國立政治大學國際經營與貿易學系研究所

碩士學位論文

垂直結合廠商防止連續結合的先占策略

Preempting Successive Mergers by a Vertically Merged Firm

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Abstract

We investigate strategies that an incumbent vertically merged firm will implement to achieve maximal profit. When a horizontal merger occurs, it will decrease the profit of a vertically merged firm. Thus, the vertically merged firm will preempt the horizontal merger by merging with one of the downstream firms. However, this leaves open possibility for remaining firms to merge vertically. We then further analyze how a vertically merged firm preempts subsequent vertical mergers. We find that, among various preempting strategies, it is most profitable for the firm to merge with all of the downstream firms.

Keywords: preempting successive mergers, vertically merged firm

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1 Introduction

Many real world mergers involve rival bids from both horizontally and vertically related firms. For example, in 2009, Oracle outbid IBM by 10 cents per share for the acquisition of Sun Microsystems Inc. This is considered a case of vertical merger because, unlike IBM and Sun, Oracle and Sun have little business overlap and their products complement each other (Clark and Worthen, 2009). In 2015, Ambit Microsystems Inc. vertically integrated with the Asia Pacific Telecom Co., Ltd., the top five telecom company in Taiwan, to acquire the 4G market (Hung and Gold, 2014). In 2017, the embattled Japanese conglomerate Toshiba sought a sale of the memory chip unit to make up for a multi-billion-dollar write-down in its nuclear operations. Recently, Toshiba Corporation finally completed the sale of its memory business, Toshiba Memory Corporation, to a consortium led by Bain Capital Private Equity, SK Hynix and Apple Inc (Narioka, 2018). This deal is viewed as a horizontal merger because the main product of Toshiba is NAND flash which complements with DRAM that SK Hynix and other corporation produce. In this paper, we set up a game-theoretical model to analyze the different incentives of a horizontally and a vertically related firm to acquire a downstream firm.

Among various reasons for mergers, one of them is to preempt rivals from merging. Colangelo's (1995) seminal work demonstrates that vertical mergers often preempt horizontal mergers because the gain from eliminating double marginalization outweighs the gain from horizontal market power. In a follow-up study, Gelves and Heywood (2016) argue that with sufficient downstream cost asymmetry, a horizontal merger may preempt a vertical one if the horizontal merger results in a cost reduction for an inefficient firm. In this paper, we consider all possible mergers and investigate how an incumbent firm can do to preempt mergers. Several preempting strategies presented in this paper have not been addressed in previous studies. For example, the control of the intermediate good may be one way to preempt mergers. Besides, both of the aforementioned papers assume that there are two upstream and two downstream firms, while we make a more complex assumption. That is, we assume there are two upstream firms and three downstream firms and among these five firms, one upstream and one downstream firm are

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vertically merged. Furthermore, Colangelo (1995) only considers mergers when downstream goods are substitutes, while we extend the analysis to cases in which downstream goods can be either substitutes or complements.

Ordover, Saloner and Salop (1990) set up a model to investigate the incentives of an integrated firm and the remaining unintegrated input suppliers to exclude rivals and the possible counterstrategies of competitors. Yao and Zhou (2015) show that a market structure is stable only when no firm merges or all firms merge, so mergers always occur in waves. Following the approaches taken by these papers, we use a three-stage game to incorporate all the features of interest.

In March 2018, Singapore-based Broadcom Ltd decided to bid 117 billion dollars to acquire Qualcomm Inc. According to The Wall Street Journal, it is said that Intel's worried about the market power a combined Broadcom and Qualcomm would hold. In response, it could make an offer to buy Broadcom if it looks like Broadcom will succeed in its hostile bid for Qualcomm (Greenwald, 2018). However, in the end, President Trump signed an order to halt the deal on concerns that a takeover of Qualcomm by the Singapore-based company would erode the United States' lead in mobile technology and give China the upper hand (Meyersohn and Horowitz, 2018). In a successive model, we analyze how an incumbent firm, a vertically merged firm, preempts mergers. First, it preempts the horizontal merger by merging with one of the downstream firms. Second, it preempts another vertical merger by merging with all of downstream firms.

In this paper, we will specifically look into how a vertically merged firm can preempt a horizontal merger and another vertical merger. We find that to preempt a horizontal merger, it costs less to merge with one of the downstream firms than to merge with an upstream firm. Furthermore, we find that to preempt another vertical merger, the vertically merged firm merges with all of downstream firms.

The remainder of this paper is organized as follows. Section 2 formulates the model and derives the equilibrium outcomes. Section 3 presents when does a vertical (horizontal) merger preempt a horizontal (vertical) merger and formulates the successive model to look into how the vertically merged firm preempts mergers. This section is also applied to analyze the Broadcom and Qualcomm case. The final section concludes

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the paper.

2 The Model

Consider two upstream firms B_1, B_2 produce a homogeneous input and sell to three downstream firms D_1, D_2, D_3. One unit of input is transferred into one unit of output and the downstream firms each produces a differentiated good. Assume that firms in both the upstream and the downstream market compete a la Cournot. Following H*ä*ckner (2000, 2003), the final consumers' preference takes the following form:

$$U(q, I) = \sum_{i=1}^{3} q_i - \frac{1}{2}\left(\sum_{i=1}^{3} q_i^2 + 2\gamma \sum_{i\neq j} q_i q_j\right) + I. \quad (1)$$

Rearrange the utility function, we get:

$$U(q) = \sum_{i=1}^{3} q_i - \frac{\gamma}{2}\left(\sum_{i=1}^{3} q_i\right)^2 - \frac{1-\gamma}{2}\sum_{i=1}^{3} q_i^2. \quad (2)$$

That is, the utility is quadratic in the consumption of three downstream goods. The parameter $\gamma \in [-1, 1]$ measures substitutability among the final goods in the downstream markets. For $\gamma \in (0, 1]$, the two final goods are substitutes; for $\gamma \in [-1, 0)$, the two final goods are complements. The consumers maximize utility subject to the following budget constraint:

$$\sum_{i=1}^{3} p_i q_i + I \leq \sum_{i=1}^{3} \pi_i + \sum_{j=1}^{3} \Pi_j, \quad (3)$$

where $\sum_{i=1}^{3} \pi_i$ and $\sum_{j=1}^{3} \Pi_j$ denote the aggregate downstream and upstream profits, respectively. With the first-order condition determining the optimal consumption of good i being

$$\frac{\partial U}{\partial q_i} = 1 - q_i - \gamma(q_j + q_k) - p_i = 0, i \neq j \neq k, \quad (4)$$

Hence, firm i's inverse demand is given by

$$p_i = 1 - q_i - \gamma(q_j + q_k), i \neq j \neq k, \quad (5)$$

Assume that the upstream firms produce the input at zero cost. To procure the input from the upstream market, independent downstream firms or horizontally merged firms

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pay the per unit market input price w, which they take as given. The vertically merged firm can acquire the input from its upstream division at zero cost. The total downstream production constitutes the derived demand for input. w is determined by equating the input demand and the input supply. We use backward induction to solve for the subgame perfect Nash equilibrium.

