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The welfare effects of entry: the role of the input market

Arijit Mukherjee · Udo Broll · Soma Mukherjee

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Abstract In a successive Cournot oligopoly, we show the welfare effects of entry in the final goods market with no scale economies but with cost difference between the firms. If the input market is very concentrated, entry in the final goods market increases welfare. If the input market is not very concentrated, entry in the final goods market may reduce welfare if the entrant is moderately cost inefficient. Hence, entry in the final goods market is more desirable if (1) the input market is very concentrated or (2) the cost difference between the incumbents and the entrant is either very small or very large. It follows from our analysis that entry increases the profits of the incumbent final goods producers if their marginal costs are sufficiently lower than the entrant's marginal cost.

Keywords Entry · Profit · Vertical structure · Welfare

JEL Classification L13 · L50

1 Introduction

The purpose of this paper is to consider the welfare effects of entry in the final goods market when the input market is imperfectly competitive and the entrant final goods

A. Mukherjee (✉)
School of Economics, University of Nottingham and The Leverhulme
Centre for Research in Globalisation and Economic Policy,
University Park, Nottingham NG7 2RD, UK
e-mail: arijit.mukherjee@nottingham.ac.uk; ar_25@hotmail.com

U. Broll
Dresden University of Technology, Dresden, Germany

S. Mukherjee
University of Nottingham, Nottingham, UK

producer is cost inefficient as compared to the incumbent final goods producers. We show that the input-market concentration may play an important role.

The welfare effects of entry in imperfectly competitive markets have received attention for a long time. There are two strands of this literature. One strand of literature shows that entry in an imperfectly competitive market may be welfare reducing in the presence of scale economies. The earlier works in this area implicitly assume that the input markets are perfectly competitive, and therefore, entry does not affect the marginal costs of the firms (Williamson 1968; Dixit and Stiglitz 1977; von Weizsäcker 1980; Perry 1984; Mankiw and Whinston 1986; Suzumura and Kiyono 1987; Okuno-Fujiwara and Suzumura 1993; Anderson et al. 1995; Fudenberg and Tirole 2000). However, recent works look at the vertical structure[1] where the marginal costs of the firms are endogenously determined (Ghosh and Morita 2007a, 2007b,Mukherjee 2009).[2] The second strand of the literature shows the welfare effects of entry in the absence of scale economies but under marginal cost asymmetries between the final goods producers. Klemperer (1988) shows that if the entrant final goods producer is cost inefficient as compared to the incumbent final goods producer, entry may be welfare reducing.[3] Ghosh and Saha (2007) confirm this conclusion with free entry. While these papers do partial equilibrium analyses, Crettez and Fagart (2009) show the welfare effects of entry in a general equilibrium analysis. Considering competitive and non-competitive product markets, they show that entry may reduce welfare even if the firms within a sector are symmetric and the technologies display constant returns to scale. In their analysis, the general equilibrium effect of entry in a given sector on the outputs of other sectors is responsible for welfare reducing entry.

However, a common feature of the above-mentioned works is generally the ignorance of input markets. Our paper fills this gap by considering entry in a successive Cournot oligopoly where the entrant final goods producer is less cost efficient than the incumbent final goods producers.[4] To show the implications of cost asymmetry, we abstract our analysis from scale economies, yet we will discuss the possible implications of scale economies in the concluding section.

In a partial equilibrium analysis, we show that if the input market is very concentrated, entry in the final goods market increases welfare. If the input market is not

[1] Vertical relationship between the firms is quite 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 relationships. Komiya (1975) pointed out the industries such as iron and steel, petroleum refining, petrochemicals, cement, paper and pulp, and sugar refining with the tendency to develop excessive competition. While the industries mentioned in Komiya (1975) are characterized by homogeneous products and oligopoly, they produce intermediate goods for the final goods producers.

[2] Mukherjee and Mukherjee (2008) show the welfare effects of entry in the presence of technology licensing, which affects the marginal cost of the licensee.

