-informed, mobile and price-sensitive buyers.

This paper is based on the premise that in an actual market, advertising includes both elements of persuasion and information. Any monopolistic potential that might be created by enhanced product differentiation and loyalty is counterbalanced by the competitive pressure resulting from different sellers attempting to concentrate demand upon their own brands. Which of these two forces is more powerful is a question that can be answered only by looking at the empirical evidence.

Thus, we propose to formally discriminate between the two alternative hypotheses:

Hypothesis 2a (Advertising = Persuasion school)

Potential entrants perceive a greater risk of entry failure in markets with high advertising intensity:

$$\frac{\partial}{\partial(\frac{A}{S})} \left(\frac{1 - \alpha}{\alpha} \right) > 0$$

Hypothesis 2b (Advertising = Information school)

Potential entrants perceive a greater likelihood of success in markets where advertising is important:

$$\frac{\partial}{\partial(\frac{A}{S})} \left(\frac{1 - \alpha}{\alpha} \right) < 0$$

where $\frac{A}{S}$ is the advertising intensity (advertising-to-sales ratio) in a given market.

III. Data and Measurement Problems

Our sample consists of all the 4-digit U.S. manufacturing industries which experienced net entry between the census years 1972 and 1977. There were 266 such industries.[14]

The Appendix provides the definitions and sources of the variables used in this paper. We restrict our attention below to those variables which entail measurement and definitional difficulties.

Price-Cost Margin

The theory underlying this model suggests that the pre-entry price-cost margin of the incumbents is a pertinent variable in an equation explaining entry. We modify the traditional measure of this variable (value-added minus payroll divided by sales) commonly employed as a proxy for profitability in inter-industry studies by taking into account capital costs. These costs include both depreciation and the opportunity cost of capital. In addition, in this corrected measure of the margin, advertising expenditures are capitalized rather than treated as current expenses.

The corrected definition of the price-cost margin for the ith 4-digit industry is therefore given by: [15]

$$\Pi_o^i = \frac{VA_o^i - W_o^i - (r+\lambda_M^i)\cdot M_o^i - (r+\lambda_B^i)\cdot B_o^i - (r+\lambda_A)\cdot A_o^i}{S_o^i} \qquad i = 1, \ldots, 266$$

where VA_o^i = value added; W_o^i = payroll; r = opportunity cost of capital; λ_M^i, λ_B^i, λ_A = the annual depreciation rates for machines, buildings, and advertising; M_o^i, B_o^i = fixed depreciable assets in the form of machines and buildings; A_o^i = advertising expenditures; and S_o^i = industry sales.

Sunk Costs

If exit occurs after an asset depreciates by k%, then the unrecoverable portion of the original investment in that asset equals at most 1-k%. The k% that has depreciated is already captured in AC^T and is a normal cost of doing business (borne also by the incumbents). The remaining 1-k%, however, will have to undergo resale, which will produce a sunk cost not faced by the incumbents who are assumed to continue their operations. Thus the expressions:

$$SUM_e^i = M_o^i \cdot MES_e^i \cdot (1-\lambda_M^i)$$
$$SUB_e^i = B_o^i \cdot MES_e^i \cdot (1-\lambda_B^i)$$
$$SUA_e^i = A_o^i \cdot MES_e^i \cdot (1-\lambda_A)$$

provide a measure of the portion of the original investment in machines, buildings, and advertising, respectively, that might be unrecoverable in the event of exit.[16] It is assumed here that entry occurs at a scale MES_e and that the capital-to-sales and advertising-to-sales ratios are the same for the new entrants and the incumbents. It is also important to recognize that SUM_e and SUB_e overestimate the true sunk costs, since they do not account for the actual resale or internal fungibility of the respective assets. However, SUA_e should be very close to the true sunk cost of advertising.

Thus, the rate of depreciation has a dual effect: a higher such rate signifies a larger AC^T — a greater cost of doing business in an industry; at the same time, however, the higher this rate, the lower the sunk costs in the event of exit — the lower $(1-S_K) \cdot K_e$ and $(1-S_A) \cdot A_e$ will be.

