

Research Article

Partial Cross-Ownership, Cost Asymmetries, and Welfare

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Received 9 July 2015; Accepted 19 October 2015

Academic Editor: Udo Broll

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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, although 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 and (ii) the size 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 relatively more efficient and the extent of the market is not too large.

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 [1, 2]. One illustrative example [3, page 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, for example, in telephone, energy, and banking industries. Sometimes, cross-ownership may be restricted in a specific industry (e.g., in the US media industry in 1975 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 Röller [4] find that cross-ownership is an important factor in explaining noncompetitive prices; as regards the energy industry in North-Europe, Amundsen and Bergman [5, page 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 [6, page 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.”

From a theoretical point of view it has been well-established that as the degree of cross-ownership among rivals increases, the equilibrium in the market becomes less competitive (e.g., Farrell and Shapiro [7], as regards the standard Cournot oligopoly model).

Many other effects of the partial cross-ownership (PCO) have been theoretically investigated. Among many others, we mention, for instance, those regarded in the fields of the industrial organization literature: (1) the managerial firms, where ownership and control are separated and the managerial incentives in a Cournot duopoly framework have to be determined under PCO [8]; (2) the incentives of firms to engage in tacit collusion [9]; (3) the incentives to acquire cost-saving production technologies [3]; (4) the level of privatization in case of differentiated products mixed duopoly [10]; (5) an increasing horizontal product differentiation (i.e., an increasing market power by firms) which counterintuitively reduces profits when the labour market is unionised [11]; (6) the link between knowledge transfer and PCO, where alliance partners can choose the level of PCO to connect themselves,

showing that PCO can endogenously arise in equilibrium and identifying conditions under which PCO can benefit consumers and/or society (e.g., under which PCO should be prohibited, partially permitted, or fully permitted by antitrust authorities) [12]; (7) consumer surplus and social welfare, which, when the labour market is unionised and unions are sufficiently wage-oriented, may, counterintuitively, increase with PCO (despite the induced reduction of the degree of competition) [13].

Moreover the role of PCO has been investigated also in the fields of the public economics and the environmental economics literature, for instance, with the analyses of noncooperative provision of public consumption goods and public production factors under PCO [14] and of the setting of cooperative and noncooperative environmental taxes with two firms with PCO located in different countries [15], respectively.

Despite the large amount of economic literature on this topic, the relationship between cross-ownership and social welfare has not been yet wholly clarified.¹ In particular, a main question is the following: despite the evidenced negative effect on competition, may social welfare benefit from the existence of cross-ownership? In this paper we try to answer this interesting economic issue, which also has evident antitrust policy implications.²

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 reduced by an increase of the share of one-sided ownership in a duopoly with heterogeneous costs. To do so, we develop a standard Cournot model with linear demand and cost, where the latter may be asymmetric between firms. The main result is that cross-participation at ownership level, although 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 and (ii) the size of the market is not too large. Therefore, it follows that, under the circumstances pointed out above, cross-ownership could turn to social welfare's advantage and be popular with the antitrust policy-maker. The value added of the paper is to analyse the welfare effect of one-sided cross-ownership—which, differently from a partial merger, implies only partial ownership but not partial control—and to point out that an opportune market size does exist, below which the positive reallocation effect indirectly induced by the behaviour of the shareholder with a participation in the more efficient rival firm is able to outweigh the welfare-reducing effect of the reduced degree of competition. In particular, we find the sufficiently small market size which warrants a welfare-enhancing effect of a certain share of acquisition of a rival firm, so offering an interesting antitrust policy implication.

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 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 Cournot duopoly. There are two firms, 1 and 2, producing a homogeneous good and two shareholders, *A* and *B*. Firm 1 is completely owned by shareholder *A*, who owns a participation also in firm 2. We denote by h ($0 < h < 1/2$) the fraction of shares that shareholder *A* has in firm 2. Therefore although firm 2 is jointly owned by the two shareholders, shareholder *B* has the majority of shares and thus also the control of the firm. Shareholders are assumed to maximize their total profit, which means that the objective function of shareholder *A* is

$$\pi_A = \pi_1 + h\pi_2, \quad (1)$$

while the objective function of shareholder *B* is

$$\pi_B = (1 - h)\pi_2, \quad (2)$$

where profits of firm i can be written as

$$\pi_i = p_i q_i - c_i q_i, \quad i = 1, 2, \quad (3)$$

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

$$p_i(q_i, q_j) = a - q_j - q_i. \quad (4)$$

By considering (3) and (4), each shareholder chooses the output level that maximizes its objective function ((1) and (2)). Solving these problems in each of the cases, the following firm i 's best-reply functions are obtained:

$$\begin{aligned} q_1(q_2) &= \frac{(a - q_2(1 + h) - c_1)}{2}, \\ q_2(q_1) &= \frac{(a - q_1 - c_2)}{2}. \end{aligned} \quad (5)$$

