The Optimal Trading Partner for an Upstream Monopolist

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1 March 2016

The Optimal Trading Partner for an Upstream Monopolist Preliminary version[*,†]

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March 27, 2016

Abstract

We examine an optimal trading partner for an upstream monopolist, an input supplier, in a situation in which the intensity of market competition depends on trading partner choice. The upstream monopolist supplies the input to either the incumbent or the entrant. We assume only incumbent has the outside option which it can make the input by itself and then produces the final product. On the other hand, the entrant does not have the outside option. If the upstream firm chooses the incumbent as its trading partner, it can have a bilateral monopoly relationship with the incumbent. If the upstream firm chooses the entrant as its trading partner, it faces downstream competition. We show trading with the entrant can yield greater profits for the upstream monopolist than trading with the incumbent. Thus, the upstream monopolist has incentives to encourage downstream competition through its trading partner choice. Our paper suggests that the existence of the incumbent's outside option encourages new entry into the downstream market.

JEL Classification: L13; C78

Keywords: Upstream monopolist; Trading partner choice; Bargaining game; Profits; Outside Option

[*] All remaining errors are my own. Comments welcome.

[†] This paper was supported in part by Grants from Showa Women's University.

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1 Introduction

In the context of supplier-buyer relations, a supplier's trading partner affects its revenues and must be chosen carefully. Supplier-buyer relations exist in many industries. For instance, in the automobile industry, suppliers negotiate with buyers and sell parts to car assemblers after reaching an agreement. Japanese car assemblers have recently tended toward setting up production in developing countries to sell fully assembled cars, making these facilities the entrant in developing countries. This affects Japanese suppliers' strategies in choosing their trading partner. When both an incumbent and new entrant exist in the developing country, suppliers must determine which of the two options is the optimal trading partner since different trading partners may have a different impact on their revenues. In the automobile industry, suppliers are often bound to one car assembler with an exclusive contract (Milliou and Petrakis, 2007). Our paper assumes an upstream monopolist and determines its optimal trading partner by considering an exclusive contract between the supplier and the designated buyer.

We provide a simple model to examine the optimal trading partner for the upstream monopolist in the following setting. There is an upstream monopolist (an input supplier) and both an incumbent and entrant firm (two buyers). The incumbent has only the outside option where it can make the input itself and produce the final product. On the other hand, the entrant does not have the outside option. In this scenario, the upstream monopolist first decides with whom to negotiate. Second, it negotiates with one of the two firms and determines a two-part tariff contract. We apply a Nash bargaining approach. In our paper, the number of firms depends on which firm the supplier chooses to negotiate with. If it chooses the entrant and reaches an agreement, the entrant and the incumbent are active in the downstream market, and the two firms compete in quantity. If the supplier negotiates with the incumbent and reaches an agreement, only the incumbent is active in the downstream market.

The analysis provided several results. For the upstream monopolist, trading with the entrant can yield greater profits if the incumbent's outside option is not too efficient or it is closer to the per-unit fee offered to the incumbent. The upstream monopolist prefers to promote market competition by trading exclusively with the entrant, even if its bargaining power against the entrant (the incumbent) is small (large) and the per-unit fee offered to the incumbent is efficient. On the other hand, the incumbent's profit may decrease because the incumbent's outside option may encourage entry.

This paper is related to studies examining the optimal number of trading partners. Chemla (2003) shows that an upstream monopolist has incentives to promote downstream competition to lower downstream bargaining power. The upstream monopolist would want to contract with a number of trading partners to ensure enough downstream competition.[1] Matsushima and Shinohara (2014) examine the factors determining a supplier's number of trading partners and show that a supplier bargains with two buyers if it has higher bargaining power against buyers and a lower or higher variable cost to the value of the good, whereas it bargains with one buyer if it has lower bargaining power and a moderate level of variable costs.[2] Our paper examines the optimal trading partner when the upstream

[1] Chemla (2003) also shows that the upstream firm's profit increases with the number of downstream firms in the case of upstream competition.

[2] Matsushima and Shinohara (2014) also consider a situation where the supplier endogenously determines its quality investment level and show that the equilibrium investment level can be higher when the supplier bargains with one buyer rather than two buyers, and if it has low efficiency quality investment, its bargaining power against the buyers is weak, and its variable costs are high.

monopolist negotiates exclusively with its buyer assuming only one of the two buyers has an outside option.

This paper is also related to studies of equilibrium market structures. Inderst and Wey (2003) analyze the equilibrium up and downstream market structures in bilateral oligopolistic markets by considering bargaining, mergers, and technology choices. They show that incentives for downstream mergers depend on upstream firms' cost efficiency and suggest that downstream firms should strategically choose a particular market structure that affects upstream firms' technology levels. The incentives for upstream mergers depends on whether the goods are substitutes or complements. However, they do not discuss the relationship between bargaining power and the number of trading partners, as Matsuhima and Shinohara (2014) discuss and we examine here.

