Advertising and Entry Barriers Revisited

by

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I. Introduction

In a paper in the Southern Economic Journal, 1974, R.Schmalansee has claimed to demonstrate that "even though established firms have built up loyalty to their brands or sell to inert customers, this does not given them any advantage to deter entry. Only if capital markets are serious imperfect and potential entrants lack valuable assets to use as collateral might the market position of the established firms hinder entry". This proposition was cited by Needham and repeated by Schmalansee, in articles appearing in the Journal of Industrial Economics, September, 1976. A fortiori, one might be led to suppose that in the absence of lagged effects advertising is quite powerless to create entry barriers.

It is the purpose of this note to point out that both these views are quite mistaken, if we adopt the conventional view (Bain, 1968) that entry barriers allow established firms to maintain supernormal profits whilst ensuring that entering firms will make a loss.[1/] This requires us to examine the possibility of an established firm earning positive profits whilst rendering entry unprofitable via its advertising strategy. Schmalansee does not do this. Instead, he compares the post entry profitability of the established and the entering firm.

We initially follow Schmalansee in adopting what he termed Sylos' postulate in relation to advertising - that the entering firm assumes that the post-entry level of advertising stays the same. We shall show that, within Schmalansee's own model, advertising can be used to deter entry even without any lagged effects. We shall also point out that lags in the effect of advertising can enhance this by making more credible to the entering firm the threat implicit in the Sylos postulate.

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* I am grateful to Avinash Dixit and Normal Ireland for comments on a previous draft. Any remaining errors are my own.

1/ Bain (1968, p.252) defines the condition of entry as follows:

"Somewhat more precisely, the condition of entry refers to the extent to which, in the long run, established firms can elevate their selling prices above the minimum average costs of production and distribution (those costs associated with operation at optimal scales) without inducing potential entrants to enter the industry". Emphasis added.

II. Schmalansee's model

Barred variables refer to the established firm, unbarred variables to the potential entrant.

$Q(t)$, $\bar{Q}(t)$ = unit sales in period t of entrant and established firm respectively.

$A(t)$, $\bar{A}(t)$ = advertising spending in period t.

w_i = weights in the distributed lagged effect of advertising.

r = the relevant interest rate

β = $1/(1 + r)$

V, $\bar{V}$ = present value of firm

γ = $\sum_{0}^{\infty} \beta^i w_i$

m = the difference between price and average production cost.

π = net present value accruing as a result of current outlays.

$Q(t) = \sum_{i=0}^{\infty} w_i Q^* \left[A(t-i), \bar{A}(t-i), Z(t-i)\right]$ Q and $\bar{Q}$ are assumed symmetric.

Z = list of exogenous variables (suppressed in the rest of the analysis)

Schmalansee shows that, under the Sylos postulate, if entry occurs the entrant's advertising will satisfy the usual Dorfman-Steiner conditions.

He shows that

$$V = \sum_{0}^{\infty} \beta^t \left[m \gamma Q^*(t) - A(t)\right] \qquad (5)^{1/} \qquad (1)$$

$$\bar{V} = \bar{V}_f + \bar{V}_0 \qquad (10) \qquad (2)$$

where

$$\bar{V}_f = \sum_{t=0}^{\infty} \beta^t \left[m \bar{\gamma} \bar{Q}^*(t) - \bar{A}(t)\right] \qquad (10a) \qquad (2a)$$

$$\bar{V}_o = \sum_{t=0}^{\infty} \beta^t \sum_{i=1}^{\infty} w_{t+i} \bar{Q}^*(-i) \qquad (10b) \qquad (2b)$$

V_o is the present value accruing to the established firm as a result of its past outlays, and cannot be altered in period 0. The relevant consideration is the effect on $\bar{V}_f$ of the established firm's advertising policy. To quote Schmalansee ". . . we can drop the time subscripts and consider a typical period, comparing the net present value accruing to the entrant as a result of current outlays,

$$\pi = m \gamma Q^*(A, \bar{A}) - A, \qquad (11) \qquad (3)$$

and that accruing to the established firms

1/ Schmalansee's equation number is given first.

$$\bar{\pi} = m \bar{\gamma} \bar{Q}^*(\bar{A}, A) - \bar{A} \qquad (12) \qquad (4)$$

"There would appear to be only two considerations under which the established firms could maintain $\bar{\pi}$ positive whilst forcing π to zero. First, there might be an asymmetry in the demand functions." The other possibility that Schmalansee mentions is "seriously imperfect" capital markets which might raise r and hence lower β for the extrant.

