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Cross ownership and divestment incentives[☆]

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ABSTRACT

Even though cross ownership raises industry profits, we demonstrate that it is prone to a commitment problem. Specifically, we show that producers in a Cournot duopoly have unilateral incentives to resell their minority share-holdings in the rival to outside investors, leading to an equilibrium with complete divestments. This feature challenges the stability of cross ownership configurations.

1. Introduction

With cross ownership competing product market firms hold minority shares in each other. Existing studies have explored the effects of cross ownership from different perspectives. An important insight from this literature is that cross ownership tends to soften product market competition. The pioneering study by Reynolds and Snapp (1986), for example, demonstrates that non-controlling minority shareholdings tend to relax the intensity of competition because managers internalize the effects their product market decisions have on rivals.

We develop a model to demonstrate that cross ownership in a product market with imperfect competition creates incentives for divestment of this ownership to investors, like pension funds or financial institutions, outside the product market. Doing so grants the divestor a strategic commitment to compete more aggressively, which is profitable in markets with Cournot competition where the production decisions are strategic substitutes. The divestment is beneficial for the trading partners, but this benefit comes at the expense of the product market rival. Our analysis thus contributes by showing that divestments to investors outside the product market pose a threat to the stability of cross ownership configurations. This finding seems particularly relevant as the recent literature focusing on various effects of overlapping ownership (for example López and Vives, 2019) often takes the ownership configuration as given. It suggests a potential rationale for product market firms to apply "right of first refusal" clauses granting priority to the majority owner in case of ownership resale.[1] Our analysis gives reasons to expect that such clauses, when raising barriers for ownership resale, can be anticompetitive by making cross ownership configurations sustainable.

2. The model

Two product market firms A and B are engaged in quantity competition. Firm i's operating profit function is $\pi_i(q_i, q_j)$, where q_i and q_j denote the production volumes of firms i and j, respectively, with $i, j = A, B$ and $j \neq i$.

We are interested in the robustness of "pure" passive cross ownership with no ownership in the hands of any outside investor. Suppose that firm i holds minority proportion s_i of passive shares in its rival j, with $s_i < 1/2$. Do the product market firms have incentives to divest shares held in their rivals to investors not present in the industry? We analyze this question within the framework of the following game.

Stage 1: Each product market firm makes a secret take-it-or-leave offer to an outside investor, proposing to resell r_i, with $r_i \leq s_i$, of its shares in j in return for a fixed fee F_i.[2] The investor buying from i is denoted as I_i with $I_i \neq I_j$.[3]

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1 Walker (1999) discusses extensively the economic effects of "rights of first refusal" clauses.

2 Alternatively, one can refer to a capital market where investors are engaged in Bertrand competition.

3 We capture that product market firms can divest their minority stakes to outside investors who are not common owners in the industry.

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Stage 2: Each investor accepts ($\alpha_i = 1$) or rejects ($\alpha_i = 0$). When indifferent, the investor accepts. The outcomes of stages 1 and 2 become common knowledge.
Stage 3: The product market firms engage in quantity competition.

With cross ownership, firms' profits are connected through a chain of interactions: firm i holds a minority share in firm j, which in turn holds a minority share in i, and so on. Following the approach by Gilo et al. (2006), "real" shareholders, denoted controllers, have decision-making power according to the following ownership configuration. Controller i holds the proportion $1-s_j$ of shares in product market firm i. Firm i's other shareholders are its rival j (proportion $s_j - \alpha_j r_j$) and investor I_j (proportion $\alpha_j r_j$). Each investor is controlled by a sole and exclusive owner.