This paper also is related to investigations of upstream firm incentives to promote downstream competition. Caprice (2005) shows that a cost-efficient upstream firm can obtain higher profits with the number of downstream firms under upstream competition because the rent-shifting effect dominates the profit-reducing effect resulting from an increase in a number of firms.[3] Sandonis (2012) presents a similar result by considering observable contracts and free-entry in a downstream market. Our paper examines whether the upstream monopolist has incentives to promote downstream competition under secret contracts when it chooses its optimal trading partner.

The rest of the paper is organized as follows. Section 2 presents the model and Section 3 presents the analysis of quantity competition. Section 4 concludes the paper.

2 The Model

We consider a market with an upstream monopolist and two downstream firms. We assume that the two downstream firms compete on quantity. One of the two downstream firms is the incumbent (I) and the other is a new entrant (E).

Firm i ($i = E, I$) transforms one unit of input into one unit of final product. The upstream monopolist supplies the input to firm i if they agree on a trading contract. We assume that the upstream monopolist offers a contract to either firm.[4] If firm i accepts the offer from the upstream monopolist, it can buy the input. However, if firm i rejects the offer from the upstream monopolist, it cannot buy the input. Only firm I has the outside option in which it manufactures the input itself and then produces the final product.

Note that the number of downstream firms depends on the outcome of bargaining among the firms. If the upstream monopolist agrees with firm E, the downstream market is a duopoly because firm I can itself make the input. If the upstream monopolist reaches an agreement with firm I, the downstream market is a monopoly because firm E cannot produce its final product without the upstream monopolist's input. That is, the upstream monopolist has a bilateral monopoly relationship with its buyer.

Let q_i ($i = E, I$) denote the quantity supplied by downstream firm i. The inverse demand function is $p(q_E, q_I)$ ($p(q_I)$) if the downstream market is a duopoly (monopoly). The upstream monopolist has constant marginal cost

[3] Caprice (2005) uses a bilateral oligopoly model and assumes upstream competition. He also assumes secret contracts between the upstream firm and its buyer, as we do here.

[4] We assume that the upstream monopolist cannot supply more than one buyer. We set this assumption to examine its optimal trading partner when it trades exclusively with one buyer. This reflects the technical difficulty of simultaneously supplying components to buyers (see Fisher et al. 1999; Ramdas and Sawhney 2001; and Ramdas and Randall 2008 for details).

production, c_i ($i = E, I$). Firm i incurs a two-part tariff, $w_i q_i + T_i$ if it contracts with the upstream monopolist, where w_i is a per-unit fee and T_i is a fixed fee. Firm I must incur a marginal input cost m_I if it makes the input itself. If firm I contracts with the upstream monopolist, its marginal input cost c_I is lower than m_I. To simplify the analysis, we assume that $c_E \leq c_I < m_I$.

We consider a three-period game. Period 1 occurs before negotiations, when the upstream monopolist determines the firm it will negotiate with first. If it chooses firm E (firm I) as the first negotiator, at stage 1 in period 2, it negotiates with firm E (firm I). If there is an agreement at negotiation at stage 1, firms E and I are active (only firm I is active) in the downstream market and the game goes to period 3; otherwise, the upstream monopolist negotiates with firm I (firm E) at stage 2 in period 2. If there is an agreement during negotiations in stage 2, only firm I is active (firms E and I are active) in the downstream market and the game goes to period 3; otherwise, the upstream monopolist is inactive and only firm I is active in the downstream market. In period 2, a contracting pair determines a two part tariff contract. In period 3, the two firms compete in quantity.

3 Analysis

We consider two sub-games that follow the decision in period 1: (i) the upstream monopolist negotiates with firm E at stage 1 in period 2 and (ii) the upstream monopolist negotiates with firm I at stage 1 in period 2. We first assume a general demand function and solve the two sub-games.

3.1 Case 1: The entrant is the first negotiator

We solve the bargaining game in case 1 through backward induction. At stage 2 in period 2, the upstream monopolist negotiates with firm I. Given the two-part tariff contract, the profit for firm I is

$$\pi_I^M(q_I, w_I) = (p(q_I) - w_I)q_I - T_I^1.$$

, where the superscript 1 indicates case 1. Given the per-unit fee w_I, the first-order conditions of firm I to maximize profit is

$$\frac{\partial \pi_I^M(q_I, w_I)}{\partial q_I} = \frac{\mathrm{d}p(q_I)}{\mathrm{d}q_I} q_I + p(q_I) - w_I = 0. \tag{1}$$

