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# Excessive entry in a bilateral oligopoly

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**Abstract:** In a bilateral oligopoly, Ghosh and Morita ('Social desirability of free entry: a bilateral oligopoly analysis, 2007, IJIO) show that entry is always socially insufficient if the upstream agents have sufficiently strong bargaining power. We show that this conclusion is very much dependent on the use of "efficient bargaining" model in their analysis. Using a "right-to-manage" model, we show that, even if the upstream agents have full bargaining power, entry is excessive in a bilateral oligopoly if the cost of entry is not very high. Hence, whether the anti-competitive entry regulation is justified under bilateral oligopoly depends on the bargaining structure between the upstream and the downstream agents.

**Key Words:** Bilateral oligopoly; Excessive entry; Free entry; Insufficient entry

**JEL Classification:** L13; L40

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# Excessive entry in a bilateral oligopoly

## 1. Introduction

While there is a vast literature on the welfare effects of entry, the previous works did not pay attention to the vertical relationship between the firms, which is very common in real world. For example, automobile manufacturers purchase steel, tire and many other parts produced by other firms. The markets for microprocessors, aircraft-engines, packaged products and energy or power generating sectors are also characterized by vertical relationship. However, it is often found that the vertical relationships between the firms are characterized by bilateral relationships. For example, the survey by Cusumano and Takeishi (1991) find that the cases of procuring parts from only one supplier account for 59% of their U.S. sample and 70% of their Japanese sample. They also found that the relationships between the manufacturers and the suppliers are long term and stable.

In a recent paper, Ghosh and Morita (2007) show that, in case of bilateral oligopoly, entry is always insufficient if the suppliers of the intermediate products have sufficiently strong bargaining power.[1] While the finding by Ghosh and Morita (2007) is interesting, we show that this result is very much dependent on their use of "efficient bargaining" model, where the upstream and the downstream agents bargain over both the input prices and input quantities. Using the "right-to-manage" model of a vertically related industry, where the upstream and the downstream agents bargain for the input prices and the downstream agents keep the autonomy in determining the

[1] In another paper, Ghosh and Morita (2005) show insufficient entry in a vertical structure, where the intermediate products are sold through the market instead of vertical negotiations.

amount of the inputs to be used, we show that, even if the upstream agents have full bargaining power, entry is excessive in a bilateral oligopoly if the cost of entry is not very high. Hence, our paper complements Ghosh and Morita (2007) and shows that whether the anti-competitive entry regulation is justified under bilateral oligopoly depends on the bargaining structure between the upstream and the downstream agents.

It is worth mentioning that right-to-manage model is a standard and widely used model of a vertically related industry. For example, considering the upstream agents as labor unions, Nickell and Andrews (1983), Corneo (1995), Bughin and Vannini (1995), Naylor (2002), Lommerud et al. (2003), Haucap and Wey (2004), López and Naylor (2004) and Mukherjee (2007), to name a few, use the right-to-manage model in different contexts to show the implications of imperfectly competitive markets. Further, Layard et al. (1991) provide arguments for using the right-to-manage model vis-à-vis the efficient bargaining model.

It must be noted that we do not mean that the use of the efficient bargaining model is not appropriate. The point we want to make here is that whether a vertically related industry follows the efficient bargaining model or the right-to-manage model is perhaps an empirical question, and they may be seen in different industries or in different countries. Therefore, when examining the justification for anti-competitive entry regulation under bilateral oligopoly, one must be careful about the bargaining structure between the upstream and the downstream agents.

The remainder of the paper is organized as follows. Section 2 considers a right-to-manage model of a bilateral oligopoly and shows the results. Section 3 concludes.

## 2. The model and the results

Let us consider an industry with a large number of symmetric downstream firms, each of whom must decide whether to enter the downstream sector. In case of entry, each downstream firm needs to incur an entry cost $K$. If $n$ downstream firms enter, each of them is the paired with an upstream firm. The upstream firms provide inputs to the respective downstream firms. To convey the message of this paper in the simplest way, i.e., to show that excessive entry occurs under bilateral oligopoly with significant bargaining power of the upstream agents, we believe that it is enough to consider the case of full (or maximum) bargaining power of the upstream firms. Hence, we consider that the upstream firms set the input prices and the respective downstream firms purchase inputs according to their requirements. The downstream firms then transform the inputs to a final homogeneous good with a constant marginal cost, which is normalized to zero. For simplicity, we assume that the cost of producing the input is zero. We also assume that the downstream firms have symmetric production technology, and each downstream firm requires one input to produce one unit of output. It is also worth mentioning that a downstream firm can use only the inputs produced by the upstream firm who is paired with this downstream firm.

We assume that the inverse market demand function is

$$P = a - q, \tag{1}$$

where the notations have usual meanings.

