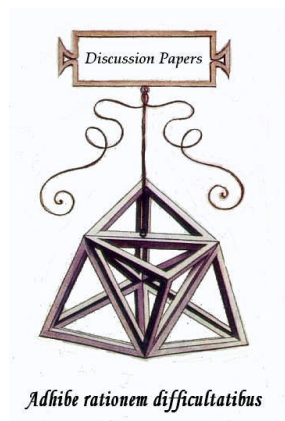




Discussion Papers

Collana di

E-papers del Dipartimento di Scienze Economiche – Università di Pisa



Luciano Fanti

Cross-participated firms and welfare

Discussion Paper n. 127

2011

Discussion Paper n. 127: presentato Novembre 2011

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Cross-participated firms and welfare

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Abstract The present study analyses the effects on social welfare of the existence of cross-participation at ownership level in a Cournot duopoly. We show that cross-participation, despite it lowers the degree of competition by reducing total output and consumer surplus, may increase social welfare, provided that i) the firm owned by a single shareholder is less efficient than the other (cross-participated) firm; ii) the size of the market is neither too large nor too small. Therefore, the policy implication is that larger cross-participations at ownership level should be favoured, despite their anticompetitive nature, when the cross-participated firm is more efficient and the extent of the market is not too large.

Keywords Cross-ownership, Duopoly, Social welfare

JEL Classification D43; L13; L4

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1. Introduction

A cornerstone of economic theory is that from a social welfare point of view a higher degree of competition is always preferred. In this paper we depart from the standard Cournot model, only through the assumption that cross-participation exists at ownership level. For instance, in the automobile industry there are examples of partial ownership of rivals (Alley, 1997). One illustrative example (Barcena-Ruiz and Oilazola, 2007, p. 1) is given by the French firm Renault, which acquired a 36.8% equity stake in Nissan Motor in 1999 (Renault Presse, 10/20/99). Furthermore, many other examples can be actually found, e.g. in telephone, energy and banking industries. Sometimes, cross-ownership may be restricted in some industry (for instance in the media industry newspapers was barred from owning television stations in the same market). There is a vast literature that deals with the consequences of cross-ownership by firms on prices and quantities in many industries. A consensus has emerged around the fact that cross-ownership reduces competition, increases prices and thus should harm welfare: for instance, as regards the telecommunications industry, Parker and Roller (1997) find that cross-ownership is an important factor in explaining non-competitive prices; as regards the energy industry in North-Europe, Amundsen and Bergman (2002, p. 73) argue that “partial ownership relations between generators tend to increase horizontal market power and thus the market price of electricity”; while as regards the banking sector Trivieri (2007, p. 79) concludes that “Italian banks involved in cross-ownership were less competitive than the other national credit firms, thus supporting the view that cross-ownership may represent an obstacle to industrial competition”.

The issue of the cross-ownership has been investigated from a theoretical point of view. For instance, as regards its effects on: 1) the managerial incentives in a Cournot duopoly framework where owners and managers are separate identities (Macho-Stadler and Verdier, 1991); 2) the non-cooperative provision of public consumption goods and public production factors (Dickescheid, 2001); 3) the incentives of firms to engage in tacit collusion (Gilo et al., 2006); 4) the incentives to acquire cost-saving production technologies (Barcena-Ruiz and Oilazola, 2007); 5) the level of privatization in case of differentiated products mixed duopoly (Pal, 2010); 6) the setting of cooperative and non-cooperative environmental taxes with two firms located in different countries (Barcena-Ruiz and Campo, 2011).

Despite the large amount of economic literature on this topic, the relationship between cross-ownership and social welfare has not been yet wholly clarified. In particular, a main question is: despite the evidenced negative effect on competition with increased prices, may social welfare benefit from the existence of cross-ownership? In this paper we try to answer this interesting economic issue.

Therefore, in this paper we investigate whether the conventional wisdom above mentioned, i.e. a more competitive market yields higher welfare at equilibrium, still holds when the competition is, loosely speaking, reduced by an increase of the share of ownership of the other firm by the shareholder which owns entirely one firm. To do so, we develop a standard Cournot model with linear demand and costs, where the latter may be asymmetric between firms. The main result is that cross-participation at ownership level, despite it reduces competition by reducing total output and consumer surplus, may increase social welfare, provided that *i)* the firm owned by a single shareholder is less efficient than the other (cross-participated) firm; *ii)* the size of the market is neither too large nor too small. Therefore, it follows that, under the rather

realistic circumstances above pointed out, cross-ownership could turn to social welfare's advantage and be popular with the policy-maker.