Scale of Entry

We construct a proxy for the scale of entry, MES_e, in each industry using the available distribution of plants within the industry according to employment size. Let n_j and S_j denote the number of plants and total sales of the jth size group, respectively. Also, let m denote the number of group sizes within the industry. Then we use as our proxy the following measure:

$$MES_e = S_e/S_o$$

where $S_e = \frac{1}{m}\sum_{j=1}^{m} \overline{S}_j$, $\overline{S}_j = \frac{S_j}{n_j}$ and $S_o = \sum_{j=1}^{m} S_j$.

Our measure is therefore the simple average of the representative plants of each size group. [17]

Entry

The constraints imposed by the availability of data permit only a measure of net entry between the census years:

$$n_e^i = N_{77}^i - N_{72}^i$$

where N^i is the number of firms in the ith industry in 1977 and 1972, respectively. Such a measure does not capture such factors as entry and subsequent exit within the inter-census interval nor does it capture entry by acquisition or vertical integration. [18] However, our estimates will not be affected if we assume that these factors are small in comparison or proportional to net entry, or simply random with respect to the right-hand side variables in our equation.

IV. Specification and Estimation

This is a single equation model relating the rate of entry n_e in a given industry to its structural and conduct characteristics. The underlying theory of the model suggests that the pertinent variables explaining entry are: Π_o, the pre-entry margin of the incumbents; $MES_e = \frac{q_e}{Q_o}$, the scale of entry; ε_p , the price-elasticity of demand; g and $\tilde{g}$, the rates of growth in demand for the industry's product and expected expansion by the incumbents, respectively; $\frac{1-\alpha}{\alpha}$, the perceived relative probability of failure; and $SU_e = (1-S_K)\cdot\frac{K_e}{S_e} + (1-S_A)\cdot\frac{A_e}{S_e}$, the unrecoverable portion of the original investment in the event of exit (sunk cost).

The structural characteristics of the model imply that cross-industry inference is appropriate. We therefore propose a cross-sectional test of our model. Our hypotheses will be formulated in two forms. The first form will be a set of parametric restrictions testing the effects of Π_o, MES_e, ε_p, g and $\tilde{g}$. The second form will consist of the explicit parametrization of sunk costs SU_e and the risk of entry $\frac{1-\alpha}{\alpha}$. Such a parametrization will permit us to identify the separate effects of advertising implied by our model.

To test Hypothesis 1, we impose on the irrecoverable costs of entry the functional form:

$$SU_e = a_1 \cdot SUM_e + a_2 \cdot SUA_e \tag{IV.1}$$

where SUM_e and SUA_e provide a measure of the portion of the original investment in machines and advertising which is sunk in the event of exit.[19]

To discriminate between Hypotheses 2a and 2b, we need first an appropriate specification for the "perceived" probability of success, α. The logistic function provides a particularly convenient basis for such a specification. We therefore propose the following log-linear relationship to describe the odds of entry failure:[20]

$$\ln\left(\frac{1-\alpha}{\alpha}\right) = \beta_o + \beta_1 \ln \Pi_o + \beta_2 \ln C_o + \beta_3 \ln\left(\frac{A_o}{S_o}\right) \tag{IV.2}$$

where C_o and A_o/S_o represent the industry's pre-entry level of structural concentration and advertising intensity, respectively. This specification will also permit the testing of the following hypotheses:

Hypotheses 3

The threat of an aggressive post-entry reaction (such as output expansion) is more credible when incumbents have positive profits to protect and are able to cover transitory losses:

thus, $\frac{\partial}{\partial \Pi_o} \left(\frac{1-\alpha}{\alpha}\right) > 0.$