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 (5) we obtain the equilibrium output by firm i :

$$q_1 = \frac{[a(1 - h) - 2c_1 + c_2(1 + h)]}{3 - h}, \quad (6)$$

$$q_2 = \frac{[a - 2c_2 + c_1]}{3 - h}. \quad (7)$$

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

$$q_1 \geq 0 \iff a \geq a^{q_1} = \frac{[2c_1 - c_2(1+h)]}{1-h}, \quad (8)$$

$$q_2 \geq 0 \iff a \geq a^{q_2} = 2c_2 - c_1. \quad (9)$$

From the observation of (6) and (7) the following remark holds.

Remark 1. 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 market and thus the latter firm is “more aggressive.” Moreover, it is easy to observe again from (6) that $\partial q_1 / \partial h < 0$,³ which implies that

$$\pi_A = \frac{[h(c_1 - c_2) + a + c_2 - 2c_1][a(1-h) + c_2(1+h) - 2c_1] + h(2a + c_1 - 2c_2)^2}{(3-h)^2}. \quad (12)$$

Now, we are in position to investigate the effects of the cross-ownership on (i) single firms' profits, (ii) profits of shareholder A, and (iii) industry profits.

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

Proof. Result 1 is established by the following derivative:

$$\frac{\partial \pi_1}{\partial h} = -\frac{[a + c_1 - 2c_2][a(1+h) + c_2(1-3h) - 2c_1(1-h)]}{(3-h)^2} \quad (13)$$

$$\geq 0 \iff$$

$$a \leq a^{\pi_1} = \frac{2c_1(1-h) - c_2(1-3h)}{1+h}. \quad \square$$

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

Proof. Result 2 is established by the following derivative:

$$\frac{\partial \pi_2}{\partial h} = \frac{2[a + c_1 - 2c_2]^2}{(3-h)^3} > 0. \quad (14) \quad \square$$

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

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 (3), (4), (6), and (7), the equilibrium firms' profit is given by

$$\pi_1 = \frac{[h(c_1 - c_2) + a + c_2 - 2c_1][a(1-h) + c_2(1+h) - 2c_1]}{(3-h)^2}, \quad (10)$$

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

Total industry profits are

$$\Pi = \pi_1 + \pi_2. \quad (11)$$

Total profits accruing to shareholder A are given by (1) by exploiting (10):

Proof. Result 3 is established by the following derivative:

$$\frac{\partial \pi_A}{\partial h} = \frac{[a + c_1 - 2c_2][2a + c_1(5-h) - c_2(7-h)]}{(3-h)^3} \geq 0 \iff \quad (15)$$

$$a \geq a^{\pi_A} = \frac{c_2(7-h) - c_1(5-h)}{2}. \quad \square$$

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

Proof. Result 4 is established by the following derivative:

$$\frac{\partial \Pi}{\partial h} = \frac{[a + c_1 - 2c_2][a(1-h) + c_1(4-2h) - c_2(5-3h)]}{(3-h)^3} \geq 0 \iff \quad (16)$$

$$\geq 0 \iff$$

$$a \geq a^{\Pi} = \frac{c_2(5-3h) - 2c_1(2-h)}{1-h}.$$

We have to distinguish the firm's profit from the shareholder's profit. Note that inequalities in (15) and (16) have to hold: otherwise, as regards the former, shareholder A does not have incentive to increase his/her cross-ownership share, and, as regards the latter, there would not be room to compensate

shareholder B for having reduced his/her ownership share in firm 2. \square

Therefore the following remark holds.

Remark 2. (1) Given the market size parameter $a > a^{\pi_A}$, while the profit of 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 :⁴ this means that the increase in the profits perceived by the increasing share of ownership in firm 2 either is additive with the increase in the profit of firm 1 or, in any case, always overcomes the reduction in the profit of firm 1. (2) The profit of firm 2 is always increasing with h (while the profit of shareholder B is, of course, always decreasing with h). (3) Total industry profits are always increasing with h .⁵

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 on the whole holds true.