Controlling shareholder i maximizes its firm's accounting profit, denoted Γ_i, according to

$$\Gamma_i = \alpha_i F_i + \pi_i + (s_i - \alpha_i r_i)\,\Gamma_j \text{ for } i, j = A, B \text{ with } j \neq i. \tag{1}$$

The model views firms as owning one production facility and holding a minority stake in the other firm.[4] Solving system (1) yields

$$\Gamma_i = \frac{\alpha_i F_i + \pi_i + (s_i - \alpha_i r_i)\left(\alpha_j F_j + \pi_j\right)}{1 - (s_i - \alpha_i r_i)\left(s_j - \alpha_j r_j\right)}. \tag{2}$$

Assumption 1. The following conventional properties hold for $i, j = A, B$ with $j \neq i$:

$$\frac{\partial \pi_i}{\partial q_j} < 0 \; (substitutable \;\; products), \tag{A1}$$

$$\frac{\partial^2 \Gamma_i}{\partial q_i \partial q_j} < 0 \; (strategic \;\; substitutes), \tag{A2}$$

$$\frac{\partial^2 \Gamma_i}{\partial q_i^2} < 0 \; (second - order \;\; condition), \tag{A3}$$

$$H \equiv \frac{\partial^2 \Gamma_i}{\partial q_i^2}\frac{\partial^2 \Gamma_j}{\partial q_j^2} - \frac{\partial^2 \Gamma_i}{\partial q_i \partial q_j}\frac{\partial^2 \Gamma_j}{\partial q_i \partial q_j} > 0 \; (stability). \tag{A4}$$

It can be shown that cross ownership preserves strategic substitutability (the property $\frac{\partial^2 \pi_i}{\partial q_i \partial q_j} < 0$ implies $\frac{\partial^2 \Gamma_i}{\partial q_i \partial q_j} < 0$).

3. Analysis

We analyze the effects of divestment on the product market equilibrium by restricting ourselves to the case where i's offer is accepted ($\alpha_i = 1$) and investigating the role of r_i. We apply the principle of backward induction, starting with stage 3. Controller i determines q_i to maximize i's profit (2). The associated first-order conditions equal

$$\frac{\partial \Gamma_i}{\partial q_i} = \frac{\partial \pi_i}{\partial q_i} + (s_i - r_i)\frac{\partial \pi_j}{\partial q_i} = 0 \text{ for } i, j = A, B, j \neq i. \tag{3}$$

The degree to which controller i internalizes j's operating profit in the product market is determined by the proportion of shares firm i keeps in j $(s_i - r_i)$.

Let $\left(q_i^*, q_j^*\right) = \left(q_i^*\left(r_i, r_j\right), q_j^*\left(r_i, r_j\right)\right)$ denote the equilibrium quantities. The following Result, proven in the Appendix, characterizes how the divestment affects the product market equilibrium.

Result 1. *The divestment r_i makes firm i more aggressive ($dq_i^*/dr_i > 0$), whereas it makes firm j less aggressive ($dq_j^*/dr_i < 0$).*

A higher divestment reduces the degree to which i internalizes j's operating profit. This induces i to expand its production. As production decisions are strategic substitutes, j's associated response is to decrease its production volume.[5]

In stage 2, investor I_i accepts if and only if the fixed fee does not exceed I_i's valuation of the divested stake, or $F_i \leq r_i \Gamma_j$. Each investor operates with rational expectations.

We next analyze the divestment offer by firm i in stage 1. Firm i fully extracts investor I_i's rents through the fixed fee by setting $F_i = r_i \Gamma_j$. The offer is accepted in equilibrium ($\alpha_i = 1$).[6] With the optimal fixed fee, firms' accounting profits, given by system (2), simplify to

$$\Gamma_i = \pi_i + s_i \Gamma_j \;\text{ for }\; i, j = A, B \;\text{ with }\; j \neq i. \tag{4}$$

System (4) is solved as

$$\Gamma_i = \frac{\pi_i + s_i \pi_j}{1 - s_i s_j} \;\text{ for }\; i, j = A, B \;\text{ with }\; j \neq i. \tag{5}$$

