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# Strategic trading partner selection for an upstream licensor\*

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## Abstract

This paper examines the determinant of trading partner selection for a licensor. The licensor negotiates with either a downstream incumbent which has its own production facility (the outside option) or a downstream entrant, and determines a two-part tariff for licensing. If the licensor trades with the entrant (the incumbent), the downstream market becomes a duopoly (monopoly). We find that the licensor's bargaining power over the incumbent does not influence the licensor's decision on its trading partner although that over the entrant, its marginal costs of licensing to the entrant and the incumbent, and the incumbent's outside value matter for its decision.

**JEL Classification:** C78; L14; D21

**Keywords:** Trading partner; Nash bargaining game; Outside option

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\*All remaining errors are my own. Comments welcome.

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# 1 Introduction

Many luxury brand firms have licensing agreements globally to develop their business, and gain licensing revenues. For instance, *Burberry*, a British luxury-brand firm, licenses its trademark to manufacturers (downstream firms) in many countries, and obtains licensing revenues 109.4m£ in 2013. Approximately 60% of those was obtained by its licensed business in Japan.<sup>1</sup> *Prada*, an Italian luxury-brand firm, also develops its licensed business, and gains licensing revenues 43.4m€ in 2015.<sup>2</sup> *Prada annual reports* state that *Prada* chooses carefully the licensing partner for its licensed business in order to achieve success in the global luxury-goods market. What factors determine the licensing partner for luxury brand firms? To address such an issue, this paper investigates the determinant of the licensing partner selection.

We provide a simple model which explains the determinant to select an upstream licensor's downstream partner (licensing partner). The setting is as follows. There are an incumbent and an entrant in a downstream market. They compete in quantity. The upstream licensor first decides with whom to negotiate. Second, it negotiates with the chosen downstream firm, and determines a two-part tariff for licensing. In the negotiation between the upstream licensor and the chosen downstream firm, we adopt a Nash bargaining approach.<sup>3</sup> We assume that only the incumbent has its own production facility, and thereby it is able to produce the final product even without a licensing agreement with the upstream licensor. In other words, only the incumbent has the outside option.<sup>4</sup> Therefore, the downstream market structure depends on with whom the upstream licensor negotiates. If the upstream licensor first negotiates with the entrant and the first negotiation reaches an agreement, the downstream market is a duopoly because the incumbent uses its own production facility (the outside option). However, if the first negotiation reaches a disagreement, it second negotiates with the incumbent. If the second negotiation reaches an agreement, the market is a bilateral monopoly because the entrant does not have a production facility (an outside option). If the second negotiation also reaches a disagreement, the upstream licensor is not active and the incumbent monopolizes the market. On the other hand, if the upstream licensor first negotiates with the incumbent and the first negotiation reaches an agreement, the market is a bilateral monopoly. However, if the first negotiation reaches a disagreement, it second negotiates with the entrant. If the second negotiation reaches an agreement, the downstream market is a duopoly because the incumbent uses its own production facility (the outside option). If the second negotiation also reaches a disagreement, the upstream licensor is not active and the incumbent monopolizes the market.

We find that the upstream licensor's bargaining power over the incumbent which is denoted by  $\beta$  does not matter for the upstream licensor's decision on its trading partner although that over the entrant which is denoted by  $\alpha$  matters for its decision. When the upstream licensor trades with the entrant (the incumbent), in addition to the net gain obtained from trading with the incumbent (the entrant) after the negotiation breakdown which is weighted by  $\beta$  ( $\alpha$ ), the upstream licensor obtains the net gain from trading with the entrant (the incumbent) which is weighted by  $\alpha$  ( $\beta$ ) (the gross profit obtained from trading with the entrant (the incumbent) minus the net gain obtained from trading with

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<sup>1</sup>See *Burberry Group plc annual report 2013*.

<sup>2</sup>See *Prada annual report 2015*.

<sup>3</sup>Naylor (2002) adopts a Nash bargaining game in the bilateral oligopoly model.