From equation (1), the output is $q_I^M(w_I)$. The profit is

$$\pi_I^M(w_I) = (p(q_I^M(w_I)) - w_I)q_I^M(w_I) - T_I^1.$$

The upstream monopolist's profit is

$$\Pi_I^M(w_I) = (w_I - c_I)q_I^M(w_I) + T_I^1.$$

The upstream monopolist can take profit of firm i by imposing a fixed fee on firm i. Thus, it sets an optimal per-unit fee that maximizes the joint profits for the contracting pair, the upstream monopolist and firm I. The joint profit is given by

$$\Pi_I^M(w_I) + \pi_I^M(w_I) = (w_I - c_I)q_I^M(w_I) + (p(q_I^M(w_I)) - w_I)q_I^M(w_I).$$

We can get the following equation from the first-order conditions that maximize the joint profit:

$$\{-c_I + \frac{\mathrm{d}p(q_I^M(w_I))}{\mathrm{d}q_I^M(w_I)} q_I^M(w_I) + p(q_I^M(w_I))\} \frac{\mathrm{d}q_I^M(w_I)}{\mathrm{d}w_I} = 0$$

, where $\frac{\mathrm{d}q_I^M(w_I)}{\mathrm{d}w_I} < 0$. From the envelope theorem, the optimal per-unit fee is $w_I^* = c_I$. That is, the upstream monopolist sets an optimal per-unit fee equal to its marginal cost. Thus, the equilibrium output is $q_I^M(c_I)$ and the equilibrium profit is $\pi_I^M(c_I)$. On the other hand, if the negotiation breaks down and firm I exerts its outside option, then the profit of firm I is $\pi_I^M(m_I)$. Because the upstream monopolist's outside value is zero and that of buyer I is $\pi_I^M(m_I)$, the upstream monopolist's net gain from the trade is T_I^1, and that for buyer I is $\pi_I^M(c_I) - T_I^1 - \pi_I^M(m_I)$. T_I^1 is determined such that $T_I^1 : \pi_I^M(c_I) - T_I^1 - \pi_I^M(m_I) = \beta : (1-\beta)$ is satisfied, where $\beta \in (0,1)$ is the power of the upstream monopolist in bargaining with firm E, and $(1-\beta)$ is the power of firm E. The profit of the upstream monopolist is

$$T_I^1 = \beta(\pi_I^M(c_I) - \pi_I^M(m_I)). \tag{2}$$

At stage 1, the upstream monopolist anticipates the negotiation at stage 2 in period 2 with firm E. Firm I exerts its outside option if the negotiation at stage 1 reaches an agreement, and thus, the downstream market is a duopoly. Given the two part tariff contract, the profit for firms E and I are

$$\pi_E^D(q_E, q_I, w_I) = (p(q_E, q_I) - w_E)q_E - T_E^1$$

$$\pi_I^D(q_E, q_I) = (p(q_E, q_I) - m_I)q_I + T_E^1,$$

respectively. Given the per-unit fee w_E, the first-order conditions of firm E to maximize profit is

$$\frac{\partial \pi_E^D(q_E, q_I, w_E)}{\partial q_E} = \frac{\partial p(q_E, q_I)}{\partial q_E} q_E + p(q_E, q_I) - w_E = 0. \tag{3}$$

The first-order conditions of firm I to maximize profit is

$$\frac{\partial \pi_I^D(q_E, q_I)}{\partial q_I} = \frac{\partial p(q_E, q_I)}{\partial q_I} q_I + p(q_E, q_I) - m_I = 0. \tag{4}$$

From equations (3) and (4), firm E's output is $q_E^D(w_E, m_I)$ and $q_I^D(w_E, m_I)$. We assume that each firm has no information about the contract the upstream monopolist offers its competitor.[5] Note that firm E expects firm I to produce quantities $q_I^D(\grave{w}_E, m_I)$, where $\grave{w}_E$ is firm I's expectation of an optimal per-unit fee that the contracting pair determines. Given $q_I^D(\grave{w}_E, m_I)$, the contracting pair determines an optimal per-unit fee w_E. The joint profit is

$$\Pi_E^D(w_E, m_I) + \pi_E^D(w_E, m_I) = (w_E - c_E)q_E^D(w_E, m_I) + (p_E(q_E^D(w_E, m_I), q_I^D(\grave{w}_E, m_I)) - w_E)q_E^D(w_E, m_I).$$

The first-order condition is

$$\{-c_E + \frac{\partial p_E(q_E^D(w_E, m_I), q_I^D(\grave{w}_E, m_I))}{\partial q_E^D(w_I, m_I)} q_E^D(w_E, m_I) + p_E(q_E^D(w_E, m_I), q_I^D(\grave{w}_E, m_I))\} \frac{\partial q_E^D(w_E, m_I)}{\partial w_E} = 0.$$

, where $\frac{\partial q_E^D(w_E, m_I)}{\partial w_E} < 0$. From the envelope theorem, the optimal per-unit fee is $w_E^* = c_E$. That is, the upstream monopolist an optimal per-unit fee equal to its marginal cost. Thus, the equilibrium output and profit of firm E