3.1. Consumer's Welfare. In equilibrium consumer's surplus is

$$CS = \frac{(q_1 + q_2)^2}{2} = \frac{[(2-h)a - c_1 - (1-h)c_2]^2}{2(3-h)^2}. \quad (17)$$

$$SW = \frac{h^2 S_1 - 2h[3a^2 - 2a(2c_1 + c_2) + c_2^2 + 2c_1^2] + 8a^2 - 8a(c_1 + c_2) + 11c_1^2 - 14c_1c_2 + 11c_2^2}{2(3-h)^2}, \quad (19)$$

where $S_1 = a^2 - 2ac_1 + c_2(2c_1 - c_2)$.

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

Proof. Result 6 is established by the following derivative:

$$\frac{\partial SW^C}{\partial h} = \frac{(a + c_1 - 2c_2)[2h(c_2 - c_1) - a - 4c_2 + 5c_1]}{(3-h)^3} \geq 0 \iff \quad (20)$$

$$a \leq a^{sw} = c_1(5 - 2h) - c_2(4 - 2h).$$

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

However we should establish that the "threshold" value of the size of the market, below which the counterintuitive result (i.e., an anticompetitive change may be welfare-improving)

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

Proof. Result 5 is established in two steps (i) by the following derivative:

$$\frac{\partial CS}{\partial h} = \frac{(a + c_1 - 2c_2)[h(a - c_2) + c_1 + c_2 - 2a]}{(3-h)^3} \geq 0 \iff \quad (18)$$

$$a \leq a^{cs} = \frac{c_1 + c_2(1-h)}{2-h};$$

(ii) by observing that $a^{q_1} > a^{cs}$, and thus, given a nonnegative firm 1's output, the above derivative cannot be positive.

Moreover, we note that for having an economically meaningful model so far the sole relevant condition is the usual one: a sufficiently large market size measured by the parameter a , in particular, $a > a^{q_1}$. \square

3.2. Social Welfare. As known, social welfare equals the sum of consumer surplus (CS) and producer surplus ($PS_i = \pi_i + FC_i$, where FC_i denotes fixed cost); in this case producer surplus equals profits because of the absence of fixed costs. Hence social welfare (SW) is defined as $SW = CS + \pi_1 + \pi_2$ and at equilibrium is given by

emerges, is also economically feasible (i.e., quantities and profits of shareholders are nonnegative for the size of market for which the cross-participation is socially preferred). For establishing this, we state the following proposition.

Proposition 3. *Social welfare is increasing with an increasing cross-participation share, 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) $h < 1/2$.

Proof. The proof is articulated in some parts. We begin by recalling the three "threshold" values of a (described above in (20), (8), and (9), resp.):

$$(1.a) \quad a < a^{sw} = c_1(5 - 2h) - c_2(4 - 2h);$$

$$(1.b) \quad a \geq a^{q_1} = [2c_1 - c_2(1+h)]/(1-h);$$

$$(1.c) \quad a \geq a^{q_2} = 2c_2 - c_1.$$

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

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

Lemma 4. *The difference $(a^{sw} - a^{q1})$ is positive if the two following conditions are satisfied:*

$$a^{sw} - a^{q1} = \frac{(2h^2 - 7h + 3)(c_1 - c_2)}{1 - h} > 0 \iff$$

$$c_1 > c_2, \quad (21)$$

$$h < \frac{1}{2}.$$

Proof. Let us define $H = (2h^2 - 7h + 3)$ and easily show that $H > 0 \iff h < h_1 = 0.5$ and $h > h_2 = 3$. Then, the difference is positive; that is, $(a^{sw} - a^{q1}) > 0$, in two cases: (i) $c_1 > c_2$ and $h < 1/2$; (ii) $c_1 < c_2$ and $h > 1/2$.

Since in 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 case (i) is relevant, which proves Lemma 4. \square

As a consequence of Lemma 4, both conditions (2) and (3), together with the inequality at the right-hand member of condition (1), in Proposition 3 hold.

Secondly, we prove that the inequality at the left-hand member of condition (1) of Proposition 3 (i.e., $2c_2 - c_1 < 2c_1 - c_2(1 + h)$) always holds.

Lemma 5. *Consider $2c_2 - c_1 < 2c_1 - c_2(1 + h)$.*

Proof. (1) By simple manipulations of the inequality we easily see that the reversion of its sign requires that $h > h^* = (3c_1/c_2 - 1)$. (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 condition (1) holds.