<sup>4</sup>This assumption reflects the behavior of a Japanese apparel manufacturer, *Sanyo Shokai*. *Sanyo Shokai* has manufactured the final product after *Burberry* terminated the licensing agreement with *Sanyo Shokai* in 2015.

the incumbent (the entrant) after the negotiation breakdown which is weighted by  $\beta$  ( $\alpha$ ). Because the entrant does not have a production facility (an outside option), the entrant's outside value is not included in the net gain obtained from trading with the entrant. Thereby, the gross profit obtained from trading with the entrant when the upstream licensor trades with the entrant which is weighted by  $\alpha$  is equal to the net gain obtained from trading with the entrant after the negotiation with the incumbent breaks down which is weighted by  $\alpha$ . Thus, these two cancel each other out when the upstream licensor compares the profits in the two trade cases. We then find that the remaining ones are weighted by  $\beta$ . This means that the upstream licensor's bargaining power over the incumbent does not influence the comparison of the upstream licensor's profits in the two trade cases although it influences the absolute amount of that.

This paper is related to the literatures on trading partner selection. Several theoretical papers examine the number of downstream partner that maximizes an upstream firm's revenue. Chemla (2003) shows that an upstream firm has incentives to contract with many downstream partners in order to lower downstream firms' bargaining power by promoting the downstream competition. Matsushima and Shinohara (2014) examines the determinant of the number of buyers for an input supplier. Rey and Salant (2012) and Kishimoto and Watanabe (2017) investigate the determinant of the number of licensees for property owners. Our paper examines the determinant of a downstream partner selection for an upstream licensor which trades exclusively with a downstream firm.

This paper is organized as follows: Section 2 presents the model and Section 3 does its results. We then consider the situation where no firm has a production facility (an outside option) as a benchmark. Section 4 discusses, and Section 5 concludes the paper.

## 2 The model

We consider a market with an upstream licensor and two downstream firms, an incumbent ( $I$ ) and an entrant ( $E$ ). The two downstream firms produce the final product, and compete in quantity. The upstream licensor first chooses firm  $i$  ( $i = I, E$ ) as its negotiation partner, and second, it negotiates with the chosen firm  $i$  and determines a two-part tariff for licensing,  $(w_i, T_i)$ , where  $w_i$  denotes a per-unit fee and  $T_i$  does a fixed fee. In the negotiation between the upstream licensor and the chosen firm  $i$ , we adopt a Nash bargaining approach.

We assume that only firm  $I$  has its own production facility, and thereby it can produce the final product even without a licensing agreement with the upstream licensor. In other words, only firm  $I$  has the outside option. Therefore, the structure of the downstream market depends on with whom the upstream licensor trades. If the upstream licensor trades with firm  $E$ , the downstream market is a duopoly because firm  $I$  uses its own production facility. If the upstream licensor trades with firm  $I$ , the market is a bilateral monopoly because firm  $E$  does not have a production facility.

Let  $q_i$  denote the quantity supplied by 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 licensor has a marginal cost of licensing to firm  $i$ ,  $c_i$  ( $i = I, E$ ). If the incumbent (the entrant) is a licensee, the marginal cost of the upstream licensor is  $c_I$  ( $c_E$ ). We assume that the marginal cost of licensing to firm  $E$ ,  $c_E$ , is equal to or smaller than that to firm  $I$ ,  $c_I$  ( $c_E \leq c_I$ ). Firm  $I$  incurs a marginal cost of production,  $h_I$ , if it uses its own production facility. The marginal cost of production,  $h_I$ , is larger

than the marginal cost of licensing to firm  $I$ ,  $c_I$  ( $c_E \leq c_I < h_I$ ).

We consider a three-period game. In period 1, the upstream licensor determines the first negotiation partner. If it chooses firm  $E$  (firm  $I$ ) as the first negotiation partner, it negotiates with firm  $E$  (firm  $I$ ) at stage 1 in period 2. If the first negotiation reaches an agreement, 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 licensor negotiates with firm  $I$  (firm  $E$ ) at stage 2 in period 2. If the second negotiation reaches an agreement, 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 licensor is inactive and only firm  $I$  is active in the market. In period 2, a negotiating pair determines a two-part tariff for licensing. In period 3, the downstream firms set quantity if possible.

### 3 Analysis

We consider two sub-games that follow the decision in period 1: the entrant is the first negotiation partner (case 1); the incumbent is the first negotiation partner (case 2). Assuming a general demand function, we solve the two sub-games through backward induction.

#### 3.1 Benchmark: no firm has an outside option

As a benchmark, we first consider a situation in which no firm has a production facility (an outside option). In this situation, the downstream market is a monopoly regardless of the outcome of bargaining among the upstream licensor and firm  $i$  ( $i = I, E$ ).