[5] We assume that each firm can observe an exclusive contract between the upstream monopolist and its competitor.

are $q_E^D(c_E, m_I)$ and $\pi_E^D(c_E, m_I)$, respectively. Because firm I expects this optimal per-unit fee determined by the contracting pair, its equilibrium output and profit are $q_I^D(c_E, m_I)$ and $\pi_I^D(c_E, m_I)$, respectively. Because the upstream monopolist's outside value is T_I^1 and that of buyer I is zero, the upstream monopolist's net gain from the trade is $T_E^1 - T_I^1$ and that for buyer I is $\pi_E^D(c_E, m_I) - T_E^1$. T_E^1 is determined such that $T_E^1 - T_I^1 : \pi_E^D(c_E, m_I) - T_E^1 = \alpha : (1-\alpha)$ is satisfied, where $\alpha \in (0, 1)$ is the power of the upstream monopolist in bargaining with firm E, and $(1 - \alpha)$ is the power of firm E. The upstream monopolist's profit is

$$T_E^1 = \alpha\pi_E^D(c_E, m_I) + (1-\alpha)(\beta(\pi_I^M(c_I) - \pi_I^M(m_I))) \equiv \Pi_D. \tag{5}$$

Π_D denotes the profit for the upstream monopolist when firm E is the first negotiating partner. From equation (5), the upstream monopolist has incentives to trade exclusively with firm E as the first negotiating trade partner if the following condition holds.

$$\pi_E^D(c_E, m_I) > \beta(\pi_I^M(c_I) - \pi_I^M(m_I)). \tag{6}$$

3.2 Case 2: The incumbent is the first negotiator

We solve the bargaining game in case 2 through backward induction. At stage 2, period 2, the upstream monopolist negotiates with firm E. The optimal per-unit fee is $w_E^* = c_E$ and the equilibrium output is $q_E^D(c_E, m_I)$. The equilibrium profit is $\pi_E^D(c_E, m_I)$. Because the upstream monopolist and buyer E's outside value is zero, the upstream monopolist's net gain from the trade is T_E^2 and that of buyer E is $\pi_E^D(c_E, m_I) - T_E^2$, where the superscript 2 indicates case 2. T_E^2 is determined such that $T_E^2 : \pi_E^D(c_E, m_I) - T_E^2 = \alpha : (1-\alpha)$ is satisfied. The upstream monopolist's profit is

$$T_E^2 = \alpha\pi_E^D(c_E, m_I). \tag{7}$$

At stage 1 in period 2, the upstream monopolist anticipates the negotiation at stage 2 in period 2 with firm I. The optimal per-unit fee is $w_I^* = c_I$ and the equilibrium output is $q_I^M(c_I)$. The equilibrium profit is $\pi_I^M(c_I)$. On the other hand, if the negotiation breaks down and firm I takes its outside option, then the profit of firm I is $\pi_I^D(c_E, m_I)$. Because the upstream monopolist's outside value is T_E^2 and that of buyer I is $\pi_I^D(c_E, m_I)$, the upstream monopolist's net gain from the trade is $T_I^2 - T_E^2$ and for buyer I is $\pi_I^M(c_I) - T_I^2 - \pi_I^D(c_E, m_I)$. T_I^2 is determined such that $T_I^2 - T_E^2 : \pi_I^M(c_I) - T_I^2 - \pi_I^D(c_E, m_I) = \beta : (1-\beta)$ is satisfied. The upstream monopolist's profit is

$$T_I^2 = \beta(\pi_I^M(c_I) - \pi_I^D(c_E, m_I)) + (1-\beta)\alpha\pi_E^D(c_E, m_I) \equiv \Pi_M. \tag{8}$$

Π_M denotes the upstream monopolist's profit when firm I is the first negotiator. From equation (8), the upstream monopolist has incentives to trade exclusively with firm E as the first negotiator if the following condition holds:

$$\pi_I^M(c_I) - \pi_I^D(c_E, m_I) > \alpha\pi_E^D(c_E, m_I). \tag{9}$$

3.3 General function case

We consider the following four patterns: (a) both equations (6) and (9) hold, (b) only equation (6) holds, (c) only equation (9) holds, and (d) neither equations (6) or (9) hold. That is, in pattern (a), the upstream monopolist has incentives to trade exclusively with the entrant (the incumbent) at stage 1 in period 2. In pattern (b), it trades exclusively with the entrant only in period 2. In pattern (c), it trades exclusively with the incumbent only in period 2. In pattern (d), it has incentives to trade exclusively with the incumbent (the entrant) at stage 2 in period 2 because it has no incentives to do exclusively with the entrant (the incumbent) at stage 1 in period 2.