3 The Successive Model

In March 2018, two computer chip leaders brought about a number of concerns on the development of the next generation of mobile networks. Broadcom Ltd. planned to bid for its rival Qualcomm Inc. to about 117 billion dollars, in an attempt to force what could be the largest-ever technology deal. Intel, the leading semiconductor company, mulled a bid for Broadcom, according to a report from The Wall Street Journal (March 11, 2018). The newspaper said that Intel worried about the power a combined Broadcom and Qualcomm would hold. In response, it could make an offer to buy Broadcom.

Although the merger did not take place in the end, we adopt this case to our model. As mentioned before, we consider the case that there are two upstream firms B_1 and B_2 producing a homogeneous input and selling it to three downstream firms D_1, D_2 and D_3. $B_1 + D_1$ have formed a vertically merged firm such as Intel and will trade in the upstream market. D_2 and D_3 are assumed to be Broadcom Ltd. and Qualcomm Inc., respectively, since they are in charge of manufacturing and selling chips. In the following model, we will prove that if the horizontal merger $D_2 + D_3$ decreases the profit of the vertically merged firm $B_1 + D_1$, $B_1 + D_1$ would take actions to preempt the horizontal merger $D_2 + D_3$.

In order to incorporate all the features of interest, we analyze a three-stage game. In the first stage, the bidding stage, a horizontally and a vertically related firm have different incentives to acquire a downstream firm. As long as the horizontal merger occurs and it decreases the profit of the incumbent vertically merged firm, we enter the second stage. The vertical merged firm will preempt the horizontal merger by merging with one of the downstream firms. In the last stage, to compete with the incumbent vertically merged firm, another vertical merger will occur. However, the profit of the

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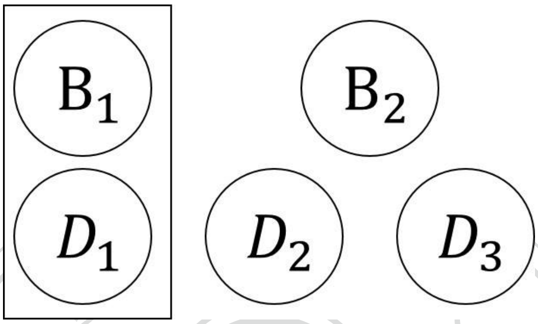
incumbent vertically merged firm will decrease, thus, it will preempt another vertical merger by merging with all of downstream firms.

3.1 A Vertically Merged Firm, a Non-Merged Upstream Firm and Two Non-Merged Downstream Firms



As mentioned before, let $s > 0$ be the input that the vertically merged firm $B_1 + D_1$ sells in the upstream market. On the other hand, firm $B_1 + D_1$ buys the input in the upstream market if $s < 0$. Besides, s can be equally divided into two parts, s_2 and s_3. Furthermore, b is the input that the independent upstream firm B_2 sells or buys in the upstream market. Similarly, b can be equally divided into two parts, b_2 and b_3. The downstream firms' objective functions are therefore given as follows:

$$\max_{q_1} \pi_{B_1+D_1} = p_1 q_1 + w(s_2 + s_3). \tag{6}$$

$$\max_{q_2} \pi_{D_2} = (p_2 - w)q_2. \tag{7}$$

$$\max_{q_3} \pi_{D_3} = (p_3 - w)q_3. \tag{8}$$

Downstream profit maximization yields the following equilibrium quantities as functions of w:

$$q_1^*(w) = -\frac{2 - w\gamma - \gamma + 2}{2(\gamma^2 - \gamma - 2)},\ q_2^*(w) = \frac{2w + \gamma - 2}{2(\gamma^2 - \gamma - 2)},\ q_3^*(w) = \frac{2w + \gamma - 2}{2(\gamma^2 - \gamma - 2)}. \tag{9}$$

Combining equation (9) and the upstream market-clearing condition,

$$s_2 + b_2 + s_3 + b_3 = q_2^*(w) + q_3^*(w). \tag{10}$$

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We derive the inverse demand for the intermediate good as follows:

$$w = \frac{(\gamma-2)(s_2\gamma+b_2\gamma+s_3\gamma+b_3\gamma-1+s_2+b_2+s_3+b_3)}{2}. \tag{11}$$

In the upstream market, given the equilibrium downstream production quantities, firm B_1+D_1 chooses s, firm B_2 chooses b to maximize their profits. Upstream profit maximization yields:

$$\begin{aligned} s_i &= \frac{2\gamma^2+\gamma-2}{4\gamma^3+\gamma^2-9\gamma-6}, \forall i \in \{2,3\}, \\ b_i &= \frac{\gamma^2-2\gamma-2}{(\gamma+1)4\gamma^2-3\gamma+6}, \forall i \in \{2,3\}. \end{aligned} \tag{12}$$

Accordingly, the equilibrium input price, downstream prices and downstream product quantities for firm B_1+D_1 and the independent downstream firm D_2 and D_3 are as follows:

$$\begin{aligned} w^{1U2D} &= \frac{(\gamma-2)(2\gamma^2+\gamma-2)}{2(4\gamma^2-3\gamma-6)}, \\ p_1^{1U2D} &= -\frac{2\gamma^2-5\gamma+6}{2(4\gamma^2-3\gamma-6)}, \\ p_i^{1U2D} &= \frac{2\gamma^3-3\gamma^2+2\gamma-4}{2(4\gamma^2-3\gamma-6)}, \forall i \in \{2,3\}, \\ q_1^{1U2D} &= -\frac{2\gamma^2-5\gamma+6}{2(4\gamma^2-3\gamma-6)}, \\ q_i^{1U2D} &= \frac{3\gamma-4}{4\gamma^2-3\gamma-6}, \forall i \in \{2,3\}. \end{aligned} \tag{13}$$

The profits of the firm B_1+D_1, D_2 and D_3 are now:

$$\begin{aligned} \pi_{B_1+D_1}^{1U2D} &= \frac{(5\gamma+2)(2\gamma^2-3\gamma-1)(2\gamma^2-\gamma-2)}{4(4\gamma^2-3\gamma-6)^2(\gamma+1)}, \\ \pi_{D_i}^{1U2D} &= \frac{(3\gamma-4)^2}{(4\gamma^2-3\gamma-6)^2}, \forall i \in \{2,3\}. \end{aligned} \tag{14}$$

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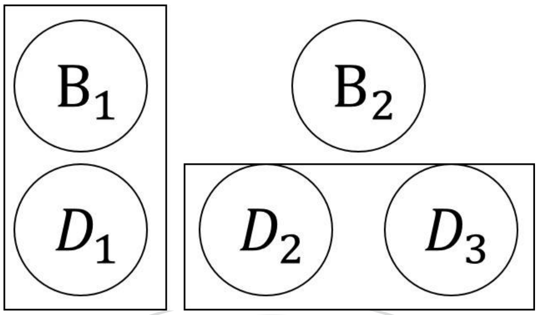
3.2 A Vertically Merged Firm, a Horizontally Merged Firm and a Non-Merged Upstream Firm



Now, we examine the influence on the vertically merged firm B_1+D_1 when downstream horizontal merger $D_2 + D_3$ occurs. In other words, when Broadcom Ltd. merges with Qualcomm Inc., are Intel's profit being affected?