Firm i's optimal divestment r_i maximizes Γ_i given by (5). The divestment does not have a direct effect on operating profits; the effect of divestment follows exclusively from the changes in equilibrium outputs q_i^* and q_j^*, according to Result 1. We obtain that

$$\frac{d\Gamma_i(r_i, r_j)}{dr_i} = \frac{1}{1 - s_i s_j}\left[\frac{dq_i^*}{dr_i}\left(\frac{\partial \pi_i}{\partial q_i} + s_i \frac{\partial \pi_j}{\partial q_i}\right) + \frac{dq_j^*}{dr_i}\left(\frac{\partial \pi_i}{\partial q_j} + s_i \frac{\partial \pi_j}{\partial q_j}\right)\right]. \tag{6}$$

Further, the equilibrium quantities satisfy the first-order conditions (3). By substituting these into (6), and rearranging, we obtain

$$\frac{d\Gamma_i(r_i, r_j)}{dr_i} = \underbrace{\frac{dq_i^*}{dr_i}}_{>0}\underbrace{\frac{\partial \pi_j}{\partial q_i}}_{<0}\frac{r_i}{1 - s_i s_j} + \underbrace{\frac{dq_j^*}{dr_i}}_{<0}\underbrace{\frac{\partial \pi_i}{\partial q_j}}_{<0}\frac{1 - s_i s_j + s_i r_j}{1 - s_i s_j}. \tag{7}$$

The first term captures that the divestment generates an externality between firm i and investor I_i in the product market. Specifically, firm i, when optimizing its production, does not internalize that increased production ($dq_i^*/dr_i > 0$) hurts the investor's profit ($\partial \pi_j / \partial q_i < 0$). The magnitude of this externality is proportional to the share held by the investor (r_i). It reduces the fixed fee firm i can extract from investor I_i, making the divestment less attractive. The second term captures the strategic advantage resulting from the divestment. By Result 1, the divestment reduces j's equilibrium output ($dq_j^*/dr_i < 0$), raising i's operating profit ($\partial \pi_i / \partial q_j < 0$).

Result 2. *Firm i always has incentives to divest some proportion of its cross-holdings in firm j.*

The proof follows directly from (7). When r_i is small, the strategic advantage to i generated by the divestment (second term) dominates relative to the externality that the divestment creates (first term).

The strategic reason for divestment resembles Reitman's (1994) result, which shows that the acquisition of partial ownership is not individually rational when at least three firms are engaged in Cournot competition. Reitman's (1994) intuition relates to the external effect according to which the main beneficiaries of a partial ownership arrangement are product market firms outside that arrangement. Our model differs by studying divestment incentives in the presence of an investor outside

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[4] The alternative approach, following Reynolds and Snapp (1986), focuses on firms directly maximizing a weighted average of its own profits and those of the rival.

[5] When firms set prices (strategic complements), increased divestment induces both firms to compete more aggressively.

[6] Firm i can set $F_i = r_i = 0$ if it would prefer not to divest.

the product market.[7] This expands the set of unstable cross ownership configurations to also include duopolistic industries. Moreover, perfect observability is critical for strategic commitment. Reitman's analysis rests on the demanding assumption that product market firms can observe minority ownership transfers they are not directly involved in. The stability issue we identify requires merely that product market firms observe their own shares and shareholders.

Since Result 2 holds for arbitrary minority holdings, it raises the question whether there is an equilibrium with complete divestments of the cross-holdings. The next Result, proven in the Appendix, formally confirms this hypothesis for a symmetric Cournot configuration satisfying[8]

$$\pi_i(q_i, q_j) = p\left(q_i + q_j\right) q_i - cq_i, \text{ with } p' < 0, p'' \leq 0, \text{ and } s \equiv s_i = s_j. \tag{8}$$

Result 3. *In the Cournot configuration (8), there is a unique symmetric equilibrium with complete divestments of the minority cross-holdings*

Result 3 implies that firms completely exhaust their divestment options. Our model thus predicts that cross-holdings do not survive as an equilibrium configuration with symmetric Cournot competition. Result 3 can be compared with Flath (1991), who studies acquisition rather than stability of cross ownership.

