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Exclusive contracts with vertically differentiated products

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Abstract

In this paper we develop a simple model to analyze the effects of exclusive contracts in vertically integrated markets where both the upstream and the downstream market are characterized as oligopolies and manufacturers produce vertically differentiated products. We find that firms prefer to deal exclusively with retailers. If the extent of consumers' heterogeneity is small, manufacturers offer exclusive contracts unilaterally. On the other hand, if consumers' valuations differ significantly both manufacturers engage in exclusive contracting.

1. Introduction

Contracts between a manufacturer and its retailers often contain exclusive contracting provisions that prohibit one or both parties from trading with anyone else. Many papers have studied this sort of contractual relationships, but the principal focus is on contracts that prevent retailers from selling goods to compete directly with the manufacturers product.

The literature offers three types of explanations for these exclusionary provisions.¹ First, exclusive contracts can serve to prevent entry of potentially more efficient competitors (Rasmusen, Ramseyer and Wiley (1991), Segal and Whinston (2000a)). Secondly, exclusive contracts can be used to extract rents from a third party (Aghion and Bolton (1997)). By using contractually specified damages, an incumbent and its retailer can strategically force the entrant to lower the price he offers to the retailer, which will increase the incumbent and retailer's joint profits. Finally, exclusive contracts can be viewed as a method to motivate agents to make relationship-specific investments (Segal and Whinston (2000b), de Meza and Selvaggi (2004)).

Several papers examine exclusive contracting in a multiplayer setting (Hart and Tirole (1990), Besanko and Perry (1994), Stefanadis (1998) and Spector (2004)). The principal finding of these works is that under exclusive contracting arrangements, the manufacturing firms profits are unambiguously higher; nevertheless, they result in a decline in both consumer and aggregate welfare.

The current literature, however, provides no explanation for why many manufacturers do not use exclusive contracts. This is puzzling in view of the common finding just noted that their profits would unambiguously be greater were they to do so. Indeed, little attention is paid to the reason that some manufacturers deliberately commit themselves to sell their products exclusively through a specific retailer, without any formal contractual restriction on their behavior. However, such contracts are commonly used practices in different industries. Well-known examples are found in industries such as telecommunications or the food industry.

In the present paper, we fill the gap in the theoretical literature by providing a simple model that explains unilateral exclusivity of the part of a manufacturer when dealing with a retailer. We consider an industry in which two manufacturers sell products of different qualities, through retailers, to a population of consumers who differ in the value they place on quality. The manufacturers first decide whether to deal exclusively with a specific retailer while retailers compete in prices. Our equilibrium analysis reveals that, for a given part of the parameter space, both of the manufacturing firms offer exclusive contracting. However, in some parameter regions, only one of them offers an exclusive contract and this firm can be the high or low quality producer. Most interestingly, the scope of exclusive contracting intimately depends on the degree of consumer taste heterogeneity. Thus if this heterogeneity is large, both firms offer exclusive contracts, but if it is small, then only one of them does so. As we will show, the principle of trade-off is that exclusivity limits ex post competition (allowing firms to benefit from near monopoly prices), but at the cost of limiting market share (because of double marginalization). Moreover, as we will show, the degree of consumer taste heterogeneity affects this trade-off in a predictable way.

2. The Model

Consider a market in which two manufacturers are selling products with different qualities through retailers to the consumers. Each product $i = A, B$ is characterized by its quality $s_i \geq 0$. Consumers are heterogeneous in their quality valuation and their preferences are described as follows: a consumer identified by θ derives the following utility from buying one unit of a product i :

$$U(\theta) = v + \theta s_i - p_i \tag{1}$$

¹For detailed overview of the literature, see Whinston (2006)

where v is a positive constant, s_i is a quality parameter and p_i is the price of product i . The population of consumers is described by the parameter θ which is uniformly distributed between $\underline{\theta}$ and $\bar{\theta}$, with $\bar{\theta} > \underline{\theta} > 0$. We assume that v is large enough for all consumers to find a product that yields a positive payoff in equilibrium.