Pattern (a): Both equations (6) and (9) hold. In this case, the upstream monopolist has incentives to trade exclusively with the entrant (the incumbent) at stage 1 in period 2. From equations (5) and (8), the difference between Π_D and Π_M is

$$\Pi_D - \Pi_M = \beta\{\alpha\pi_E^D(c_E, m_I) + \alpha\pi_I^M(m_I) - \alpha\pi_I^M(c_I) - \pi_I^M(m_I) + \pi_I^D(c_E, m_I)\}.$$

We can thus obtain the following conditions.

$$\begin{cases} \Pi_D > \Pi_M & \text{if } \; min\{1, \dfrac{\pi_I^M(c_I) - \pi_I^D(c_E, m_I)}{\pi_E^D(c_E, m_I)}\} > \alpha > \dfrac{\pi_I^M(m_I) - \pi_I^D(c_E, m_I)}{\pi_E^D(c_E, m_I) + \pi_I^M(m_I) - \pi_I^M(c_I)} \text{ and } \dfrac{\pi_E^D(c_E, m_I)}{\pi_I^M(c_I) - \pi_I^M(m_I)} > \beta, \\ \Pi_D < \Pi_M & \text{if } \; \alpha \leq \dfrac{\pi_I^M(m_I) - \pi_I^D(c_E, m_I)}{\pi_E^D(c_E, m_I) + \pi_I^M(m_I) - \pi_I^M(c_I)} \text{ and } \dfrac{\pi_E^D(c_E, m_I)}{\pi_I^M(c_I) - \pi_I^M(m_I)} > \beta. \end{cases}$$

Proposition 1 *The upstream monopolist prefers to trade exclusively with the entrant if and only if α and β satisfies equation (10).*

$$min\{1, \frac{\pi_I^M(c_I) - \pi_I^D(c_E, m_I)}{\pi_E^D(c_E, m_I)}\} > \alpha > \frac{\pi_I^M(m_I) - \pi_I^D(c_E, m_I)}{\pi_E^D(c_E, m_I) + \pi_I^M(m_I) - \pi_I^M(c_I)} \; and \; \frac{\pi_E^D(c_E, m_I)}{\pi_I^M(c_I) - \pi_I^M(m_I)} > \beta. \tag{10}$$

This proposition indicates that trading with the entrant can yield greater profits for the upstream monopolist when m_I is moderate or large. The upstream monopolist may then benefit by promoting competition, even if the per-unit fee c_I is efficient and β is large and α is small because it can get a higher fixed fee by offering the efficient per-unit fee to the entrant when the incumbent with the inefficient outside option is active. Also, equation (6) implies that the existence of the incumbent's outside option may encourage entry. Thus, the incumbent's profits may decrease if the upstream monopolist trades exclusively with the entrant. This is especially because equation (6) holds when c_I is close to m_I, and its existence remains even if the incumbent's outside option is moderate.

Pattern (b): Only equation (6) holds. In this situation, the upstream monopolist trades exclusively with the entrant only in period 2. Then, we must have

$$\pi_E^D(c_E, m_I) > \beta(\pi_I^M(c_I) - \pi_I^M(m_I)), \tag{11}$$

$$\pi_I^M(c_I) - \pi_I^D(c_E, m_I) \leq \alpha\pi_E^D(c_E, m_I). \tag{12}$$

From equations (5) and (7), the difference between Π_D and T_E^2 is

$$\Pi_D - T_E^2 = (1-\alpha)\beta\{\pi_I^M(c_I) - \pi_I^M(m_I)\}.$$

Because $\alpha \in [0, 1]$ and $c_I < m_I$, $\Pi_D \geq T_{2D}$.

Proposition 2 *The upstream monopolist trades exclusively with the entrant if and only if (11) and (12) are satisfied. If $\alpha \in [0, 1)$, the upstream monopolist profits more from choosing the entrant as the first rather than second negotiator.*

This proposition indicates that the upstream monopolist's profits depend on the timing of trading with the entrant because the upstream monopolist can obtain its added value $(1-\alpha)T_I^1$ by choosing the incumbent as the first negotiator. On the other hand, from the equation (6), the incumbent may not benefit because the incumbent's outside option may encourage entry.

Pattern (c): Only equation (9) holds In this situation, the upstream monopolist trades exclusively with the incumbent only in period 2. Then, we must have

$$\pi_E^D(c_E, m_I) \leq \beta(\pi_I^M(c_I) - \pi_I^M(m_I)), \tag{13}$$

$$\pi_I^M(c_I) - \pi_I^D(c_E, m_I) > \alpha\pi_E^D(c_E, m_I). \tag{14}$$

From equations (2) and (8), the difference between T_I^1 and Π_M is

$$T_I^1 - \Pi_M = \beta\{\pi_I^D(c_E, m_I) - \pi_I^M(m_I)\} - (1-\beta)\alpha\pi_E^D(c_E, m_I).$$

Because $\beta \in [0, 1]$ and $\pi_I^D(c_E, m_I) < \pi_I^M(m_I)$, $T_I^1 < \Pi_M$.

