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Passive cross holding as a strategic entry deterrence

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HIGHLIGHTS

- We study cross holding in a market with an incumbent and a potential entrant.
- We show that the incumbent uses cross holding as a strategic device to deter the other firm's entry.
- Firms' joint profit is maximized when the incumbent monopolizes the market.
- The incumbent distributes part of its monopoly profit to compensate the entrant for staying out.

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ABSTRACT

This paper builds a duopoly model to study the strategic effects of cross holding on entry deterrence. We show that, in equilibrium, the incumbent optimally chooses strictly positive cross holdings in each other to deter entry for the potential entrant.

1. Introduction

Cross holding refers to the situation in which one firm holds shares in another firm. In recent years, cross holdings between firms have been frequently observed in various industries, such as airlines (Clayton and Jorgensen, 2005), automobiles (Alley, 1997), financial sectors (Dietzenbacher et al., 2000), and broadcasting (Brito et al., 2014).

A substantial amount of literature analyzes the impact of cross holding on oligopoly competition. Reynolds and Snapp (1986) analyze the competitive implications of cross holdings, assuming passive ownerships between firms. For an oligopoly with a homogeneous product, the authors show that the aggregate output level falls as cross holdings increase. Farrell and Shapiro (1990) propose a duopoly setting and focus on the unilateral effects of partial ownership. Considering the effects of both direct and indirect cross holdings, Flath (1991) adopts a different approach in a duopoly setting and demonstrates that no firm will acquire shares in a rival unless its own operating earnings increase with cross holdings.

This paper builds a model to illustrate that cross holding can be used as a strategic device for an incumbent to deter entry for a potential entrant. We analyze a two-period model where the incumbent first decides whether to offer equity positions to the entrant and then the entrant decides whether to accept the offer and whether to enter the market. We find that the incumbent strategically chooses strictly positive equity positions that induce the entrant to accept the offer and also deter entry. Furthermore, the two firms' joint profit is maximized in equilibrium. The results accord well with intuition. Without entry, the incumbent monopolizes the market and earns the highest possible profit. Hence, the incumbent will offer positive equity positions to deter entry and compensate the entrant for staying outside.

There are a few papers in the literature that discuss the effects of cross holding on entry deterrence. Hansen and Lott (1995)

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show that cross holding can affect the entry decision. In their model, an entrant who decides *not* to enter will strategically hold positive equity positions in the incumbent because it knows that the incumbent's stock prices will rise once the market knows the entrant's decision to stay out. Clayton and Jorgensen (2005) study the strategic role of cross holding and demonstrate how it affects entry in a Cournot duopoly game. They assume the entrant decides whether to enter prior to the choice of equity positions. Hence, the strategic value of cross holding is *not* to deter entry. Rather, cross holding affects a firm's entry decision because it has other strategic values that affect a firm's subsequent competitive behavior. In contrast, this paper considers the case in which an incumbent strategically uses cross holding as a device to deter entry for a potential competitor. In this strand, Mathews (2006) studies the entrant firm's entry incentives in a different context with strategic alliances. The author argues that partners of strategic alliances can structure a one-way equity transaction that non-contractually eliminates the inefficient entry incentive caused by transfers of technology from an entrepreneurial firm to its established partner.

2. The model

Consider the market for a homogeneous product in which there is an incumbent (firm 1) and a potential entrant (firm 2). The firms have a common constant marginal cost, which, without loss of generality, is taken to be zero. Market demand is given by the inverse demand function $p(Q)$, where p is price, Q is total output and $p'(Q) < 0$. The timeline is as follows:

1. The incumbent offers (v_1, v_2) to the entrant, where v_i is firm i's equity position in the other firm. Assume $0 \leq v_i \leq 1$.
2. The entrant decides whether to accept the incumbent's offer. If the entrant accepts, then the equity positions are (v_1, v_2); if the entrant rejects, then the equity positions are $(0, 0)$.
3. The entrant decides whether to enter the market. The fixed entry cost is C.
4. (a) If the entrant does not enter the market, then the incumbent produces as a monopoly. (b) If the entrant enters the market, then the two firms engage in Cournot competition.

We will assume throughout the paper that (a) the entrant (firm 2) operates in another (independent) market and earns profit $\hat{\pi}$, (b) the entry cost C is small enough such that the entrant will enter the market without positive cross holdings, (c) the entrant accepts the offer if it is indifferent between accepting and rejecting, and (d) cross holdings between firms are passive[1] in the sense that each firm is entitled to a share of its rival's profit but not decision making.

3. Equilibrium

There are four different situations regarding this sequential-move game:

Case 1. The incumbent offers positive (v_1, v_2); the entrant accepts the offer and enters the market.

Case 2. The incumbent offers positive (v_1, v_2); the entrant accepts the offer and does not enter.