III. Criticism of Schmalansee's approach and an alternative

Schmalansee's equation (12) highlights the source of all his conclusions . Quite clearly, this refers to the post entry profitability[1/] of the established firm. There is nothing in the theory of entry barriers as conceived by Bain that requires $\bar{\pi}$ be positive following entry. A sufficient condition for an entry barrier to exist in this tradition is that price could be maintained above average cost whilst entry would be unprofitable for the entering firm, and perhaps even for the established firm. Since it is reasonable to assume that unprofitable entry will not occur, the post entry profitability of the established firm is irrelevant as long as entry is forestalled.

Therefore, the relevant criterion should be, can π be negative whilst pre entry profitability for the established firm,

$$\bar{\pi}' = m \bar{\gamma} \bar{Q}^*(\bar{A}, 0) - \bar{A} \qquad (5)$$

1/ We use the terms profitability and profit as shorthand for "net present value accruing". If there are no lags the latter is profit as conventionally measured.

is positive?

This is possible even with complete symmetry of demand functions and equal interest rates (i.e. $\bar{\gamma} = \gamma$, $\bar{Q}^* = Q$). If $A = \bar{A}$ then quite clearly $\bar{\pi}' > \pi$ since $\frac{\partial \bar{Q}^*}{\partial \bar{A}} < 0$.

To complete the proof we need to show that some function Q^* exists that yields a positive $\bar{\pi}'$ and a negative π.

Example 1

Consider the function

$$Q^* = \max \{0, (\alpha + 1)A - \tfrac{1}{2} A^2 - \bar{A}\}; \quad \alpha > 0 \tag{6}$$

and its equivalent for the established firm.

$$\bar{Q}^* = \max \{0, (\alpha + 1)\bar{A} - \tfrac{1}{2} \bar{A}^2 - A\}; \tag{7}$$

This has fairly simple properties. For instance, advertising by the established firm does not reduce the marginal effectiveness of advertising for the entrants. However, there is a critical value of advertising below which sales are zero. 1/

The case for a stronger assumption that $\frac{\partial^2 Q^*}{\partial A \, \partial \bar{A}} < 0$ is by no means persuasive and so is not incorporated in this first example. Otherwise, for $Q^* > 0$ the function has the properties specified by Schmalansee (p. 581)

$$\frac{\partial Q^*}{\partial A} > 0 \text{ for } \alpha > 0 \text{ and } A < \frac{\alpha + 1}{2} \tag{8}$$

1/ This, and the assumption that $\frac{\partial^2 Q}{\partial A \, \partial \bar{A}} = 0$ are changed in example 2.

$$\frac{\partial^2 Q^*}{\partial A^2} < 0 \tag{9}$$

$$Q^*(0, \bar{A}) = 0 \tag{10}$$

$$\frac{\partial Q^*}{\partial \bar{A}} < 0 \tag{11}$$

Without loss of generality we may normalise so that $m\gamma = 1$

$$\therefore \quad \pi = \alpha A - \tfrac{1}{2}A^2 - \bar{A} \tag{12}$$

$$\bar{\pi} = \alpha \bar{A} - \tfrac{1}{2}\bar{A}^2 - A \tag{13}$$

Under the Sylos postulate the optimal level of the entrant's advertising is

$$A^* = \alpha \tag{14}$$

whence post entry profits are

$$\pi = \tfrac{1}{2}\alpha^2 - \bar{A} \tag{15}$$

To deter entry the established firm must set the entry deterring level of advertising

$$\bar{A}' = \tfrac{1}{2}\alpha^2 + \varepsilon \tag{16}$$

where $\varepsilon > 0$, but may be very small. In the limit, as $\varepsilon \to 0$, the

established firm's profit is

$$\bar{\pi}'(\bar{A}, 0) = \tfrac{1}{2}\alpha^3 - \tfrac{1}{2}\frac{\alpha^4}{4} \tag{17}$$