[3] Lahiri and Ono (1988) show the welfare effects of cost reduction in a less cost efficient firm. Though they have not considered the issue of entry explicitly, a result similar to Klemperer (1988) follows from their analysis. Mukherjee (2007a) shows that entry increases welfare under Stackelberg competition irrespective of the marginal cost difference between the incumbent and the entrant final goods producers.

[4] If horizontal merger is viewed as an opposite situation of entry, our paper may be related to the literature on the welfare effects of horizontal mergers in a vertical structure. See, e.g., Gans (2007) and the references therein.

very concentrated, entry in the final goods market may reduce welfare if the entrant is moderately cost inefficient. Hence, entry in the final goods market is more desirable if (1) the input market is very concentrated or (2) the cost difference between the incumbents and the entrant final goods producers is either very small or very large.

Given the input price, entry of a less cost efficient entrant in the final goods market increases competition as well as creates production inefficiency by shifting output from the cost efficient incumbents to the less cost efficient entrant. As shown in the existing literature (Klemperer 1988; Lahiri and Ono 1988), if the entrant is sufficiently cost inefficient as compared to the incumbents, entry reduces welfare. However, entry in our analysis creates an input price effect. It reduces the input price compared to non-entry by increasing the elasticity of the input demand function, thus reducing the marginal costs of the incumbents. This input price effect creates a positive impact on welfare. In sum, our result is due to the following important trade-off: entry tends to reduce the profits of the incumbents by increasing competition, yet it tends to increase their profits by reducing their marginal costs. The net effect is determined by the cost inefficiency of the entrant and the input price effect.

It follows from our analysis that entry in the final goods market increases the profits of the incumbent final goods producers if the entrant is sufficiently cost inefficient as compared to the incumbents. Tyagi (1999) and Naylor (2002) also show the profit raising effects of entry in a vertical structure. While Tyagi (1999) and Naylor (2002), respectively, show the implications of the demand structure and the upstream agent's preference over the input price and input quantity, cost asymmetry between the incumbents and the entrant is responsible for our result.

The remainder of the paper is organized as follows. Section 2 describes the model and shows the results. Section 3 concludes.

2 The model and the results

Consider an economy with successive Cournot oligopoly as in Greenhut and Ohta (1976); Salinger (1988), Abiru et al. (1998), Ishikawa and Spencer (1999) and Ghosh and Morita (2007a), to name a few. Assume that there are $m \geq 1$ symmetric incumbent final goods producers and an entrant final goods producer denoted by firm $m+1$. As in Yoshida (2000), we assume that all final goods producers have Leontief technologies and use two inputs, say, input 1 and input 2. Input 1 is produced in a perfectly competitive input market at a per-unit cost $d > 0$. Hence, the price of this input is d. Input 2 is produced in an imperfectly competitive input market with $n \geq 1$ symmetric input suppliers, which compete like Cournot oligopolists and the corresponding input price is determined from the input demand function. Each input supplier faces a constant marginal cost production, which is assumed to be zero, for simplicity.

We assume that the entrant final goods producer is technologically less efficient as compared to the incumbent final goods producers. There are several ways to model asymmetry between the final goods producers. We take a simple approach for analytical convenience. It is needless to say that our qualitative results are not sensitive to this modeling approach. We normalize each incumbent final goods producer's requirement for input 1 to zero, and assume that each incumbent final goods producer requires one unit of input 2 to produce one unit of the final goods. However, the entrant final goods producer requires λ units of input 1 and one unit of input 2 to produce one unit of the final goods. If the price of input 2 is denoted by w, the marginal cost of each incumbent final goods producer is w, while the marginal cost of the entrant final goods producer is $w + c$, where $c = \lambda d$.[5] Therefore, c is the measure of cost inefficiency of the entrant as compared to the incumbent final goods producers. For a given d, as λ reduces, it reduces the entrant's cost inefficiency as compared to the incumbent final goods producers.[6]

Assume that the utility function of a representative consumer is

$$U(q, H) = aq - \frac{q^2}{2} + H, \tag{1}$$

where $a > 0$, q is the total output of the final good and H is a numeraire good. The utility function (1) gives the following inverse market demand function:

$$P = a - q, \tag{2}$$

where P is price of the product.