Therefore, from Lemmas 4 and 5, it follows that Proposition 3 is proved. \square

Finally we should ascertain that when the market size is as 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 mentioned in Proposition 3 hold) but also shareholder A finds it profitable to increase his/her share of ownership in firm 2 (i.e., $a^{\pi_A} < a < a^{sw}$). The following lemma holds.

Lemma 6. *When the market size is as such that is socially preferable to increase the share of cross-ownership (i.e., $a < a^{sw}$), shareholder A always gains by increasing his/her share of ownership in firm 2 and the industry profits are always increasing with h (i.e., $a^{\pi} < a^{\pi_A} < a < a^{sw}$).*

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

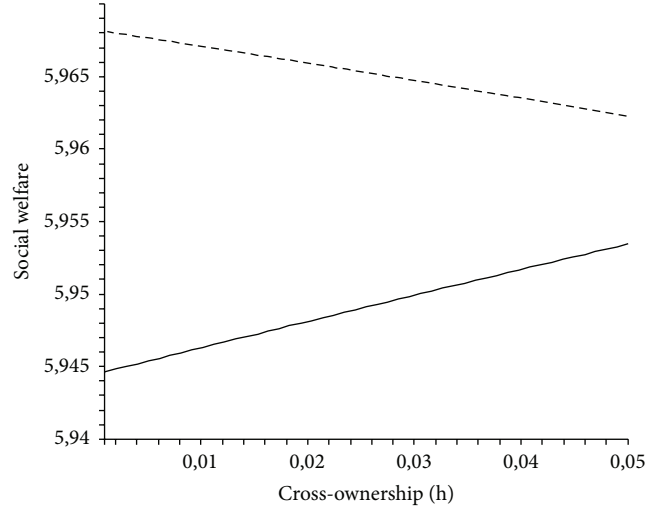


FIGURE 1: Social welfare behaviour for increasing h ($a = 7$, dashed line (values scaled for 0.428); $a = 5$, solid line).

Therefore from Lemma 6 we argue that an interval of the market size, in which both social welfare and shareholder A 's profits increase with an increasing share of cross-ownership, always does exist.⁷

The economic intuition is as follows: since on the one hand the negative effect of the reduced competition (i.e., the increases of h) on the consumer surplus is lower, the lower is the market size measure a , and since on the other hand the positive effect of the reduced competition on industry profits is increasing with a , then an interval of values of a , in which the reduced competition increases industry profits more than it reduces consumer's surplus, does always exist.⁸ This may occur only if the participated firm is more cost efficient than the participating firm. Otherwise, with symmetric costs (or participated firm's cost inefficiency), the standard result that partial cross-participation reduces welfare would be confirmed.

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. This example illustrates whether and how it is socially preferred that shareholder A increases his/her share of participation in firm 2. Suppose, for simplicity, that the cross-ownership is very small; namely, $h = 0.001$, and the “size” of market demand and costs are the following: $a = 5$, $c_1 = 2$, $c_2 = 1$. 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 $a^{q1} = 3$. Figure 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, for example, $a = 7$, the higher the cross-ownership, the lower the social welfare.

Moreover it should be noted that not only a small cross-participation is welfare-preferred, as displayed in Figure 1 for $0 < h < 0.05$: indeed, it is easy to see, again using the above mentioned parametric configuration (i.e., $a = 5$, $c_1 = 2$, $c_2 = 1$), that even if the share of cross-ownership is rather high (e.g., 30% or even 45%), a sizable range of a value for which it would be socially optimal, a further increase in such a share still does exist.⁹

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 negative effect on competition, social welfare may benefit from the existence of cross-participations at ownership level.

We have shown the following in a standard Cournot duopoly: (1) total industry production is 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 accordance with the general belief that less competition implies less output; (2) profits of shareholder A (B) are increasing (decreasing) with the share of cross-ownership of A , and this occurs although firm 1 may reduce profits; (3) the industry profits are increasing with the share of cross-ownership (again although firm 1 may have reduced profits); (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 reduced competition always increases industry profits less than it reduces the consumer surplus so that on the whole social welfare is always reduced, it has been shown that, under a simple cost asymmetry (i.e., the participated firm is more efficient than the participating firm), the social welfare may be increasing with the share of cross-ownership.¹⁰ 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 which 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 not too large and, more in detail, depends on the interaction between the cost differential (i.e., the difference in efficiency between firms) and the existing share of cross-ownership. Furthermore it is shown that the lower the existing share of cross-ownership, the more likely the positive effect on welfare of an increase of such a share.

