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Pre-emptive mergers and downstream cost asymmetry

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HIGHLIGHTS

- The paper uniquely models pre-emptive mergers in which downstream costs differ.
- When the downstream cost difference is large enough, the horizontal merger dominates.
- This reverses the finding that vertical integration dominates for identical downstream costs.
- When downstream products are complements, the upstream firm rarely bids.
- This failure reflects the upstream firm's gain from the horizontal merger eliminating a bottleneck.

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ABSTRACT

With sufficient downstream cost asymmetry a horizontal merger will be chosen over a vertical merger. This results because the technology transfer is large and the incentive to vertically merge shrinks as the horizontal merger eliminates a cost asymmetry induced "bottleneck."

1. Introduction

This paper determines the role of downstream cost asymmetry when firms decide to integrate either vertically or horizontally. Colangelo (1995, 1997) demonstrates that, with constant shared downstream marginal costs, the vertical merger always pre-empts the horizontal merger. The gain from eliminating double marginalization exceeds the gain from horizontal market power. As Yao and Zhou (2015) demonstrate, these issues continue to be of interest but researchers have yet to return to the original model and relax the assumption of identical downstream costs. With a sufficient cost difference downstream, the horizontal merger pre-empts the vertical merger by increasing the benefits of the downstream merger and decreasing the benefits of vertical integration.

Previous studies separately examine horizontal mergers in a differentiated Cournot market and the incentive for vertical foreclosure. Lommerud and Sorgard (1997) and Hsu and Wang (2010) show that increasing the degree of constant, shared product differentiation increases the profit from horizontal mergers. Ordover et al. (1990) analyze the incentive of firms to engage in vertical foreclosure, an analysis moved to product differentiation in vertical markets by Hackner (2003), Pepall and Norman (2001), Matsushima (2009) and Mukherjee and Zanchettin (2012).

This paper combines these two strands of literature, as did Colangelo (1995). It introduces cost asymmetry (see Faulí-Oller, 2002 and Gelves, 2014) in a horizontal setting to uniquely examine whether horizontal or vertical integration prevails. The results highlight how the threat of a profitable downstream merger reduces the incentive for vertical merger.

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2. Pre-merger equilibrium

Consider three firms, two downstream and one upstream, producing at zero marginal cost. One unit of input can be transformed into one unit of final good at cost zero for Firm 1 but at $c_2 > 0$ for Firm 2. The upstream monopolist sells inputs to the downstream firms at prices v_1 and v_2, respectively. The downstream firms face the demand function $q_i = 1 - p_i + \gamma p_j$, where $i = 1, 2; \; -1 < \gamma < 1$. For $0 < \gamma < 1$, goods are substitutes and for $-1 < \gamma < 0$, they are complements.

In the first stage, the upstream monopolist chooses input prices v_i to maximize profit. In the second stage, the downstream firms compete in final prices. We initially examine the pre-merger case using backward induction to generate the benchmark profits.

The profit functions of the downstream firms are:

$$\pi_1 = p_1 q_1 - v_1 q_1 \tag{1}$$

$$\pi_2 = p_2 q_2 - v_2 q_2 - c_2 q_2. \tag{2}$$

Each firm maximizes with respect to its own price yielding two best response functions to solve simultaneously.

$$p_1 = \frac{2(1+v_1) + \gamma\,(1+c_2+v_2)}{4-\gamma^2} \quad \text{and} \quad p_2 = \frac{2\,(1+c_2+v_2) + \gamma(1+v_1)}{4-\gamma^2}. \tag{3}$$

The monopolist's profit is

$$\pi_U = v_1 q_1 + v_2 q_2. \tag{4}$$

Substituting in (3), the upstream monopolist maximizes with respect to v_1 and v_2 yielding:

$$v_1 = \frac{1}{2(1-\gamma)} \quad \text{and} \quad v_2 = \frac{1-c_2(1-\gamma)}{2(1-\gamma)}. \tag{5}$$