We consider the following game. At stage 1, the profit maximizing input suppliers produce their outputs like Cournot oligopolists. At stage 2, the profit maximizing final goods producers choose their outputs like Cournot oligopolists and the profits are realized. We solve the game through backward induction.

In the following analysis, we will say that entry has occurred if the $m + 1$th firm is present in the final goods market. Therefore, under entry, there are $m + 1$ firms producing the final good. The marginal cost of the ith firm, $i = 1, 2, \ldots, m$, is w and the marginal cost of the $m + 1$th firm is $w + c$. However, under non-entry, the $m + 1$th firm does not produce the final good. Therefore, under non-entry, there are symmetric m firms producing the final good, and each of these firms faces the marginal cost w. Hence, in the following analysis, the equilibrium values under non-entry are equivalent to the case of $c = 0$ with m as the total number of final good producers.

It may worth noting that like the existing literature such as Klemperer (1988), Ghosh and Morita (2007a,b), Ghosh and Saha (2007) and Mukherjee (2009), we assume that the incumbent firms do not have credible pre-commitment strategies. This may happen if the pre-commitment strategies of the incumbents are easily reversible.[7] As a result, the pre and post-entry games are characterized by Cournot competition.

[5] Different requirements for input 2 can also create cost asymmetries between the incumbent and the entrant final goods producers. Our qualitative results remain under this alternative modeling strategy.

[6] Instead of considering two inputs of production, another way of considering asymmetry between the firms is to assume that all firms face the same input coefficients, but they differ in terms of other costs such as distribution costs. With this approach, the distribution cost per-unit of output is normalized to zero for the incumbent final goods producers and it is c for the entrant.

[7] For example, if the incumbents can adjust their prices easily or if their investments are either easily reversible or easily transferrable among different products, the commitment values of prices and investments are reduced.

It is shown in Mukherjee (2007a) that if the incumbent has a pre-commitment strategy and behaves like a Stackelberg leader against the entrant, entry always increases welfare in an imperfectly competitive product market with outputs as the strategic variables. We acknowledge the importance of the incumbents' pre-commitment strategies and therefore, Stackelberg competition ex-post entry. However, our consideration of Cournot competition ex-post entry helps us to distinguish the effect of the vertical structure to that of Stackelberg competition. In other words, Cournot competition in the pre and post-entry games allow us to show the effects of endogenous input price determination without influencing our results through a change in the type of product market competition.

2.1 The case of entry

Let us start the analysis with entry. There are $m + 1$ final goods producers. Given the input prices, the ith incumbent final goods producer and the entrant final goods producer (i.e., the $m + 1$th firm) maximize the following expressions:

$$\underset{q_i}{\mathrm{Max}}(a - q - w)q_i \tag{3}$$

$$\underset{q_{m+1}}{\mathrm{Max}}(a - q - w - c)q_{m+1} \tag{4}$$

where $i = 1, \ldots, m$ and $q = \sum_1^m q_i + q_{m+1}$.

The equilibrium output of each incumbent final goods producer and the equilibrium output of the entrant final goods producer are respectively

$$q_i = \frac{a - w + c}{m + 2} \quad \text{and} \quad q_{m+1} = \frac{a - w - c(m + 1)}{m + 2}. \tag{5}$$

The total demand for input 2 is

$$q = mq_i + q_{m+1} = I = \frac{a(m + 1) - w(m + 1) - c}{m + 2}. \tag{6}$$

The derived demand for input follows from (6) and it is $w = \frac{a(m+1)-I(m+2)-c}{m+1}$. It shows the input price for a total demand for input 2, which is equal to the total outputs of the final goods producers, since we consider that one unit of input 2 is required to produce one unit of the final goods.