Hypothesis 4

The threat of an aggressive post-entry reaction is more credible when the free-rider effect in driving the entrant out is smaller:

thus, $\frac{\partial}{\partial C_o} \left(\frac{1-\alpha}{\alpha}\right) > 0.$

In a previous paper we tested and found support for the hypothesis that entrants expect incumbents to expand at the same rate as demand grows.[21] This finding implies that the first term in Equation (II.7) is obviated and it points to the following specification for estimating our model:

$$n_e = \delta_o \frac{(1+g)^{\delta_1}}{MES_e^{\delta_2}} \Pi_o^{\delta_3} \varepsilon_p^{\delta_4} \left[1 - \frac{1}{\Pi_o} (a_1 SUM_e + a_2 SUA_e) \cdot e^{\beta_o} \Pi_o^{\beta_1} C_o^{\beta_2} \left(\frac{A_o}{S_o}\right)^{\beta_3}\right]. \tag{IV.3}$$

Hypothesis 1 will be confirmed if $\hat{a}_2$ is significantly positive. If $\hat{\beta}_3$ is greater (less) than zero and significant, then we reject Hypothesis 2b (2a) in favor of Hypothesis 2a (2b).

It is also important to recognize the precise prediction our model makes with respect to the sign and magnitude of the coefficients δ_o, δ_1, δ_2, δ_3 and δ_4. Specifically, the hypothesis of interest is a test of:

$H_o : \underset{\sim}{\Theta} = \underset{\sim}{\Theta}_o$ against $H_1 : \underset{\sim}{\Theta} \neq \underset{\sim}{\Theta}_o$

where $\underset{\sim}{\Theta} = (\delta_o, \delta_1, \delta_2, \delta_3, \delta_4)$ and $\underset{\sim}{\Theta}_o = (1, 1, 1, 1, 1)$.

Finally, given that our simple theory does not generate completely specified empirical tests, we attempt to assess the robustness of any predictions based on such tests to alternative specifications.

V. Empirical Results

Table 1a presents the nonlinear least squares estimates of the parameters in Equation (IV.3).[22] These estimates are obtained by taking the logarithms on both sides and minimizing the sum of squares using some suitable nonlinear algorithm.[23] The results support Hypothesis 1 (sunk cost barrier effect of advertising) and decisively reject Hypothesis 2a (Advertising = Persuasion View) in favor of Hypothesis 2b (Advertising = Information View).

The 95 percent confidence intervals for δ_1, δ_2 and δ_3 are:

δ_1 : (.369, 1.331)

δ_2 : (.803, 1.075)

δ_3 : (.202, .962).

Thus, at the 5 percent level, the separate hypotheses that $\delta_1 = 1$ and $\delta_2 = 1$ are not rejected. At this level of significance only the hypothesis that $\delta_3 = 1$ is rejected.[24]

We impose next the parametric restrictions implied by the model (i.e. we set $\delta_1 = 1$, $\delta_2 = 1$, $\delta_3 = 1$) and reestimate Equation (IV.3). The results are presented in Table 1b. According to the likelihood ratio test, the joint hypothesis that $\delta_1 = 1$, $\delta_2 = 1$, and $\delta_3 = 1$ is not rejected at the 5 percent level.[25]

The estimated equation (Table 1b) predicts the following 95 percent confidence intervals for a_2 and β_3 :

a_2: (3.592, 11.091)

β_3: (-.809, -.723)

The finding that a_2 is significantly positive supports Hypothesis 1 -- it suggests that advertising gives rise to a sunk cost barrier to entry. In addition, the fact that β_3 is found to be significantly negative indicates an inverse relationship between the perceived relative probability of exit and advertising intensity -- entrants perceive a greater likelihood of success in markets where advertising is important.

In Tables 2a and 2b we present estimates of the parameters of the model based on alternative specifications of the relative probability of exit, $\frac{1-\alpha}{\alpha}$. It is worth noting that the basic predictions of the model are robust -- Hypothesis 1 continues to receive strong support while Hypothesis 2a is again decisively rejected in favor of Hypothesis 2b.

The 95 percent confidence intervals for β_1 and β_2 are (from Table 1b):

β_1 : (1.581, 2.205)

β_2 : (.829, 1.347).

In agreement with the findings of our previous paper these results confirm Hypothesis 3 (incumbents who have positive profits to protect and can cover transitory losses are more likely to react aggresively in the face of entry) and Hypothesis 4 (incumbents are more likely to react aggressively when the free-rider effect in driving the entrant out is smaller).