4. Concluding comments

We study the stability of cross ownership as an instrument for firms to relax product market competition. We establish that duopolistic Cournot competitors have unilateral incentives to sell their minority shareholdings in the rival to an outside investor, leading to an equilibrium with complete divestments. Whereas we have not formally studied the acquisition of cross holdings, by identifying a force operating against their retention, our analysis suggests that cross holdings may not be acquired in the first place. In this respect it remains for future research to investigate factors limiting divestment, for example outside investors facing an informational disadvantage, alternative modes of product market competition, or various forms of divesting active cross ownership.[9] When such factors limit divestment, cross ownership arrangements can be profitable by relaxing competition. Studying their dynamics, for example considering changes in informational frictions, potentially offers new insights into empirical patterns of acquisition and divestment of cross ownership. We leave this pursuit as a promising direction for future research.

Appendix

Proof of Result 1. Total differentiation of the first-order conditions (3) with respect to q_i, q_j and r_i defines the system

$$\frac{\partial^2 \Gamma_i}{\partial q_i^2} dq_i^* + \frac{\partial^2 \Gamma_i}{\partial q_i \partial q_j} dq_j^* + \frac{\partial^2 \Gamma_i}{\partial q_i \partial r_i} = 0 \tag{9}$$

$$\frac{\partial^2 \Gamma_j}{\partial q_j^2} dq_j^* + \frac{\partial^2 \Gamma_j}{\partial q_i \partial q_j} dq_i^* = 0. \tag{10}$$

Solving yields

$$\begin{cases} \dfrac{dq_i^*}{dr_i} = -\dfrac{\dfrac{\partial^2 \Gamma_j}{\partial q_j^2} \dfrac{\partial^2 \Gamma_i}{\partial q_i \partial r_i}}{H} > 0 \\ \dfrac{dq_j^*}{dr_i} = \dfrac{\dfrac{\partial^2 \Gamma_j}{\partial q_i \partial q_j} \dfrac{\partial^2 \Gamma_i}{\partial q_i \partial r_i}}{H} < 0. \end{cases} \tag{11}$$

We sign (11) using (A2)–(A4), combined with $\frac{\partial^2 \Gamma_i}{\partial q_i \partial r_i} = -\frac{\partial \pi_j}{\partial q_i} > 0$ (by (3) and (A1)). ■

Proof of Result 3. With symmetric Cournot competition, represented by (8), we have

$$\begin{cases} \dfrac{\partial \pi_i}{\partial q_i} = p + p' q_i - c \\ \dfrac{\partial^2 \pi_i}{\partial q_i^2} = 2p' + p'' q_i < 0 \\ \dfrac{\partial^2 \pi_i}{\partial q_i \partial q_j} = p' + p'' q_i < 0 \\ \dfrac{\partial \pi_i}{\partial q_j} = p' q_i < 0 \\ \dfrac{\partial^2 \pi_i}{\partial q_j^2} = p'' q_i < 0. \end{cases} \tag{12}$$

Firstly, we show that there is no symmetric interior equilibrium by contradiction. We would have $r \equiv r_i = r_j$, $q_i^* = q_j^*$, and $\frac{\partial \pi_j}{\partial q_i} = \frac{\partial \pi_i}{\partial q_j}$, so that $\frac{d\Gamma_i(r_i, r_j)}{dr_i} = 0$ in (7) whenever

$$\frac{dq_i^*}{dr_i} r + \frac{dq_j^*}{dr_i} \left(1 - s^2 + sr\right) = 0. \tag{13}$$

Substitution of (11), simplifying, and using symmetry ($\frac{\partial^2 \Gamma_j}{\partial q_j^2} = \frac{\partial^2 \Gamma_i}{\partial q_i^2}$ and $\frac{\partial^2 \Gamma_j}{\partial q_i \partial q_j} = \frac{\partial^2 \Gamma_i}{\partial q_i \partial q_j}$), we obtain

$$r = \frac{\dfrac{\partial^2 \Gamma_i}{\partial q_i \partial q_j}}{\frac{\partial^2 \Gamma_i}{\partial q_i^2}} \left(1 - s^2 + sr\right). \tag{14}$$

