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Kazumichi, Iwasa and Toru, Kikuchi
Kobe University, Kobe University

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Cost Hetrogeneity and Strategic Divisionalization

Kazumichi Iwasa and Toru Kikuchi*

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Abstract

In this note, we consider a simple duopoly environment in which two parent firms compete in a market. We assume that there are cost differentials between these two parent firms. The parent firms' choices of divisionalization are modeled as a two-stage game. It will be shown that the number of divisions of a parent firm with a cost advantage (i.e., lower marginal costs) is relatively large. The results imply that the cost advantage of one parent firm will be magnified through divisionalization decisions.

*Graduate School of Economics, Kobe University, Japan, e-mail: kikuchi@econ.kobe-u.ac.jp

1 Introduction

In today's world of global competition, firm behavior is critical in determining market structure. In particular, many firms recognize their retail and distribution facilities (i.e., 'downstream' divisions) as an important strategic device to obtain better access to markets.

We argue that in the presence of divisionalization decisions, cost heterogeneity among firms affects market outcomes because of the changed competition structure. To illustrate this point, we consider a simple duopoly environment in which two parent firms compete in a market. We assume that there are cost differentials between these two parent firms. The parent firms' choices of divisionalization are modeled as a two-stage game. It will be shown that the number of divisions of a parent firm with a cost advantage (i.e., lower marginal costs) is relatively large. The results imply that the cost advantage of one parent firm will be magnified through divisionalization decisions.

This paper is closely related to the recent literature on strategic divisionalization. Corchon (1991), Polasky (1992), Baye et al. (1996a, b), and Yuan (1999) analyze the strategic incentives for firms to form independent divisions. Their analyses concentrated on the case of identical cost structure. Contrary to this, we concentrate on the case of asymmetric cost structure.

2 The Model

Consider a model with two parent firms, Firm A and Firm B . Parent firms intend to make divisionalization decisions in a market. The inverse demand function is $p = \alpha - \beta Q$, where p is the price and Q is the total output of the product, respectively. A divisionalization game is modeled as a simultaneous-move, two-stage game among profit-maximizing parent firms. In the first stage, each parent firm chooses a number of competing units, which we will henceforth call ‘divisions’. In the second stage, all these divisions participate in the market as independent Cournot-Nash players in a simultaneous-move homogeneous product oligopoly. Letting n^i denote the number of divisions chosen by Firm i in the first stage and q^i the output of each division of Firm i . The cost of adding another division, $F > 0$, is constant and identical for both parent firms. It is assumed that there are cost differentials between the two firms’ divisions: we normalize Firm A divisions’ marginal cost to zero, while c ($c > 0$) represents Firm B divisions’ marginal costs.

We can solve for the second-stage Cournot equilibrium outputs as a function of the number of divisions chosen in the first-stage. Given the number of divisions, the equilibrium output of each division and equilibrium price

become¹

$$q^A = \frac{\alpha + n^B c}{\beta(1 + n^A + n^B)}, \quad (1)$$

$$q^B = \frac{\alpha - (n^A + 1)c}{\beta(1 + n^A + n^B)}, \quad (2)$$

$$p = \frac{\alpha + n^B c}{1 + n^A + n^B}. \quad (3)$$

Note that, due to cost differentials, each Firm *A* division produces more than each Firm *B* division (i.e., $q^A > q^B$).

Then, we can write the profit for each parent firm as

$$\Pi^A = \frac{n^A(\alpha + n^B c)^2}{\beta(1 + n^A + n^B)^2} - n^A F, \quad (4)$$

$$\Pi^B = \frac{n^B[\alpha - (n^A + 1)c]^2}{\beta(1 + n^A + n^B)^2} - n^B F. \quad (5)$$

In the first-stage, each parent firm chooses the number of divisions in the third market, taking as given the divisionaliation decisions of its rival. Differentiating (4) and (5) with respect to the number of divisions, and setting the result equal to zero yields the following reaction functions for each parent firm.²³

$$\Pi_{n^A}^A = \frac{(1 - n^A + n^B)(\alpha + n^B c)^2}{\beta(1 + n^A + n^B)^3} - F = 0, \quad (6)$$

¹Note that each Firm *A* division's profit is $q^A(\alpha - \beta Q)$ while each Firm *B* division's profit is $q^B(\alpha - \beta Q - c)$, where $Q = \sum q^A + \sum q^B$.

²Subscripts denote partial derivatives throughout.

³It is straightforward to check that the second-order conditions are met.

$$\Pi_{n^B}^B = \frac{(1 + n^A - n^B)[\alpha - (n^A + 1)c]^2}{\beta(1 + n^A + n^B)^3} - F = 0. \quad (7)$$

The comparative statics effects (dn^A/dc) and (dn^B/dc) can be obtained by totally differentiating these conditions with respect to n^A , n^B , and c as follows:

$$\Pi_{n^A n^A}^A dn^A + \Pi_{n^A n^B}^A dn^B + \Pi_{n^A c}^A dc = 0, \quad (8)$$

$$\Pi_{n^B n^A}^B dn^A + \Pi_{n^B n^B}^B dn^B + \Pi_{n^B c}^B dc = 0. \quad (9)$$

These equations can be solved as

$$dn^A/dc = (\Pi_{n^B c}^B \Pi_{n^A n^B}^A - \Pi_{n^A c}^A \Pi_{n^B n^B}^B)/D, \quad (10)$$

$$dn^B/dc = (\Pi_{n^B n^A}^B \Pi_{n^A c}^A - \Pi_{n^A n^A}^A \Pi_{n^B c}^B)/D, \quad (11)$$

where $D = \Pi_{n^A n^A}^A \Pi_{n^B n^B}^B - \Pi_{n^A n^B}^A \Pi_{n^B n^A}^B$. Given the assumption that n^A and n^B are strategic substitutes (i.e., $\Pi_{n^A n^B}^A < 0$ and $\Pi_{n^B n^A}^B < 0$) as defined by Bulow et al. (1985), we can obtain that $(dn^A/dc) > 0$ and $(dn^B/dc) < 0$.⁴

Proposition: *In the divisionalization game in the market, the parent firm with the lowest costs will have the largest number of divisions.*

This implies the dominance of the cost-advantaged firm's divisions in the market: not only each division with a cost-advantage produces a larger

⁴This assumption holds and a stable equilibrium with $D > 0$ exists when (i) c is sufficiently small and (ii) $(\beta F)^{1/2} + c < \alpha < 3\sqrt{3}(\beta F)^{1/2}$ is satisfied.

output ($q^A > q^B$), but also the number of such divisions becomes larger in the market ($n^A > n^B$). The principle involved is that, since the motivation to divisionalization is to commit a higher output level in the product market, a cost-competitive parent firm (which has a higher incentive to shift profits) will choose a larger number of divisions in the first stage.

3 Conclusion

In a two-stage game with divisionalization, it has been shown that a cost advantage for a parent firm will result in a relatively larger number of divisions in the market. In other words, an initial cost-advantage for one firm will be magnified through divisionalization decisions.

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