We consider the following game. At stage 1, the downstream firms decide whether to enter the industry or not. At stage 2, each upstream firm sets the input price for the respective downstream firm. At stage 3, the downstream firms compete

like Cournot oligopolists to determine their equilibrium outputs, and buy the inputs according to their requirements. The profits are realized. We solve the game through backward induction.

Given that $n$ downstream firms have entered and the $i$th upstream firm, $i = 1,2,...,n$, charged $w_i$ as the per-unit price for its input, the $i$th downstream firm, $i = 1,2,...,n$, maximizes the following expression to determine its output:

$$\underset{q_i}{Max}(a - q - w_i)q_i - K. \tag{2}$$

Note that $K$ is sunk at the output stage and $q = \sum_{i=1}^{n} q_i$.

The equilibrium output of the $i$th downstream firm is

$$q_i = \frac{a - nw_i + \sum_{\substack{j=1 \\ i \neq j}}^{n} w_j}{n+1}, \qquad i = 1,2,...,n. \tag{3}$$

Since, each downstream firm requires one input to produce one unit of output, (3) also shows the input demand faced by the $i$th upstream firm, $i = 1,2,...,n$. Therefore, the $i$th upstream firm maximizes the following expression to determine $w_i$:

$$\underset{w_i}{Max} \frac{w_i(a - nw_i + \sum_{\substack{j=1 \\ i \neq j}}^{n} w_j)}{n+1}, \qquad i = 1,2,...,n. \tag{4}$$

Given the symmetry of the firms, the equilibrium input prices are $w_1^* = w_2^* ... = w_n^* = \frac{a}{n+1}$. As the number of firms in the downstream sector increases, it reduces the equilibrium input price.

Hence, the equilibrium net profit of the $i$th downstream firm who has decided to enter the downstream sector is

$$\pi_i = \frac{a^2 n^2}{(n+1)^4} - K . \qquad (5)$$

For the analytical convenience, we consider the number of firms as a continuous variable. Hence, entry in the downstream sector occurs until the net profit of a new entrant becomes zero. Therefore, given the symmetry of the firms, the free entry equilibrium number of firms in the downstream sector is given by the following zero profit condition:

$$\pi_i = 0$$

or $$\frac{a^2 n^2}{(n+1)^4} = K . \qquad (6)$$

In other words, condition (6) shows the number of firms entering the downstream sector in the free entry equilibrium. It follows from (6) that, if the cost of entry (i.e., $K$ falls), the number of firms in the free entry equilibrium increases.

Let us now determine the welfare maximizing number of firms, where the welfare is given by the sum of the total net profits of the downstream firms, the total profits of the upstream firms and consumer surplus. Following the literature on excess-entry theorem, we consider the second-best problem of welfare maximization. In other words, we determine the welfare maximizing number of firms subject to Cournot behavior of the firms. Hence, the social planner can control the number of firms entering the downstream sector, but it cannot control the output choice behavior of the firms.

If $n$ downstream firms produce, it follows from (5) that the net profit of the $i$th downstream firm is $\pi_i = \frac{a^2 n^2}{(n+1)^4} - K$, $i = 1,2,...,n$. Hence, the total net profit of the downstream firms is

$$n\pi_i = \frac{a^2 n^3}{(n+1)^4} - nK . \tag{7}$$

Given that the equilibrium input prices are $w_1^* = w_2^* ... = w_n^* = \frac{a}{n+1}$, the equilibrium amount of input supplied by the $i$th upstream firm is $q_i = \frac{an}{(n+1)^2}$, $i = 1,2,...,n$. Hence, the profit of the $i$th upstream firm is $U_i = \frac{a^2 n}{(n+1)^3}$, $i = 1,2,...,n$. Therefore, the total profit of the upstream firms is

$$nU_i = \frac{a^2 n^2}{(n+1)^3} . \tag{8}$$

Since, the total final goods production is equal to $nq_i = \frac{an^2}{(n+1)^2}$, consumer surplus, which is $\frac{(nq_i)^2}{2}$, is

$$CS = \frac{a^2 n^4}{2(n+1)^4} . \tag{9}$$

Therefore, the social planner chooses $n$ to maximize social welfare (which is the sum of (7), (8) and (9)):

$$\begin{aligned} \underset{n}{Max} W &= \underset{n}{Max} \frac{a^2 n^3}{(n+1)^4} - nK + \frac{a^2 n^2}{(n+1)^3} + \frac{a^2 n^4}{2(n+1)^4} \\ &= \underset{n}{Max} \frac{a^2 n^2 (n^2 + 4n + 2)}{2(n+1)^4} - nK . \end{aligned} \tag{10}$$

The welfare maximizing $n$ is given by

$$\frac{2a^2 n(2n+1)}{(n+1)^5} = K . \tag{11}$$

It follows from (11) that as the cost of entry (i.e., $K$) falls, the welfare maximizing number of firms increases.