The maximization problem for the kth supplier of input 2 is, $k = 1, 2, \ldots, n$,

$$\underset{I_k}{\mathrm{Max}}\, wI_k = \underset{I_k}{\mathrm{Max}} \frac{I_k(a(m + 1) - I(m + 2) - c)}{m + 1}, \tag{7}$$

where $I = \sum_1^n I_k$.

Due to the symmetry of the input suppliers, the equilibrium output of each supplier of input 2 is

$$I_k = \frac{a(m+1) - c}{(n+1)(m+2)}, \quad k = 1, 2, \ldots, n. \tag{8}$$

The total equilibrium supply of input 2 is

$$I = nI_k = q = \frac{n(a(m+1) - c)}{(n+1)(m+2)}. \tag{9}$$

The equilibrium price of input 2 is

$$w = \frac{a(m+1) - c}{(n+1)(m+1)}. \tag{10}$$

If $c > 0$, the equilibrium price of input 2 reduces with the number of suppliers of input 2 but it increases with the number of final goods producers. Hence, the number of final goods producers can affect the price charged by the imperfectly competitive input market in the presence of asymmetric cost final goods producers. This modifies the "independence" result of Greenhut and Ohta (1976), where the input prices are independent of the number of symmetric cost final goods producers, but it is in line with Mukherjee (2007b) where the firms differ in terms of labor productivities and the input price depends on the number of final goods producers. The intuition for this result follows easily from Dhillon and Petrakis (2002), which show that the input prices are independent of the number of final goods producers if the equilibrium outputs and profits of the final goods producers are log-linear in the input price and the market features such as the number of final goods producers. It is immediate from (5) that the equilibrium outputs of the final goods producers do not satisfy log-linearity in the input prices and the number of final goods producers.

Since the total final goods production is negatively related to the price of input 2, more suppliers of input 2 help to increase the total final goods production by reducing the price of input 2, while the higher price of input 2 due to more final goods producers partially offsets the positive effects of more final goods producers on the final goods production.

The profit of each incumbent final goods producer and the profit of the entrant final goods producer are respectively

$$\pi_i = \frac{[an(m+1) + c((n+1)(m+1) + 1)]^2}{(n+1)^2(m+1)^2(m+2)^2}, \quad i = 1, 2, \ldots, m \tag{11}$$

$$\pi_{m+1} = \frac{[an(m+1) - c((n+1)(m+1)^2 - 1)]^2}{(n+1)^2(m+1)^2(m+2)^2}. \tag{12}$$

The entrant produces positive output if $c < \frac{an(m+1)}{(n+1)(m+1)^2 - 1} \equiv c^{\max}$.

Welfare under entry, i.e., when the $m+1$th firm is present in the final goods market, is

$$\begin{aligned}W_e &= U - cq_{m+1} = aq - \frac{q^2}{2} - cq_{m+1} + H\\&= \frac{an[a(m+1)-c]}{(n+1)(m+2)} - \frac{n^2[a(m+1)-c]^2}{2(n+1)^2(m+2)^2}\\&\quad - \frac{c[an(m+1)-c((n+1)(m+1)^2-1)]}{(n+1)(m+1)(m+2)} + H. \end{aligned} \tag{13}$$

2.2 The situation under non-entry

Now consider the situation under non-entry. If we put $c = 0$ and consider the number of final goods producers as m, the equilibrium values shown in subsect. 2.1 are equivalent to the situation under non-entry.

Under non-entry, the equilibrium total supply of input 2 and the equilibrium price of input 2 are respectively

$$I = nI_k = q = \frac{anm}{(n+1)(m+1)}, \tag{14}$$

and

$$w = \frac{a}{(n+1)}. \tag{15}$$

The profit of each final goods producer is

$$\pi_i = \frac{a^2n^2}{(n+1)^2(m+1)^2}, \quad i = 1, 2, \ldots, m. \tag{16}$$

Welfare under non-entry is

$$\begin{aligned}W_{ne} &= U = aq - \frac{q^2}{2} + H\\&= \frac{a^2nm}{(n+1)(m+1)} - \frac{a^2n^2m^2}{2(n+1)^2(m+1)^2} + H\\&= \frac{a^2mn(2(m+1)+(m+2)n)}{2(m+1)^2(n+1)^2} + H.\end{aligned} \tag{17}$$

2.3 The effects of entry on the input price and profits

Now see the effects of entry on the price of input 2, profits and welfare.

