Exclusive contracts in bilaterally duopolistic industries

Barna Bakó* Marco Haan†

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Abstract

This paper investigates the incentives of manufacturers to deal exclusively with retailers in bilaterally oligopolistic industries with brand differentiation by manufacturers. With highly differentiated products exclusive contracts are shown to generate higher profits for symmetric manufacturers, who thus have an incentive to insist on exclusive contracting. However, if the products are close substitutes no exclusivity will emerge in equilibrium. By introducing asymmetric upstream firms we find that the cost effective manufacturers offer unilaterally exclusive contracts to retailers when product differentiation is moderate

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1 Introduction

A puzzling feature of many industries is that manufacturers commit themselves to sell exclusively through few retailers to the final consumers. At first glance it can be hard to understand why producers would engage in lessening the downstream competition. Intuitively, one would expect that tougher competition leads to lower prices, which implies higher sales for the manufacturer. Yet, we

*Department of Microeconomics, Corvinus University of Budapest, e-mail: `barna.bako@uni-corvinus.hu` *(presenter)*

†Department of Economics, Econometrics and Finance, Faculty of Economics and Business, University of Groningen, e-mail: `m.a.haan@rug.nl`

encounter with such exclusive contracts in several industries, with most notable examples in telecommunications and in the pharmaceutical industry.

The practice of exclusive contracts has been a subject of interest in the recent literature, though most of the articles study such contracting situations suggesting triangle structures (monopolistic player on one side and duopolistic agents on the other side). While these results have generated important insights about the nature of such contracting games, it is fair to say that the analysis of exclusive contracts in successive oligopolies has been largely ignored in the literature and less is known about the consequences in setups where both the upstream and the downstream market contain more then one player. The analysis below focuses on the strategic decision as whether exclusive contracts are profitable in a bilaterally duopolistic setting or not.

It is well-known[1] that when retailers can observe the contracts offered by a manufacturer to different retailers the joint profit maximizing outcome can be achieved. This result, however, relies crucially on contract observability. If the manufacturer deals secretly with the retailers a free-riding effect evolves that restrain the parties to achieve the joint profit of an integrated vertical structure. As first shown by Hart and Tirole (1990) in the presence of contract externalities exclusive contracts can be used to solve this problem (see also O'Brien and Shaffer (1992), McAfee and Schwartz (1994) and Segal and Whinston (2003)).[2] They arrive to the conclusion that a single upstream producer, which sells its product through undifferentiated retailers always offers an exclusive contract to a retailer. Intuitively, in their case there is no loss from selling through a single retailer and contracting externalities are eliminated with exclusive representation. However, this result can be spurious if there is more than one producer. The reason is that while an exclusive contract solves the problem of opportunism between retailers, it pares down the manufacturer's sales, which, if it is unilateral, can lead to less profit for the producer. Such profit reducing effect can outweigh the profit increasing effect arising by solving the problem of contracting externality. Therefore, producers may experience a prisoners' dilemma in their contracting decision. As we show in this paper this dilemma will emerge when products produced by manufacturers are sufficiently close substitutes. In this case the producers will abstain from using exclusive contracts.

2 The model

We consider the following vertical structure. There are two upstream manufacturers (M_1 and M_2) and two downstream retailers (R_A and R_B). The manufacturers face constant marginal costs c_i, $(i = 1, 2)$, the retailers, in addition to the costs of obtaining the products from the manufacturers have a constant unit cost c_j $(j = A, B)$, which are normalized to zero. We assume that final goods are symmetrically differentiated, and the inverse demands for the final good i

[1] See Whinston (2006) for discussions of these issues.

[2] The main concern of Hart and Tirole (1990) was vertical integration which was adopted to study exclusive contracts by O'Brien and Shaffer (1992).

can be given by

$$p_i(q_i, q_{-i}, \delta) \tag{1}$$

where $i, -i = 1, 2$, $i \neq -i$ and $\delta \in (0, 1)$. We interpret δ as the degree of product differentiation. For δ close to 1 downstream firms supply homogenous products, while for δ close to 0 the firms supply to independent markets. We impose the following assumption on the demand curves:

Assumption 1 *The demand curves are strictly decreasing, continuously differentiable and intersect both axis.*

The game Γ we consider is as follows. First, manufacturers decide simultaneously whether or not to offer exclusive contracts to one of the retailers. This decision is observable for every player. Next, if a manufacturer decides not to engage in exclusive contracts, it will make secret offers to each retailer in the form of (q_{ij}, t_{ij}), with q_{ij} the quantity that the manufacturer i offers to the retailer j, and t_{ij} the total transfer that the manufacturer i gets from retailer j. In the third step, retailers announce simultaneously whether they accept any of the offers. A retailer that rejects the offers has nothing to sell and earns zero profit. In the final stage quantity competition occurs among retailers, and markets clear.

