Paying not to sell

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Abstract

In this paper we show that, in the presence of buyer and seller power, a monopolist can enter into a costly contractual relationship with a low-quality supplier with the sole intention of improving its bargaining position relative to a high-quality supplier, *without ever* selling the good produced by that firm.

Keywords: Monopoly; Vertical product differentiation; Vertical relationships

JEL classification: L12, L13, L14.

1 Introduction

We analyze the behavior of a monopolistic retailer that may enter into a contractual relationship with two upstream producers supplying goods of different quality. Unlike the existing literature, we assume that all firms retain bargaining power in the setting of the supply contract. We show that the monopolist always signs contracts with both firms. Although the equilibrium contracts are efficient (upstream price equals upstream marginal production cost), the monopolist sets downstream prices so as to always sell the high-quality variant of the good only. It nevertheless pays a fixed fee to the low-quality producer in order to improve its outside option and hence its bargaining position relative to the high-quality supplier. In the following, Section 2 presents the model and Section 3 identifies and characterizes its unique equilibrium. Finally, Section 4 positions our paper relative to the extant literature.

2 The model

Two upstream firms, denoted 1 and 2, produce a vertically differentiated good of quality s_1 and s_2 respectively, with $s_2 > s_1 > 0$. A downstream monopolist purchases the good(s) from one (or both) firm(s) and sells it (them) to the final consumers. Both the production and retail costs are zero.

Consumers are heterogeneous in their quality appreciation θ, which is uniformly distributed with density $\frac{1}{\overline{\theta}-\underline{\theta}}$ over $[0, 1]$. A consumer enjoys an indirect Mussa and Rosen (1978) utility $U(\theta) = \theta s_i - p_i$ if she buys a product of quality s_i at price p_i, and zero if she abstains from consuming, $i \in \{1, 2\}$. As a unit mass of consumers exists, the market demands are written $D_1(p_1, p_2) = \frac{1}{\overline{\theta}-\underline{\theta}} \left(\frac{p_2-p_1}{s_2-s_1} - \frac{p_1}{s_1} \right)$ and $D_2(p_1, p_2) = \frac{1}{\overline{\theta}-\underline{\theta}} \left(1 - \frac{p_2-p_1}{s_2-s_1} \right)$ when both goods are supplied; and $D_i(p_i) = \frac{1}{\overline{\theta}-\underline{\theta}} \left(1 - \frac{p_i}{s_i} \right)$ when variant i only is offered.

Consider a three-stage game. At stage 1 the downstream monopolist commits to an exclusive relationship with firm $i \in \{1, 2\}$ only, or to a non-exclusive relationship with both firms. At stage 2 the monopolist bargains simultaneously with each of its suppliers over a two-part-tariff contract (w_i, t_i), where w_i is a per-unit input price and t_i is the fixed fee. At stage 3, the monopolist sets the final price(s) for the goods purchased.

We solve by backward induction the sub-games with an exclusive contract and that with non-exclusive ones, and compare their outcomes to find the subgame-perfect Nash equilibrium of the whole game.

3 Equilibrium

3.1 Exclusive contracts

Stage 3. The monopolist commits to an exclusive relationship with producer $i \in \{1,2\}$. The pricing stage profit for the monopolist is $(p_i - w_i)D_i(p_i) - t_i$, which is maximized for $p_i(w_i) = \frac{s_i+w_i}{2}$. By plugging the price back into the profit we find that this profit is $\Pi_i(w_i,t_i) = \frac{(s_i-w_i)^2}{4} - t_i$. The profit of supplier i is $w_i D_i(p_i) + t_i$, which, at $p_i(w_i)$, writes $\pi_i(w_i,t_i) = \frac{(s_i-w_i)w_i}{2s_i} + t_i$.

Stage 2. The optimal two-part tariff (w_i, t_i) is obtained through the generalized Nash bargaining solution. Let $\alpha \in]0,1[$ (res. $\beta \in]0,1[$) be the power of the monopolist in the bargaining with the high-(res. low-)quality producer, and, accordingly, let $1-\alpha$ and $1-\beta$ be the power of the high- and low-quality producers respectively.[1] The outside options for all the firms are zero: if no agreement is reached, no firm has alternative sources of profit. The Nash product is, therefore, $B(w_i,t_i) = [\Pi(w_i,t_i)]^{\mu}[\pi(w_i,t_i)]^{1-\mu}$, with $i = 1,2$ and $\mu = \alpha$ (res. $\mu = \beta$) if, and only if $i = 2$ (res. $i = 1$). Maximization of $B_i(w_i,t_i)$ with respect to w_i and t_i gives $w_i = 0$ and $t_i = \frac{(1-\mu)s_i}{4}$. The variable part of the tariff is set so as to maximize the joint profits of the chain, and the total profits are apportioned according to the sharing rule determined by the bargaining weights. By plugging the optimal two-part tariff back into price, demand and profits we obtain their values at the equilibrium of these sub-games:

$$p_i^I = \frac{s_i}{2}, \quad D_i^I = \frac{1}{2}, \tag{1}$$

$$\Pi_i^I = \mu\frac{s_i}{4}, \quad \pi_i^I = (1-\mu)\frac{s_i}{4}; \tag{2}$$

[1]We let α and β vary over the open interval $]0,1[$ to allow for a positive bargaining power for all the firms.