Manufacturer i produces at c_i marginal cost an s_i quality product and sells at price w_i to the retailers. Qualities are exogenous and without loss of generality we assume $s_B > s_A$. We normalize $c_B > c_A = 0$ and we assume the fixed cost of production is zero. For simplicity, retailers $j = 1, \dots, n$ have no retailing costs above the cost of obtaining the products from manufacturers. For the sake of tractability we restrict our attention to the case of $n = 2$. Generalizing the model for n retailers is straightforward.

We solve the following sequential game for its subgame perfect Nash equilibrium. In the first stage, manufacturers simultaneously decide on whether to commit themselves to deal exclusively with a retailer and set their prices in the form of w_i . These decisions then become common knowledge. In the second stage, retailers simultaneously announce if they accept any of the offers and compete in Bertrand fashion. The game is solved by backward induction.

Hereafter we investigate the retailers' pricing decisions taking as given the decisions of manufacturers made in the first stage of the game. There are four subgames to consider corresponding to the following: no manufacturer offers exclusive contract; manufacturer B (the high quality manufacturer) is dealing exclusively with a retailer, while the other manufacturer sells its product without limitation; manufacturer A (the low quality manufacturer) is engaged unilaterally in exclusive contracting and both manufacturers sell exclusively through retailers.

Since $s_B > s_A$, all consumers prefer the high quality product to the low quality product when $p_A = p_B$. Thus, in order to exclude the case when manufacturer B benefits from the possibility of preempting the market with a limit price such as $p_B = p_A + \underline{\theta}(s_B - s_A)$ we make the following assumption

Assumption 1

$$\begin{aligned} \frac{c_B}{s_B - s_A} < 2\bar{\theta} - \underline{\theta} & \text{ if } \bar{\theta} \leq \frac{c_B}{s_B - s_A} \\ 2\underline{\theta} - \bar{\theta} < \frac{c_B}{s_B - s_A} & \text{ if } \bar{\theta} > \frac{c_B}{s_B - s_A} \end{aligned}$$

(A1) implies that in equilibrium both manufacturers enjoy positive market shares and earn positive profits in each subgame.

Nash equilibrium in the subgames is obtained in two steps. First, we compute the candidate equilibrium. Second, we identify the parameters configuration for which candidates effectively yield the corresponding outcome.

No exclusive contracts. When there is no manufacturer who offers exclusive contract to any of the retailers both products are available for purchasing at every retailer. Demand addressed to product i is defined by the set of consumers who maximize their utility when buying product i rather than product $-i$. Given (p_A, p_B) , where $p_i = \min \{p_{i1}, p_{i2}\}$, p_{ij} being the price of product i at the retailer j ($i = A, B$ and $j = 1, 2$), we denote by $\tilde{\theta}(p_A, p_B)$ the marginal consumer who is indifferent between consuming product A or product B . By definition he satisfies $\tilde{\theta}(p_A, p_B)s_A - p_A = \tilde{\theta}(p_A, p_B)s_B - p_B$. Accordingly, consumers with $\theta \leq \tilde{\theta}(p_A, p_B)$ strictly prefer product A over product B and therefore consumers in the interval $\theta \in [\underline{\theta}, \tilde{\theta}(p_A, p_B)]$ will purchase the product A at one of the retailers. Whereas those with $\theta \in (\tilde{\theta}(p_A, p_B), \bar{\theta}]$ will purchase product B from one of B 's retailer. Demand for different products can be given by

$$D_A(p_A, p_B) = \frac{1}{\bar{\theta} - \underline{\theta}} \left(\frac{p_B - p_A}{s_B - s_A} - \underline{\theta} \right) \tag{2}$$

and

$$D_B(p_B, p_A) = \frac{1}{\bar{\theta} - \underline{\theta}} \left(\bar{\theta} - \frac{p_B - p_A}{s_B - s_A} \right) \tag{3}$$

Let $D_{i1}(p_i, p_{-i})$ denote the demand function for product i faced by retailer 1 and $D_{i2}(p_i, p_{-i})$ the demand function for product i faced by retailer 2, respectively. Thus,

$$D_{ij}(p_i, p_{-i}) = \begin{cases} D_i(p_{ij}, p_{-i}) & \text{if } p_{ij} < p_{i,-j} \\ D_i(p_{ij}, p_{-i})/2 & \text{if } p_{ij} = p_{i,-j} \\ 0 & \text{otherwise} \end{cases} \quad (4)$$

and $D_i(p_i, p_{-i}) = \sum_{j=1,2} D_{ij}(p_i, p_{-i})$.

