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SHORT-RUN INDUSTRY PERFORMANCE
AND
POTENTIAL COMPETITION

by

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1. Introduction

Conventional predictions suggest that an intensification of potential competition due to the fall in non-price barriers to entry causes a reduction in the entry-retarding industry price (Kamien and Schwartz [9], Gaskins [5], Baron [2]). In a recent contribution (De Bondt [3]) we pointed out that this prediction may be reversed when established firms realize that there is a positive finite entry lag between a rival's decision to enter and his appearance as an entrant. Our intention in this note is to elaborate on this finding. Exploring the comparative statics analysis of our earlier work we argue that, with an entry lag, the constant pre-entry price attains a minimum value for some intermediate degree of exogenous potential competition where entry is neither free nor blockaded. This intermediate value and the corresponding minimum price policy are characterized.

2. The Framework

At a given time zero an innovating firm introduces a new product for which it has to decide on a pre-entry pricing policy. For simplifying reasons we suppose the firm knows it is the sole innovator, but this assumption can be relaxed. It realizes that to market a rival product, potential entrants need

at least a time interval τ to plan and construct necessary facilities. This entry lag τ can be expected to vary from one industry to another, depending on the complexity and peculiarities of existing production and distribution technology (see Bain [1] and Hicks [6]), we consider $0 \leq \tau \leq \infty$. Typically, however, it takes new rivals a longer time period to become established industry members. They require time to recognize and evaluate the new profit opportunities, to decide on scrapping and replacing possible former operations, to collect inputs necessary to reach a stage from where only a time period τ separates them from entry; in short, to arrive at an irrevocable decision to become an entrant. The incumbent firm is uncertain when such a decision (stage) will be reached, but knows that it causes entry a time period τ later, and believes that its rapidity is directly related to the profitability of entry.

In the original Kamien-Schwartz model [9] entry decisions are dependent on the established firm's current price policy - signalling future profitability to potential entrants - but an entry lag is not considered. Adapting their framework to allow for such a lag we view the incumbent firm assessing the probability of entry by a time t , $F(t)$, in such a way that the probability of entry at a time t given that entry did not occur earlier, $F'(t)/(1-F(t))$, is an increasing convex function of the price a time period τ earlier. With a constant pricing policy p this is formalized as

$$F(t) = 0 \quad 0 \leq t \leq \tau \quad (1)$$

$$F'(t)/(1-F(t)) = \gamma H(p) \quad t \geq \tau$$

where $0 \leq \gamma \leq \infty$, $H(0) = 0$, $H' \geq 0$, $H'' \geq 0$ and prime denoting differentiation

The expected time until entry is $\tau + 1/\gamma H(p)$. The function $\gamma H(p)$ reflects the case of entry, i.e. the degree of potential competition, as viewed by the established firm. It is inversely related to both (to the incumbent firm) endogenous and exogenous elements, respectively the pre-entry price p and the

traditional non-price barriers to entry. See Jacquemin [8] for a discussion of those barriers in a European context. An increase in the parameter γ reflects an intensification in the exogenous part of the threat of entry through a fall in non-price barriers to entry and results in the expectation by the established firm that entry decisions will be reached earlier and that consequently entry will be speedier.

The established firm's pricing problem can now be written as :

$$\max_p V(p) = \int_0^{\infty} e^{-\rho t} [\pi_1(p)(1-F(t)) + \pi_2 F(t)] \quad \rho = r - g \quad (2)$$

subject to (1), with $\pi_1(p)$: current pre-entry profits ; π_2 : maximum post-entry gains, both subject to an industry trend g , and $r > g$ a rate of time discount. We assume that $\pi_1'' < 0$, $\max_p \pi_1(p) = \pi_1(p^m) > \pi_2$, and $H'(p^m) > 0$.

The magnitude of π_2 makes it worthwhile for the firm to retard entry ; the latter restriction is imposed without loss of generality.

3. Short-Run Industry Performance and Potential Competition

The maximization of the long-run profits V can be rewritten taking the integration of F from (1) into account, as

$$\max_p V(p) = \ell(p) \pi_1(p) + m(p) \pi_2 \quad (3)$$

with

$$\ell(p) = (1 - e^{-\rho \tau} / \rho) + e^{-\rho \tau} / \gamma H(p)$$

and

$$m(p) = 1/\rho - \ell(p)$$

The firm maximizes a weighted sum of pre- and post-entry gains with the weights depending on structural- and firm-specific parameters, (see Hicks [6] and Kamien and Schwartz [9]).

Let p^0 denote a regular interior optimal policy to problem (3); then

$$V'(p^0) = \ell(p^0) \pi_1'(p^0) + \ell'(p^0) (\pi_1(p^0) - \pi_2) = 0 \quad (4)$$

and $V''(p^0) < 0$.

Short-run monopoly profits are reaped ($p^0 = p^m$) in trivial pricing situations, where retarding efforts are considered unnecessary or futile ($\gamma_H(p^m) = 0$, $\tau \rightarrow \infty$, $\gamma_H \rightarrow \infty$ and $\tau > 0$). In nontrivial circumstances ($\gamma_H(p^m) > 0$, $\tau < \infty$, $\gamma_H < \infty$) the firm sacrifices some current pre-entry profits ($p^0 < p^m$) in an attempt to discourage entry, but not so much that gains would be foregone should entry occur ($\pi_1(p^0) > \pi_2$). See Kamien and Schwartz [9] and De Bondt [3] for a discussion of these and other inferences from the model.