Proposition 1 *If the entrant final goods producer is cost inefficient as compared to the incumbent final goods producers, the equilibrium price of input* 2 *is lower under entry than under non-entry.*

Proof Since $c > 0$, the comparison of the equilibrium prices of input 2 shown in (10) and (15) proves the result. □

It is clear from (10) and (15) that if $c > 0$, entry in the final goods market increases price elasticity of demand for input 2,[8] and reduces the equilibrium input price.

Now compare the equilibrium profits of the incumbent final goods producers under entry and under non-entry. The profit of each incumbent final goods producer is higher under entry than under non-entry if

$$\frac{[an(m+1)+c((n+1)(m+1)+1)]^2}{(n+1)^2(m+1)^2(m+2)^2} > \frac{a^2n^2}{(n+1)^2(m+1)^2}$$

or

$$c > \frac{an}{(n+1)(m+1)+1} \equiv c^*, \tag{18}$$

where $c^* < c^{\max}$. On one hand, entry in the final goods market tends to reduce the profits of the incumbents through higher competition. On the other hand, entry tends to increase the profits of the incumbents by reducing the input price. These two effects are balanced if the marginal cost of the entrant is c^*.

The following proposition is immediate from the above discussion.

Proposition 2 *Entry in the final goods market increases the profit of each incumbent final goods producer if* $c \in (c^*, c^{\max})$.

Entry in the final goods market has two effects on the profits of the incumbent final goods producers. First, for a given input price, entry in the final goods market reduces the profit of the incumbent final goods producers by increasing competition in the final goods market. Second, entry in the final goods market reduces the price of input 2, and tends to increase the profits of the final goods producers. If the entrant is sufficiently cost inefficient, i.e., c is very high, the competition effect is negligible, while entry reduces the marginal cost of the incumbent final goods producers due to the input price effect. Hence, entry in the final goods market increases the profits of the incumbent final goods producers if c is sufficiently high, i.e., $c \in (c^*, c^{\max})$.

Irrespective of the number of producers of input 2 and the number of final goods producers, there always exists c such that entry in the final goods market increases the profits of the incumbent final goods producers. We get that if either the number of final goods producer increases (i.e., m increases) or the number of suppliers of input

[8] The inverse demand functions for input 2 under entry and under non-entry are respectively $w + \frac{c}{m+1} = a - \frac{q(m+2)}{m+1}$ and $w = a - \frac{q(m+1)}{m}$. If $c > 0$, the price elasticity of demand for the former inverse demand function is $\frac{w}{a-w-\frac{c}{m+1}}$, which is higher than the price elasticity of demand for the latter inverse demand function, which is $\frac{w}{a-w}$.

2 increases (i.e., n increases), it increases $\frac{c^*}{c^{\max}}$. Therefore, initial higher competition either in the final goods market or in the market for input 2 reduces the gap between c^* and $c^{\max}$, thus reducing the range of c over which entry in the final goods market increases the profits of the incumbent final goods producers. If competition in the final goods market is already very high, a further increase in competition due to entry does not have much effect on the profits of the incumbent firms, while entry creates a positive input price effect. However, higher competition in the final goods market also reduces the cost difference required for a profitable entry, thus reduces the range of c over which entry occurs. On the balance, the possibility of higher profits of the incumbent final goods producers following entry reduces with higher competition in the final goods market. On the other hand, if the market for input 2 is already very competitive, which generates significantly lower input prices, entry in the final goods market does not have significant input price effect, while the negative competition effect reduces the profits of the incumbent final goods producers. Hence, the possibility of higher profits of the incumbent final goods producers following entry reduces with higher competition in the market for input 2.