The downstream firms' objective functions are given as follows:

$$\max_{q_1} \pi_{B_1+D_1} = p_1q_1 + w(s_2 + s_3). \tag{15}$$

$$\max_{q_2,q_3} \pi_{D_2+D_3} = (p_2 - w)q_2 + (p_3 - w)q_3. \tag{16}$$

s is the input that the vertically merged firm $B_1 + D_1$ sells or buys. Besides, $s = s_2 + s_3$ and $s_2 = s_3$. Downstream profit maximization yields the following equilibrium quantities as functions of w:

$$q_1^*(w) = -\frac{1 + w\gamma}{\gamma^2 - 2\gamma - 2},\ q_2^*(w) = \frac{-2 + \gamma + 2w}{2(\gamma^2 - 2\gamma - 2)},\ q_3^*(w) = \frac{-2 + \gamma + 2w}{2(\gamma^2 - 2\gamma - 2)}. \tag{17}$$

Combining equation (17) and the upstream market-clearing condition,

$$s_2 + b_2 + s_3 + b_3 = q_2^*(w) + q_3^*(w). \tag{18}$$

Similarly, the input that the firm B_2 sells or buys is b. Besides, $b = s_2 + b_3$ and $b_2 = b_3$. We derive the inverse demand for the intermediate good as follows:

$$w = \frac{1}{2}s_2\gamma^2 - s_2\gamma - s_2 + \frac{1}{2}b_2\gamma^2 - b_2\gamma - b_2 + \frac{1}{2}s_3\gamma^2 - s_3\gamma - s_3 + \frac{1}{2}b_3\gamma^2 - b_3\gamma - b_3 + 1 - \frac{1}{2}\gamma. \tag{19}$$

In the upstream market, given the equilibrium downstream production quantities, firm $B_1 + D_1$ chooses s, firm B_2 chooses b to maximize their profits. Upstream profit maxi-

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mization yields:

$$s_i = \frac{\gamma^3 - 3\gamma^2 - \gamma + 2}{2\gamma^4 - 7\gamma^3 - \gamma^2 + 12\gamma + 6}, \forall i \in \{2,3\},$$
$$b_i = \frac{\gamma^3 - 4\gamma^2 + 4\gamma + 4}{2(\gamma^2 - 2\gamma - 2)(2\gamma^2 - 3\gamma - 3)}, \forall i \in \{2,3\}. \tag{20}$$

Accordingly, the equilibrium input price, downstream price and production for the vertically merged firm and the horizontally merged firm are:

$$w^{1U} = \frac{\gamma^3 - 3\gamma^2 - \gamma - 2}{2(2\gamma^2 - 3\gamma - 3)},$$
$$p_1^{1U} = -\frac{\gamma^2 - \gamma + 3}{2(2\gamma^2 - 3\gamma - 3)},$$
$$p_i^{1U} = \frac{\gamma^3 - 2\gamma - 2}{2(2\gamma^2 - 3\gamma - 3)}, \forall i \in \{2,3\},$$
$$q_1^{1U} = -\frac{\gamma^2 - \gamma + 3}{2(2\gamma^2 - 3\gamma - 3)},$$
$$q_i^{1U} = \frac{3\gamma - 4}{2(2\gamma^2 - 3\gamma - 3)}, \forall i \in \{2,3\}. \tag{21}$$

The profits of the firm $B_1 + D_1$, firm $D_2 + D_3$ and the firm B_2 are:

$$\pi_{B_1+D_1}^{1U} = \frac{(\gamma^2 - \gamma - 1)(5\gamma^4 - 23\gamma^3 + 19\gamma^2 + 20\gamma + 2)}{4(2\gamma^2 - 3\gamma - 3)^2(\gamma^2 - 2\gamma - 2)},$$
$$\pi_{D_2+D_3}^{1U} = \frac{(\gamma + 1)(3\gamma - 4)^2}{2(2\gamma^2 - 3\gamma - 3)^2},$$
$$\pi_{B_2}^{1U} = \frac{(\gamma^3 - 3\gamma^2 - \gamma + 2)(\gamma^3 - 4\gamma^2 + 4\gamma + 4)}{2(2\gamma^2 - 3\gamma - 3)^2(\gamma^2 - 2\gamma - 2)}. \tag{22}$$

Given a vertically merged firm $B_1 + D_1$, and then adopting from Colangelo (1995), an upstream firm B_2 knows that it will bid a maximum of $\pi_{B_2+D_2}^v - \pi_{B_2}^h$ and a downstream firm D_3 will bid a maximum of $\pi_{D_2+D_3}^h - \pi_{D_3}^v$. Hence, D_3 will win the bid game and a horizontal merger will take place if and only if $\pi_{D_2+D_3}^h - \pi_{D_3}^v > \pi_{B_2+D_2}^v - \pi_{B_2}^h$.

Lemma 1 *Given the vertically merged firm $B_1 + D_1$, the downstream horizontal merger $D_2 + D_3$ will occur when $-0.517 < \gamma < 1$. That is, the downstream firm D_3's incentive to merge with D_2 is stronger than the upstream firm B_2's incentive. Specifically, $\pi_{D_2+D_3}^{1U} - \pi_{D_3}^{1D} > \pi_{B_2+D_2}^{1D} - \pi_{B_2}^{1U}$, where $\pi_{D_2+D_3}^{1U}$ is the profit of the horizontal merged firm when there are one horizontally merged firm, one vertically merged firm and one independent upstream firm in the market, $\pi_{D_3}^{1D}$ is the profit of the independent downstream firm*

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when there are two vertically merged firms and one independent downstream firm in the market, $\pi^{1D}_{B_2+D_2}$ *is the profit of the vertically merged firm when there are two vertically merged firms and one independent downstream firm in the market,* $\pi^{1U}_{B_2}$ *is the profit of the independent upstream firm when there are one vertically merged firm, one horizontally merged firm and one independent upstream firm in the market.*

Proof.