Proposition 3 *The upstream monopolist trades exclusively with the incumbent if and only if (13) and (14) hold. The upstream monopolist profits more from choosing the incumbent as the first rather than second negotiator.*

This proposition indicates that the upstream monopolist's profits depend on the timing of trading with the incumbent. This is because the upstream monopolist can obtain its added value $(1-\beta)T_E^2$ by choosing the incumbent as the first negotiator.

Pattern (d): Neither equation (6) or (9) hold. In this situation, the upstream monopolist has incentives to trade exclusively with the incumbent (the entrant) at stage 2 in period 2 because it has no incentives to do so exclusively with the entrant (the incumbent) at stage 1 in period 2. Then, we must have

$$\pi_E^D(c_E, m_I) \leq \beta(\pi_I^M(c_I) - \pi_I^M(m_I)), \tag{15}$$

$$\pi_I^M(c_I) - \pi_I^D(c_E, m_I) \leq \alpha\pi_E^D(c_E, m_I). \tag{16}$$

We then compare T_I^1 with T_E^2. From equations (2) and (7), the difference between T_I^1 and T_E^2 is given by

$$T_I^1 - T_E^2 = \beta\{\pi_I^M(c_I) - \pi_I^M(m_I)\} - \alpha\pi_E^D(c_E, m_I).$$

We can thus obtain the following conditions.

$$\begin{cases} T_I^1 > T_E^2 \qquad \text{if} \quad \alpha \leq \dfrac{\beta\{\pi_I^M(c_I) - \pi_I^M(m_I)\}}{\pi_E^D(c_E, m_I)}, & (17) \\ T_I^1 < T_E^2 \qquad \text{if} \quad \alpha > \dfrac{\beta\{\pi_I^M(c_I) - \pi_I^M(m_I)\}}{\pi_E^D(c_E, m_I)}. & (18) \end{cases}$$

Considering equation (15), $T_I^1 < T_E^2$ does not hold and $T_I^1 > T_E^2$ holds.

Proposition 4 *The upstream monopolist prefers to trade with the incumbent if and only if (15) and (16) hold and α satisfies* (19).

This proposition indicates that the upstream monopolist can benefit from a bilateral monopoly when m_I and α are small. This is because the upstream monopolist cannot get a higher fixed fee by offering the efficient per-unit fee to the entrant if an incumbent with an efficient outside option is active and α is small.

3.4 Linear Demand Function Case

We assume a linear demand function, $p_i = a - q_i(or\ \ p_i = a - (q_i + q_j)), i = E, I$. The equilibrium outputs are

$$q_I^M(c_I) = \frac{(a - c_I)}{2},\ \ q_I^M(m_I) = \frac{(a - m_I)}{2},$$

$$q_E^D(c_E, m_I) = \frac{(a - 2c_E + m_I)}{3},\ \ q_I^D(c_E, m_I) = \frac{(a + c_E - 2m_I)}{3}.$$

The equilibrium profits are

$$\pi_I^M(c_I) = \frac{(a - c_I)^2}{4},\ \ \pi_I^M(m_I) = \frac{(a - m_I)^2}{4}$$

$$\pi_E^D(c_E, m_I) = \frac{(a - 2c_E + m_I)^2}{9},\ \ \pi_I^D(c_E, m_I) = \frac{(a + c_E - 2m_I)^2}{9}.$$

We assume $a = 1$, $c_E = 0$, and $c_I = hm_I$ and $h \in (0, 1)$. Then, the interior condition is $m_I < \frac{a + c_E}{2}$. Equation (6), in which the upstream monopolist chooses the entrant as the first negotiator is given by

$$\pi_E^D(c_E, m_I) - \beta\{\pi_I^M(c_I) - \pi_I^M(m_I)\} = \frac{1}{36}\{4 + 2m_I(4 + 9(h - 1)\beta + m_I^2(4 - 9(h^2 - 1)\beta)\}. \tag{19}$$

From equation (19), the discriminant is given by

$$D = \frac{1}{36}(h - 1)\beta(12 - 9\beta + h(4 + 9\beta)). \tag{20}$$

Because this discriminant is negative, equation (6) holds for any β. That is, the upstream monopolist has incentives to choose the entrant as the first negotiator regardless of its bargaining power against the incumbent. Thus, in the linear demand function case, only patterns (a) and (b) are observed.