with $i = 1, 2$ and $\mu = \alpha$ (res. $\mu = \beta$) if, and only if $i = 2$ (res. $i = 1$). If committed to an exclusive relationship, the monopolist signs a contract with the high-(res. low-)quality producer if, and only if $\Pi_2^I > \Pi_1^I \Leftrightarrow \frac{\alpha}{\beta} > \frac{s_1}{s_2}$ (res. $\Pi_2^I < \Pi_1^I \Leftrightarrow \frac{\alpha}{\beta} < \frac{s_1}{s_2}$).

3.2 Non-exclusive contracts

Stage 3. The monopolist may sign a contract with both producers and, thus, sell both goods to the final consumers. In this case its profits are written as

$$\sum_{i=1}^{2}[(p_i - w_i)D_i(p_1, p_2) - t_i]. \tag{3}$$

Standard computations yield the optimal prices at this stage: $p_i(w_i, t_i) = \frac{s_i + w_i}{2}$, for $i = 1, 2$. Accordingly, the profits for the monopolist, the high-quality producer and the low-quality producer are $\Pi(w_1, w_2, t_1, t_2) = \frac{s_1\left[\Delta s(s_2 - 2w_2) + w_2^2\right] + w_1(s_2 w_1 - 2s_1 w_2)}{4s_1 \Delta s} - t_1 - t_2$, $\pi_2(w_1, w_2, t_2) = \frac{w_2(\Delta s - w_2 + w_1)}{2\Delta s} + t_2$ and $\pi_1(w_1, w_2, t_1) = \frac{w_1(s_1 w_2 - s_2 w_1)}{2s_1 \Delta s} + t_1$, where $\Delta s \equiv s_2 - s_1$.

Stage 2. The monopolist simultaneously bargains over the two-part tariff with the two producers.[2] The bargaining weights are unchanged compared to the case of exclusive contracts, and they are common knowledge among the firms. The outside options for the upstream firms are still zero: if no agreement is reached they cannot sell their good. Yet, in this case, the outside option for the monopolist is no longer zero, because, if the agreement with firm i is not reached, the bargaining with firm j $(i, j \in \{1, 2\}, i \neq j)$ continues, as in the case of exclusive contracts. Thus, the outside option of the monopolist in the bargaining with firm 1 is Π_2^I and that with firm 2 is Π_1^I. Accordingly,

[2]The analysis is developed in the case of public contracts. However, since the monopolist knows the terms of both contracts, the distinction between public and secret contracts is immaterial here.

the two Nash products are

$$B_1(w_1, w_2, t_1, t_2) = [\Pi(w_1, w_2, t_1, t_2) - \frac{\alpha s_2}{4}]^{\beta}[\pi_1(w_1, w_2, t_1)]^{1-\beta}, \tag{4}$$

$$B_2(w_1, w_2, t_1, t_2) = [\Pi(w_1, w_2, t_1, t_2) - \frac{\beta s_1}{4}]^{\alpha}[\pi_2(w_1, w_2, t_2)]^{1-\alpha}. \tag{5}$$

The joint maximization of (4) and (5) yields the equilibrium two-part tariffs with non-exclusive contracts. They are $w_1^{II} = 0$, $t_1^{II} = \frac{s_1\beta(1-\alpha)(1-\beta)}{4(\alpha+\beta-\alpha\beta)}$ and $w_2^{II} = 0$, $t_2^{II} = \frac{(1-\alpha)[\alpha s_2 - \beta s_1 + (1-\alpha)\beta s_2]}{4(\alpha+\beta-\alpha\beta)}$.[3] By plugging these values back into the equilibrium prices and demands we obtain

$$p_2^{II} = \frac{s_2}{2}, \quad p_1^{II} = \frac{s_1}{2}, \tag{6}$$

$$D_2^{II} = \frac{1}{2}, \quad D_1^{II} = 0. \tag{7}$$

Since $w_i^{II} = 0, i \in \{1, 2\}$, the profits of the upstream firms coincide with the fixed fee of the two-part tariff: $\pi_i^{II} = t_i^{II}, i \in \{1, 2\}$. The profit of the downstream monopolist is

$$\Pi^{II} = \frac{\alpha s_2}{4} + \frac{s_1\beta^2 (1-\alpha)}{4(\alpha+\beta-\alpha\beta)}. \tag{8}$$

We state

Proposition 1. *Let $(\alpha, \beta) \in]0, 1[^2$. The monopolist*

(i) Always signs contracts with both the high- and low-quality producer.

(ii) Never sells the low-quality good.