After considering the case that the horizontal merger D_2+D_3 occurs, we move on to the case that the vertical merger B_2+D_2 occurs. The downstream firms' objective functions are given as follows:

$$\max_{q_1} \pi_{B_1+D_1} = p_1q_1 + ws. \tag{23}$$

$$\max_{q_2} \pi_{B_2+D_2} = p_2q_2 + wb. \tag{24}$$

$$\max_{q_3} \pi_{D_3} = (p_3 - w)q_3. \tag{25}$$

Downstream profit maximization yields the following equilibrium quantities as functions of w:

$$q_1^*(w) = -\frac{w\gamma - \gamma + 2}{2(\gamma^2 - \gamma - 2)},\ q_2^*(w) = \frac{w\gamma - \gamma + 2}{2(\gamma^2 - \gamma - 2)},\ q_3^*(w) = \frac{w\gamma + 2w + \gamma - 2}{2(\gamma^2 - \gamma - 2)}. \tag{26}$$

Combining equation (26) and the upstream market-clearing condition,

$$s + b = q_3^*(w). \tag{27}$$

We derive the inverse demand for the intermediate good as follows:

$$w = \frac{(\gamma - 2)(2b\gamma + 2s\gamma - 1 + 2s + 2b)}{\gamma + 2}. \tag{28}$$

In the upstream market, given the equilibrium downstream production quantities, firm $B_1 + D_1$ chooses s , firm $B_2 + D_2$ chooses b to maximize their profits. Upstream profit maximization yields:

$$s = \frac{\gamma^2 + 2\gamma - 4}{2(3\gamma^3 + 5\gamma^2 - 12\gamma - 12)},$$
$$b = \frac{\gamma^2 + 2\gamma - 4}{2(3\gamma^3 + 5\gamma^2 - 12\gamma - 12)}. \tag{29}$$

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Accordingly, the equilibrium input price, downstream price and production for the vertically merged firm and the horizontally merged firm are:

$$
\begin{aligned}
w^{1D} &= -\frac{(\gamma^3-3\gamma^2-\gamma-2)(\gamma-2)}{3\gamma^3+5\gamma^2-12\gamma-12},\\
p_i^{1D} &= \frac{(2\gamma+3)(\gamma-2)}{3\gamma^3+5\gamma^2-12\gamma-12}, \forall i \in \{1,2\},\\
p_3^{1D} &= -\frac{\gamma^3-6\gamma^2+2\gamma+8}{3\gamma^3+5\gamma^2-12\gamma-12},\\
q_i^{1D} &= \frac{(2\gamma+3)(\gamma-2)}{3\gamma^3+5\gamma^2-12\gamma-12}, \forall i \in \{1,2\},\\
q_3^{1D} &= \frac{\gamma^2+2\gamma-4}{3\gamma^3+5\gamma^2-12\gamma-12},
\end{aligned}
\tag{30}
$$

The profits of the firm B_1+D_1, firm B_2+D_2 and firm D_3 are:

$$
\begin{aligned}
\pi_{B_1+D_1}^{1D} = \pi_{B_2+D_2}^{1D} &= -\frac{(\gamma-2)(\gamma^4-9\gamma^3-20\gamma^2+38\gamma+44)}{2(3\gamma^3+5\gamma^2-12\gamma-12)^2},\\
\pi_{D_3}^{1D} &= \frac{(\gamma^2+2\gamma-4)^2}{(3\gamma^3+5\gamma^2-12\gamma-12)^2}.
\end{aligned}
\tag{31}
$$

Then, the maximal bid from an downstream firm D_3 to merge with a downstream firm D_2 is:

$$
\begin{aligned}
\pi_{D_2+D_3}^{1U} - \pi_{D_3}^{1D} =& \frac{81\gamma^9+127\gamma^8-953\gamma^7-985\gamma^6}{2(2\gamma^2-3\gamma-3)^2(3\gamma^3+5\gamma^2-12\gamma-12)^2}\\
& \frac{+3972\gamma 5+2318\gamma^4-5928\gamma^3-3336\gamma^2+3168\gamma+2016}{2(2\gamma^2-3\gamma-3)^2(3\gamma^3+5\gamma^2-12\gamma-12)^2}
\end{aligned}
\tag{32}
$$

And the maximal bid from an upstream firm B_2 to merge with a downstream firm D_2 is:

$$
\begin{aligned}
\pi_{B_2+D_2}^{1D} - \pi_{B_2}^{1U} =& -\frac{9\gamma^{12}+52\gamma^{11}-221\gamma^{10}-575\gamma^9+1311\gamma^8+2235\gamma^7}{2(3\gamma^3+5\gamma^2-12\gamma-12)^2(2\gamma^2-3\gamma-3)^2(\gamma^2-2\gamma-2)}\\
& \frac{-2081\gamma^6-4878\gamma^5-264\gamma^4+5328\gamma^3+2412\gamma^2-2160\gamma-1296}{2(3\gamma^3+5\gamma^2-12\gamma-12)^2(2\gamma^2-3\gamma-3)^2(\gamma^2-2\gamma-2)}
\end{aligned}
\tag{33}
$$

Compare the bidding function above, we get:

$\pi_{D_2+D_3}^{1U} - \pi_{D_3}^{1D} > \pi_{B_2+D_2}^{1D} - \pi_{B_2}^{1U}, -0.517 < \gamma < 1.$

Therefore, we know that given a vertically merged firm B_1+D_1, a downstream horizontal

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merger $D_2 + D_3$ will occur when $-0.517 < \gamma < 1$. Since if there are two vertical merger $B_1 + D_1$ and $B_2 + D_2$ occurs, an independent downstream firm D_3 will have no choice but buy the input at much higher cost.