This will be positive as long as $\alpha < 4$. For this to be a profitable strategy $\bar{\pi}'$ must exceed the profits attainable from allowing entry by choosing the profit maximising level of advertising, α.

$$\bar{\pi}(\bar{A}^*, A^*) = \tfrac{1}{2}\alpha^2 - \alpha \tag{18}$$

$$\pi'(\bar{A}', 0) > \pi(\bar{A}^*, A^*) \tag{19}$$

if $$\tfrac{1}{2}\alpha^3 - \tfrac{1}{8}\alpha^4 > \tfrac{1}{2}\alpha^2 - \alpha \tag{20}$$

This implies

$$\alpha^2 (\alpha - 2)^2 < 8\alpha \tag{21}$$

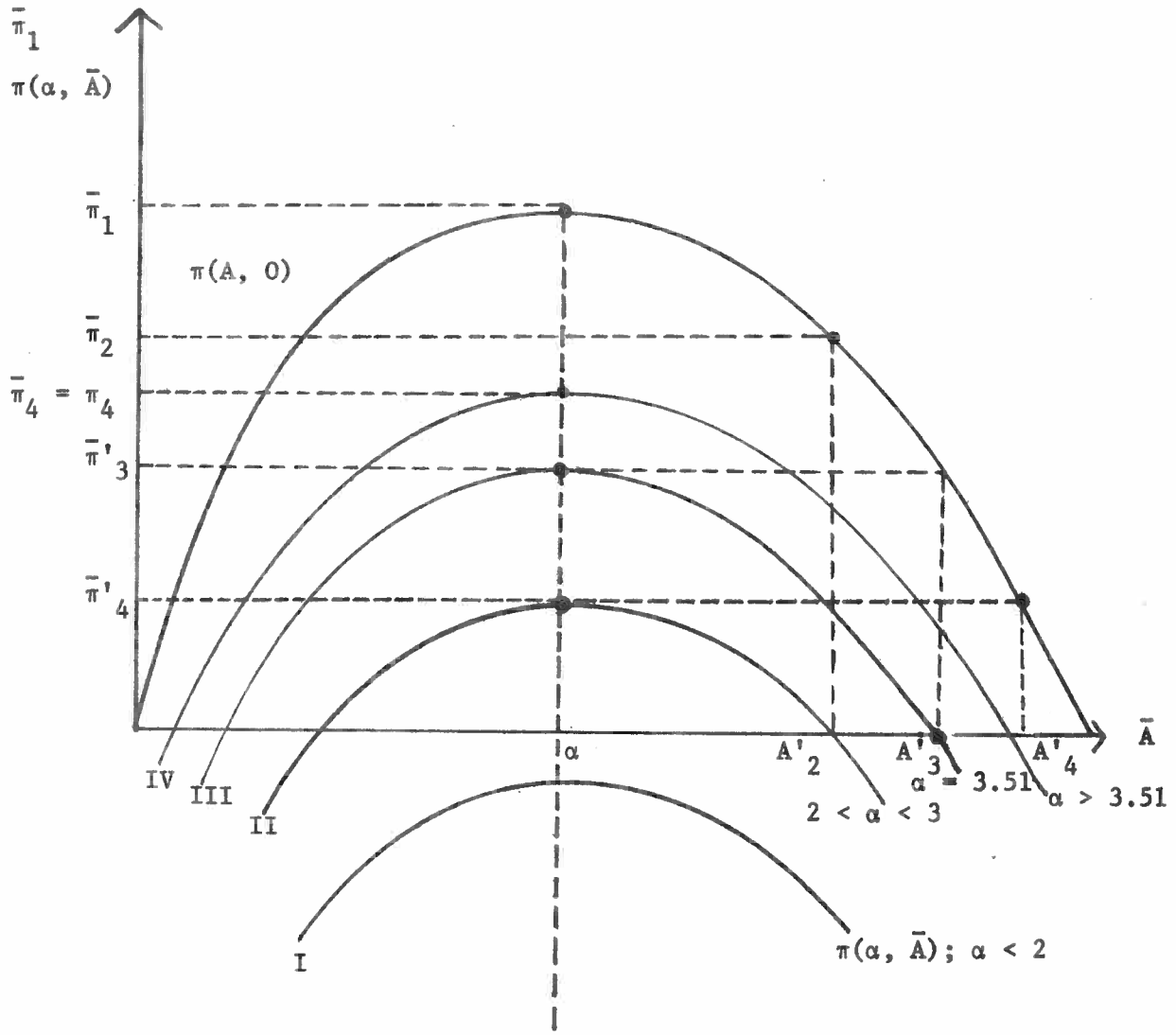
Any value of α between 0 and 3.51 will satisfy this inequality. However, for $\alpha < 2$, $\pi(A^*, \bar{A}^*)$ is negative, so that the established firm can keep his advertising at his profit maximising level without regard to entry. We have, therefore, the following conditions of entry for different values of α.

