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Product market cooperation, entry and consumer welfare

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ABSTRACT

It is usually believed that product-market cooperation among the competing firms is detrimental for the consumers. We show that this view may not be true in an endogenously determined market structure. Product-market cooperation may benefit the consumers by inducing entry of new firms. Our result is important for competition policies.

1. Introduction

Cooperation among the competing firms may raise serious concerns for antitrust policies. Regarding the welfare analysis of antitrust law, some economists favour the social welfare standard, and others favour the consumer welfare standard. After Bork (1978), the consumer welfare standard has been the goal of implementation and enforcement of antitrust laws in the United States. It is believed that, in the absence of significant synergic benefits, the firms' gains from cooperation come at the expense of the consumers (Farrell & Shapiro, 1990). However, the Schumpeterian view suggests that cooperation among the competing firms may benefit the consumers by creating positive effects on innovation (Schumpeter, 1943). There are also concerns about the adverse effects of firms' cooperation on innovation (Arrow, 1962).[1] López and Vives (2014) argue that R&D cooperation cannot be disentangled from cooperation in the product market because of financial interests or because cooperation in R&D extends to cooperation in the product market. They show that simultaneous cooperation in R&D and output can be socially optimal when spillovers are large enough (and the scope is larger than more firms there are in the market). However, if the objective is to maximize consumer surplus, then the

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[1] See Gilbert and Sunshine (1995), Gilbert and Tom (2001) and Gilbert (2006a, 2006b) for more recent concern about the adverse effects of firms' cooperation on innovation.v

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scope for cooperation is greatly reduced. Their results indicate that toughness of antitrust policy should decrease with the number of firms, the elasticity of demand and innovation function, and the intensity of spillover effects.[2]

Some recent works show that, besides innovation, there are other beneficial effects of product-market cooperation on the consumers. Symeonidis (2008) and Mukherjee (2010) show that product-market cooperation may benefit the consumers in the presence of input market imperfection. Mukherjee and Sinha (2015, 2016) respectively show that product-market cooperation may benefit the consumers in the presence of strategic trade policies and strategic foreign direct investment.

In this paper, we look at a different beneficial effect of product-market cooperation on the consumers. We show that product-market cooperation may benefit the consumers by inducing entry of new firms. On the one hand, higher product-market cooperation tends to reduce consumer surplus by reducing competition. On the other hand, higher product-market competition tends to increase consumer surplus by increasing the number of active firms in the market. If the latter effect dominates the former, relatively higher product-market cooperation makes the consumers better off. Our result shows that the antitrust authorities need to consider the possible effects of firms' cooperation on the market structure when analysing the effects of product-market cooperation on the consumers.

Our work is closely related to Brander and Spencer (1985), which also considers the welfare effect of product-market cooperation in the presence of entry. Considering the number of firms as a continuous variable and determining the equilibrium number of firms through zero profit condition, they conclude that higher product-market cooperation makes the consumers worse-off. Although the number of firms as a continuous variable is a popular modelling strategy, this assumption may have serious implications for the equilibrium outcomes, as shown by Mankiw and Whinston (1986) in a different context. Considering the firms as integers and determining the equilibrium entry decision through non-negativity constraints, we show that the welfare effect of product-market cooperation differs significantly from the predictions of Brander and Spencer (1985). While higher product market cooperation always makes the consumers worse-off in Brander and Spencer (1985), it may make the consumers better-off in our analysis. Thus, we show that the result of Brander and Spencer (1985) needs to be interpreted very carefully.

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

2. The model and the results

Consider an industry with a large number of potential firms willing to enter the industry by incurring a fixed entry cost, k. If more than one firm enters the market, the firms determine their outputs simultaneously. If only one firm enters the market, it produces like a monopolist firm. The inverse market demand function is given by $P = 1 - Q$, where P denotes price and Q is the total output. We normalize the firms' marginal production costs to zero, for simplicity.