Theorem 1 *When $-0.517 < \gamma < 0$, the downstream horizontal merger $D_2 + D_3$ will decrease the profit of the vertically merged firm $B_1 + D_1$. On the other hand, when $\gamma > 0$, the downstream horizontal merger $D_2 + D_3$ will increase the profit of the vertically merged firm $B_1 + D_1$.*

Proof.

$$\begin{aligned}
\pi^{1U}_{B_1+D_1} &= \frac{(\gamma^2-\gamma-1)(5\gamma^4-23\gamma^3+19\gamma^2+20\gamma+2)}{4(2\gamma^2-3\gamma-3)^2(\gamma^2-2\gamma-2)}, \\
\pi^{1U2D}_{B_1+D_1} &= \frac{(5\gamma+2)(2\gamma^2-3\gamma-1)(2\gamma^2-\gamma-2)}{4(4\gamma^2-3\gamma-6)^2(\gamma+1)}, \\
\pi^{1U}_{B_1+D_1} &< \pi^{1U2D}_{B_1+D_1}, if -0.517 < \gamma < 0, \\
\pi^{1U}_{B_1+D_1} &> \pi^{1U2D}_{B_1+D_1}, if \gamma > 0.
\end{aligned} \tag{34}$$

When final goods are complements, the derived demand is elastic. Therefore, the vertically merged firm $B_1 + D_1$ has an incentive to sell the intermediate good to lower the input price. However, the percentage decline in the input price is greater than the percentage increase in quantities. This is the reason why the profit of the vertically merged firm will decrease when $-0.517 < \gamma < 0$. On the other hand, when final goods are substitutes, the derived demand is inelastic. The vertically merged firm $B_1 + D_1$ has an incentive to buy the intermediate good to raise the input price and its profit will increase.

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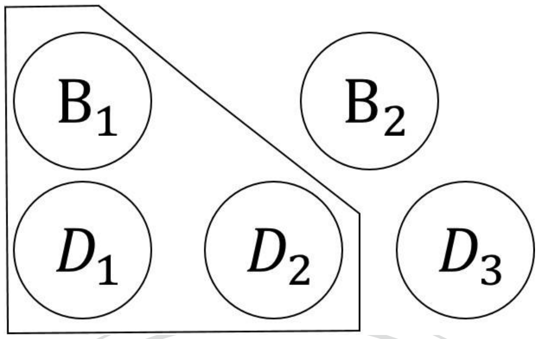
3.3 A Vertically Merged Firm Preempts the Horizontal Merger by Merging with the Downstream Firm



We know that the profit of the vertically merged firm $B_1 + D_1$ will decrease because of the downstream horizontal merger when $-0.517 < \gamma < 0$, thus, it will take actions to preempt the horizontal merger. There are two ways to achieve the goal. One is merging with either a downstream firm D_2 or D_3. The other is merging with the independent upstream firm B_2 and setting the input price which leaves two downstream firms D_2 and D_3 no incentives to merge.

We first consider the case that the vertically merged firm $B_1 + D_1$ preempts the horizontal merger $D_2 + D_3$ by merging with the downstream firm D_2. The downstream firms' objective functions are given as follows:

$$\max_{q_1,q_2} \pi_{B_1+D_1+D_2} = p_1 q_1 + p_2 q_2 + ws. \tag{35}$$

$$\max_{q_3} \pi_{D_3} = (p_3 - w) q_3. \tag{36}$$

Downstream profit maximization yields the following equilibrium quantities as functions of w:

$$q_1^*(w) = -\frac{w\gamma - \gamma + 2}{2(\gamma^2 - 2\gamma - 2)},\ q_2^*(w) = -\frac{w\gamma - \gamma + 2}{2(\gamma^2 - 2\gamma - 2)},\ q_3^*(w) = \frac{w\gamma + w - 1}{\gamma^2 - 2\gamma - 2}. \tag{37}$$

Combining equation (35) and the upstream market-clearing condition,

$$s + b = q_3^*(w). \tag{38}$$

We derive the inverse demand for the intermediate good as follows:

$$w = \frac{-2s\gamma - 2s + s\gamma^2 - 2b\gamma - 2b + b\gamma^2 + 1}{\gamma + 1}. \tag{39}$$

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In the upstream market, given the equilibrium downstream production quantities, firm $B_1 + D_1 + D_2$ chooses s and firm B_2 chooses b to maximize their profits. Upstream profit maximization yields:

$$
\begin{aligned}
s &= \frac{\gamma^3 - 2\gamma^2 - \gamma + 1}{2\gamma^4 - 7\gamma^3 - \gamma^2 + 12\gamma + 6}, \\
b &= -\frac{\gamma^3 - 4\gamma - 2}{2(\gamma^2 - 2\gamma - 2)(2\gamma^2 - 3\gamma - 3)}.
\end{aligned} \tag{40}
$$

Accordingly, the equilibrium input price, downstream prices and downstream production quantities for the merged firm and independent firm are:

$$
\begin{aligned}
w^P &= \frac{\gamma^3 - 4\gamma - 2}{2(\gamma + 1)(2\gamma^2 - 3\gamma - 3)}, \\
p_i^P &= \frac{3\gamma^2 - 4\gamma - 6}{4(2\gamma^2 - 3\gamma - 3)}, \forall i \in \{1, 2\}, \\
p_3^P &= \frac{\gamma^3 + \gamma^2 - 5\gamma - 4}{2(\gamma + 1)(2\gamma^2 - 3\gamma - 3)}, \\
q_i^P &= \frac{3\gamma^2 - 4\gamma - 6}{4(\gamma + 1)(2\gamma^2 - 3\gamma - 3)}, \forall i \in \{1, 2\}, \\
q_3^P &= \frac{\gamma - 2}{2(2\gamma^2 - 3\gamma - 3)}.
\end{aligned} \tag{41}
$$

The profits of the firm $B_1 + D_1 + D_2$, firm B_2 and firm D_3 are:

$$
\begin{aligned}
\pi_{B_1+D_1+D_2} &= \frac{(\gamma - 2)(13\gamma^5 - 24\gamma^4 - 58\gamma^3 + 48\gamma^2 + 108\gamma + 40)}{8(\gamma + 1)(2\gamma^2 - 3\gamma - 3)^2(\gamma^2 - 2\gamma - 2)}, \\
\pi_{B_2} &= -\frac{(\gamma^3 - 4\gamma - 2)^2}{4(\gamma + 1)(2\gamma^2 - 3\gamma - 3)^2(\gamma^2 - 2\gamma - 2)}, \\
\pi_{D_3} &= \frac{(\gamma - 2)^2}{4(2\gamma^2 - 3\gamma - 3)^2}.
\end{aligned} \tag{42}
$$

Theorem 2 *Between two ways to preempt the downstream horizontal merger $D_2 + D_3$, it is more profitable for the vertically merged firm $B_1 + D_1$ to merge with a downstream firm D_2 or D_3 than merge with an independent upstream firm B_2.*

Proof.

$$
\begin{aligned}
\pi_{B_1+D_1}^{1U} &= \frac{(\gamma^2 - \gamma - 1)(5\gamma^4 - 23\gamma^3 + 19\gamma^2 + 20\gamma + 2)}{4(2\gamma^2 - 3\gamma - 3)^2(\gamma^2 - 2\gamma - 2)}, \\
\pi_{B_1+D_1+D_2} &= \frac{(\gamma - 2)(13\gamma^5 - 24\gamma^4 - 58\gamma^3 + 48\gamma^2 + 108\gamma + 40)}{8(\gamma + 1)(2\gamma^2 - 3\gamma - 3)^2(\gamma^2 - 2\gamma - 2)}, \\
\pi_{B_1+D_1+D_2} &> \pi_{B_1+D_1}^{1U}, -0.517 < \gamma < 0.
\end{aligned} \tag{43}
$$

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We compare the profit of the vertically merged firm when it preempts the horizontal merger to that in the case that it does not preempt. We find that it is more profitable to preempt the horizontal merger.