An analysis of the estimated sunk costs seems to indicate that the advertising component of these costs is more important than the component due to physical capital. This finding is in agreement with those of previous studies. [26]

The public policy debate on the entry-deterring role of advertising has mainly focussed on industries which rely heavily on advertising. Thus, we restrict our attention next to those industries where advertising is important (primarily the consumer goods industries). Estimates based on such a restricted sample appear in Table 3.

Our analysis establishes the presence of two countervailing effects of advertising on entry. On the one hand, advertising impedes entry because it gives rise to a sunk cost barrier. On the other hand, however, it appears that advertising reduces the risk underlying the entry environment as perceived by the potential entrant. In this sense, advertising facilitates entry. As the results of Table 3 seem to indicate, the positive effect of advertising in terms of reducing the perceived relative probability of failure, $\frac{1-\alpha}{\alpha}$, dominates the sunk cost barrier effect in industries, where advertising plays an important role. We find that the overall impact of advertising on entry (taking into account also the effect on the measured rates of profit) is positive for 216 industries, according to results in Table 2a, and for 252 industries according to results in Table 3, out of a total of 262 industries examined.

Finally, we tested the sensitivity of our results by varying the assumed annual depreciation rate for advertising between 10 and 90 percent. Our principal findings remain unchanged within the examined range of λ_A. However, the sunk cost barrier effect tends to diminish as λ_A is increased.

Conclusions

The paper attempts to provide a direct test of hypothesis that advertising serves as a barrier to new competition. The role of advertising as a potential barrier to entry is explored in the context of a simple model of entry behavior. Such a model isolates three separate effects of advertising on entry: the effect on the measured rates of profit, the effect on the irreversible costs of entry, and the effect on the uncertainty underlying the environment faced by potential entrants.

The empirical estimates show that for the potential entrant, the need to advertise leads to an unrecoverable entry cost in the case of failure and thus advertising creates a sunk cost barrier to entry. However, our estimates also establish the presence of countervailing force due to advertising. We find that entrants perceive a greater likelihood of success in markets where advertising plays an important role.

Our findings indicate that for the majority of the industries examined, the overall impact of advertising on entry is positive, that is advertising actually facilitates entry. This evidence raises new questions about the appropriate interpretation on the observed positive correlation between advertising intensity and profitability in the cross-section.

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TABLE 1a

$$n_e = e^{\delta_o} \frac{(1+g)^{\delta_1}}{MES_e^{\delta_2}} \Pi_o^{\delta_3} \left[1 - \frac{1}{\Pi_o}(a_1 SUM_e + a_2 SUA_e)\, \Pi_o^{\beta_1} C_o^{\beta_2} \left(\frac{A_o}{S_o}\right)^{\beta_3}\right] e^u$$

Parameters	δ_0	δ_1	δ_2	δ_3	a_1	a_2	β_1	β_2	β_3
Estimates	.164	.850	.939	.582	.040	5.667	1.659	1.112	-.689
	(.220)	(.244)	(.069)	(.193)	(.014)	(2.528)	(.170)	(.144)	(.032)

TABLE 1b

$$n_e = e^{\delta_o} \frac{(1+g)}{MES_e} \Pi_o \left[1 - \frac{1}{\Pi_o}(a_1 SUM_e + a_2 SUA_e)\, \Pi_o^{\beta_1} C_o^{\beta_2} \left(\frac{A_o}{S_o}\right)^{\beta_3}\right] e^u$$

Parameter	δ_0	a_1	a_2	β_1	β_2	β_3
Estimates	.497	.029	7.341	1.893	1.088	-.766
	(.103)	(.010)	(1.913)	(.159)	(.132)	(.022)

Asymptotic Standard Errors in Parentheses

Annual Depreciation Rate of Advertising: $\lambda_A = .5$

Number of Observations = 262

Table 2a

$$n_e = e^{\delta_o} \frac{(1+g)^{\delta_1}}{MES_e^{\delta_2}} \Pi_o^{\delta_3} \left[1 - \frac{1}{\Pi_o} (a_1 SUM_e + a_2 SUA_e)\, e^{\beta_1 \Pi_o^{\beta_2} \cdot C_o^{\beta_3} + \beta_4 \left(\frac{A_o}{S_o}\right)^{\beta_5}} \right] e^u$$