The retailers choose simultaneously p_{A1} , p_{B1} , p_{A2} and p_{B2} to maximize their profits. Since retailers compete in Bertrand fashion, every retailer set prices which are equal to their marginal costs and earn zero profits. Then the i th manufacturer problem is

$$\max_{w_i} \pi_i = D_i(w_i, w_{-i})(w_i - c_i) \quad (5)$$

This yields the manufacturers' wholesale prices. Hence

Lemma 1 (*Equilibrium prices and profits when no manufacturers deal exclusively with retailers*). *If no manufacturer sells exclusively through any retailer the equilibrium prices and profits are as follows*

$$\begin{aligned} p_{A1}^{nn*} = p_{A2}^{nn*} = w_A^{nn*} &= \frac{1}{3}[c_B + (s_B - s_A)(\bar{\theta} - 2\underline{\theta})] & \pi_1^{nn*} &= 0 \\ p_{B1}^{nn*} = p_{B2}^{nn*} = w_B^{nn*} &= \frac{1}{3}[2c_B + (s_B - s_A)(2\bar{\theta} - \underline{\theta})] & \pi_2^{nn*} &= 0 \\ \pi_A^{nn*} &= \frac{[c_B + (\bar{\theta} - 2\underline{\theta})(s_B - s_A)]^2}{9(\bar{\theta} - \underline{\theta})(s_B - s_A)} & \pi_B^{nn*} &= \frac{[c_B - (2\bar{\theta} - \underline{\theta})(s_B - s_A)]^2}{9(\bar{\theta} - \underline{\theta})(s_B - s_A)} \end{aligned}$$

Lemma 1 indicates that for any given quality configuration the high quality manufacturer sets a higher wholesale price and earns a higher profit than the low quality firm. Moreover, in equilibrium manufacturer B always serves a larger market area. These results, in which manufacturer B has a quality advantage over manufacturer A are in line with the findings in literature.

The high quality firm sells exclusively. When only the high quality manufacturer engages in exclusive contracting then its product is available for purchasing at only one retailer shop, while the low quality product can be purchased at any retailer. Without loss of generality we assume that manufacturer B offers an exclusive contract to retailer 2. The demand functions for product A faced by retailer j can be given by (4). While the demand for product B faced by retailer 2 is equal to $D_B(p_B, p_A)$ given by (3), since retailer 2 is the only retailer who sells the product B . Therefore, retailers compete in Bertrand fashion at the market for product A and set $p_{A1} = p_{A2} = w_A$. Since retailer 2 is a monopoly at the retail market for the high quality product, the price set by retailer for this product satisfies

$$p_{B2}^* = \arg \max_{p_{B2}} \frac{1}{\bar{\theta} - \underline{\theta}} \left(\bar{\theta} - \frac{p_{B2} - w_A}{s_B - s_A} \right) (p_{B2} - w_B) \quad (6)$$

This yields to $p_{B2}^* = \frac{1}{2}[w_A + w_B + \bar{\theta}(s_B - s_A)]$.

Moving backward and substituting the retailers' prices into the manufacturers' profit functions and solving the problems for w_A and w_B , we obtain the equilibrium outcome for the respective subgame. Lemma 2 summarizes this result.