After considering the case that the vertically merged firm $B_1 + D_1$ preempts the horizontal merger $D_2 + D_3$ by merging a downstream firm D_2 or D_3, we move on to the case that it preempts the horizontal merger $D_2 + D_3$ by merging with an independent upstream firm B_2 and then setting an input price which makes two downstream firms D_2 and D_3 have no incentive to merge with each other. The downstream firms' objective functions are given as follows:

$$\max_{q_1} \pi_{B_1+D_1+B_2} = p_1 q_1 + w(s_2 + s_3). \tag{44}$$

$$\max_{q_2} \pi_{D_2} = (p_2 - w) q_2. \tag{45}$$

$$\max_{q_3} \pi_{D_3} = (p_3 - w) q_3. \tag{46}$$

As mentioned before, the input that the vertically merged firm $B_1 + D_1 + B_2$ sells or buys is s. Besides, $s = s_2 + s_3$ and $s_2 = s_3$. Downstream profit maximization yields the following equilibrium quantities as functions of w:

$$q_1^*(w) = -\frac{2w\gamma - \gamma + 2}{2(\gamma^2 - \gamma - 2)},\ q_2^*(w) = \frac{2w + \gamma - 2}{2(\gamma - 2)(\gamma + 1)},\ q_3^*(w) = \frac{2w + \gamma - 2}{2(\gamma^2 - \gamma - 2)}. \tag{47}$$

Combining equation (45) and the upstream market-clearing condition,

$$s_2 + s_3 = q_2^*(w) + q_3^*(w). \tag{48}$$

We derive the inverse demand for the intermediate good as follows:

$$w = \frac{(s_2\gamma + s_2 + s_3\gamma + s_3 - 1)(\gamma - 2)}{2}. \tag{49}$$

In the upstream market, given the equilibrium downstream production quantities, firm $B_1 + D_1$ chooses s and let two downstream firms' profits equal to $\frac{(\gamma+1)(3\gamma-4)^2}{2(2\gamma^2-3\gamma-3)^2}$ which is the profit that they merge horizontally, we get:

$$s_i = \frac{\sqrt{\gamma + 1}(3\gamma - 4)}{2(2\gamma^2 - 3\gamma - 3)}, \forall i \in \{2, 3\}. \tag{50}$$

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The profit of the vertically merged firm $B_1 + D_1 + B_2$ is:

$$\pi_{B_1+D_1+B_2} = \frac{27\gamma^5 - 24\sqrt{\gamma+1}\gamma^4 - 59\gamma^4 + 92\sqrt{\gamma+1}\gamma^3 - 42\gamma^3}{4(2\gamma^2-3\gamma-3)^2}$$
$$\frac{-80\sqrt{\gamma+1}\gamma^2 + 121\gamma^2 - 36\sqrt{\gamma+1}\gamma + 18\gamma + 48\sqrt{\gamma+1} - 55}{4(2\gamma^2-3\gamma-3)^2} \tag{51}$$

Then, we compare two ways that the vertically merged firm $B_1 + D_1$ can apply to preempt the horizontal merger $D_2 + D_3$, we get:

$$\pi_{B_1+D_1+D_2} > \pi_{B_1+D_1+B_2}, -0.517 < \gamma < 0. \tag{52}$$

Although there are two ways for the vertically merged firm $B_1 + D_1$ to preempt the horizontal merger D_2+D_3, in fact, it will only preempt the horizontal merger by merging with a downstream firm D_2 or D_3. It costs a lot to merge with an upstream firm B_2 since an independent upstream firm B_2 has more market power than a downstream firm D_2 or D_3. Thus, we complete the proof.

Lemma 2 *We consider the case which is different from the previous discussion. That is, there are not only two firms, B_2 and D_3, participate in the bidding game, but the vertically merged firm $B_1 + D_1$ also takes part in. In other words, there are three firms intend to merge with D_2. However, although this bidding game is not the same as before, we obtain the similar outcome. When there are three firms competing to merge with D_2, the vertically merged firm $B_1 + D_1$ offers the highest price when $-0.517 < \gamma < 0.853$. Compared to the Theorem 2 that the vertically merged firm $B_1 + D_1$ merges with D_2 when $-0.517 < \gamma < 0$, the vertically merged firm $B_1 + D_1$ now are more likely to merged with D_2. However, the difference in the upper bound will not bring the serious problem to our later discussion and we can obtain the same conclusion.*

Proof. The vertically merged firm $B_1 + D_1$, the independent upstream firm B_2 and the independent downstream firm D_3 intend to merge with D_2.

We first consider the maximal bid from a vertically merged firm $B_1 + D_1$ to merge with

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a downstream firm D_2:

$$\begin{aligned}
&\pi_{B_1+D_1+D_2} - \pi^{1D}_{B_1+D_1} - \pi^{1U}_{B_1+D_1} \\
&= -\frac{10\gamma^{12} + 17\gamma^{11} - 206\gamma^{10} - 400\gamma^{9} + 1666\gamma^{8} + 3046^{7} - 5896\gamma^{6}}{8(\gamma+1)(2\gamma^2-3\gamma-3)^2(\gamma^2-2\gamma-2)(\gamma+2)^2(\gamma^3+2\gamma^2-4\gamma-4)} \\
&\frac{-9276\gamma^{5} + 7208\gamma^{4} + 12800\gamma^{3} - 432\gamma^{2} - 5632\gamma - 1792}{8(\gamma+1)(2\gamma^2-3\gamma-3)^2(\gamma^2-2\gamma-2)(\gamma+2)^2(\gamma^3+2\gamma^2-4\gamma-4)}.
\end{aligned} \tag{53}$$

The maximal bid from an upstream firm B_2 to merge with a downstream firm D_2 is:

$$\begin{aligned}
&\pi^{1D}_{B_2+D_2} - \pi_{B_2} - \pi^{1U}_{B_2} \\
&= -\frac{2\gamma^{12} - 9\gamma^{11} - 46\gamma^{10} + 176\gamma^{9} + 310\gamma^{8} - 1054\gamma^{7} - 970\gamma^{6}}{4(\gamma+1)(2\gamma^2-3\gamma-3)^2(\gamma^2-2\gamma-2)(\gamma+2)^2(\gamma^3+2\gamma^2-4\gamma-4)} \\
&\frac{+1868\gamma^{5} + 1700\gamma^{4} - 704\gamma^{3} - 752\gamma^{2} + 64\gamma + 96}{4(\gamma+1)(2\gamma^2-3\gamma-3)^2(\gamma^2-2\gamma-2)(\gamma+2)^2(\gamma^3+2\gamma^2-4\gamma-4)}.
\end{aligned} \tag{54}$$