Parameter	δ_0	δ_1	δ_2	δ_3	a_1	a_2	β_1	β_2	β_3	β_4	β_5
Estimates	.079	.863	.925	.469	.165	954.6	39.146	.056	.028	-47.485	.033
	(.135)	(.250)	(.070)	(.199)	(.111)	(219.5)	(4.886)	(.013)	(.010)	(5.009)	(.007)

Table 2b

$$n_e = \frac{(1+g)}{MES_e} \Pi_o \left\{1 - \frac{1}{\Pi_o} (a_1 SUM_e + a_2 SUA_e) \cdot \left[\beta_1 \Pi_o^{\beta_2} C_o^{\beta_3} + \beta_4 \left(\frac{A_o}{S_o}\right)^{\beta_5} \right] \right\} e^u$$

Parameter	a_1	a_2	β_1	β_2	β_3	β_4	β_5
Estimates	.187	3.978	19.270	.116	.079	-17.587	.017
	(.010)	(2.122)	(1.467)	(.020)	(.021)	(1.072)	(.006)

Asymptotic Standard Errors in Parentheses
Annual Depreciation Rate of Advertising: $\lambda_A = .4$
Number of Observations = 262

Table 3

$$n_e = e^{\delta_o} \frac{1+g}{MES_e} \Pi_o \left[1 \quad \frac{1}{\Pi_o} (a_1 SUM_e + a_2 SUA_e)\right) \Pi_o^{\beta_1} C_o^{\beta_2} \left(\frac{A_o}{S_o}\right)^{\beta_3}] e^u$$

$$\frac{A_o}{S_o} > .01$$

Parameter	δ_o	a_1	a_2	β_1	β_2	β_3
Estimates	1.939 (.287)	.001 (.0009)	1.186 (.125)	1.065 (.075)	.090 (.068)	-1.113 (.033)

Asymptotic Standard Errors in Parentheses
Annual Depreciation Rate of Advertising: $\lambda_A = .5$
Number of Observations = 262

FOOTNOTES

1. Comanor and Wilson (1979) provide an overview of the literature.

2. There is some controversy regarding the importance of economies of scale in advertising. See Comanor and Wilson, supra note 1, and the references cited therein.

3. See Scherer Ch. 9 and Comanor and Wilson, supra note 1.

4. Bloch (1974) and Ayanian (1975) purport to show that the correlation between advertising and profitability becomes insignificant once advertising outlays are capitalized. Demsetz (1979) also claims that the observed correlation is explainable in terms of accounting practices. However, Weiss (1969) and Comanor and Wilson (1974) reach different conclusions. Regarding the difficulty of interpreting such a correlation in the cross-section, see Spence (1980).

5. For studies representing and supporting the view, see: Telser (1964); Steiner (1973); Brozen (1974); Nelson (1974); Benham (1978); Leffler (1981).

6. Baumol and Willig (1982) maintain that the likelihood of failure may be higher for potential entrants who know that competition with the incumbent is inevitable, while the incumbent may have faced less rivalry in the past and may have discounted the possibility of later active rivalry.

7. The "Advertising = Market Power View" was developed by Chamberlin (1933) and pursued further by Bain (1956) and Comanor and Wilson (1974). For the "Advertising = Competition View," see, among others: Telser (1964); Brozen (1974); Nelson (1974).

8. For such entry models, see, among others: Spence (1977); Schmalensee (1978); Salop (1979); von Weizsacker (1980).

9. A discussion of these barriers appears in Baumol and Willig (1981).

10. To simplify the analysis we implicitly assume two possible outcomes following entry: a passive, noncooporative incumbent response leading to some equilibrium with the entrant staying in; and a predatory reaction by incumbents forcing the entrant to exit.

11. See Caves and Porter (1977); for a formal analysis, also see Baumol and Willig (1981); Baumol, Panzar and Willig (1982).