We first examine the difference in signs between Π_D and Π_M in pattern (a).

$$\Pi_D - \Pi_M = \beta\{\alpha\pi_E^D(c_E, m_I) + \alpha\pi_I^M(m_I) - \alpha\pi_I^M(c_I) - \pi_I^M(m_I) + \pi_I^D(c_E, m_I)\}. \tag{21}$$

Considering equation (9), the relationship between Π_D and Π_M for any β is given by

$$\begin{cases} \Pi_D > \Pi_M & \text{if } min\{1, \dfrac{\pi_I^M(c_I) - \pi_I^D(c_E, m_I)}{\pi_E^D(c_E, m_I)}\} > \alpha > \dfrac{\pi_I^M(m_I) - \pi_I^D(c_E, m_I)}{\pi_E^D(c_E, m_I) + \pi_I^M(m_I) - \pi_I^M(c_I)}, & (22) \\ \Pi_D \leq \Pi_M & \text{if } \alpha \leq \dfrac{\pi_I^M(m_I) - \pi_I^D(c_E, m_I)}{\pi_E^D(c_E, m_I) + \pi_I^M(m_I) - \pi_I^M(c_I)}. & (23) \end{cases}$$

Substituting the equilibrium profits into the above equation, we have

$$\begin{cases} \Pi_D > \Pi_M & \text{if } min\{1, \dfrac{((3h - 4)m_I - 1)((3h + 4)m_I - 5)}{4(1 + m_I)^2}\} > \alpha > \dfrac{(m_I + 1)(7m_I - 5)}{(9h^2 - 13)m_I^2 - (18h - 10)m_I - 4}, \\ \Pi_D \leq \Pi_M & \text{if } \alpha \leq \dfrac{(m_I + 1)(7m_I - 5)}{(9h^2 - 13)m_I^2 - (18h - 10)m_I - 4}. \end{cases}$$

In pattern (b), the difference in sign between Π_D and T_E^2 is given by

$$\Pi_D - T_E^2 = (1-\alpha)\{\pi_I^M(c_I) - \pi_I^M(m_I)\} \tag{24}$$

because $\alpha \in [0,1]$ and $c_I < m_I$, $\Pi_D \geq T_E^2$. From equation (12), the relationship between Π_D and T_E^2 is given by

$$\begin{cases} \Pi_D > T_E^2 & if \;\; 1 > \alpha \geq \dfrac{\pi_I^M(c_I) - \pi_I^D(c_E, m_I)}{\pi_E^D(c_E, m_I)}, \\ \Pi_D = T_E^2 & if \;\; \alpha = 1. \end{cases}$$

Substituting the equilibrium profit into the above equation, we have

$$\begin{cases} \Pi_D > T_E^2 & \text{if} \;\; 1 > \alpha \geq \dfrac{((3h-4)m_I - 1)((3h+4)m_I - 5)}{4(1+m_I)^2}, \\ \Pi_D = T_E^2 & \text{if} \;\; \alpha = 1. \end{cases}$$

For the linear demand function, we summarize the optimal trading partner for the upstream monopolist as follows. The upstream monopolist prefers to trade with the entrant as the first negotiator if α satisfies equation (25).

$$1 > \alpha > \frac{(m_I+5)(7m_I-5)}{(9h^2-13)m_I^2 - (18h-10)m_I - 4} \tag{25}$$

The upstream monopolist prefers to trade with the incumbent as the first negotiator if α satisfies equation (26).

$$\alpha \leq \frac{(m_I+5)(7m_I-5)}{(9h^2-13)m_I^2 - (18h-10)m_I - 4}. \tag{26}$$

Assuming specific values of m_I, we examine areas where the upstream monopolist prefers to trade exclusively with the entrant (the incumbent). In figure 1, $m_I = 0.45$. In figure 2, $m_I = 0.3$. In figure 3, $m_I = 0.2$. In figure 4, $m_I = 0.1$. Each figure has the following three areas: (i) $\Pi_D < \Pi_M$, (ii) $\Pi_D > \Pi_M$, and (iii) $\Pi_D > T_E^2$. The horizontal axis is h and the vertical axis is α in all figures. Note that the shaded areas represent cases in which the upstream monopolist contracts with the entrant. The upstream monopolist benefits by promoting competition in the shaded areas.