The maximal bid from a downstream firm D_3 to merge with a downstream firm D_2 is:

$$\begin{aligned}
&\pi^{1U}_{D_2+D_3} - \pi_{D_3} - \pi^{1D}_{D_3} \\
&= \frac{18\gamma^{9} + 25\gamma^{8} - 224\gamma^{7} - 60\gamma^{6} + 944\gamma^{5} - 644\gamma^{4} - 656\gamma^{3} + 608\gamma^{2} + 128\gamma - 128}{4(2\gamma^2-3\gamma-3)^2(\gamma^3+2\gamma^2-4\gamma-4)^2}
\end{aligned} \tag{55}$$

Comparing the bidding function above, we get:

$$\begin{aligned}
\pi_{B_1+D_1+D_2} - \pi^{1D}_{B_1+D_1} - \pi^{1U}_{B_1+D_1} &> \pi^{1U}_{D_2+D_3} - \pi_{D_3} - \pi^{1D}_{D_3} \\
&> \pi^{1D}_{B_2+D_2} - \pi_{B_2} - \pi^{1U}_{B_2}, -0.517 < \gamma < 0.853,
\end{aligned} \tag{56}$$

$$\begin{aligned}
\pi^{1U}_{D_2+D_3} - \pi_{D_3} - \pi^{1D}_{D_3} &> \pi_{B_1+D_1+D_2} - \pi^{1D}_{B_1+D_1} - \pi^{1U}_{B_1+D_1} \\
&> \pi^{1D}_{B_2+D_2} - \pi_{B_2} - \pi^{1U}_{B_2}, 0.853 < \gamma < 1.
\end{aligned} \tag{57}$$

Therefore, we know that the vertically merged firm $B_1 + D_1$ offers the highest price to obtain the higher profit by merging with the downstream firm D_2 when $-0.517 < \gamma < 0.853$. It is because as long as the vertically merged firm $B_1 + D_1$ merges with D_2, its output increases. However, when the final goods becomes more substitute, the incentive for the independent downstream firm D_3 to merge with D_2 gets stronger. Since if the vertically merged firm $B_1 + D_1$ merges with D_2, the input price will be higher and the profit of the independent downstream firm D_3 will decrease.

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3.4 A Vertically Merged Firm Preempts the Vertical Merger by Merging with the Downstream Firm

Lemma 3 *The independent upstream firm B_2 will merge with the independent downstream firm D_3 to compete with the vertically merged firm $B_1 + D_1 + D_2$. Both upstream and downstream divisions' profits of the merged firm $B_2 + D_3$ will be higher than they stay independent.*

Proof.

The downstream firms' objective functions are given as follows:

$$\max_{q_1,q_2} \pi_{B_1+D_1+D_2} = p_1 q_1 + p_2 q_2. \tag{58}$$

$$\max_{q_3} \pi_{B_2+D_3} = p_3 q_3. \tag{59}$$

Downstream profit maximization yields the following equilibrium quantities:

$$q_1^* = \frac{\gamma - 2}{2(\gamma^2 - 2\gamma - 2)},\ q_2^*(w) = \frac{\gamma - 2}{2(\gamma^2 - 2\gamma - 2)},\ q_3^*(w) = -\frac{1}{2(\gamma^2 - 2\gamma - 2)}. \tag{60}$$

The profits of the firm $B_1 + D_1 + D_2$ and the firm $B_2 + D_3$ are:

$$\begin{aligned} \pi_{B_1+D_1+D_2} &= \frac{(\gamma+1)(\gamma-2)^2}{2(\gamma^2 - 2\gamma - 2)^2}, \\ \pi_{B_2+D_3} &= \frac{1}{2(\gamma^2 - 2\gamma - 2)^2}. \end{aligned} \tag{61}$$

Then, we compare the sum of independent upstream firm B_2's profit and independent downstream firm D_3's profit to the vertically merged firm's profit $B_2 + D_3$, we find that vertical merger $B_2 + D_3$ will take place.

$$\pi_{B_2+D_3} > \pi_{B_2} + \pi_{D_3}, -0.517 < \gamma < 0. \tag{62}$$

In other words, double vertical mergers $B_1 + D_1 + D_2$ and $B_2 + D_3$ will occur. However, if the double vertical merger occurs, the profit of the vertically merged firm $B_1 + D_1 + D_2$ will decrease. As a result, the vertically merged firm $B_1 + D_1 + D_2$ will preempt the vertical merger $B_2 + D_3$. There are two ways to achieve the goal. One is merging with D_3, the other is buying the intermediate good strategically.

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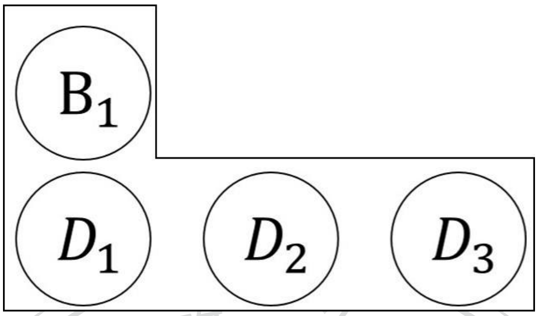
Theorem 3 *Between two ways to preempt another vertical merger $B_2 + D_3$, it is more profitable for the vertically merged firm $B_1 + D_1 + D_2$ to merge with the downstream firm D_3 than buy the intermediate good strategically.*



Proof. First, we consider the case that the vertically merged firm $B_1 + D_1 + D_2$ merges with a downstream firm D_3. The downstream firm's objective function is given as follows:

$$\max_{q_1,q_2,q_3} \pi_{B_1+D_1+D_2+D_3} = p_1q_1 + p_2q_2 + p_3q_3. \tag{63}$$

In this case, the independent upstream firm B_2 no longer exits in the market. The vertically merged firm $B_1 + D_1 + D_2 + D_3$ becomes the monopoly.
Downstream profit maximization yields the following equilibrium quantities:

$$q_i = \frac{1}{2(2\gamma+1)}, \forall i \in \{1, 2, 3\}. \tag{64}$$

The profit of the firm $B_1 + D_1 + D_2 + D_3$ is

$$\pi_{B_1+D_1+D_2+D_3} = \frac{3}{4(2\gamma+1)}. \tag{65}$$

Therefore, we know the gain when the vertically merged firm $B_1 + D_1 + D_2$ merges with D_3. That is, the profit of the vertically merged firm $B_1 + D_1 + D_2 + D_3$ minus the opportunity cost:

$$\pi_{B_1+D_1+D_2+D_3} - \pi_{D_3} = \frac{12\gamma^4 - 38\gamma^3 - 2\gamma^2 + 50\gamma + 23}{4(2\gamma^2 - 3\gamma - 3)^2(2\gamma+1)}. \tag{66}$$

Then, we consider the case that the vertically merged firm $B_1 + D_1 + D_2$ buys the

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intermediate good strategically to preempt the vertical merger $B_2 + D_3$.