12. See Salop (1979). It is important to recognize that the effectiveness of any pre-entry commitment in capital by the incumbents as an instrument of deterrence will depend on the rate of depreciation of the said capital. If this rate is very high then such commitment will not be entry-deterring.

13. See Schmalensee (1974).

14. The exclusion of those industries which experienced net exit might be perceived as leading to a sampling bias. It should be noted however that entry and exit are not necessarily symmetric (exit is not a symmetrical function of entry barriers). Thus, a more complete approach to the problem would entail a separate equation explaining exit.

15. See Grabowski and Mueller (1978).

16. Because the service lives of assets (machines and buildings) are reduced for tax purposes, we use tax depreciation rather than the true economic depreciation for constructing these proxies of sunk costs.

17. It is assumed here that there is no a priori strong basis for assigning probabilities of entry into each of the size groups.

18. It should be noted that such factors as the pre-entry margin of incumbents, the scale of entry and the price-elasticity of demand impose an upper limit to the number of additional firms that could fit in the industry. Such factors therefore point to net entry as being the appropriate measure of entry.

19. In Kessides (1982), we tested and found support for the hypothesis that the required original investment in machines and equipment comprises a component of entry cost that is unrecoverable in the event of exit, while not so for buildings and structures. The basis of this hypothesis was the belief that in general plant is more sunk than buildings.

20. The relationship with the logistic function becomes apparent when (IV.2) is solved for α.

21. See Kessides, supra note 19.

22. Using Hoel's comparison of forecasts test (Quandt 1970, ch. 6) we rejected the additive error specification in favor of the multiplicative one.

    In order to achieve identification, we drop β_o from the estimated equation.

    In addition, the price-elasticity term was found to be statistically insignificant -- probably because of a poor proxy -- and subsequently it was suppressed into the error term.

23. For this estimation we employed the quadratic hill-climbing method. See Goldfeld and Quandt (1972).

24. Note that since ε_p is suppressed into the error term, $\delta_o = 1$ is no longer a maintained hypothesis.

25. $$T = \frac{\tilde{\sigma}^2}{\hat{\sigma}^2} = \frac{4.026}{3.965} = 1.015 < c^* = 1 + \frac{3}{253} F^{.95}_{253} = 1.031$$

where $\hat{\sigma}^2$ and $\tilde{\sigma}^2$ are the maximum likelihood estimates of variance in Tables 1a and 1b respectively. Thus the maintained Hypothesis is not rejected at the 5 percent level.

26. See Biggadike (1976).

Appendix

Definition of Variables

Abbreviated Name	Definition	Source
N_{72}	Number of firms in 1972	1972 Census of Manufactures
N_{77}	Number of firms in 1977	1977 Census
A_o	Industry advertising expenditures	1972 Input-Output Tables for the U.S. and 1974 Annual Line of Business Report
B_o	Fixed depreciable assets in the form of buildings and structures	1971 Annual Survey of Manufacturers
M_o	Fixed depreciable assets in the form of machines and equipment	1971 Survey
λ_A	Depreciation rate for advertising	set at .4
λ_B	Depreciation rate for buildings and structures (total industry tax depreciation charges for buildings and structures divided by fixed assets in this form)	1977 Census
λ_M	Depreciation rate for machines and equipment (calculated in the same manner as above)	1977 Census
S_e	Expected sales of an entrant (simple average of all the representative plants from the shipments size distribution)	1972 Census
S_o	Total industry sales	1972 Census
$MES_e = S_e/S_o$	Scale of entry	derived
g	Industry sales in 1972 divided by sales in 1967 minus 1.00 (growth in demand)	1972, 1967 Censuses
C_o	Four-firm concentration ratio	1972 Census

Abbreviated Name	Definition	Source
r	Interest rate	set at .06
ε_p	Price-elasticity of demand	Levin *
Π_o	Price-cost margin -- value added less payroll less capital costs divided by sales	1972 Census

* These estimates are based on data provided by Richard C. Levin whose generosity is gratefully acknowledged.