To study in detail the effect of exogenous potential competition on short-run market performance as reflected in the magnitude of p^0 , we partially differentiate (4) and learn that

$$\text{sign } dp^0/d\gamma = \text{sign} [(\gamma_H(p^0))^2 (1 - e^{-\rho\tau}) - \rho^2] \quad (5)$$

With a zero lag an intensification of the exogenous threat of entry leads to a lower (nontrivial) pre-entry price, as conventionally predicted, but for a positive lag this prediction may be reversed. In an Appendix we show that this implies:

Proposition 1: Given the assumptions and $0 < \tau < \infty$, unique regular optimum policies p^0 attain a minimum value p^{00} such that $\pi_2 < \pi_1(p^{00}) < \pi_1(p^m)$ for an

intermediate (exogenous) degree of potential competition γ^0 , $0 < \gamma^0 < \infty$.

The established firm recognizing an entry lag and potential entry makes a maximum effort to retard entry when the exogenous threat of entry attains some intermediate value where entry is neither free (γ^∞) nor blocked ($\gamma=0$). This result holds for any positive finite value of the lag τ . The entry-retarding price p^0 drops from p^m to p^{00} as the threat of entry (through a reduction in the barriers to entry) intensifies from $\gamma = 0$ to $\gamma = \gamma^0$. A further intensification from $\gamma = \gamma^0$ to $\gamma^0 + \infty$ has the opposite effect, since p^0 increases from p^{00} to p^m with incumbent giving up on his attempts to discourage entry. A moderation or intensification of potential competition from γ^0 thus leads to a higher industry price in the short-run but for apparently different reasons. When the indicated modifications from γ^0 make entry decisions less likely, a larger sacrifice to discourage entry no longer appears necessary; when they ease entry, the sacrifice becomes less worthwhile since new rivals need in any case a time interval τ to enter. For a zero lag this last consideration does not apply and a more intense threat of entry leads to a larger sacrifice of current profits to compensate for the easier entry.

Next we characterize p^{00} and γ^0 . Let δ be a parameter reflecting the height of the pre-entry profit function π_1 . Comparative statics analysis learns (see Appendix) :

Proposition 2 : For p^{00} and γ^0 defined in Proposition 1 : (a) $\partial\gamma^0/\partial\tau < 0$, $\partial\gamma^0/\partial\delta > 0$, $\partial\gamma^0/\partial\pi_2 < 0$; (b) $\partial p^{00}/\partial\tau > 0$, $\partial p^{00}/\partial\delta < 0$, $\partial p^{00}/\partial\pi_2 > 0$, $\partial p^{00}/\partial\tau > 0$, $\partial p^{00}/\partial g < 0$.

An intuitive explanation for these results can be provided. We find that the longer the entry lag, the smaller the threat of entry where an intensification leads the firm to switch from further sacrificing gains to reaping

more pre-entry gains. The longer the lag the readier the firm "gives up" on additional foregoing of short-run gains, because it takes new rivals anyway a longer time to enter and the effect on discouraging entry is postponed to a more distant future. The higher pre-entry gains, the more there is to protect, and the more intense exogenous potential competition has to be before the firm finds it no longer worthwhile to lower price with an intensification in the threat of entry. Similar arguments can be made for π_2 , while the intuitive explanations made elsewhere [3, 9] still apply for the remaining restrictions.

5. Conclusions

In this note we demonstrated that short-run industry performance reflected by a constant pre-entry price may improve with the threat of potential competition up to a point, from where further intensification of such exogenous potential rivalry becomes counterproductive. Our results need to be viewed as tentative in view of the restrictions of the model but constitute a novel basis for further empirical and theoretical research on the link between industry performance and elements of market structure. Subsequent research should also clarify the relation between short- and long-run performance for industries recognizing potential competition (see Ruffin [11], Kamien and Schwartz [10] and De Bondt [4]).

APPENDIX

To verify Proposition 1, we consider a situation where unique regular optimum policies p^0 exist for any γ , $0 \leq \gamma \leq \infty$. Equation (3) implicitly defines a (differentiable) function $p^0(\gamma)$, the shape of which we want to investigate for $0 < \gamma < \infty$. Recalling the comments following (3), we know that for $0 < \gamma < \infty$, $p^0(0) = p^m$ and $\lim_{\gamma \rightarrow \infty} p^0(\gamma) = p^m$. One can also verify (see [3]) that $0 < p^0(\gamma) < p^m$ for $0 < \gamma < \infty$. The (continuous) function $p^0(\gamma)$, starting at p^m for $\gamma=0$, must therefore attain at least one minimum for a positive finite γ , in order to reach p^m at $\gamma \rightarrow \infty$. But one easily sees that at any stationary point of $p^0(\gamma)$, where $dp^0/d\gamma = 0$, $\text{sign } d^2p^0/d\gamma^2 = \text{sign } 2\gamma H^2(1-e^{-\rho\tau}) > 0$ for $0 < \gamma < \infty$ and $0 < \gamma < \infty$. Hence, $p^0(\gamma)$ attains a unique minimum which we denote by $p^{00} = p^0(\gamma^0)$, $0 < \gamma^0 < \infty$.

In Proposition 2 we claim changes in p^{00} and γ^0 for (small) changes in the other parameters of the model. To obtain the indicated results note that p^{00} and γ^0 solve simultaneously equation (3) and

$$(\gamma^0 H(p^{00}))^2 (1-e^{-\rho\tau}) - \rho^2 = 0, \text{ since } dp^0/d\gamma \Big|_{p=p^{00}, \gamma=\gamma^0} = 0.$$

The sign restrictions can be found by totally differentiating the indicated system of equations and applying well-known methods. (Details are available from the author)

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