We may illustrate this diagrammatically (see fig. 1). The upper curve shows the established firm's $\bar{\pi}$ at different levels of advertising before entry. The lower curves show the entrant's maximum profit for given levels of $\bar{A}$. For curve I entry is blockaded and profits are $\bar{\pi}_1$. For

Table I

Range of α	Condition of entry
$0 < \alpha < 2$	Blockaded by advertising
$2 < \alpha < 3.51$	Effectively impeded by advertising
$3.51 < \alpha$	Ineffectively impeded by advertising

Fig. 1



curve II entry is effectively impeded and profits are $\bar{\pi}_2$. For curve III the established firm is indifferent between allowing entry or preventing it. For curve IV the entry deterring level of profit is less than the post-entry level so the firm may as well earn $\bar{\pi}_1$ in the short run and allow entry.

Example 2

In this example we allow the each firm's advertising to influence both the average and marginal effectiveness of the rival's advertising.

$$Q^* = \max \{0, (\alpha + 1 - k\bar{A})A - \tfrac{1}{2} A^2\}, \ \alpha, k > 0 \tag{22}$$

$$\bar{Q}^* = \max \{0, (\alpha + 1 - kA)\bar{A} - \tfrac{1}{2} \bar{A}^2\} \tag{23}$$

In this formulation, there is no threshold level of A necessary to generate positive Q^* as long as $\bar{A} < (\alpha + 1)/k$. In fact the established firm can make entry unprofitable by setting[1/]

$$\bar{A}' = \frac{\alpha}{k} + \varepsilon ; \qquad \varepsilon > 0 \tag{24}$$

Since the profit maximising value for $\bar{A}$ where there is no threat of entry is α, $k > 1$ implies that entry is blockaded by advertising. Profits $\bar{\pi}'$ associated with the entry deterring strategy $\bar{A}'$ are, as $\varepsilon \to 0$

$$\bar{\pi}' = \frac{\alpha^2}{k} \left(1 - \frac{1}{2k}\right) \tag{25}$$

This will be positive as long as $k > \tfrac{1}{2}$. However, to decide whether entry prevention is profitable, we need to compare $\bar{\pi}'$ with the

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1/ We use ' to indicate entry preventing levels and * to indicate post-entry optimal values of advertising and profits.

maximum possible value of post entry profits. Under the Sylos postulate this will occur by setting the Stackelberg leadership level of advertising (Osborne, 1973, points this out for the quantity-setting case). This involves the established firm choosing its optimal point the entrant's reaction function, and is more complicated in this example than in example 1.

Since the entrant's optimal value of A

$$A^* = \alpha - k\bar{A} \tag{26}$$

$$\bar{\pi}(\bar{A}) = \{\alpha - k(\alpha - k\bar{A})\}\bar{A} - \tfrac{1}{2}\bar{A}^2 \tag{27}$$

whence the optimal value of $\bar{A}$ assuming entry is allowed

$$\bar{A}^* = \frac{\alpha(1 - k)}{2k^2 - 1} \tag{28}$$

To keep $\bar{A}^*$ finite we require $k > 1/\sqrt{2}$. However, a higher value of k than this $((1 + \sqrt{13})/6 = 0.7676)$ is sufficient to deter entry since it implies $\bar{A}^* = \alpha/k$. With k below this value we should expect a corner solution for $\bar{A}$ so (28) would not hold.