##### 3.1.1 Quantity setting and per-unit fee

When the upstream licensor negotiates with firm  $i$  at stage 2 (stage 1) in period 2, given the two-part tariff contract, the profit of firm  $i$  in period 3 is

$$\pi_i^m(q_i, w_i) = (p(q_i) - w_i)q_i - T_i,$$

where the superscript  $m$  indicates monopoly. The first-order condition for profit maximization is

$$\frac{\partial \pi_i^m(q_i, w_i)}{\partial q_i} = \frac{dp(q_i)}{dq_i} q_i + p(q_i) - w_i = 0. \quad (1)$$

From Eq.(1), the output is  $q_i(w_i)$ . The profit of firm  $i$  is

$$\pi_i^m(q_i(w_i), w_i) = \pi_i^m(w_i) - T_i,$$

where  $\pi_i^m(w_i) \equiv (p(q_i(w_i)) - w_i)q_i(w_i)$  indicates the gross profit for firm  $i$ . The profit of the upstream licensor is

$$\Pi_i^m(q_i(w_i), w_i) = (w_i - c_i)q_i(w_i) + T_i,$$

where the subscript  $i$  ( $i = I, E$ ) indicates the profit of the upstream licensor obtained when it trades with firm  $i$ . The joint profit of the upstream licensor and firm  $i$  is given by

$$\Pi_i^m(q_i(w_i), w_i) + \pi_i^m(q_i(w_i), w_i) = (p(q_i(w_i)) - c_i)q_i(w_i).$$

The first-order condition for the joint profit maximization:

$$\left\{ -c_i + \frac{d p(q_i(w_i))}{d q_i(w_i)} q_i(w_i) + p(q_i(w_i)) \right\} \frac{d q_i(w_i)}{d w_i} = 0,$$

From the envelope theorem, the optimal per-unit fee is  $w_i^* = c_i$ . That is, the upstream licensor optimally sets the per-unit fee at the marginal cost of licensing to firm  $i$ ,  $c_i$ . Thus, the equilibrium output of firm  $i$  is  $q_i(c_i)$ , and the equilibrium profit of firm  $i$  and the upstream licensor,  $\pi_i^m(q_i(c_i), c_i)$  and  $\Pi_i^m(q_i(c_i), c_i)$ , respectively, are

$$\pi_i^m(q_i(c_i), c_i) = \pi_i^m(c_i) - T_i,$$

$$\Pi_i^m(q_i(c_i), c_i) = T_i.$$

### 3.1.2 Fixed fee in case 1 where the entrant is the first negotiation partner

At stage 2 in period 2, the upstream licensor negotiates with firm  $I$ .  $T_I$  is determined such that  $T_I : \pi_I^m(c_I) - T_I = \beta : (1 - \beta)$  is satisfied, where the parameter  $\beta \in (0, 1)$  represents the bargaining power of the upstream licensor relative to that of firm  $I$ . Therefore, we obtain

$$T_I = \beta \pi_I^m(c_I).$$

This represents the upstream licensor's outside value when it trades with firm  $E$ .

At stage 1 in period 2, anticipating the negotiation at stage 2 in period 2, the upstream licensor negotiates with firm  $E$ .  $T_E$  is determined such that  $T_E - T_I : \pi_E^m(c_E) - T_E = \alpha : (1 - \alpha)$  is satisfied, where the parameter  $\alpha \in (0, 1)$  represents the bargaining power of the upstream licensor relative to that of firm  $E$ . Therefore, the profit of the upstream licensor is given by

$$T_E^n = \alpha(\pi_E^m(c_E) - \beta \pi_I^m(c_I)) + \beta \pi_I^m(c_I), \quad (2)$$

where the superscript  $n$  indicates that no firm has an outside option. In the first term,  $\pi_E^m(c_E) - \beta \pi_I^m(c_I)$  represents the net gain obtained from trading with firm  $E$ .

From Eq.(2), the upstream licensor has incentives to trade with the first negotiation partner, firm  $E$ , if the following condition holds.

$$\pi_E^m(c_E) > \beta \pi_I^m(c_I). \quad (3)$$

### 3.1.3 Fixed fee in case 2 where the incumbent is the first negotiation partner

At stage 2 in period 2, the upstream licensor negotiates with firm  $E$ .  $T_E$  is determined such that  $T_E : \pi_E^m(c_E) - T_E = \alpha : (1 - \alpha)$  is satisfied. Therefore, we obtain

$$T_E = \alpha \pi_E^m(c_E).$$

This represents the upstream licensor's outside value when it trades firm  $I$ .