The rest of this paper is organized as follows. In Section 2, we present the basic model in which two firms compete in the product market when there is cross-ownership. The product market is assumed to be characterized by Cournot competition. We derive Cournot-Nash equilibrium values for the key variables of interest. Section 3 analyses social welfare, showing whether and how it is affected by cross-ownership changes. Section 4 closes the paper with conclusions and further remarks.

2. The model

We consider a single industry consisting of two firms, 1 and 2, which produce a homogeneous good. There are two shareholders, A and B. Firm 1 is completely owned by share-holder A, who owns a participation also in firm 2. Therefore firm 2 is jointly owned by the two shareholders, with shareholder B having the majority of shares and thus also the control of firm 2. We denote by h ($0 < h < 1/2$) the fraction of shares that shareholder A has in firm 2. Shareholders are assumed to maximize their total profit, which means that the objective function of shareholder A is

$$\pi_A = \pi_1 + h\pi_2 \quad (1.1)$$

while the objective function of shareholder B is

$$\pi_B = (1-h)\pi_2, \quad (1.2)$$

where profits of firm i can be written as $\pi_i = p_i q_i - c_i q_i$, $i=1, 2$ (2)

and where c_i is assumed to capture all short-run marginal cost. In particular we assume $c_2 < c_1$.

The derived product market demand is linear and, for firm i for example, is given by

$$p_i(q_i, q_j) = a - q_i - q_j \quad (3)$$

From Eqs. (1), (2) and (3) under profit-maximization, firm i 's best-reply function are the following:

$$q_1(q_2) = \frac{(a - q_2(1+h) - c_1)}{2} \quad (4.1)$$

$$q_2(q_1) = \frac{(a - q_1 - c_2)}{2} \quad (4.2)$$

As $h > 0$ the best-reply functions are downward-sloping, that is, under the Cournot assumption, the product market game is played in strategic substitutes. From (4.1) and (4.2) we obtain the equilibrium output by firm i :

$$q_1 = \frac{[a(1-h) - 2c_1 + c_2(1+h)]}{3-h} \quad (5.1)$$

$$q_2 = \frac{[a - 2c_2 + c_1]}{3-h} \quad (5.2)$$

As usual, the condition for ensuring a non-negative production is that the size of the market, proxied by a , is sufficiently high, as the following inequalities state:

$$q_1 \geq 0 \Leftrightarrow a \geq a^{q_1} = \frac{[2c_1 - c_2(1+h)]}{1-h} \quad (6.1)$$

$$q_{21} \geq 0 \Leftrightarrow a \geq a^{q_2} = 2c_2 - c_1 \quad (6.2)$$

From the observation of (5.1) and (5.2) the following remark holds:

Remark: Firm 1 has a lower output than firm 2 since the former firm, in contrast with the latter firm, internalizes the fact that the two firms compete in the product and thus the latter firm is “more aggressive”. Moreover, it is easy to observe again from (5.1) that $\frac{\partial q_1}{\partial h} < 0$, which implies that the output level of firm 1 decreases with the percentage of the shares that shareholder A has in firm 2 (i.e. the greater the value of parameter h , the lower the output level of firm 1).

From (2), (3), (5.1) and (5.2), the equilibrium firms' profit is given by:

$$\pi_1 = \frac{[h(c_1 - c_2) + a + c_1 - 2c_2][(1-h)(a - c_2) - 2c_1]}{(3-h)^2} \quad (7.1)$$

$$\pi_2 = \frac{(2a + c_1 - 2c_2)^2}{(3-h)^2} \quad (7.2)$$

$$\text{Total industry profits are: } \Pi = \pi_1 + \pi_2 \quad (8)$$

Total profits accruing to the share-holder A are given by (1.1), (7.1) and (7.2):

$$\pi_A = \frac{[h(c_1 - c_2) + a + c_1 - 2c_2][(1-h)(a - c_2) - 2c_1] + h(2a + c_1 - 2c_2)^2}{(3-h)^2} \quad (9)$$

Now, we are in position to investigate the effects of the cross-ownership on single firms' profits, profits of the share-holder A and industry profits.