Suppose that firms can compete non-cooperatively or behave cooperatively ex-post entry. Because firms always have the opportunities to revert from cooperation to non-cooperation, firms' entry decisions are less reversible than their cooperation decisions. Therefore, it is more sensible to consider firms' cooperation decisions after entry.[3] Hence, we consider the following three-stage game. At stage 1, the firms decide whether or not to incur a fixed entry cost k to enter the market. At stage 2, the firms, decide whether or not to form a cooperative behaviour, denoted by λ (more on this later), which needs to be within the approved level of the antitrust authority. At stage 3, the firms in the market choose their outputs simultaneously, and the profits are realized. We solve the game through backward induction.

If n firms enter the market and compete non-cooperatively ex-post entry, the ith firm's profit is, $\pi_i = Pq_i - k$, $i = 1,\ldots, n$. Standard calculation gives the equilibrium outcome under non-cooperative behaviour as $q_i^{NC} = \frac{1}{n+1}$, $Q^{NC} = \frac{n}{n+1}$, and $\pi_i^{NC} = \frac{1}{(n+1)^2} - k$, where $i = 1,\ldots, n$.

If n firms enter the market and they form a cooperative behaviour after entry, the ith firm, $i = 1,\ldots, n$, maximizes the following expression to determine its output, q_i:

$$\max_{q_i} (1-Q)q_i + \sum_{\substack{j=1 \\ i\neq j}}^{n} \lambda(1-Q)q_j. \tag{1}$$

Following Symeonidis (2008) and Mukherjee (2010), we consider that $\lambda \in [0,1]$ shows the firms' cooperative behaviour in the product market. If $\lambda = 0$, the firms do not cooperate in the product market and the maximization problem reduces to the standard Cournot maximization problem. On the other extreme, $\lambda = 1$ implies that the maximization problem corresponds to joint profit maximization. The intermediate values of λ show imperfect cooperation among the firms, which may be due to the antitrust policies.[4] Standard calculation gives the equilibrium outcome under cooperation as $q_i^C(n,\lambda) = \frac{1}{1+n+\lambda(n-1)}$, $Q^C(n,\lambda) = \frac{n}{1+n+\lambda(n-1)}$, and $\pi_i^C = \frac{1+\lambda(n-1)}{[1+n+\lambda(n-1)]^2} - \mathrm{k}$, $i = 1,\ldots, n$.

[2] Gustafson et al. (2015) provide evidence that existing studies relating financial condition to product market cooperation produce mixed results because of unique features of the industries examined. In particular, all evidence suggesting that poor financial condition decreases cooperation comes from the airline industry during periods of high idle capacity.

[3] Our result will hold even if one considers a solution procedure like Brander and Spencer (1985). Unlike their paper, the product-market collusion parameter is independent of n in our paper. Appealing to the folk theorem (Friedman, 1971), we can say that tacit collusion is always be sustainable and the collusion parameter can be independent on n if the discount factor is high enough. Hence, for our analysis, the $g(n)$ function in Figure 2 of Brander and Spencer (1985) would be a straight line and the equilibrium number of firms would be determined by a curve similar to $f(n)$. However, in our paper, the $f(n)$ curve does not show the zero profit condition but it shows the non-negativity constraint.

[4] See Symeonidis (2008) for detailed motivations for the treatment of imperfect cooperation parameter.

By comparing the equilibrium profits of the ith firm under non-cooperation and under cooperation, it is clear that the ith firm can earn a higher profit under cooperation. Hence, the firms prefer cooperation than non-cooperation ex-post entry. Furthermore, the above expressions suggest that if λ increases, it reduces the total output for an exogenously given number of firms.

Lemma 1. *For a given n, if* λ *increases, it increases* $\pi_i^C(\mathrm{n},\lambda)$.

Proof. Since k is independent of λ, a higher λ increases $\pi_i^C(n,\lambda)$ if it increases $\frac{1+\lambda(\mathrm{n}-1)}{[1+\mathrm{n}+\lambda(\mathrm{n}-1)]^2}$. We get that $\frac{\partial\pi_i^C(n,\lambda)}{\partial\lambda} = \frac{(n-1)^2(1-\lambda)}{[1+n+\lambda(n-1)]^3}>0$. ■

The above result suggests that if the degree of cooperation ex-post entry increases , it increases a firm's incentive for entry by increasing its net profit. Hence, the number of firms entering the market increases with higher product-market cooperation.