At stage 1 in period 2, anticipating the negotiation at stage 2 in period 2, the upstream licensor negotiates with firm  $I$ .  $T_I$  is determined such that  $T_I - T_E : \pi_I^m(c_I) - T_I = \beta : (1 - \beta)$  is satisfied. The profit of the upstream licensor is given by

$$T_I^n = \beta(\pi_I^m(c_I) - \alpha \pi_E^m(c_E)) + \alpha \pi_E^m(c_E). \quad (4)$$

In the first term,  $\pi_I^m(c_I) - \alpha \pi_E^m(c_E)$  represents the net gain obtained from trading with firm  $I$ .

From Eq.(4), the upstream licensor has incentives to trade with the first negotiation partner, firm  $I$ , if the following condition holds.

$$\pi_I^m(c_I) > \alpha \pi_E^m(c_E). \quad (5)$$

### 3.1.4 Selection of the trading partner

In period 1, the upstream licensor determines its trading partner. Assuming that Eq.(3) and Eq.(5) hold, we examine the determinant of its trading partner selection when no firm has a production facility (an outside option).

Because firm  $E$ 's outside value is zero, its outside value is not included in the net gain obtained from trading with firm  $E$ ,  $\pi_E^m(c_E) - \beta \pi_I^m(c_I)$ . Thereby, the gross profit obtained from trading with firm  $E$  when the upstream licensor trades with firm  $E$  which is weighted by the upstream licensor's bargaining power over firm  $E$ ,  $\alpha \pi_E^m(c_E)$  in Eq.(2), is equal to the upstream licensor's outside value when it trades firm  $I$ ,  $\alpha \pi_E^m(c_E)$  in Eq.(4). Because firm  $I$ 's outside value is also zero, its outside value is not included in the net gain obtained from trading with firm  $I$ ,  $\pi_I^m(c_I) - \alpha \pi_E^m(c_E)$ . Thereby, the gross profit obtained from trading with firm  $I$  when the upstream licensor trades with firm  $I$  which is weighted by the upstream licensor's bargaining power over firm  $I$ ,  $\beta \pi_I^m(c_I)$  in Eq.(4), is equal to the upstream licensor's outside value when it trades firm  $E$ ,  $\beta \pi_I^m(c_I)$  in Eq.(2). Therefore, comparing Eq.(2) and Eq.(4), these two cancel each other out. We then find that the remaining ones are weighted by the upstream licensor's bargaining powers over the downstream firms,  $\alpha$  and  $\beta$ . This is understood by the following equation. This means that the upstream licensor's bargaining powers over the downstream firms do not affect the comparison of the upstream licensor's profits in the two cases although they affect the absolute amount of that.

$$T_E^n - T_I^n = \alpha \beta (\pi_E^m(c_E) - \pi_I^m(c_I)), \quad (6)$$

Considering  $c_E \leq c_I$ , we find that the upstream licensor prefers to trade with firm  $E$  rather than firm  $I$  if and only if  $\pi_E^m(c_E) > \pi_I^m(c_I)$ . We have the following proposition.

**Proposition 1** *In the situation where no firm has a production facility, the parameters of the upstream licensor's*

*bargaining power over the downstream firms have no effect on the upstream licensor's decision on its trading partner. The determinant of the upstream licensor's trading partner selection is just the marginal costs of the upstream licensor,  $c_E$  and  $c_I$ .*

### 3.2 Only the incumbent has its own outside option

We consider the situation in which only the incumbent has its own production facility (the outside option). In this situation, the downstream market structure depends on with whom the upstream licensor negotiates unlike the benchmark.

#### 3.2.1 Quantity competition and per-unit fee

When the upstream licensor negotiates with firm  $I$  at stage 2 (stage 1) in period 2, because the mathematical procedures is the same as in the benchmark, we briefly show the equilibrium values. Because the optimal per-unit fee is  $w_I^* = c_I$ , the equilibrium output of firm  $I$  is  $q_I(c_I)$ . The equilibrium profit of firm  $I$  and the upstream licensor,  $\pi_I^m(q_I(c_I), c_I)$  and  $\Pi_I^m(q_I(c_I), c_I)$ , respectively, are