Result 1. *Firm 1's profit may be increased (decreased) with increasing cross-ownership depending on whether a is sufficiently low (high).*

Proof: the result 1 is established by the following derivative:

$$\frac{\partial \pi_1}{\partial h} = -\frac{[a + c_1 - 2c_2][a(1+h) + c_2(1-3h) - 2c_1(1-h)]}{(3-h)^2} \begin{matrix} > 0 \\ < 0 \end{matrix} \Rightarrow a \begin{matrix} < \\ > \end{matrix} a^{\pi_1} = \frac{2c_1(1-h) - c_2(1-3h)}{1+h} \quad (10)$$

Result 2. *Firm 2's profit is always increasing with increasing cross-ownership.*

Proof: the result 2 is established by the following derivative:

$$\frac{\partial \pi_2}{\partial h} = \frac{2[a + c_1 - 2c_2]^2}{(3-h)^3} > 0 \quad (11)$$

Result 3. *Share-holder A's profit may be increased (decreased) when cross-ownership is increased depending on whether a is sufficiently high (low).*

Proof: the result 3 is established by the following derivative:

$$\frac{\partial \pi_A}{\partial h} = \frac{[a + c_1 - 2c_2][2a + c_1(5-h) - c_2(7-h)]}{(3-h)^3} \begin{matrix} > 0 \\ < 0 \end{matrix} \Rightarrow a \begin{matrix} > \\ < \end{matrix} a^{\pi_A} = \frac{c_2(7-h) - c_1(5-h)}{2} \quad (12)$$

Result 4. *Total industry profit may be increased (decreased) when cross-ownership is increased depending on whether a is fairly high (low).*

Proof: the result 4 is established by the following derivative:

$$\frac{\partial \Pi}{\partial h} = -\frac{[a + c_1 - 2c_2][a(1-h) + c_2(4-2h) - c_1(5-3h)]}{(3-h)^2} \begin{matrix} > \\ < \end{matrix} 0 \Rightarrow a \begin{matrix} > \\ < \end{matrix} a^\Pi = \frac{c_2(5-3h) - 2c_1(2-h)}{2} \quad (13)$$

We have to distinguish the firm's profit from the shareholder's profit.

Therefore the following remark holds: 1) while the profit of the firm 1 may be increasing with h for lower level of h and decreasing with h for higher level of h , the profit of shareholder A is always increasing with h : this means that the increase in the profits perceived by the increasing share of ownership in the firm 2 either is additive with the increase in the profit of the firm 1 or, in any case, always overcomes the reduction in the profit of the firm 1; 2) the profit of the firm 2 is always increasing with h (while the profit of the shareholder B is, of course, always decreasing with h).

3. Welfare analysis

In this section, we investigate whether the conventional wisdom that a higher share of cross-ownership, implying reduced competition, should yield lower welfare at equilibrium for consumers and for society in the overall, holds true.

3.1 Consumer's welfare

In equilibrium consumer's surplus is

$$CS = \frac{(q_1 + q_2)^2}{2} = \frac{[(2-h)a - c_1 - (1-h)c_2]^2}{2(3-h)^2} \quad (14)$$

Result 5. *Consumer's welfare is always reduced by an increase in the share of cross-ownership, h .*

Proof: the result 5 is established by the following derivatives

$$\frac{\partial CS}{\partial h} = \frac{(a + c_1 - 2c_2)[h(a - c_2) + c_1 + c_2 - 2a]}{(3-h)^2} < 0 \quad (15)$$

3.2. Social welfare

Social welfare (SW) is defined as $SW = CS + 2\pi$, and under Cournot equilibrium is given by

$$SW = \frac{h^2 S_1 - 2h[3a^2 - 2a(2c_1 + c_2) + c_2^2 + 2c_1^2] + 8a^2 - 8a(c_1 + c_2) + 11c_1^2 - 14c_1c_2 + 11c_2^2}{(3-h)^2} \quad \text{where} \quad (16)$$

$$S_1 = a^2 - 2ac_1 + c_2(2c_1 - c_2) \quad (16)$$

Result 6. *Social welfare may be increased (decreased) when cross-ownership is increased depending on whether a is sufficiently low (high).*

Proof: the result 6 is established by the following derivative:

$$\frac{\partial SW^C}{\partial h} = \frac{(a + c_1 - 2c_2)[2h((c_2 - c_1) - a - 4c_2 + 5c_1)]}{(3-h)^2} \begin{matrix} > \\ < \end{matrix} \Leftrightarrow a \begin{matrix} \leq \\ > \end{matrix} a^{sw} = c_1(5-2h) - c_2(4-2h) \quad (17)$$

Interestingly, the above result suggests, rather counter-intuitively, that the social welfare may be improved by a larger cross-participation share, despite the latter implies a less fierce competition, provided that a (i.e. loosely speaking, the extent of the market demand) is fairly low.