The economic intuition is simple: since shareholder A , when deciding the output level of firm 1, internalizes (while shareholder B does not internalize) the fact that firms 1 and 2 compete in the product market, then 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 profits of the more efficient firm always overcome the possible reduction of the less efficient firm's

profits, so increasing both the cross-participating shareholder's profits and aggregate industry profits. The latter, in particular, increase more than the consumer surplus reduction, provided that the extent of the market is not too large.

Therefore, the interesting 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.

At the best of my knowledge, the result that the antitrust authority should analyse in more detail if the participation occurs in a relatively more efficient firm by owners of a relatively inefficient firm and if the market is relatively small is new and contributes to extending the vast literature on antitrust policy concerns.¹¹

Conflict of Interests

The author declares that there is no conflict of interests regarding the publication of this paper.

Endnotes

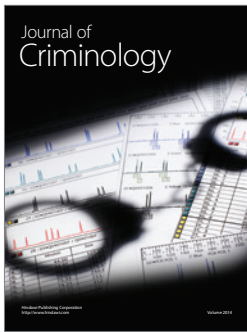
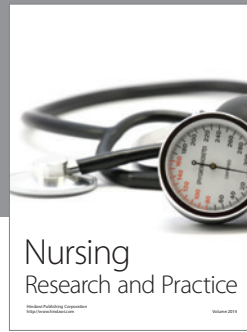
1. Exceptions are the above mentioned works by Ghosh and Morita [12] and Fanti [13]. However, both works differ from the present paper because, as regards the welfare effects, the former focuses on the issue of the knowledge transfer under PCO and the latter considers the issue of workers' unionisation, while in the present paper knowledge transfers are absent and input prices are exogenously given.
2. Although the economic analysis of the competitive effects of partial cross-ownership has been developed by Reynolds and Snapp [16], Bresnahan and Salop [17], Farrell and Shapiro [7], Nye [18], and O'Brien and Salop [19], "the competitive analysis of partial ownership interests is less well established" (O'Brien and Salop, [19], page 560). In particular, the issue of asymmetric costs between the participating and the participated firms is not so far, at the best of our knowledge, fully explored, and thus the present paper is a further contribution for well establishing "the competitive analysis of partial ownership interests."
3. As regards firm 2's output, $\partial q_2 / \partial h > 0$ holds.
4. Note that since $a^{\pi_1} > a^{\pi_A}$ and $\partial a^{\pi_1} / \partial h < 0$, then starting, for instance, from a configuration $a^{\pi_A} < a < a^{\pi_1}$ when h sufficiently increases firm 1's profit becomes decreasing with h , while the profit of shareholder A is always increasing with h .
5. Since $a^{\pi_A} > a^{\Pi}$, then when the condition for increasing the cross-ownership share by shareholder A is satisfied (i.e., $a^{\pi_A} < a$) industry profits are always increasing with h .
6. In fact it is easy to see that also $a^{q_1} > a^{\pi_A}$ holds true.
7. Moreover it is easy to see that $a^{q_1} - a^{\pi_A} = (h^2 - 6h + 9)(c_1 - c_2)/2(1 - h) > 0$ and $a^{q_1} - a^{\Pi} = (2c_1(h^2 - 3h + 4) - c_2(3h^2 - 6h + 7))/2(1 - h) > 0$; that is, if

the market size is, as necessarily assumed in any standard duopoly model, sufficiently high to ensure a positive output, then shareholder A 's and industry's profits are always increasing with an increasing h . Thus the sole relevant threshold values of a are those denoting the market size interval ($a^{sw} - a^{q1}$) (see (21)) in which the counterintuitive result in Proposition 3 holds.

8. Note that a higher a implies on the one hand higher prices and thus lower consumer's surplus but on the other hand a higher unit margin for the firms and thus higher profits.
9. Indeed the range of the "extent" of the market demand for which social welfare is increasing with an increasing one-sided cross-ownership in the more efficient firm is given by values of a included between $a^{sw} = 5.4$ and $a^{q1} = 3.85$ when $h = 0.3$, and between $a^{sw} = 5.1$ and $a^{q1} = 4.63$ when $h = 0.45$.
10. Note that the one-sided cross-ownership does not imply control and thus in this case it is not "directly" working for the mechanism of production reallocation towards the more efficient plant which, instead, would be present under a social planner or a multiplant monopolist.
11. The contributions studying the welfare effects of partial cross-ownership are relevant because they are less investigated than those of both mergers and coordination of price or output decisions and are considered an important issue for antitrust and regulatory policy (e.g., see O'Brien and Salop, [19]).

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