Lemma 2 (*Equilibrium prices and profits when only a specific retailer sells exclusively the high quality product*). *Suppose the high quality manufacturer unilaterally offers an exclusive contract to a retailer. The equilibrium prices and profits are as follows*

$$p_{A1}^{ne*} = p_{A2}^{ne*} = w_A^{ne*} = \frac{1}{3}[c_B + (s_B - s_A)(3\bar{\theta} - 4\underline{\theta})]$$

$$\begin{aligned}
 p_{B2}^{ne*} &= \frac{1}{2}[c_B + (s_B - s_A)(3\bar{\theta} - 2\underline{\theta})] & w_B^{ne*} &= \frac{1}{3}[2c_B + (s_B - s_A)(3\bar{\theta} - 2\underline{\theta})] \\
 \pi_A^{ne*} &= \frac{[c_B + (s_B - s_A)(3\bar{\theta} - 4\underline{\theta})]^2}{18(\bar{\theta} - \underline{\theta})(s_B - s_A)} & \pi_B^{ne*} &= \frac{[c_B - (s_B - s_A)(3\bar{\theta} - 2\underline{\theta})]^2}{18(\bar{\theta} - \underline{\theta})(s_B - s_A)} \\
 \pi_2^{ne*} &= \frac{[c_B - (s_B - s_A)(3\bar{\theta} - 2\underline{\theta})]^2}{36(\bar{\theta} - \underline{\theta})(s_B - s_A)} & \pi_1^{ne*} &= 0
 \end{aligned}$$

By granting a downstream firm with exclusivity, the high quality manufacturer causes a double marginalization problem, which has a negative effect on the quantity sold from its product. The high quality manufacturer's market share is $\frac{(s_B - s_A)(3\bar{\theta} - 2\underline{\theta}) - c_B}{6(s_B - s_A)(\bar{\theta} - \underline{\theta})}$ compared to the case when it is not involved in exclusive contracting, $\frac{(s_B - s_A)(2\bar{\theta} - \underline{\theta}) - c_B}{3(s_B - s_A)(\bar{\theta} - \underline{\theta})}$. However, in equilibrium, manufacturer B 's wholesale price, profit and market size is still higher than those of manufacturer A .

The low quality firm sells exclusively. Now suppose that the low quality manufacturer sells exclusively through a retailer. Without loss of generality we assume that the retailer who carry the low quality manufacturer's product is the retailer 1. Again, since retailer 1 is a unique retailer regarding the low quality product, it sets its monopoly price for this product while at the high quality product's market, retailers compete as Bertrand competitors and set their prices equal to the wholesale prices. The analysis goes the same way as in the previous case, when the high quality manufacturer solely engages in exclusive contracting. Formally, we obtain the following equilibrium outcome.

Lemma 3 (*Equilibrium prices and profits when a retailer sells exclusively the low quality product*). Suppose the low quality manufacturer offers an exclusive contract to a retailer. The equilibrium prices and profits are as follows

$$\begin{aligned}
 p_{A1}^{en*} &= \frac{1}{2}[c_B + (s_B - s_A)(2\bar{\theta} - 3\underline{\theta})] & w_A^{en*} &= \frac{1}{3}[c_B + (s_B - s_A)(2\bar{\theta} - 3\underline{\theta})] \\
 p_{B1}^{en*} &= p_{B2}^{en*} = w_B^{en*} \frac{1}{3}[2c_B + (s_B - s_A)(4\bar{\theta} - 3\underline{\theta})] \\
 \pi_A^{en*} &= \frac{[c_B + (s_B - s_A)(2\bar{\theta} - 3\underline{\theta})]^2}{18(\bar{\theta} - \underline{\theta})(s_B - s_A)} & \pi_B^{en*} &= \frac{[c_B - (s_B - s_A)(4\bar{\theta} - 3\underline{\theta})]^2}{18(\bar{\theta} - \underline{\theta})(s_B - s_A)} \\
 \pi_1^{en*} &= \frac{[c_B + (s_B - s_A)(2\bar{\theta} - 3\underline{\theta})]^2}{36(\bar{\theta} - \underline{\theta})(s_B - s_A)} & \pi_2^{en*} &= 0
 \end{aligned}$$

Both manufacturers sell exclusively. When both manufacturers offer exclusive contracts to retailers, the market prices equal the wholesale prices plus the retailers' monopoly margins.² Solving the problem backward and taking the wholesale prices as given, retailers set $p_{A1} = \frac{1}{3}[2w_A + w_B + (s_B - s_A)(\bar{\theta} - 2\underline{\theta})]$ and $p_{B2} = \frac{1}{3}[w_A + 2w_B + (s_B - s_A)(2\bar{\theta} - \underline{\theta})]$, respectively. Substituting these into the manufacturers' profit functions and maximizing them with respect of w_A and w_B yield the following lemma.