Checking the profitability of allowing entry we find that

$$\bar{\pi}^* = \frac{3}{2}\,\frac{\alpha^2(1 - k)^2}{(2k^2 - 1)} \tag{29}$$

This needs to be compared with (25), and from this we get the condition that allowing entry will be profitable if $k < 0.9077$.

Table 2. Condition of entry for example 2

Range of k	Entry condition
$k > 1$	Entry blockaded by advertising
$1 > k > 0.9077$	Entry effectively impeded by advertising
$0.9077 > k > 0.7676$	Entry ineffectively impeded by advertising

Along lines adopted by Osborne (1973) and Dixit (1978) we may illustrate the entry condition graphically using conventional Cournot reaction functions and isoprofit curves. The figures are not to scale but are for illustrative purposes only. They should be self-explanatory. 1/

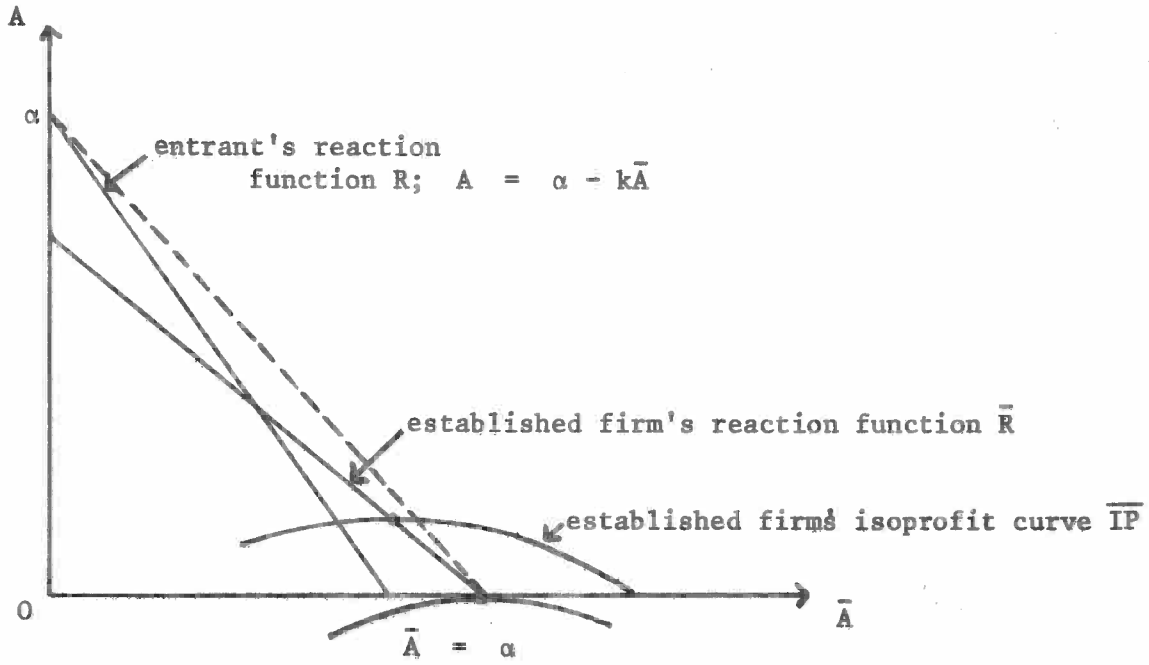

Fig. 2 The monopolistic level of advertising is sufficient to deter entry ($k > 1$)

1/ For example 1 the reaction functions of the entrant is a horizontal line at $A = \alpha$ and that of the established firm is $\bar{A} = \alpha$.