It can be verified that $v_1 > v_2$. Substituting (5) into (3) and using the demand and profit functions, yields the downstream prices, quantities and profits.[1]

$$p_1 = \frac{c_2\gamma\,(1-\gamma) + (2+\gamma)(3-2\gamma)}{2(2+\gamma)(2-\gamma)(1-\gamma)} \quad \text{and} \quad p_2 = \frac{2c_2\,(1-\gamma) + (2+\gamma)(3-2\gamma)}{2(2+\gamma)(2-\gamma)(1-\gamma)} \tag{6}$$

$$q_1 = \frac{2+\gamma(1+c_2)}{2(2-\gamma)(\gamma+2)} \quad \text{and} \quad q_2 = \frac{\gamma(1+c_2\gamma) + 2(1-c_2)}{2(2-\gamma)(\gamma+2)} \tag{7}$$

$$\pi_1 = \frac{(\gamma + c_2\gamma + 2)^2}{4(\gamma^2-4)^2} \tag{8}$$

$$\pi_2 = \frac{(\gamma + c_2\gamma^2 + 2 - 2c_2)^2}{4(\gamma^2-4)^2} \tag{9}$$

$$\pi_U = \frac{c_2^2\left(\gamma^3 + 2 - \gamma^2 - 2\gamma\right) + c_2(2\gamma^2 + 2\gamma - 4) + 2(2+\gamma)}{4\,(1-\gamma)\,(4-\gamma^2)}. \tag{10}$$

Note that all profits are affected by the cost difference (c_2) and that the inefficient firm earns less profit than the efficient firm. Sales of the efficient firm rise and of the inefficient firm fall as the cost difference grows. In aggregate, however, the upstream firm loses profit as the cost difference grows because the inefficient firm loses its ability to compete downstream when goods are substitutes. Even when goods are complements, the profit of the upstream firm remains limited by the output of the inefficient firm, a limitation identified as a "bottleneck". As a consequence, upstream profits fall when the cost difference grows.

3. Vertical and horizontal merger

Now imagine vertical integration between the upstream monopoly and Firm 1, a merger more profitable than with Firm 2.[2] In the first stage, the integrated firm chooses v_2.[3] In the second stage, the vertically integrated firm and Firm 2 compete in downstream prices. The profit of the vertically integrated firm is:

$$\pi_V = p_1 q_1 + v_2 q_2. \tag{11}$$

The vertically integrated firm maximizes (11) with respect to p_1 and Firm 2 maximizes (2) with respect to p_2. This yields two best response functions solved simultaneously:

$$p_1 = \frac{2 + \gamma(1+c_2+3v_2)}{4-\gamma^2} \quad \text{and} \quad p_2 = \frac{2(1+c_2) + \gamma + v_2(2+\gamma^2)}{4-\gamma^2}. \tag{12}$$

Given (12), the vertically integrated firm maximizes (11) with respect to v_2 yielding:

$$v_2^V = \frac{8 + 8c_2\gamma - 8c_2 + \gamma^3}{2(8+\gamma^2-8\gamma-\gamma^3)}. \tag{13}$$

Substituting (13) into (12) and the resulting prices into the demand and profit functions yield the equilibrium under vertical integration:

$$p_V = \frac{\gamma\,(2-\gamma) - 2c_2\gamma\,(1-\gamma) + 8}{2(8+\gamma^2)(1-\gamma)} \quad \text{and} \quad p_2^V = \frac{4c_2\,(1-\gamma) + \gamma(2\gamma - 4 - \gamma^2) + 12}{2(8+\gamma^2)(1-\gamma)} \tag{14}$$

$$q_V = \frac{\gamma^3 + \gamma^2 + (6c_2+2)\,\gamma + 8}{2(\gamma^2+8)} \quad \text{and} \quad q_2^V = \frac{\left(2+\gamma^2\right)(1-c_2)}{\gamma^2+8} \tag{15}$$

$$\pi_V = \frac{\gamma^3 + \gamma^2 + 8c_2\gamma + 4\gamma + 4c_2^2(1-\gamma) - 8c_2 + 12}{4(8+\gamma^2-8\gamma-\gamma^3)} \tag{16}$$

$$\pi_2^V = \frac{(1-c_2)^2\left(2+\gamma^2\right)^2}{(\gamma^2+8)^2}. \tag{17}$$

The merger eliminates double marginalization between the upstream firm and the efficient downstream firm resulting in a much lower downstream price for good 1. The integrated firm reduces the input price to Firm 2 after the merger to alleviate the bottleneck.

Now imagine an alternative merger between the two downstream firms that allows technology (or superior management) transfer to the inefficient firm (i.e. $c_2 = 0$ after the merger). The objective function for the horizontally integrated firm is:

$$\pi_H = p_1 q_1 + p_2 q_2 - v_1 q_1 - v_2 q_2. \tag{18}$$

[1] Equilibrium values are all positive when $0 < \gamma < 1$. They remain positive for $-1 < \gamma < 0$, except $q_2 > 0$ requires that $c_2 < \frac{2+\gamma}{2-\gamma^2}$.

[2] A proof that the merger with Firm 1 dominates is available upon request.

[3] It can be shown that the profit from setting $v_1 = 0$ is greater than setting any $v_1 > 0$.