Case 3. The incumbent offers positive (v_1, v_2); the entrant denies the offer and enters the market.

Case 4. The incumbent does not make an offer (i.e., $(0, 0)$); the entrant enters the market.

In case 1, both firms hold positive shares of equity in its rival. Under Cournot competition, each firm simultaneously chooses the optimal quantity, q_i, to achieve profit maximization. Hence, firm i's optimization problem is

$$\max_{q_i}(1 - v_j)\pi_i\left(q_i, q_j\right) + v_i\pi_j\left(q_i, q_j\right),$$

where $\pi_1(q_1, q_2) = p(Q)q_1$ and $\pi_2(q_1, q_2) = p(Q)q_2 + \hat{\pi}$. Firm i's first-order condition is therefore

$$(1 - v_j)\left(p'(Q)q_i + p(Q)\right) + v_i p'(Q)q_j = 0. \tag{1}$$

We assume that the second-order condition holds, i.e.,

$$(1 - v_j)\left(p''(Q)q_i + 2p'(Q)\right) + v_i p''(Q)q_j < 0. \tag{2}$$

With this assumption, the existence of the optimal solution can be guaranteed.[2] If the inverse demand function is concave, $p''(Q) < 0$, then (2) is satisfied. In equilibrium, firm i's optimal choice is $q_i^s(v_1, v_2)$ such that (1) holds for both firms. We thus write both firms' profits in equilibrium as follows[3]:

$$\begin{cases} \pi_I^s = (1 - v_2)p(Q^s(v_1, v_2))q_1^s(v_1, v_2) \\ \quad + v_1\left(p(Q^s(v_1, v_2))q_2^s(v_1, v_2) + \hat{\pi}\right); \\ \pi_E^s = v_2 p(Q^s(v_1, v_2))q_1^s(v_1, v_2) \\ \quad + (1 - v_1)\left(p(Q^s(v_1, v_2))q_2^s(v_1, v_2) + \hat{\pi}\right) - C, \end{cases} \tag{3}$$

where $Q^s(v_1, v_2) = q_1^s(v_1, v_2) + q_2^s(v_1, v_2)$.

In case 2, the incumbent acts as a monopoly and picks its output to maximize its profit: $\pi = (1 - v_2)p(Q)Q + v_1\hat{\pi}$. The first-order condition is

$$p'(Q)Q + p(Q) = 0, \tag{4}$$

which yields the optimal output Q^m. We thus write both firms' profits in equilibrium as follows:

$$\begin{cases} \pi_I^m = (1 - v_2)p(Q^m)Q^m + v_1\hat{\pi}; \\ \pi_E^m = v_2 p(Q^m)Q^m + (1 - v_1)\hat{\pi}. \end{cases} \tag{5}$$

In case 3 and case 4, the entrant firm enters the market without cross holding and competes with the incumbent in Cournot. Substituting $v_1 = v_2 = 0$ into (1) yields that

$$p'(Q)q_i + p(Q) = 0. \tag{6}$$

Let q_i^c denote the optimal output for firm i. We obtain both firms' profits in equilibrium as follows:

$$\begin{cases} \pi_I^c = p(Q^c)q_1^c; \\ \pi_E^c = p(Q^c)q_2^c + \hat{\pi} - C, \end{cases} \tag{7}$$

where $Q^c = q_1^c + q_2^c$. In our paper, $C < p(Q^c)q_2^c$ holds such that the entrant will surely enter the market without cross holding.

The following game tree in Fig. 1 describes the sequential-move game between the incumbent firm 1 and the entrant firm 2.

Let Π denote two firms' joint profit. It follows from the previous analysis that (a) in case 1, $\Pi^s = p(Q^s(v_1, v_2))Q^s(v_1, v_2) + \hat{\pi} - C$; (b) in case 2, $\Pi^m = p(Q^m)Q^m + \hat{\pi}$; and (c) in case 3 and case 4, $\Pi^c = p(Q^c)Q^c + \hat{\pi} - C$. Obviously, the two firms' joint profits Π^m and Π^c are independent of v_1 and v_2.

Proposition 1. *The two firms' joint profit is maximized in case 2. That is, $\Pi^m > \Pi^s$, and $\Pi^m > \Pi^c$.*

[1] Passive partial ownership assumption is widely used in the literature, such as Farrell and Shapiro (1990), Flath (1991), Gilo et al. (2006) and Jovanovic and Wey (2014).

[2] The condition in (2) also guarantees the existence of optimal solutions for the maximization problems in other cases.

[3] In the following, we use subscripts "I" and "E" to denote "Incumbent" and "Entrant" respectively; we use superscripts "s", "m" and "c" to denote "positive shares", "monopoly" and "Cournot competition with no shares", respectively.