$$\pi_I^m(q_I(c_I), c_I) = \pi_I^m(c_I) - T_I,$$

$$\Pi_I^m(q_I(c_I), c_I) = T_I.$$

When the upstream licensor negotiates with firm  $E$  at stage 1 (stage 2) in period 2, the downstream market is a duopoly because firm  $I$  uses the outside option if the negotiation at this stage reaches an agreement. Given the two-part tariff contract, the profit of firms  $E$  and  $I$  in period 3, respectively, are

$$\pi_E^d(q_E, q_I, w_E) = (p(q_E, q_I) - w_E)q_E - T_E,$$

$$\pi_I^d(q_E, q_I, h_I) = (p(q_E, q_I) - h_I)q_I,$$

where the superscript  $d$  indicates duopoly. The first-order conditions for profit maximization are

$$\frac{\partial \pi_E^d(q_E, q_I, w_E)}{\partial q_E} = \frac{\partial p(q_E, q_I)}{\partial q_E} q_E + p(q_E, q_I) - w_E = 0, \quad (7)$$

$$\frac{\partial \pi_I^d(q_E, q_I, h_I)}{\partial q_I} = \frac{\partial p(q_E, q_I)}{\partial q_I} q_I + p(q_E, q_I) - h_I = 0. \quad (8)$$

From Eq.(7) and (8), the output of firm  $E$  is  $q_E(w_E, h_I)$ . We now assume that the two-part tariff contract does not observable for firm  $I$ . Thereby, the output of firm  $I$  is  $q_I(\hat{w}_E, h_I)$ , where  $\hat{w}_E$  is firm  $I$ 's expectation on the per-unit fee that the upstream licensor offers firm  $E$ . Therefore, the profit of firm  $E$  is

$$\pi_E^d(q_E(w_E, h_I), q_I(\hat{w}_E, h_I), w_E, \hat{w}_E, h_I) = \pi_E^d(w_E, \hat{w}_E, h_I) - T_E,$$

where  $\pi_E^d(w_E, \hat{w}_E, h_I) \equiv (p(q_E(w_E, h_I), q_I(\hat{w}_E, h_I)) - w_E)q_E(w_E, h_I)$  denotes the gross profit for firm  $E$ . The

profit of firm  $I$  is

$$\pi_I^d(q_E(w_E, h_I), q_I(\dot{w}_E, h_I), w_E, \dot{w}_E, h_I) = \pi_I^d(w_E, \dot{w}_E, h_I),$$

where  $\pi_I^d(w_E, \dot{w}_E, h_I) \equiv (p(q_E(w_E, h_I), q_I(\dot{w}_E, h_I)) - h_I)q_I(\dot{w}_E, h_I)$ . The profit of the upstream licensor is

$$\Pi_E^d(q_E(w_E, h_I), w_E, h_I) = (w_E - c_E)q_E(w_E, h_I) + T_E.$$

The joint profit for the upstream licensor and firm  $E$  is given by

$$\Pi_E^d(q_E(w_E, h_I), w_E, h_I) + \pi_E^d(q_E(w_E, h_I), q_I(\dot{w}_E, h_I), w_E, \dot{w}_E, h_I) = (p(q_E(w_E, h_I), q_I(\dot{w}_E, h_I)) - c_E)q_E(w_E, h_I).$$

The first-order condition for the joint profit maximization is

$$\left\{ -c_E + \frac{\partial p(q_E(w_E, h_I), q_I(\dot{w}_E, h_I))}{\partial q_E(w_E, h_I)} q_E(w_E, h_I) + p(q_E(w_E, h_I), q_I(\dot{w}_E, h_I)) \right\} \frac{\partial q_E(w_E, h_I)}{\partial w_E} = 0.$$

From the envelope theorem, the optimal per-unit fee is  $w_E^* = c_E$ . That is, the upstream licensor optimally sets the per-unit at the marginal cost of licensing to firm  $E$ ,  $c_E$ . Thus, the equilibrium output of firm  $E$  is  $q_E(c_E, h_I)$ . Because firm  $I$  expects the per-unit fee,  $c_E$ , the equilibrium output of firm  $I$  is  $q_I(c_E, h_I)$ . The equilibrium profits of firms  $E$  and  $I$ ,  $\pi_E^d(q_E(c_E, h_I), q_I(c_E, h_I), c_E, h_I)$  and  $\pi_I^d(q_E(c_E, h_I), q_I(c_E, h_I), c_E, h_I)$ , respectively, are