Due to private contracts, when a retailer receives an offer it has to form a conjecture about the contracts received by the other retailer. Here, we restrict our attention to *passive beliefs* in which, a retailer after receiving an out of equilibrium offer, continues to believe that the other retailer receives its equilibrium offers (see Segal and Whinston (2003)). Furthermore, if a retailer receives an exclusive contract, then it knows the other retailer has not received any offer from the same manufacturer.

Let $(q_{1A}^*, q_{1B}^*, q_{2A}^*, q_{2B}^*, t_{1A}^*, t_{1B}^*, t_{2A}^*, t_{2B}^*)$ denote the equilibrium outcome. With passive beliefs if retailer $j(= A)$ receives an offer from manufacturer $i(= 1)$ such that $(q_{1A}, t_{1A}) \neq (q_{1A}^*, t_{1A}^*)$ it still believes that the other retailer receives its equilibrium offers $(q_{ij}^*, t_{ij}^*)_{ij \neq 1A}$ and accepts this contract if and only if $p_1(q_{1A} + q_{1B}^*, q_{2A}^* + q_{2B}^*)q_{1A} \geq t_{1A}$ and $p_2(q_{2A}^* + q_{2B}^*, q_{1A} + q_{1B}^*)q_{2A}^* \geq t_{2A}^*$ respectively. Given this, the manufacturer's offer must be pairwise stable in the sense that

$$q_{1A}^* = \arg\max_{q_{1A}} [(p_{1A} - c_1)q_{1A} + t_{1B}^* - c_1 q_{1B}^*] \tag{2}$$

which is the joint profit of M_1 and R_A. Moreover, these are the same conditions that would hold if the manufacturers wouldn't exist and the retailers would compete as multi-product duopolists, each with c_1 and c_2 product specific marginal costs.

We solve the game using backward induction. First consider the subgame where the manufacturers don't commit themselves to sell exclusively for any of the downstream players and offer a non-exclusive contract to both of the retailers. In equilibrium q^*_{ij} must satisfy

$$q^*_{ij} = \arg\max_{q_{ij}} [p_i(q_{ij} + g^*_{i-j}, q^*_{-ij} + q^*_{-i-j}) - c_i] q_{ij} \tag{3}$$

for every $i, -i = 1, 2$ $(i \neq -i)$, $j, -j = A, B$ $(j \neq -j)$.

Now consider the case when manufacturer M_i offers an exclusive contract to the retailer R_j. In this case the product of M_i is available for purchasing only at R_j, yet the other manufacturer's product is still possible to buy at any retailers. In this case the profit maximization problem boils down to

$$q^*_{ij} = \arg\max_{q_{ij}} [p_i(q_{ij} + 0, q^*_{-ij} + q^*_{-i-j}) - c_i] q_{ij} \tag{4}$$

where $i, -i = 1, 2$ $(i \neq -i)$, $j, -j = A, B$ $(j \neq -j)$ and $q^*_{ij} = 0$ if $ij = 1B$.

Solving for q_{ij} $(ij = 1A, 2A, 2B)$, and substituting them to the profit functions yields the equilibrium values of Π^{e*}_{ij} and Π^*_{-i}.

Then, by solving the game backward, we obtain the manufacturers' payoffs in the different sub-games at stage 1 as shown in Table 2.

Table 1: The payoff matrix

		M_2 no excl. contract	M_2 excl. R_A	M_2 excl. R_B
M_1	no excl. contract	(Π^*_1, Π^*_2)	$(\Pi^{e*}_1, \Pi^{e*}_{2A})$	$(\Pi^{e*}_1, \Pi^{e*}_{2B})$
	excl. R_A	$(\Pi^{e*}_{1A}, \Pi^{e*}_2)$	$(\Pi^{ee*}_{1A}, \Pi^{ee*}_{2A})$	$(\Pi^{ee*}_{1A}, \Pi^{ee*}_{2B})$
	excl. R_B	$(\Pi^{e*}_{1B}, \Pi^{e*}_2)$	$(\Pi^{ee*}_{1B}, \Pi^{ee*}_{2A})$	$(\Pi^{ee*}_{1B}, \Pi^{ee*}_{2B})$