Substituting equation (28) into equation (26) and (25), we get the following equilibrium quantities, the non-merged upstream and downstream firm's profit as functions of s_3+b_3:

$$q_1^*(s_3+b_3) = -\frac{s_3\gamma + b_3\gamma - 1}{2(\gamma+1)},\ q_2^*(s_3+b_3) = -\frac{s_3\gamma + b_3\gamma - 1}{2(\gamma+1)},\ q_3^*(s_3+b_3) = s_3 + b_3,$$
$$\pi_{B_2}^*(s_3+b_3) = -\frac{(-2s_3\gamma - 2s_3 + s_3\gamma^2 + 1)^2}{4(\gamma+1)(\gamma^2 - 2\gamma - 2)},\ \pi_{D_3}^*(s_3+b_3) = \frac{(-2s_3\gamma - 2s_3 + s_3\gamma^2 - 1)^2}{4(\gamma^2 - 2\gamma - 2)^2}. \tag{67}$$

As the leader, the vertically merged firm $B_1+D_1+D_2$ will take into account the follower's strategy, that is, the non-merged upstream firm's strategy. Therefore, we can use the first-order condition of the non-merged upstream firm's profit function to get the input that it sells or buys (b_3) as the function of the input that the vertically merged firm $B_1 + D_1 + D_2$ sells or buys (s_3).

$$b_3^* = -\frac{s_3\gamma^2 - 2s_3\gamma - 2s_3 + 1}{2(\gamma^2 - 2\gamma - 2)}. \tag{68}$$

To preempt the vertical merger, the vertically merged firm $B_1+D_1+D_2$ has to make the sum of non-merged upstream and downstream firms' profits at least equal to $\frac{1}{(\gamma^2-2\gamma-2)^2}$ which is the profit of the merged vertical firm $B_2 + D_3$ in the case that double vertical merger occurs. Substituting equation (68) into equation (67) and let the sum of two profits equal to $\frac{1}{(\gamma^2-2\gamma-2)^2}$, we get:

$$s_3^* = -\frac{\gamma^2 + \gamma + 1}{(\gamma^4 - 5\gamma^3 + \gamma^2 + 12\gamma + 6)}. \tag{69}$$

Since $s_1 < 0$ when $\gamma \in (-0.517, 0)$, we can infer that the vertically merged firm $B_1 + D_1 + D_2$ buys the input in the upstream market to raise the input price. As long as the non-merged upstream firm B_2 earns the same profit as the case that double vertical merger occurs, it has no incentive to merge vertically. Therefore, the vertically merged firm $B_1+D_1+D_2$ preempts the vertical merger B_2+D_3. Finally, to ensure the vertically merged firm $B_1 + D_1 + D_2$ will do so, we have to check if its profit in the case that it

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preempts the vertical merger is more than the case that it does not preempt.

$$\pi^*_{B_1+D_1+D_2} = \frac{(\gamma-2)(13\gamma^5 - 24\gamma^4 - 58\gamma^3 + 48\gamma^2 + 108\gamma + 40)}{8(\gamma+1)(\gamma^2-2\gamma-2)(2\gamma^2-3\gamma-3)^2},$$
$$\pi^{2V}_{B_1+D_1+D_2} = \frac{(\gamma+1)(\gamma-2)^2}{2(-2\gamma-2+\gamma^2)^2},$$
$$\pi^*_{B_1+D_1+D_2} > \pi^{2V}_{B_1+D_1+D_2}, -0.517 < \gamma < 1. \tag{70}$$

Therefore, we know that when $-0.517 < \gamma < 0$, a vertically merged firm $B_1 + D_1 + D_2$ buys the intermediate good strategically by the amount of $-\frac{\gamma^2+\gamma+1}{\gamma^4-5\gamma^3+\gamma^2+12\gamma+6}$ so that the input price raises to $-\frac{2}{\gamma^2-3\gamma-3}$ which preempts the vertical merger $B_2 + D_3$.
Finally, we compare equation (66) to the equation (70) to determine which way leads to the higher profit:

$$\pi_{B_1+D_1+D_2+D_3} - \pi_{D_3} > \pi^*_{B_1+D_1+D_2}, -0.5 < \gamma < 0. \tag{71}$$

To conclude, between two ways to preempt another vertical merger $B_2 + D_3$, it costs less for the vertically merged firm $B_1 + D_1 + D_2$ to merge with a downstream firm D_3 than buy the intermediate good strategically since it gains more to be a monopoly.

4 Conclusion

In this paper, we attempt to investigate the strategies that the vertically merged firm will implement to achieve maximal profit. First, we analyze when the horizontal merger $D_2 + D_3$ will occur. Then, we show that a horizontal merger between $D_2 + D_3$ will decrease the profit of the vertically merged firm $B_1 + D_1$. Thus, it will take actions to preempt the horizontal merger $D_2 + D_3$. We further analyze how the vertically merged firm B_1+D_1 preempts subsequent mergers. That is, it will merge with all of downstream firms and become a monopoly.

The theoretical model provides hints about the forces at work in the real world merger events. For example, our model shows in the Broadcom and Qualcomm case, how the vertically merged firm, Intel, will preempt the horizontal merger between Broadcom and Qualcomm. Our model predicts that Intel will merge with one of the independent downstream firms to maintain its profit. Besides, as Intel merging with one of the

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independent downstream firms, the independent upstream firm will also merge with the other independent downstream firm to compete with the Intel. As a result, Intel will merge all of the downstream firms to preempt successive mergers.

This paper investigates sequential merger decisions which is the expansion of the previous literature. However, the model is more complicated than the model in Colangelo (1995) and Gelves and Heywood (2016). Besides, several preempting strategies presented in this paper are not considered before. For example, the control of the intermediate good may be one way to preempt mergers. Furthermore, we even consider all decisions that firms will make in response to the action of the incumbent vertically merged firm. All in all, we carefully look into every possibility of mergers and identify the most profitable strategies for an incumbent firm to preempt its rivals.

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