$$\pi_E^d(q_E(c_E, h_I), q_I(c_E, h_I), c_E, h_I) = \pi_E^d(c_E, h_I) - T_E.$$

$$\pi_I^d(q_E(c_E, h_I), q_I(c_E, h_I), c_E, h_I) = \pi_I^d(c_E, h_I)$$

The equilibrium profit of the upstream licensor,  $\Pi_E^d(q_E(c_E, h_I), c_E, h_I)$ , is

$$\Pi_E^d(q_E(c_E, h_I), c_E, h_I) = T_E.$$

### 3.2.2 Fixed fee in case 1 where the entrant is the first negotiation partner

At stage 2 in period 2,  $T_I$  is determined such that  $T_I : \pi_I^m(c_I) - T_I - \pi_I^m(h_I) = \beta : (1 - \beta)$  is satisfied, where  $\pi_I^m(h_I) \equiv (p(q_I(h_I)) - h_I)q_I(h_I)$  denotes firm  $I$ 's outside value. The profit of the upstream licensor is

$$T_I = \beta(\pi_I^m(c_I) - \pi_I^m(h_I)), \quad (9)$$

This represents the upstream licensor's outside value when it trades with firm  $E$ . This includes firm  $I$ 's outside value,  $\pi_I^m(h_I)$ , because firm  $I$  has its own production facility (the outside option). Therefore, firm  $I$ 's outside value has negative effect on the upstream licensor's outside value when it trades with firm  $E$ .

At stage 1 in period 2, anticipating the negotiation at stage 2 in period 2,  $T_E$  is determined such that  $T_E - T_I :$

$\pi_E^d(c_E, h_I) - T_E = \alpha : (1 - \alpha)$  is satisfied. The profit of the upstream licensor is

$$T_E^y = \alpha(\pi_E^d(c_E, h_I) - \beta(\pi_I^m(c_I) - \pi_I^m(h_I))) + \beta(\pi_I^m(c_I) - \pi_I^m(h_I)), \quad (10)$$

where the superscript  $y$  indicates that only firm  $I$  has its own production facility (the outside option). In the first term,  $\pi_E^d(c_E, h_I) - \beta(\pi_I^m(c_I) - \pi_I^m(h_I))$  represents the net gain obtained from trading with firm  $E$ . Unlike the negotiation with firm  $I$  at stage 2 in period 2, this does not include firm  $E$ 's outside value because firm  $E$  does not have a production facility (an outside option) and thereby firm  $E$ 's outside value is zero. Therefore, firm  $E$ 's outside value has no effect on the net gain obtained from trading with firm  $E$ .

**lemma 1** *In case 1 where the entrant is the first negotiation partner, because the entrant does not have a production facility (an outside option), the entrant's outside value is not included in the net gain obtained from trading with the entrant. On the other hand, because the incumbent has its production facility (the outside option), the incumbent's outside value is included in the upstream licensor's outside value when the upstream licensor trades with firm  $E$ .*

From Eq.(10), the upstream licensor has incentives to trade with the first negotiation partner, firm  $E$ , if the following condition holds.

$$\pi_E^d(c_E, h_I) > \beta(\pi_I^m(c_I) - \pi_I^m(h_I)). \quad (11)$$

### 3.2.3 Fixed fee in case 2 where the incumbent is the first negotiation partner

At stage 2 in period 2,  $T_E$  is determined such that  $T_E : \pi_E^d(c_E, h_I) - T_E = \alpha : (1 - \alpha)$  is satisfied. The profit of the upstream licensor is

$$T_E = \alpha\pi_E^d(c_E, h_I). \quad (12)$$

This is the upstream licensor's outside value when it trades with firm  $I$ . As with the negotiation with firm  $E$  at stage 1 in period 2 in case 1, this does not include firm  $E$ 's outside value because firm  $E$  does not have a production facility and thereby firm  $E$ 's outside value is zero.

At stage 1 in period 2, anticipating the negotiation at stage 2 in period 2,  $T_I$  is determined such that  $T_I - T_E : \pi_I^m(c_I) - T_I - \pi_I^d(c_E, h_I) = \beta : (1 - \beta)$  is satisfied,  $\pi_I^d(c_E, h_I)$  denotes firm  $I$ 's outside value. The profit of the upstream licensor is

$$T_I^y = \beta(\pi_I^m(c_I) - \pi_I^d(c_E, h_I) - \alpha\pi_E^d(c_E, h_I)) + \alpha\pi_E^d(c_E, h_I). \quad (13)$$

In the first term,  $\pi_I^m(c_I) - \pi_I^d(c_E, h_I) - \alpha\pi_E^d(c_E, h_I)$  represents the net gain obtained from trading with firm  $I$ . Unlike the negotiation with firm  $E$  at stage 2 in period 2, this includes firm  $I$ 's outside value,  $\pi_I^d(c_E, h_I)$ , because firm  $I$  has its own production facility (the outside option).