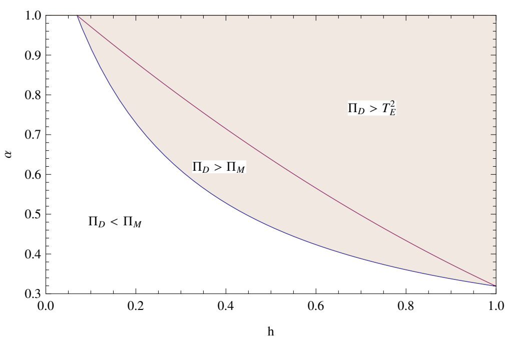

Figure 1: $m_I = 0.45$

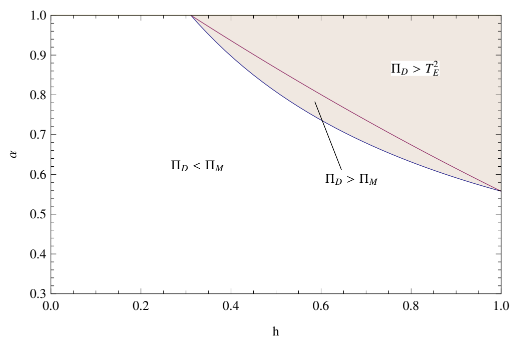

Figure 2: $m_I = 0.3$

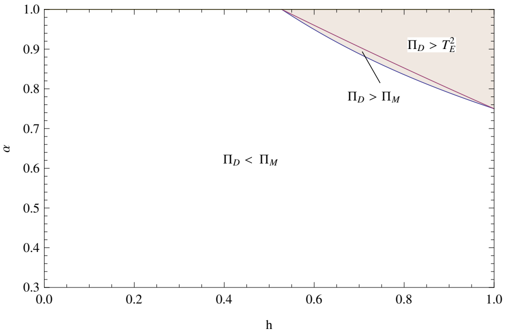

Figure 3: $m_I = 0.2$

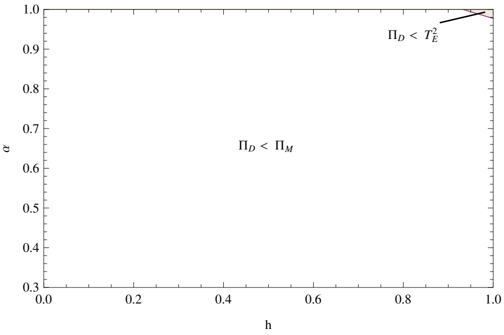

Figure 4: $m_I = 0.1$

Findings from Figure 1: $m_I = 0.45$. We consider a situation in which the incumbent's outside option is inefficient. By intuition, the upstream monopolist may have little incentive to trade with the entrant when the per-unit fee c_I is efficient and its bargaining power against the incumbent (the entrant) is large (small). However, even in this scenario, the upstream monopolist benefits from trading with the entrant because the it can obtain a higher fixed fee by offering an efficient per-unit fee to the entrant if there exists an incumbent with an inefficient outside option.

Findings from Figures 2 and 3: $m_I = 0.3$ *and* $m_I = 0.2$. We consider a situation where the incumbent's outside option is moderate. When c_I is closer to m_I, or c_I is moderate, trading with the entrant benefits the upstream monopolist if and only if it has higher bargaining power than the entrant. Trading with the incumbent cannot yield a higher fixed fee because the incumbent's per-unit fee, c_I, is not too efficient, even if the upstream monopolist has more bargaining power than the incumbent. In this scenario, because the incumbent's outside option, m_I, is not too large, its bargaining power against the entrant must be larger when the incumbent is active.

Findings from Figure 4: $m_I = 0.1$. We consider a scenario where the incumbent's outside option is efficient. In this case, the upstream monopolist benefits from trading with the entrant if and only if c_I is closer to m_I and α is closer to 1. Even if the incumbent's outside option is efficient, the upstream monopolist can benefit from the duopolistic market when its bargaining power against the entrant is considerably large or larger.

Findings from all figures. In any situation, there are areas in which the upstream monopolist prefers to trade exclusively with the entrant. For the incumbent, this implies the existence of its outside option may encourage new entrants, especially when the outside option is inefficient.

4 Conclusion

Choosing a trading partner is an important decision and a key to success for an upstream monopolist (a supplier). In this paper, we use a Nash bargaining model with an upstream monopolist (one supplier) and two buyers: the incumbent and the entrant to determine the supplier's optimal trading partner when it trades exclusively with one buyer.

We assume that the incumbent has only the outside option. The number of firms depends on which firm the upstream monopolist chooses to trade with. If the upstream monopolist chooses the incumbent, it can have a bilateral monopoly relationship with the incumbent because the entrant without an outside option is inactive. If it chooses the entrant, it faces competition because the incumbent is active and can turn to its outside option.

We therefore summarize the results as follows. For the upstream monopolist, trading with the entrant can yield greater profits when the incumbent's outside option is not too efficient or it is closer to the per-unit fee offered to the incumbent. The upstream monopolist may prefer to promote market competition by trading exclusively with the entrant, even if its bargaining power against the entrant (the incumbent) is low (high) and the per-unit fee offered to the incumbent is efficient. On the other hand, the incumbent's profit may decrease because its outside option may encourage new entrants.

The results have several implications for upstream monopolists and incumbent firms with outside options. The upstream monopolist should decide upon a trading partner considering the incumbent's outside options and its bargaining power against the entrant. For the incumbent buyer, improving its outside option costs may prevent potential competitors from entering the downstream market, even if the upstream monopolist has higher bargaining power than the incumbent.

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