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PROFIT RAISING ENTRY*

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Common wisdom suggests that entry reduces profits of incumbent firms. On the contrary, we demonstrate that if the incumbents differ in marginal costs and the entrants behave like Stackelberg followers, then entry may benefit the cost efficient incumbents while hurting the cost inefficient ones. And the total outputs of all incumbents may be higher under entry.

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I. INTRODUCTION

Since the works of Bain [1956] and Sylos-Labini [1962], the issue of entry has received a great deal of attention. In an influential paper, Seade [1980] shows that while entry may increase or reduce the incumbents' outputs, it *always reduces* their profits. This result is based on two important assumptions. First, pre and post entry product-market competition is characterized by Cournot competition. Second, all firms are symmetric in terms of production costs. However, often there are situations when neither of these assumptions holds. For example, pre-commitment strategies by incumbent firms may help them to behave like Stackelberg leaders (Spence [1977], Dixit [1980], Spulber [1981], Fershtman and Judd [1987] and Basu and Singh [1990]). Further, cost asymmetry rather than symmetry is perhaps the empirical regularity.

In this paper, we relax the two above-mentioned assumptions and examine the effects of entry on outputs and profits, in a simple framework of two incumbents and one entrant. Specifically, we allow the incumbents to differ in marginal costs, and assume that they compete in the Cournot fashion between themselves while behaving as Stackelberg leaders against the entrant. We find that the entry of a cost inefficient firm increases both the output and profit of the cost efficient incumbent, while it reduces the profit but has an ambiguous effect on the output of the cost inefficient incumbent. These results are generalized to multiple incumbents and entrants in our working paper version (Mukherjee and Zhao [2008]). It thus follows that the cost efficient incumbents may actually encourage new entry into the industry.

Evidences show that there are several industries where Stackelberg competition is relevant. As documented in Cho et al. [1998], the semiconductor industry consists of incumbent U.S. firms (e.g., Intel and Motorola) and entrant Japanese and Korean firms (Fujitsu, NEC, Samsung and Toshiba). DeMiguel and Xu [2006] demonstrate that Stackelberg structure is also relevant in the telecommunications industry. In addition, since Stackelberg competition is the standard approach to take in the presence of dominant firms or market

leaders (see e.g., Martin [2001]), we can expect our results to also hold in industries with dominant incumbents.[1]

The profit raising effect of entry features also in Tyagi [1999] and Naylor [2002]. Using a vertical structure with a single input supplier, Tyagi [1999] shows that entry may *increase* the input price, which tends to reduce the output of the final good. Under certain demand conditions, entry increases the incumbents' profits if the input-price effect dominates the added competition from entry. In a similar setup but with firm-specific bargaining over the input price, Naylor [2002] shows that entry *decreases* the input price, and if this effect dominates the competition effect, entry increases the profits of the incumbents. Our analysis differs from theirs in that we focus on the firms' cost differences and the Stackelberg leader position the incumbents enjoy over the entrant. Stackelberg leadership affects the incumbents' perception about market demand and marginal cost, leading to increases in the output and profit of the cost efficient incumbent.

II. THE MODEL AND THE RESULTS

II(i). *The Case of No Entry*

Consider two incumbent firms, 1 and 2, producing a homogenous product. The constant marginal costs of firm 1 and firm 2 are respectively 0 and $c > 0$. The firms compete in the Cournot fashion. We assume that the inverse market demand function for the product is

(1) $P = a - q$,

where the notations have usual meanings. The two firms maximize the following expressions respectively to determine their outputs:

(2) $\underset{q_1}{Max}(a-q)q_1$ and $\underset{q_2}{Max}(a-q-c)q_2$

where $q = q_1 + q_2$. The equilibrium outputs can be found as

[1] Opinion differs on the minimum size of a dominant firm. Scherer [1980] discusses about a leading firm's market share of 40%, while Landes and Posner [1981] suggest 80% or more. The European Union suggests that market shares of 80% show clear evidence of dominance and a market share of 40-50% strongly implies the ability to exploit strategic advantage against rivals (George and Jacquemin [1992]). The U.S. Merger Guidelines contain a 'leading firm proviso' based on a market share of at least 35% (US department of justice [1988]).