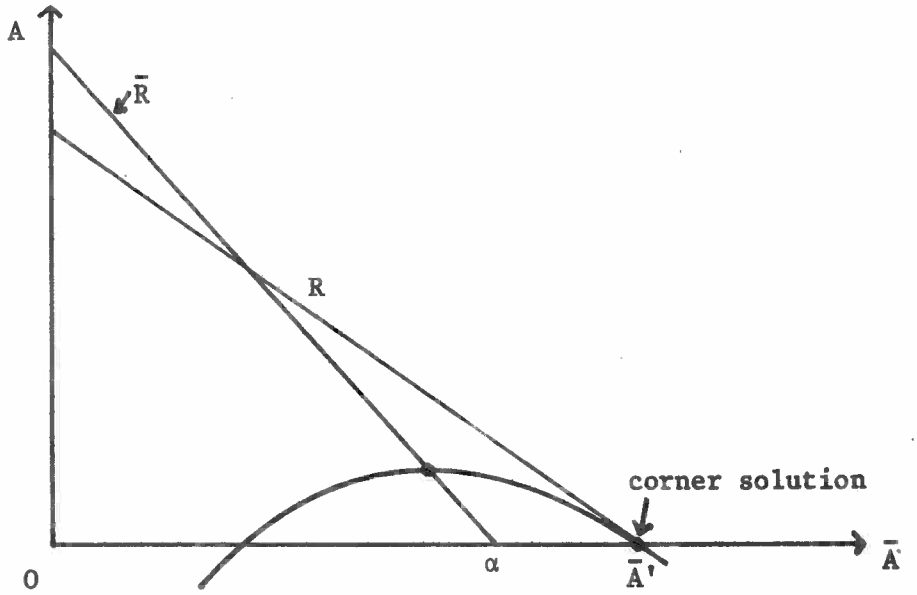

Fig. 3. Entry prevention by increasing $\bar{A}$ to $\bar{A}'$ is profitable; $1 > k > 0.9077$.

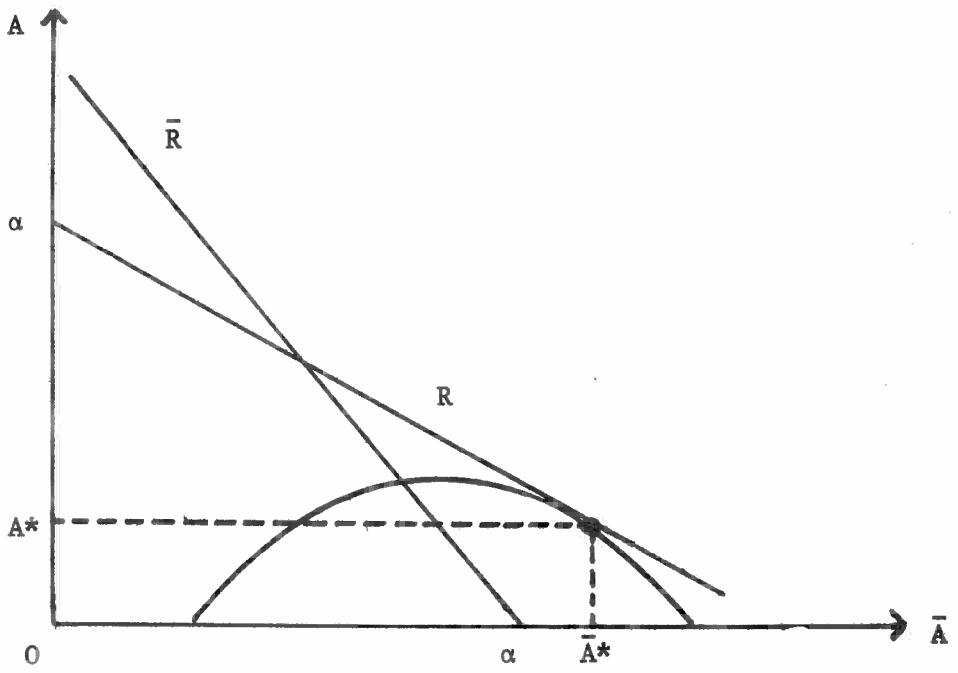

Fig. 4. It is profitable to allow entry, but under the Sylos postulate a Stackelberg leadership equilibrium is established; $k < 0.9077$