²Here we suppose that the manufacturers offer exclusive contracts to different retailers. The case when both manufacturers grant the same retailer with exclusivity doesn't yield to different result from the manufacturers point of view, however the latter case results in the foreclosure of a retailer. This can be an interesting issue for the regulators, though the fact of foreclosure doesn't have any significant effect on welfare in our model. Without loss of generality we assume that manufacturer A offers an exclusive contract to the retailer 1, and manufacturer B to the retailer 2.

Lemma 4 (Equilibrium prices and profits when retailers sell exclusively the manufacturers' products). Suppose the manufacturers offer exclusive contract to retailers. The equilibrium prices and profits are as follows

$$\begin{aligned}
 p_{A1}^{ee*} &= \frac{4}{9}[c_B + (s_B - s_A)(4\bar{\theta} - 5\underline{\theta})] & w_A^{ee*} &= \frac{1}{3}[c_B + (s_B - s_A)(4\bar{\theta} - 5\underline{\theta})] \\
 p_{B2}^{ee*} &= \frac{1}{9}[5c_B + 4(s_B - s_A)(5\bar{\theta} - 4\underline{\theta})] & w_B^{ee*} &= \frac{1}{3}[2c_B + (s_B - s_A)(5\bar{\theta} - 4\underline{\theta})] \\
 \pi_A^{ee*} &= \frac{[c_B + (s_B - s_A)(4\bar{\theta} - 5\underline{\theta})]^2}{27(\bar{\theta} - \underline{\theta})(s_B - s_A)} & \pi_B^{ee*} &= \frac{[c_B - (s_B - s_A)(5\bar{\theta} - 4\underline{\theta})]^2}{27(\bar{\theta} - \underline{\theta})(s_B - s_A)} \\
 \pi_1^{ee*} &= \frac{[c_B + (s_B - s_A)(4\bar{\theta} - 5\underline{\theta})]^2}{81(\bar{\theta} - \underline{\theta})(s_B - s_A)} & \pi_2^{ee*} &= \frac{[c_B - (s_B - s_A)(5\bar{\theta} - 4\underline{\theta})]^2}{81(\bar{\theta} - \underline{\theta})(s_B - s_A)}
 \end{aligned}$$

Having derived the profit functions for the pricing stage, we move one step backward to study the contracting decisions.

3. Equilibrium Contracting Choices

In the contracting stage manufacturers simultaneously decide whether to offer an exclusive contract to a retailer and to sell exclusively through it. By applying this strategy the manufacturer weakens the competition for its product on the market for final consumers which has a profit enhancing effect. On the other hand it causes a double marginalization problem. The payoffs corresponding to different strategies are represented by Table 1.

Table 1: The payoff matrix

		M_B	
		non-exclusively (N)	exclusively (E)
M_A	non-exclusively (N)	$(\pi_A^{nn*}, \pi_B^{nn*})$	$(\pi_A^{ne*}, \pi_B^{ne*})$
	exclusively (E)	$(\pi_A^{en*}, \pi_B^{en*})$	$(\pi_A^{ee*}, \pi_B^{ee*})$

Depending on the population's characteristic the game has several equilibria. Our main findings are stated in the next proposition.

Proposition 1 The following holds for the manufacturers' equilibrium contracting choice.