However we should establish that the “threshold” value of the size of the market below which the counterintuitive result – that is an anticompetitive change may be welfare-improving – emerges, is also economically feasible (i.e. quantities and profits of shareholders are non-negative for the size of market for which is socially preferred the cross-participation). For establishing this, we state the following proposition:

Proposition 1. *Social welfare is increasing with an increasing cross-participation share in a “feasible” economy, under the following parametric conditions (which have to hold jointly):*

$$1) 2c_2 - c_1 < 2c_1 - c_2(1+h) < a < (1-h)[c_1(5-2h) - c_2(4-2h)];$$

$$2) c_2 < c_1;$$

$$3) h < \frac{1}{2}$$

Proof: we begin by recalling the three “threshold” values of a (above described in (17), (6.1) and (6.2), respectively):

$$1.a) a < a^{sw} = c_1(5-2h) - c_2(4-2h); \quad 1.b) a \geq a^{q1} = \frac{[2c_1 - c_2(1+h)]}{1-h};$$

$$1.c) a \geq a^{q2} = 2c_2 - c_1$$

Then, we should demonstrate that when the inequality 1.a) is satisfied (i.e. the result about the positive relationship between welfare and increasing cross-participation emerges), the inequalities 1.b) and 1.c) (which ensure that the system is economically feasible) hold as well.

Firstly, we show that $a^{sw} \geq a^{q1}$ always holds. For doing this, we present the following Lemma:

Lemma 1. *The difference $(a^{sw} - a^{q1})$ is positive if the two following conditions are satisfied:*

$$a^{sw} - a^{q1} = \frac{(2h^2 - 7h + 3)(c_1 - c_2)}{1-h} > 0 \Leftrightarrow c_1 > c_2 \quad \text{and} \quad h < \frac{1}{2}$$

Proof: let's define $H = (2h^2 - 7h + 3)$ and easily show that $H > 0 \Leftrightarrow h < h_1 = 0.5$ and $h > h_2 = 3$. Then, the difference is positive, i.e. $(a^{sw} - a^{q1}) > 0$,

in two cases: i) $c_1 > c_2$ and $h < \frac{1}{2}$; ii) $c_1 < c_2$ and $h > \frac{1}{2}$.

Since in the case ii) h is out of the meaningful domain (i.e. $0 < h < 0.5$) and the assumption $c_1 > c_2$ is violated, then only the i) case is relevant, which proves Lemma 1.

As a consequence of Lemma 1, both conditions 2) and 3), together with the inequality to the right-hand member of the condition 1) of Prop. 1 hold.

Secondly, we prove that the inequality to the left-hand member of the condition 1) of Prop. 1 (i.e. $2c_2 - c_1 < 2c_1 - c_2(1+h)$) always holds:

Lemma 2. $2c_2 - c_1 < 2c_1 - c_2(1+h)$.

Proof: 1) by simple manipulations of the inequality we easily see that the reversion of its sign requires that $h > h^* = \frac{3c_1}{c_2} - 1$; 2) since $c_1 > c_2$, then $h^* > 1$ and thus it is

impossible that $h > h^*$, so that also the left-hand member of the inequality in the condition 1) holds.

Therefore, from Lemmas 1 and 2, it follows that Proposition 1 is proved. Q.E.D.

Finally we should ascertain that when the market size is such that is socially preferable to increase the share of cross-ownership (i.e. $a < a^{sw}$), not only the economy is “feasible” (i.e. the conditions in Prop. 1 hold) but also the shareholder A finds profitable to increase her share of ownership in firm 2 (i.e. $a^{\pi_A} < a < a^{sw}$). The following Lemma holds:

Lemma 3. *When the market size is such that is socially preferable to increase the share of cross-ownership (i.e. $a < a^{sw}$), shareholder A always gains by increasing her share of ownership in firm 2 (i.e. $a^{\pi_A} < a < a^{sw}$).*

Proof: $a^{sw} - a^{\pi_A} = \frac{5(h-3)(c_2 - c_1)}{2} > 0$ given that $0 < h < 0.5$ and $c_1 < c_2$.

Therefore from lemma 3 we argue that an interval of the market size in which both social welfare and shareholder A 's profits increase with increasing share of cross-ownership, always does exist.

In conclusion cross-participation, despite implying less fierce competition, improves social welfare under realistic conditions (i.e. a not too large extent of the market). For giving a “quantitative” example of these conditions a numerical illustration is performed in the following subsection.

3.3 Numerical illustration

We suppose that the cross-ownership is very small, namely $h=0.001$, and the “size” of market demand and costs are given by the following: $a=5$, $c_1 = 2$, $c_2 = 1$. The example illustrates whether and how is socially preferred that shareholder A increases her share of participation in firm 2. We see that the interval of the extent of the market demand in which rising cross-participation is welfare-improving is rather sizable, given that $a^{sw} = 6$ and $a^{q_1} = 3$. Fig. 1 clearly shows that an increase of cross-ownership is convenient for society in this illustrative case in which the extent of the market is proxied by $a=5$ conversely, it is also displayed that in a relatively too large market, e.g. $a=7$, the higher the cross-ownership, the lower social welfare is.