**Proposition 1:** (i) *The welfare maximizing number of firms is lower than the number of firms in the free entry equilibrium, if the welfare maximizing number of firm is at least 4. In this situation, entry is excessive from the social point of view.*

*(ii) If the welfare maximizing number of firm is at most 3, the number of firms in the free entry equilibrium is lower than the welfare maximizing number of firms, and entry is insufficient in this situation.*[2]

**Proof:** Assume that (11) holds, i.e., we determine the welfare maximizing number of firms. Comparing left hand sides (LHSs) of (6) and (11) at the welfare maximizing number of firms, we get that

$$\frac{a^2n^2}{(n+1)^4} \underset{<}{\geq} \frac{2a^2n(2n+1)}{(n+1)^5}$$

$$\text{if} \qquad n^2 - 3n - 2 \underset{<}{\geq} 0. \tag{12}$$

LHS of (12) is convex in $n$, and it is negative for $n \in [1, \frac{3+\sqrt{17}}{2})$, while it is positive for $n > \frac{3+\sqrt{17}}{2}$.

(i) If the welfare maximizing number of firm is at least 4, we get that $\frac{a^2n^2}{(n+1)^4} > \frac{2a^2n(2n+1)}{(n+1)^5} = K$, i.e., the number of firms in the free entry equilibrium is

[2] Though, in our analysis, we consider the number of firms as a continuous variable, while writing this proposition we keep in mind that the number of firms in reality takes integer values. Hence, we avoid writing the number of firms between 3 and 4 in the proposition.

greater than the welfare maximizing number of firms, which implies that entry is excessive in this situation.

(ii) If the welfare maximizing number of firm is at most 3, we get that $\frac{a^2n^2}{(n+1)^4} < \frac{2a^2n(2n+1)}{(n+1)^5} = K$, which implies that the number of firms in the free entry equilibrium is lower than the welfare maximizing number of firms. Hence, entry is insufficient in this situation. Q.E.D.

Since it follows from (6) and (11) that both the number of firms in the free entry equilibrium and the welfare maximizing number of firms increase with lower $K$, Proposition 1(i) suggests that entry is excessive if the cost of entry is not very high so that the welfare maximizing number of firm is at least 4. Hence, it contradicts the finding of Ghosh and Morita (2007), where entry is never excessive if the upstream agents have sufficiently strong bargaining power.

The reason for the difference between our result and that of Ghosh and Morita (2007) is attributable to the different bargaining structures considered in these papers. In Ghosh and Morita (2007), the upstream agents bargain over both the input prices and the input quantities. The possibility of bargaining over the input quantities helps the upstream and the downstream agents to choose the input quantity in a way so that they can maximize their post-entry joint profits, which are divided between them by the input prices according to their bargaining powers. As the bargaining power of the downstream agent falls, it reduces the downstream agent's share of the post-entry joint profit and therefore, it reduces its incentive for entry. If the bargaining power of the upstream agents is very high, it significantly reduces the downstream agents' incentives for entry, and creates insufficient entry from the social point of view.

In contrast, in our analysis, the upstream agents cannot determine the input quantities, and therefore, the joint profit maximizing role of the input quantities are not present here. Instead, we have the standard case of "double marginalization", and the upstream agents must be careful about the effects of the input prices on the input demands. Hence, in our analysis, even if the upstream agents have full bargaining power, the post-entry profits of the downstream agents remain significant, thus providing significant incentives for entry. Further, higher competition in the product market helps to reduce the input price, thus reinforcing the "business stealing incentive" of the new entrant. Hence, if the cost of entry is not very high, the number of downstream firms entering the industry is not very small, and the equilibrium input price is not very high. In this situation, significant business stealing incentive remains for the new entrant, thus creating excessive entry for not very high entry costs. If the entry cost is very high, the number firms entering the market is small, and therefore, the equilibrium input price is very high, which, in turn, reduces the business stealing incentive significantly and creates insufficient entry for high entry costs.

We have shown excessive entry with full bargaining power of the upstream agents. However, it must be clear that as the bargaining power of the upstream agents falls, it reduces the equilibrium wage rates for a given number of downstream agents, thus increasing the incentive for entry by raising the post-entry profits of the downstream agents. Hence, the case of excessive entry increases with lower bargaining power of the upstream agents. On the extreme case of no bargaining power of the upstream agents, our analysis coincides with the previous works on excessive entry without a vertical structure, where entry is always socially excessive.

## 3. Conclusion

Ghosh and Morita (2007) show that entry is always socially insufficient in a bilateral oligopoly if the upstream firms have sufficiently strong bargaining power. We show that this conclusion very much depends on their use of the efficient bargaining model. Using the right-to-manage model, we show that, even if the upstream agents have full bargaining power, entry is socially excessive in a bilateral oligopoly if the cost of entry is not very high. Hence, as a policy implication, whether anti-competitive entry regulation is justified in a bilateral oligopoly depends on the bargaining structure between the upstream and the downstream agents.

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## *AWPE* DATA SHEET

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