**lemma 2** *In the case where the incumbent is the first negotiation partner, because the incumbent has its own production facility (the outside option), the incumbent's outside value is included in the net gain obtained from trading with the incumbent. On the other hand, because the entrant does not have a production facility (an outside option), the*

entrant's outside value is not included in the upstream licensor's outside value when the upstream licensor trades with firm  $I$ .

This lemma states that unlike case 1, firm  $I$ 's outside value has negative effect on the net gain obtained from trading with firm  $I$  because firm  $I$  has its own production facility (the outside option).

From Eq.(13), the upstream licensor has incentives to trade with the first negotiation partner, firm  $I$ , if the following condition holds.

$$\pi_I^m(c_I) - \pi_I^d(c_E, h_I) > \alpha\pi_E^d(c_E, h_I). \quad (14)$$

### 3.2.4 Selection of the trading partner

Assuming that Eq.(11) and Eq.(14) hold, we examine the determinant of the upstream licensor's trading partner selection when only firm  $I$  has its own production facility (the outside option).

We find that the gross profit obtained from trading with firm  $E$  when the upstream licensor trades with firm  $E$  which is weighted by the upstream licensor's bargaining power over firm  $E$ ,  $\alpha\pi_E^d(c_E, h_I)$  in Eq.(10), is equal to the upstream licensor's outside value when it trades with firm  $I$ ,  $\alpha\pi_E^d(c_E, h_I)$  in Eq.(13). This occurs because firm  $E$ 's outside value is not included in the net gain obtained from trading with firm  $E$ , as described by lemma 1 and 2. Therefore, comparing Eq.(10) with Eq.(13), these two cancel each other out. We then find that the remaining ones are weighted by the upstream licensor's bargaining power over firm  $I$ ,  $\beta$ . This is understood by Eq.(15). This means that the upstream licensor's bargaining power over firm  $I$  does not affect the comparison of the upstream licensor's profits in the two cases although it affects the absolute amount of that. That is, the upstream licensor's bargaining power over firm  $I$  is not the determinant of its trading partner selection although its bargaining power over firm  $E$ , its marginal cost of licensing to firm  $i$ , and the incumbent's outside is the determinant of that.

$$T_E^y - T_I^y = \beta\{-\alpha\pi_I^m(c_I) - (1 - \alpha)\pi_I^m(h_I) + \alpha\pi_E^d(c_E, h_I) + \pi_I^d(c_E, h_I)\}. \quad (15)$$

We then find that the upstream licensor prefers to trade with firm  $E$  rather than firm  $I$  if and only if  $\alpha(\pi_I^m(c_I) - \pi_I^m(h_I)) + \pi_I^d(c_E, h_I) < \alpha\pi_E^d(c_E, h_I) + \pi_I^d(c_E, h_I)$ . We have the following proposition.

**Proposition 2** *In the situation where only the incumbent has its own production facility, the parameter of the upstream licensor's bargaining power over the incumbent has no effect on the upstream licensor's decision on its trading partner. The determinants of its trading partner selection are the upstream licensor's bargaining power over the entrant, the upstream licensor's marginal cost of licensing to the entrant/the incumbent, and the incumbent's outside value.*

From a rearrangement of Eq.(15), we have the following condition for the upstream licensor to trade with the entrant/the incumbent if the value of  $\pi_E^d(c_E, h_I) + \pi_I^m(h_I) - \pi_I^m(c_I)$  is positive in Eq.(15):

$$\left\{ \begin{array}{ll} T_E^y > T_I^y & \text{if } \frac{\pi_I^m(h_I) - \pi_I^d(c_E, h_I)}{\pi_E^d(c_E, h_I) + \pi_I^m(h_I) - \pi_I^m(c_I)} < \alpha < \min\{1, \frac{\pi_I^m(c_I) - \pi_I^d(c_E, h_I)}{\pi_E^d(c_E, h_I)}\}, \\ T_E^y < T_I^y & \text{if } 0 < \alpha < \frac{\pi_I^m(h_I) - \pi_I^d(c_E, h_I)}{\pi_E^d(c_E, h_I) + \pi_I^m(h_I) - \pi_I^m(c_I)}, \end{array} \right. \quad (16)$$