2.4 The welfare effects of entry

If either $c = 0$ or $c = c^{\max}$, $W_e - W_{ne}$ is positive.[9] Further, it follows from (13) that welfare under entry is convex in c and it is minimized at

$$\frac{a(m+1)n(2(m+2)+(m+3)n)}{K} \equiv \underline{c} < c^{\max}, \tag{19}$$

where $K = 2m(m+2)^2 + 2(m+2)(2m^2+4m+1)n + (m+1)(2m^2+6m+3)n^2$. If c is either very small or very large, welfare is higher under entry than under non-entry. If the minimum value of W_e is lower than W_{ne}, entry reduces welfare for intermediate values of c.

It follows from (13) that if $c = \underline{c}$

$$W_e = \frac{a^2 mn(m+1)(2(m+2)+(m+3)n)}{K} + H. \tag{20}$$

Whether (20) is higher than (17) depends on m and n. Several cases occur depending on m and n. If $n \leq 2$, (20) is greater than (17) for any m. That is, entry increases welfare if the market for input 2 is very concentrated.

If $n \geq 8$, (20) is lower than (17) for any m. If $n \geq 8$, i.e., if the market for input 2 is not very concentrated, entry reduces welfare for moderate values of c for any m.

However, if $3 \leq n \leq 7$, entry may either increase welfare for any c or it may reduce welfare for moderate values of c, depending on the value of m.[10]

[9] The welfare comparison for $c = 0$ is straightfoward. $W_e - W_{ne} = \frac{a^2 mn(2m(m+1)(m+2)+(m+2)(2m^2+4m+1)n+2(m+1)^2 n^2)}{2(m+1)^2(n+1)^2(m(m+2)+(m+1)^2 n)^2} > 0$ at $c = c^{\max}$.

[10] We are very grateful to an anonymous referee for helping us to do welfare comparison in this way.

Now consider a numerical example to show welfare reducing entry. Consider a situation with $a = 1$, $m = n = 10$ and $c \in (0, .083)$. With these parameter values, we get that welfare under non-entry is higher than that of under entry for $c \in (.016, .081)$. Hence, welfare is higher under entry for very high and very low values of c, while it is higher under non-entry for moderate values of c.

The following proposition summarizes the above discussion.

Proposition 3 *If the market for input* 2 *is very concentrated (i.e., $n \leq 2$), entry increases welfare for any m. Otherwise, i.e., for $n > 2$, entry may reduce welfare for moderate values of c.*

The reason for the above result is easy to understand. If there is no input price effect of entry, it follows from Klemperer (1988) and Lahiri and Ono (1988) that if the entrant is very cost inefficient, entry reduces welfare by creating significant production inefficiency even if it increases consumer surplus by increasing competition. However, entry in our vertical structure creates a positive impact on welfare by reducing the input price. If the input market is very concentrated, entry creates significant input price effect, which along with the competition effect dominates the negative production inefficiency effect, thus increasing welfare.

As the input market gets competitive, it reduces the input price. Hence, the benefit from input price reduction due to entry in the final goods market reduces with higher competition in the input market. As a result, if the input market is not very concentrated, there may be situations where entry reduces welfare even if entry provides the positive input price effect. However, in this situation, entry reduces welfare if the cost difference between the incumbents and the entrant is moderate.

If the cost inefficiency of the entrant increases, it reduces the input price (follows from (10)). Hence, if the entrant is sufficiently cost inefficient (but not so cost inefficient that entry is unprofitable), the input price effect is strong, while the competition and production inefficiency effects are negligible, since entry neither increases the total final goods production nor reduces the market share of the incumbents significantly. Therefore, entry in this situation increases welfare. If the marginal cost of the entrant is similar to that of the incumbents, entry neither creates a significant input price effect nor creates a significant production inefficiency effect, yet it creates a strong competition effect, thus increasing welfare. If the marginal cost of the entrant is moderately higher as compared to the incumbents, entry creates significant production inefficiency effect, which may dominate the positive competition and input price effects, and reduces welfare.