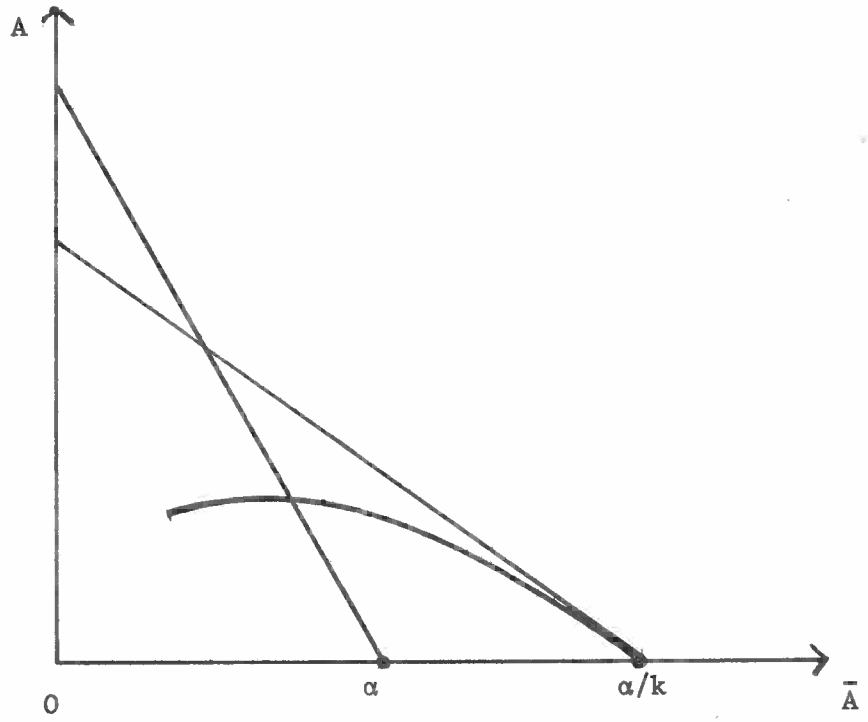

Fig. 5. The leadership equilibrium gives the entrant zero profit. k = 0.7676.

It appears that the entry condition is non-monotonic in k. This is perhaps not surprising in view of the functional terms of (28) and (29).

However, this is not the place to take this curiosum further. Enough has been said to establish a case for the possibilities that

(i) Naive (i.e. ignoring the threat of entry) profit-maximising behaviour with respect to advertising may deter entry.

(ii) Under some circumstances it may be profitable to increase advertising beyond the level indicated by the Dorfman-Steiner condition in order to either

(a) deter entry altogether

(b) establish a leadership equilibrium should entry occur.

None of this requires asymmetries in the demand relation, imperfections in capital markets, or even lagged effects. The only asymmetry is that the established firm is there first, and by virtue of this may be assumed capable of exercising Strackelberg-type leadership. The threat underlying the Sylos postulate is quite credible in example 1 since the optimal level of advertising is independent of the number of firms. In example 2 the Nash equilibrium level of advertising is less than the monopoly level and this might cast some doubt on the credibility of the Sylos postulate here.[1/]

If we reintroduce lags in the effectiveness of advertising into our analysis the problem of credibility is solved to some extent in any case.

A lag is entirely analogous to a binding commitment made now to indulge in immediately effective advertising at given times in the future. As Schelling (1960) points out, the most compelling threats are those that are binding on the threatener. Advertising with lagged effects has precisely this property.

IV. Conclusions

It has been shown that, for two very simple demand functions with respect to advertising, there may occur entry barrier effects, with or without

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1/ However, there is some empirical support for the notion that in the transition from monopoly to oligopoly advertising intensity increases.

lags in the efficacy of advertising. This contradicts Schmalansee's conclusions.

It is possible that Schmalansee has used Stigler's definition of an entry barrier.

> ". . . a cost of producing (at some or every rate of output) which must be borne by a firm which seeks to enter an industry but is not borne by firms already in the industry." (Stigler, 1968, p.67).

This would rule out the present case, in the absence of asymmetries. (It also rules out economies of scale as a possible source of barriers). Although it has some appeal I believe that it is less fruitful of useful connotations than the more conventional definition used here.

Finally, we should note that we have stayed very close to Schmalansee's assumptions. Another approach to the effect of entry barriers and advertising, which would possibly be even more in the spirit of Bain's work, is via effects on the price-cost margin, m. (see Nickell and Metcalf, 1978). A further quite straightforward refinement might be to allow for the interaction of advertising with scale economies by the introduction of a term in fixed costs.

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