Now we are in a position to determine the condition that is required for n firms entering the market in equilibrium. If the degree of cooperative behaviour is given by λ, n number firms enter the market if $\pi_i^*(n+1,\lambda)<0<\pi_i^*(n,\lambda)$ or

$$\frac{1+\lambda((n+1)-1)}{[(n+1)+1+\lambda((n+1)-1)]^2}<k<\frac{1+\lambda(n-1)}{[n+1+\lambda(n-1)]^2}. \tag{2}$$

If λ increases, it follows from Lemma 1 that both $\frac{1+\lambda((n+1)-1)}{[(n+1)+1+\lambda((n+1)-1)]^2}$ and $\frac{1+\lambda(n-1)}{[n+1+\lambda(n-1)]^2}$ increase.

Now we show the effects of higher product market cooperation on total outputs. To do this, let's start with a situation where $\lambda=\lambda^0$ and n^0 firms enter the market. This happens if

$$\frac{1+\lambda^0\left(\left(n^0+1\right)-1\right)}{\left[\left(n^0+1\right)+1+\lambda^0\left(\left(n^0+1\right)-1\right)\right]^2}<k<\frac{1+\lambda^0\left(n^0-1\right)}{\left[n^0+1+\lambda^0\left(n^0-1\right)\right]^2}. \tag{3}$$

Now consider a higher λ, say $\lambda^1(>\lambda^0)$. Lemma 1 suggests that if $n=n^0$ but $\lambda=\lambda^1(>\lambda^0)$, we can have a situation where[5]

$$\begin{aligned}&\frac{1+\lambda^0\left(\left(n^0+1\right)-1\right)}{\left[\left(n^0+1\right)+1+\lambda^0\left(\left(n^0+1\right)-1\right)\right]^2}<\frac{1+\lambda^1\left(\left(n^0+1\right)-1\right)}{\left[\left(n^0+1\right)+1+\lambda^1\left(\left(n^0+1\right)-1\right)\right]^2}\\&<\frac{1+\lambda^0\left(n^0-1\right)}{\left[n^0+1+\lambda^0\left(n^0-1\right)\right]^2}<\frac{1+\lambda^1\left(n^0-1\right)}{\left[n^0+1+\lambda^1\left(n^0-1\right)\right]^2}.\end{aligned} \tag{4}$$

We have seen that if n^0 firms enter when $\lambda=\lambda^0$, the cost of entry is such that condition (3) is satisfied. Hence, it is immediate that if $\lambda=\lambda^1(>\lambda^0)$ and condition (4) is satisfied, we get a cost of entry such that

$$\begin{aligned}&\frac{1+\lambda^0\left(\left(n^0+1\right)-1\right)}{\left[\left(n^0+1\right)+1+\lambda^0\left(\left(n^0+1\right)-1\right)\right]^2}<k<\frac{1+\lambda^1\left(\left(n^0+1\right)-1\right)}{\left[\left(n^0+1\right)+1+\lambda^1\left(\left(n^0+1\right)-1\right)\right]^2}\\&<\frac{1+\lambda^0\left(n^0-1\right)}{\left[n^0+1+\lambda^0\left(n^0-1\right)\right]^2}<\frac{1+\lambda^1\left(n^0-1\right)}{\left[n^0+1+\lambda^1\left(n^0-1\right)\right]^2},\end{aligned} \tag{5}$$

implying that the number of firms entering the market under λ^1 could be more.

If the number of firms entering the market is n^0 for $\lambda=\lambda^0$ but it is $n=(n^0+1)$ when $\lambda=\lambda^1$, the following conditions must be satisfied:

$$\left.\begin{aligned}&\frac{1+\lambda^0\left(\left(n^0+1\right)-1\right)}{\left[\left(n^0+1\right)+1+\lambda^0\left(\left(n^0+1\right)-1\right)\right]^2}<k<\frac{1+\lambda^0\left(n^0-1\right)}{\left[n^0+1+\lambda^0\left(n^0-1\right)\right]^2}\\&\frac{1+\lambda^1\left(\left(n^0+2\right)-1\right)}{\left[\left(n^0+2\right)+1+\lambda^1\left(\left(n^0+2\right)-1\right)\right]^2}<k<\frac{1+\lambda^1\left(\left(n^0+1\right)-1\right)}{\left[\left(n^0+1\right)+1+\lambda\left(\left(n^0+1\right)-1\right)\right]^2}\end{aligned}\right\}. \tag{6}$$

If condition (6) is satisfied, the total equilibrium output is $q^*(n^0,\lambda^0)=\frac{n^0}{n^0+1+\lambda^0(n^0-1)}$ for $\lambda=\lambda^0$ but it is $q^*(n^0+1,\lambda^1)=\frac{n^0+1}{(n^0+1)+1+\lambda^1((n^0+1)-1)}$ for $\lambda=\lambda^1$.