Proof. $\forall(\alpha, \beta) \in]0, 1[^2$

(i) $\Pi^{II} - \Pi_1^{I} = \frac{\alpha s_2}{4} - \frac{\alpha\beta s_1}{4(\alpha+\beta-\alpha\beta)} > 0$; $\Pi^{II} - \Pi_2^{I} = \frac{s_1(1-\alpha)\beta^2}{4(\alpha+\beta-\alpha\beta)} > 0$.

(ii) $D_1^{II} = 0$

$\square$

[3] Proof in Appendix A.

The monopolist always finds it optimal to sign non-exclusive contracts with both producers. These contracts are efficient, as the upstream price equals the upstream marginal production cost. Yet, the monopolist sets the downstream prices so that the equilibrium demand for the low-quality good is zero, to avoid cannibalization between variants. The monopolist nevertheless pays a positive fee, as determined by the contract, to the low-quality producer. The contractual relationship with the low-quality producer is only a device to improve the bargaining position of the monopolist over the high-quality producer, and has no effect on the final market.

4 Discussion

Our result connects to several strands of literature. First, it shows that the "pooling menu" (Acharyya, 1998) remains an equilibrium outcome when vertical relations and non-linear contracts are taken into account, because of the monopolist's endeavor to avoid cannibalization between variants. Yet the monopolist "subsidizes" the low-quality firm in order to have a "call option" for the low-quality good which is *never* taken up along the equilibrium path. This observation allows us to link our note to the literature on private labels. Mills (1995), analyzing successive monopolies with linear contracts, shows that private labels purchased in competitive markets may be used by retailers to increase their "bargaining power" over suppliers. Yet, depending on the relative unit prices of the (high-quality) national brand and of the (low-quality) private label, and on their quality differential, the retailer may actually sell the low-quality good. This should be contrasted with our result, which states that the monopolist *never* offers the low-quality good to consumers, even though it signs a contract with the low-quality producer. The reason is that, unlike Mills (1995), we consider non-linear contracts which do not distort the relative upstream price of products. This ultimately makes it is unprofitable for the monopolist to actually sell the low-quality good along with the high-quality one. Finally, our note relates to the analyses of the monopoly incentives towards product innovation. Lambertini and Orsini (2000) and Gabszewicz and Wauthy (2002) show that, in the absence of spillover effects, the monopolist's product innovation incentives are socially suboptimal. Our note, by contrast, suggests that a monopolist may have too many product innovation incentives. Assume,that only the high-quality good is available from an upstream producer, the monopolist may still decide to develop a low-quality variant of the good in order to improve its bargaining position relative to the supplier. Since the low-quality variant would not ever be sold on the final market, neither it would affect the pricing policy of the monopolist, any investment to develop this variety would have no positive impact on industy surplus and, accordingly, would be socially undesirable.

Appendices

A Optimal two-part tariffs with non-exclusive contracts

Consider first the maximization of (4) and (5) with respect to t_i. By solving $\frac{\partial \log[B_1(\cdot)]}{\partial t_1} = 0$ and $\frac{\partial \log[B_2(\cdot)]}{\partial t_2} = 0$ for t_1 and t_2 we obtain, respectively:

$$\begin{aligned} t_1(w_1, w_2, t_2) = \\ = \frac{(1-\alpha)(1-\beta)s_2^2 s_1 + s_2\left[s_1^2(\alpha+\beta-\alpha\beta-1) - 2(1-\beta)s_1 w_2 + (1+\beta)w_1^2\right] + s_1 w_2[2s_1 + w_2 - 2w_1 - \beta(2s_1+w_2)]}{4s_1(s_2-s_1)} + \\ - (1-\beta)t_2, \end{aligned} \tag{9}$$

$$\begin{aligned} t_2(w_1, w_2, t_1) = \\ = \frac{s_1 s_2^2(1-\alpha) + s_2\left[(1-\alpha)w_1^2 - 2s_1 w_2 - (1-\alpha)(1+\beta)s_1^2\right] - (\alpha-1)\beta s_1^3 + s_1 w_2(2s_1 + \alpha w_2 + w_2 - 2w_1)}{4s_1(s_2-s_1)} + \\ - (1-\alpha)t_1. \end{aligned} \tag{10}$$

We now use (9) (res. (10)) as a constraint in the problem of maximizing $B_1(\cdot)$ (res. $B_2(\cdot)$) with respect to w_1 (res. w_2). The solution to these programs is:

$$w_1^{II} = 0, \quad w_2^{II} = 0. \tag{11}$$

By plugging (11) into (9) and (10) and solving the system so defined we obtain the optimal fixed fees:

$$t_1^{II} = \tfrac{s_1\beta(1-\alpha)(1-\beta)}{4(\alpha+\beta-\alpha\beta)}, \quad t_2^{II} = \tfrac{(1-\alpha)[\alpha s_2-\beta s_1+(1-\alpha)\beta s_2]}{4(\alpha+\beta-\alpha\beta)}. \tag{12}$$

Second-order conditions are locally satisfied. This, together with the uniqueness of the maximizers of $B_i(\cdot), i \in \{1,2\}$, completes the proof.

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