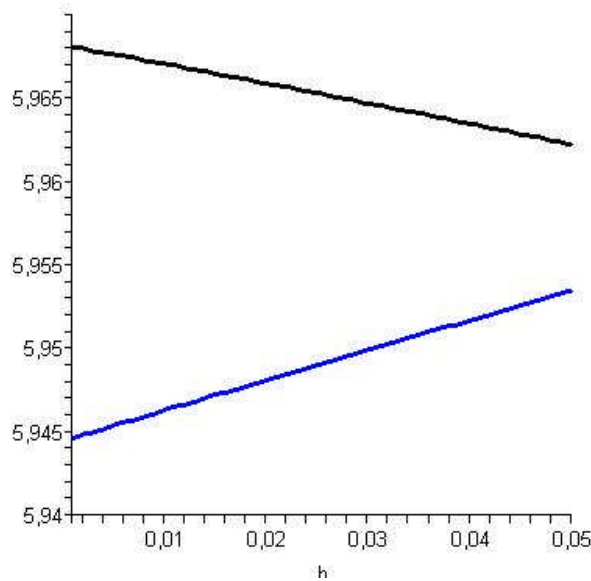


Fig. 1. Social welfare behaviour for increasing h (black line ($a=7$), blue line ($a=5$)).

Moreover it should be noted that not only a small cross-participation is welfare-preferred: indeed, it is easy to see that when the extent of market demand is given by $a=5$, then even if the share of cross-ownership is rather high - for instance, 30% or even 45% - it would be socially optimal a further increase in such a share (because when $h=0.3$, $a^{sw} = 5.4$ and $a^{q_1} = 3.85$, and when $h=0.45$, $a^{sw} = 5.1$ and $a^{q_1} = 4.63$).

4. Conclusions

Motivated by the fact that there is a vast (both empirical and theoretical) consensus on the fact that cross-ownership between competing firms decreases competition in the market, in this paper we investigated whether and how, despite the evidenced negative effect on competition, social welfare may benefit from the existence of cross-participations at ownership level.

We have shown that in a standard Cournot duopoly: 1) quantities produced by both firms are decreasing with the share of cross-ownership: since an increase of the share of cross-ownership implies a higher market concentration, then this result is in accord with the general belief that less competition means less output; 2) profits of the shareholder A (B) are increasing (decreasing) with the share of cross-ownership of A, and this occurs despite the firm 1 may reduce profit; 3) the industry profits are increasing with the share of cross-ownership of A (again despite the firm 1 may have reduced profit); 4) given the output reduction, the consumer surplus is decreasing with the share of cross-ownership.

More interestingly, the analysis of the relationship between the increase in the cross-ownership and the social welfare revealed a counterintuitive result: while it is well known that a reduction in the degree of competition, although on the one hand increases industry profits, on the other hand reduces the consumer surplus to the extent that social welfare is always reduced, it has been shown that under a well-defined parametric situation, the social welfare may be increasing with the share of cross-ownership. To the extent that we may interpret an increase in the share of ownership as a reduction of competition, our result is very interesting, in that the common belief linking a higher competition to a higher welfare may be reverted.

The result occurs when, on the one side, firm 1 is less efficient than firm 2 and, on the other side, when the size of the market is at an intermediate level (namely, neither too large nor too small), which depends on the interaction between the cost differential (i.e. the difference in efficiency between firms) and the outstanding share of cross-ownership. Furthermore it is shown that the lower the outstanding share of cross-ownership, the more likely a positive effect on welfare of an increase of such a share is. The economic intuition is simple: since when deciding the output level of firm 1, shareholder A internalizes (shareholder B does not internalize) the fact that firms 1 and 2 compete in the product market, then the firm 2's behaviour is "more aggressive". In other words, an increase in the cross-participation "forces" the more efficient firm to increase production at the expense of the output of the less efficient firm, and the increased profit of the more efficient firm always overcome the possible reduction of the less efficient firm's profit, both as regards the cross-participating shareholder and with respect to the aggregate industry profits. The latter, in particular, increases more than the consumer surplus decline, provided that the extent of the market is not too large.

Therefore, the policy implication is that larger cross-participations at ownership level should be favoured, despite their anticompetitive nature, when the cross-participated firm is more efficient and the market is not too large.

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