2.5 The implications of entry in the input market

It is well known from the previous works (e.g., Matsushima 2006, Ghosh and Morita 2007a) that entry in the final goods market may induce entry in the input market. The implications of entry in the input market on our results are easy to see.

Following Matsushima (2006), consider free entry in the market for input 2. Assume that there is large number of symmetric potential producers of input 2. However, to supply input 2, each firm needs to incur an entry cost $F^2 \geq 0$.

Consider the following game. At stage 1, conditional on entry in the final goods market, the producers of input 2 enters sequentially and the equilibrium number of producers of input 2 is determined by the zero profit condition. At stage 2, the producers of input 2 produce like Cournot oligopolists and the input price is determined. At stage 3, the final goods producers produce like Cournot oligopolists and the profits are realized. We solve the game through backward induction.

First consider the case where entry occurs in the final goods market. It follows from (8) and (10) that if there are n producers of input 2, the net profit of the kth firm, $k = 1, 2, \ldots, n$, is

$$\pi_k = \frac{(a(m+1)-c)^2}{(n+1)^2(m+1)(m+2)} - F^2. \tag{22}$$

The equilibrium number of producers of input 2 is determined by $\pi_k = 0$, which implies that

$$n_e^* = \frac{a(m+1)-c}{F\sqrt{(m+1)(m+2)}} - 1. \tag{23}$$

The equilibrium price of input 2 is

$$w_e^* = F\sqrt{(m+1)(m+2)}. \tag{24}$$

Similar calculations show that, if there is no entry in the final goods market, the equilibrium number of producers of input 2 and the price of input 2 are given by, respectively

$$n_{ne}^* = \frac{am}{F\sqrt{m(m+1)}} - 1, \tag{25}$$

$$w_{ne}^* = F\sqrt{m(m+1)}. \tag{26}$$

Both (24) and (26) show that if F falls, the price of input 2 also falls. A lower F increases the number of firms producing input 2 (see (23) and (25)), thus reducing the price of input 2 by increasing competition in that market.

If $F = 0$, the price of input 2 is zero, irrespective of entry in the final goods market. Hence, entry in the final goods market does not have the input price effect. It follows from Klemperer (1988) and Lahiri and Ono (1988) that entry in the final goods market reduces welfare if c is sufficiently higher than zero.

If $F > 0$, it follows from (23) and (25) that entry increases the equilibrium number of producers of input 2. Hence, the input price reduction due to entry in the final goods market is aggravated by the entry of new producers of input 2. This creates a further positive effect on welfare. If there is free entry of the producers of input 2, it increases the possibility of higher welfare following entry in the final goods market compared to the situation with a given number of producers of input 2.

3 Conclusion

The welfare effects of entry in oligopolistic markets attracted significant amount of attention, yet vertical relationship did not receive due attention in the literature, though several industries are characterized by vertical relationships. In a successive Cournot oligopoly, we show the welfare effects of entry in the final goods market.

We show that entry in the final goods market is more desirable if the input market is concentrated, or the marginal cost difference between the incumbent and the entrant is either very small or very large. The input price effect following entry of the final goods producers plays an important role for our results. We also show that entry in the final goods market increases the profits of the incumbent final goods producers if they are sufficiently more cost efficient than the entrant.

We have abstracted our analysis from scale economies. Following Ghosh and Morita (2007a), we conjecture that, in the presence of free entry and scale economies in the final goods market, the possibility of higher welfare under entry in our analysis may either increase or decrease. More entrants tend to increase welfare, while the entry costs tend to reduce welfare. The net effect depends on the relative strengths of these factors. In general, the industrial structure that differs in terms of vertical relationship, the cost asymmetry between the firms and scale economies play important roles in determining the welfare effects of entry.

We have focused on the cost inefficiency of the entrant final goods producer as compared to the incumbent final goods producers. If the entrant is as cost efficient as the incumbents, entry does not create production inefficiency and increases welfare.

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