Proposition 1. If n^0 firms enter the market when $\lambda=\lambda^0$ but $n=(n^0+1)$ firms enter the market when $\lambda=\lambda^1(>\lambda^0)$, the total output is higher under $\lambda=\lambda^1$ compared to $\lambda=0$ if $(\lambda^1-\lambda^0)<\frac{1-\lambda^0}{(n^0)^2}$.

Proof. We get that $q^*(n^0+1,\lambda^1)>q^*(n^0,\lambda^0)$ if $(\lambda^1-\lambda^0)<\frac{1-\lambda^0}{(n^0)^2}$, which proves the result. ■

[5] There could be another possibility, i.e., $\frac{1}{[(n^0+1)+1]^2}<\frac{1}{(n^0+1)^2}<\frac{1+\lambda^1((n^0+1)-1)}{[(n^0+1)+1+\lambda^1((n^0+1)-1)]^2}<\frac{1+\lambda^1(n^0-1)}{[n^0+1+\lambda^1(n^0-1)]^2}$. However, since this possibility will not add much too our insight, we concentrate on condition (4) only.

Proposition 1 shows that a higher product-market cooperation can increase the total output and make the consumers better off by inducing more firms to enter the market. The reason for the above result is as follows. On the one hand, for a given number of firms, higher product-market cooperation reduces the total outputs. On the other hand, higher product market cooperation tends to increase the total output by increasing the number of firms. Higher product-market cooperation increases the total output if the latter effect dominates the former, which happens if the degree of increased cooperation is not very high (i.e., $(\lambda^1-\lambda^0)<\frac{1-\lambda^0}{(n^0)^2}$).

A remark is in order at this point. The possibility of product-market cooperation may reduce the profit of each firm by attracting more firms in the market. However, this does not imply that non-cooperation is the equilibrium choice of the firms. This is for the following reason. As shown in Lemma 1, ex-post entry, the firms are better off under cooperation than under non-cooperation. Hence, non-cooperation ex-post entry is not a subgame perfect choice. Therefore, ex-post entry, cooperation will occur, which will influence the firms' entry decision.

2.1. A numerical example

Consider the following values: $\lambda^0=0$, $n^0=10$ and $\lambda^1=\frac{1}{1000}$. In this situation, 10 firms enter for $\lambda^0=0$ but 11 firms enter for $\lambda^1=\frac{1}{1000}$ if the cost of entry satisfies the conditions (6), i.e., $\frac{1}{144}<k<\frac{1}{121}$ and $\frac{33700}{56428707}<k<\frac{10100}{1442401}$, which happens since $\frac{33700}{56428707}<\frac{1}{144}<\frac{10100}{1442401}<\frac{1}{121}$. Hence, if k is such that $\frac{1}{144}<k<\frac{10100}{1442401}$, we get 10 firms under $\lambda^0=0$ but 11 firms under $\lambda^1=\frac{1}{1000}$. In this situation, the total equilibrium output $Q(10,\lambda^0=0)=\frac{10}{11}$ is less than the total equilibrium output $Q(11,\lambda^1=\frac{1}{1000})=\frac{1100}{1201}$.

3. Conclusion

Cooperation among the final goods producers is generally believed to make the consumers worse off. We show that this view may not be true if the number of firms is determined endogenously. Product-market cooperation tends to reduce the total output for a given number of firms, while it tends to increase the total output by attracting more firms in the market. If the increased product-market cooperation is not very high, relatively higher product-market cooperation increases the total output and makes the consumers better off. Our result is important for competition policies and shows that the consideration of firms as a continuous variable, as assumed in Brander and Spencer (1985), is not innocent.

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