$$\left\{ \begin{array}{ll} T_E^y > T_I^y & \text{if } \frac{\pi_I^m(h_I) - \pi_I^d(c_E, h_I)}{\pi_E^d(c_E, h_I) + \pi_I^m(h_I) - \pi_I^m(c_I)} < \alpha < \min\{1, \frac{\pi_I^m(c_I) - \pi_I^d(c_E, h_I)}{\pi_E^d(c_E, h_I)}\}, \\ T_E^y < T_I^y & \text{if } 0 < \alpha < \frac{\pi_I^m(h_I) - \pi_I^d(c_E, h_I)}{\pi_E^d(c_E, h_I) + \pi_I^m(h_I) - \pi_I^m(c_I)}, \end{array} \right. \quad (17)$$

where we now assume that  $\pi_I^d(c_E, h_I) + \pi_E^d(c_E, h_I) > \pi_I^m(c_I)$  in order to secure the condition that  $T_E^y > T_I^y$ . This assumption implies that industrial profits obtained from trading with firm  $E$  are greater than those obtained from trading with firm  $I$ .

The conditions in Eq.(16) and Eq.(17) represent that trading with firm  $E$  yields the greater profit of the upstream licensor if the upstream licensor's bargaining power over firm  $E$ ,  $\alpha$ , is relatively large. Otherwise, trading with firm  $I$  yields the greater profit of the upstream licensor. On the other hand, we find that  $T_E^y > T_I^y$  if the value of  $\pi_E^d(c_E, h_I) + \pi_I^m(h_I) - \pi_I^m(c_I)$  in Eq.(15) is negative. This represents that trading with firm  $I$  yields the greater profit of the upstream licensor in any  $\alpha$ . In sum, it is desirable for the upstream licensor to trades with firm  $E$  if and only if the value of  $\pi_E^d(c_E, h_I) + \pi_I^m(h_I) - \pi_I^m(c_I)$  is positive, and  $\alpha$  is relatively large. In other words, the upstream licensor prefers to trade with firm  $E$  if and only if there is less negative effect of the upstream licensor's outside value on the net gain obtained from trading firm  $E$  when it trades with firm  $E$  and there is larger bargaining power over the entrant.

## 4 Discussion

We now assume that the marginal cost of production when the incumbent uses its own production facility (the outside option),  $h_I$ , is nearly equal to the per-unit fee for licensing to firm  $I$ ,  $c_I$ . That is, we assume that the incumbent has its own production facility (the outside option) which is so efficient. Considering the condition Eq.(14), we find that the upstream licensor's profit obtained from trading with the incumbent,  $T_I^y$  in Eq.(13), may be greater than that obtained from trading with the entrant,  $T_E^y$  in Eq.(10). Therefore, the upstream licensor prefers to trade with the incumbent. The intuition is simple: if the upstream licensor trades with the entrant, the upstream licensor incurs a loss due to the tough downstream competition with the efficient incumbent. In contrast, assuming that the incumbent has its own production facility (the outside option) which is so inefficient, the upstream licensor prefers to trade with the entrant due to the soft downstream competition with the inefficient incumbent. We also find that, whether the incumbent's production facility (the outside option) is so efficient or not, the parameters of the upstream licensor's bargaining power over the downstream firms,  $\alpha$  and  $\beta$ , have no effect on the upstream licensor's decision on its trading partner as with the benchmark.

We now discuss on promoting downstream competition. Caprice (2005) and Sandonis (2012) show that promoting downstream competition yields greater profit for an upstream firm. Our paper shows that although trading with the entrant which does not a production facility (an outside value) promotes downstream competition, that may lead to greater profit for an upstream firm if trading with the entrant yields the incumbent's outside value and the upstream licensor's outside value smaller than those obtained from trading with the incumbent.

## 5 Concluding remarks

We investigate the determinant of trading partner selection for an upstream licensor which trades with either the incumbent or the entrant. Assuming only the incumbent has its own production facility (the outside option), we find that the upstream licensor's bargaining power over the incumbent does not affect the upstream licensor's decision on its trading partner although that over the entrant influences its decision. The factors which determines the upstream licensor's trading partner are the upstream licensor's bargaining power over the entrant and the upstream licensor's marginal cost of licensing to the entrant/the incumbent, and the incumbent's outside value.

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