(3) $q_1 = (a+c)/3$ and $q_2 = (a-2c)/3$.

Positive outputs of all firms require that $c < a/2 \equiv \hat{c}$, which is assumed to hold. The equilibrium profits of firms 1 and 2 are respectively,

(4) $\pi_1 = (a+c)^2/9$ and $\pi_2 = (a-2c)^2/9$.

II(ii). *The Case of Entry*

Now we introduce an entrant, firm 3, which can also produce the good and faces the constant marginal cost $e(\geq c)$. Such entry could arise due to exogenous knowledge spillover or patent expiry of old technologies of the incumbents. Considering the incumbents as dominant firms, or in view of the pre-commitment strategies adopted by the incumbents, we can treat the game between the incumbents and the entrants as a Stackelberg competition, where the incumbents behave like Stackelberg leaders and the entrants as followers. However, the incumbents play like Cournot oligopolists amongst them.

We consider the following game under entry. At stage 1, the incumbent firms choose their outputs simultaneously. At stage 2, the entrant determines its output and the profits are realized. We solve the game by backward induction.

Given the outputs of the incumbents, the entrant maximizes:

(5) $\underset{q_3}{Max}(a-q-e)q_3$,

where $q = q_1 + q_2 + q_3$, which gives its optimal output as $q_3 = (a-e-q_1-q_2)/2$. Firms 1 and 2 maximize respectively:

(6a) $\underset{q_1}{Max}\ \{a-q_1-q_2-(a-e-q_1-q_2)/2\}q_1 = \underset{q_1}{Max}\ (a+e-q_1-q_2)q_1/2$

(6b) $\underset{q_2}{Max}\ \{a-q_1-q_2-(a-e-q_1-q_2)/2-c\}q_2 = \underset{q_2}{Max}\ (a+e-q_1-q_2-2c)q_2/2$

The equilibrium outputs of firms 1 and 2 can be found as

(7) $q_1 = (a+e+2c)/3$ and $q_2 = (a+e-4c)/3$.

Hence, the equilibrium output of firm 3 is $q_3 = (a-5e+2c)/3$. We assume that

(8) $q_3 > 0$, i.e., $e < (a+2c)/5 \equiv \bar{e}$.

Otherwise, entry has no meaning in our analysis. If (8) holds, the outputs of the incumbents are positive since $e \geq c \geq 0$. Note that $\bar{e} \geq c$ for $c \leq a/3$. Thus if $c > a/3$, we obtain $q_3 = 0$ for any $e \geq c$. To make entry meaningful for $e \geq c$, we restrict our attention to $c < a/3 \equiv \bar{c}$.

Next, the equilibrium profits of firms 1 and 2 can be derived as respectively

(9) $\pi_1 = (a+e+2c)^2/18$ and $\pi_2 = (a+e-4c)^2/18$.

The equilibrium profit of firm 3 is $\pi_3 = (a-5e+2c)^2/36$.

Proposition 1: (i) The equilibrium output of firm 1 is higher under entry than under no entry. (ii) The equilibrium output of firm 2 is higher under entry than under no entry if $e \in (2c, \bar{e})$ and $c \in [0, a/8)$.

Proof: (i) It follows immediately from the outputs of firm 1 in (3) and (7).