Further we use (3) and symmetry ($\frac{\partial^2 \pi_i}{\partial q_i \partial q_j} = \frac{\partial^2 \pi_j}{\partial q_i \partial q_j}$ and $\frac{\partial^2 \pi_j}{\partial q_i^2} = \frac{\partial^2 \pi_i}{\partial q_j^2}$), obtaining

$$r = D\left(1 + s - r\right)\left(1 - s^2 + sr\right), \tag{15}$$

where $D \equiv \frac{\partial^2 \pi_i}{\partial q_i \partial q_j} \Big/ \left(\frac{\partial^2 \pi_i}{\partial q_i^2} + (s - r) \frac{\partial^2 \pi_i}{\partial q_j^2}\right)$. By (12) we have

$$D = \frac{p' + p'' q_i}{2p' + (1 + s - r) p'' q_i} = 1 - \frac{p' + (s - r) p'' q_i}{2p' + (1 + s - r) p'' q_i} \geq \frac{1}{2}. \tag{16}$$

Combining $r < \frac{1}{2}$, (15) and (16), we obtain $1 > (1 + s - r)\left(1 - s^2 + sr\right)$, simplified as

$$-s^2 + sr + s - s^3 + 2s^2 r - r - sr^2 < 0. \tag{17}$$

[7] Relatedly, Shy and Stenbacka (2020) characterize the equilibrium incentives of institutional owners to acquire common ownership of duopolistic firms and explore the effects on passive investors.

[8] This configuration satisfies Assumption 1.

[9] Brito et al. (2014) rank alternative forms of divesting control rights focusing on consumer welfare.

To demonstrate the contradiction, we show that the left-hand side of (17) is positive when evaluated at the value-minimizing value of r. The derivative is $-1+s(1+2s-2r)<0$, as $s<1/2$. Substituting $r=0$ into (17) yields $s\left(1-s-s^2\right)>0$ when $s<1/2$ and completes the contradiction.

Secondly, we show that complete divestment is an equilibrium. By (7), incomplete divestment is a sub-optimal response whenever

$$\left.\frac{d\Gamma_i(r_i,r_j)}{dr_i}\right|_{\substack{s_i=s_j=s\\ r_i<s\\ r_j=s}} = \frac{dq_i^*}{dr_i}\frac{\partial\pi_j}{\partial q_i}r_i + \frac{dq_j^*}{dr_i}\frac{\partial\pi_i}{\partial q_j} > 0. \tag{18}$$

By combination of (11), $\frac{\partial\pi_j}{\partial q_i}=p'q_j$, $\frac{\partial\pi_i}{\partial q_j}=p'q_i$, $p'<0$, and (A3) we see that (18) is equivalent to

$$-\frac{\partial^2\Gamma_j}{\partial q_j^2}q_jr_i + \frac{\partial^2\Gamma_j}{\partial q_i\partial q_j}q_i < 0. \tag{19}$$

We can calculate that $q_i=(1-s+r_i)\,q_j$ using (3), $r_j=s$, and (12). Therefore (19) becomes

$$\frac{r_i}{1-s+r} < G, \tag{20}$$

where $G\equiv\frac{\partial^2\Gamma_j}{\partial q_i\partial q_j}\Big/\frac{\partial^2\Gamma_j}{\partial q_j^2}=\frac{\partial^2\pi_j}{\partial q_i\partial q_j}\Big/\frac{\partial^2\pi_j}{\partial q_j^2}$. The left-hand side in (20) is below 1/2. Next, using (12), we obtain

$$G=\frac{p'+p''q_j}{2p'+p''q_j}=\frac{1}{2}+\frac{\frac{1}{2}p''q_j}{2p'+p''q_j}\geq\frac{1}{2}. \tag{21}$$

Consequently, (20) holds. ■

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