- (i) If $\bar{\theta} \leq \frac{c_B}{s_B - s_A} \left(\frac{1 + \sqrt{6}}{5} \right)$ then the Nash equilibrium is (N,E) for any value of $\underline{\theta}$, $\bar{\theta}$ which satisfies (A1).
- (ii) If $\frac{c_B}{s_B - s_A} \left(\frac{1 + \sqrt{6}}{5} \right) \leq \bar{\theta} < \frac{c_B}{s_B - s_A}$ then the Nash equilibrium is (N,E) for $\underline{\theta} \geq \bar{\theta} \left(\frac{4 + \sqrt{6}}{2} \right) - \frac{c_B}{s_B - s_A} \left(\frac{2 + \sqrt{6}}{2} \right)$ and (E,E) for any other $\underline{\theta}$ which satisfies (A1).
- (iii) If $\frac{c_B}{s_B - s_A} \leq \bar{\theta}$ the Nash equilibrium is (E,E) for $\underline{\theta} \leq \bar{\theta} \left(\frac{4 - \sqrt{6}}{5} \right) + \frac{c_B}{s_B - s_A} \left(\frac{1 + \sqrt{6}}{5} \right)$ and (E,N) for $\underline{\theta}$ higher than this threshold but smaller than the limit defined in (A1).

These outcomes are depicted in figure 1. The equilibria with the high quality firm's exclusivity is given by the dark-shaded triangle, while the ones of low quality firm are given by the light-shaded triangle. Note that in equilibrium at least one manufacturer offers an exclusive contract to a retailer. Furthermore, observe that both manufacturers engage in exclusive contracting as the consumer with the lowest valuation for quality differs significantly in his valuation from the consumer who values the quality the most. Proposition 1 indicates that the low quality firm offers exclusivity unilaterally yet the difference in consumers' valuation is not significant, yet the consumer with the highest valuation has a strong preference for the quality.

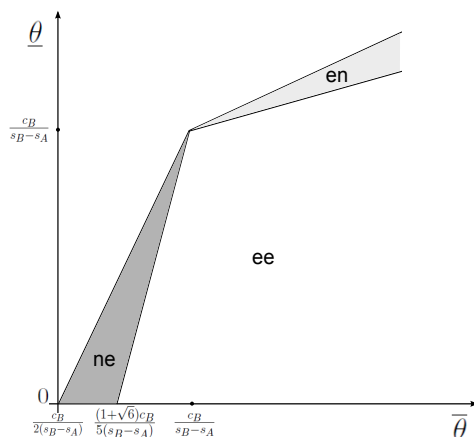


Figure 1: Equilibrium outcomes as a function of consumers' heterogeneity.

To understand the economic logic behind Proposition 1 more deeply, consider the case when the high quality manufacturer offers exclusivity to a retailer unilaterally. By exclusivity the manufacturer grants its retailer with monopoly power on its product market. As far as the players' actions are strategic complements, this yields the low quality manufacturer to price its product on the wholesale market on a higher level, resulting in higher consumer prices on the market for the final products. While the market is always fully covered this results in higher profit to the manufacturers. The relative market share loss caused by double marginalization is offset by the higher consumer prices. When consumers' taste are less concentrated, manufacturers can temper the price competition by offering exclusive contracts to the retailers which produce higher profits to them. The way exclusivity is applied in the light-shaded triangle seems somewhat counterintuitive at first. Recall here the low quality firm offers exclusivity while the high quality one does not. However, consider the following. Whereas the difference in valuations is not that significant, it is not in the interest of the high quality firm to offer exclusivity. On the other hand, as consumers value both products highly, the low quality firm may offer an exclusive contract. The underlying logic is that since there is room for further possible price increases, it will instigate a price increase for the high quality product because of strategic complementarity.

4. Conclusion

This paper focuses on the economics of exclusive contracts in multiplayer markets. We analyze the problem of contracting by assuming vertically differentiated products and consumer heterogeneity for quality. We give a simple explanation for the phenomenon of unilateral exclusive contracting by arguing that it is profitable for a manufacturer to sell its product exclusively through a retailer rather than to make the product available for purchasing at any retailer shop if the extent of consumers' heterogeneity is small.

In this paper, we assumed that manufacturers make public offers and the outcome of their contracting stage is common knowledge. Admittedly, this is a simplification. The reason for this is that little is known theoretically about how to handle contracting with several parties when contracts can have more general forms. However, often the offers of manufacturers can be observed by the competing firms which can validate our assumption. Another limitation of the model is our assumption that the competing retailers are symmetric firms. Further work is desirable to test whether our conclusions extend to the case of asymmetric retailers and other forms of contracting.

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