(ii) By (3) and (7), the output of firm 2 is higher under entry than under no entry if $2c < e$. Since $e \in [c, \bar{e})$, the condition $2c < e$ is feasible if $\bar{e} > 2c$ or $c < a/8$, where $a/8 < \bar{c} \equiv a/3$. ■

The intuition for the above results can be found from a comparison of (2) versus (6a) and (6b). If we ignore the constant $1/2$ in (6a) and (6b), since it does not affect optimization, these profit functions suggest that Stackelberg competition induces both firms 1 and 2 to perceive a higher demand (i.e., *(a + e)* in (6a) and (6b) instead of *a* in (2)) and a higher marginal cost for firm 2 (i.e., *2c* in (6b) instead of *c* in (2)) compared to the case of no entry. The perceived higher demand induces firm 1 to increase its output. However, there are opposing effects on firm 2. The perceived higher demand tends to increase firm 2's output,

while the perceived higher marginal cost tends to reduce its output. On balance, entry increases firm 2's output if the perceived demand effect outweighs the perceived marginal cost effect, which occurs if *e* is relatively high (i.e., the entrant being too inefficient) and *c* is relatively small (i.e., firm 2 being not too inefficient).

Proposition 2: (i) The profit of firm 1 is higher under entry than under no entry if $e \in (e^c(c), \bar{e})$, where $e^c(c) \equiv (\sqrt{2}-1)(a - c\sqrt{2})$ and $c \in (c^c, \bar{c})$ where $c^c \equiv a(5\sqrt{2}-6)/(12-5\sqrt{2})$.

(ii) The profit of firm 2 is lower under entry than under no entry.

Proof: (i) From (4) and (9), entry increases firm 1's profit if $e > (\sqrt{2}-1)(a - c\sqrt{2}) \equiv e^c(c)$. However, $e^c(c)$ is in the feasible range of $e \in [c, \bar{e})$ if $\bar{e} \equiv (a+2c)/5 > e^c(c)$ or

$$c > a(5\sqrt{2}-6)/(12-5\sqrt{2}) \equiv c^c, \qquad \text{where } c^c < \bar{c} \equiv a/3.$$

(ii) Similarly, entry reduces firm 2's profit if $(\sqrt{2}-1)(a+2\sqrt{2}c) > e$, which holds since $(\sqrt{2}-1)(a+2\sqrt{2}c) > \bar{e}$. ■

The intuition for Proposition 2 is as follows. While entry tends to reduce the profits of the incumbents through increased competition (which is captured by the term $1/2$ in (6a) and (6b)), the higher perceived demand curve under Stackelberg competition increases firm 1's output, and this effect tends to rise with *e*. Further, from Proposition 1 it follows that the condition on *c* in Proposition 2(i) ensures that entry reduces firm 2's output since $c^c > a/8$. Because the outputs are "strategic substitutes", firm 2's lower output helps firm 1 to further expand its output. The positive output effect outweighs the negative competition effect on firm 1's profit if both *e* and *c* are relatively high (or if neither of firms 2 and 3 are very efficient). However, though entry increases firm 2's perceived demand curve, which has a positive effect on its profit, entry tends to reduce firm 2's profit by increasing competition and firm 2's

perceived marginal cost. These negative effects dominate the positive perceived demand effect and reduce firm 2's profit.

III. CONCLUSION

We have shown that if the firms differ in marginal costs of production and the incumbents and entrants behave like Stackelberg leaders and followers respectively, entry increases output of the cost efficient incumbent but has an ambiguous effect on the cost inefficient incumbent. Further, entry increases the profit of the former firm if it is sufficiently cost efficient than the other firms. However, entry always reduces the profit of the cost inefficient incumbent.

It must be noted that the perceived demand and cost effects under Stackelberg competition do not depend on the demand structure. The effects occur since the incumbents internalize the strategic output choice of the entrant. A non-linear demand function will only affect the extent of these effects. Also note that Stackelberg competition under entry is important for our results. If the incumbents and the entrant behave like Cournot oligopolists ex-post entry, the above mentioned perceived demand and cost effects disappear, and entry reduces the profits of all incumbents.

To show the effects of entry in the simplest way, we have considered an exogenously given Stackelberg structure under entry. This structure can certainly arise endogenously following the strategies of the incumbents (see Spence [1979] and Dixit [1980]).

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