The game has several equilibria depending on the level of product differentiation. To see this consider the followings. The equilibrium profit of the manufacturer M_i depends on the number of retailers of product i, which we denote by $l = 1, 2$, the number of retailers of product $-i \neq i$, which we denote by $k = 1, 2$, the parameter δ and the level of marginal costs, considered as exogenous parameters. Following Whinston (2006) without exclusive contracts the equilibrium profits of manufacturer M_i necessarily equals $\Pi^*_i = 2\pi^*_i(2, 2, \delta, c_i, c_{-i})$. On the other hand, if both manufacturers sign exclusive contracts, they both have profits $\Pi^{ee*}_{ij} = \pi^*_i(1, 1, \delta, c_i, c_{-i})$. If one of the manufacturers, say M_i, signs an exclusive contract with a retailer, but M_{-i} does not, M_i's profits are $\Pi^{e*}_{ij} = \pi^*_i(1, 2, \delta, c_i, c_{-i})$, if it is the other way round its profits are $\Pi^{e*}_i = 2\pi^*_i(2, 1, \delta, c_i, c_{-i})$.

To ensure the existence of the equilibrium, following d'Aspremont *et al.* (1979) we assume the following:

Assumption 2 $\pi^*_i(l, k, \delta, c_i, c_{-i})$ $(i = 1, 2)$ *is strictly decreasing and continuously differentiable in* δ.

Suppose that products are completely homogenous. In this case, following Whinston (2006) we can write

$$\pi_i^*(l, k, \delta, c_i, c_{-i}) = \pi_i^*(l + k, 0, \delta, c_i, c_{-i}) \tag{5}$$

From the merger paradox (see Salant *et al.* (1983)). we know that $2\pi_i^*(3, 0, \delta, c_i, c_{-i}) > \pi_i^*(2, 0, \delta, c_i, c_{-i})$ and $2\pi_i^*(4, 0, \delta, c_i, c_{-i}) > \pi_i^*(3, 0, \delta, c_i, c_{-i})$. Hence we can impose the following:

Assumption 3 *(merger paradox assumption): Supposing homogenous products a firm's profit is always higher if it sells its product without exclusive contracts, rather than using exclusive contracts, that is,* $\pi_i^*(1, k, 1, c_i, c_{-i}) < 2\pi_i^*(2, k, 1, c_i, c_{-i})$ *for every* $i, -i, k = 1, 2$ *and* $i \neq -i$.

With $\delta = 0$ products are completely differentiated. As monopoly profits should always be higher than duopoly profits, we can then use the following:

Assumption 4 *(competition assumption): If products are completely differentiated a manufacturer's profit is always higher when it sells its product exclusively, rather than using non-exclusive contracts, that is,* $\pi_i^*(1, k, 0, c_i, c_{-i}) > 2\pi_i^*(2, k, 0, c_i, c_{-i})$ *for every* k *and every* $i, -i = 1, 2$ *and* $i \neq -i$.

One key feature of the merger paradox is that for any given number of symmetric firms in the premerger equilibrium, if the merger by a specified number of firms causes gains (respectively, losses), a merger by a larger (smaller) number of firms will cause gains (losses).[3] Thus, we assume that if a merger is profitable, then it is more profitable if the other manufacturer is having less retailers.[4] This is formalized with the following

Assumption 5 $\pi_i^*(1, 1, \delta, c, c) - 2\pi_i^*(2, 1, \delta, c, c) > \pi_i^*(1, 2, \delta, c, c) - 2\pi_i^*(2, 2, \delta, c, c)$ *for every* $i = 1, 2$.

The following propositions characterize the equilibrium outcomes of the game.

Proposition 1 *If* δ *is close enough to zero, that is when the product differentiation is strong, the only subgame perfect equilibrium is when manufacturers offer exclusive contracts to the retailers, and the retailers accept that offer.*

Proof: For exclusive contracts to be an equilibrium, we need

$$\pi_i^*(1, 2, \delta, c_i, c_{-i},) > 2\pi_i^*(2, 2, \delta, c_i, c_{-i}) \tag{6}$$

$$\pi_i^*(1, 1, \delta, c_i, c_{-i}) > 2\pi_i^*(2, 1, \delta, c_i, c_{-i}) \tag{7}$$

[3] Salant *et al.* (1983) arrives to the conclusion that for a merger to be unprofitable it is sufficient that less than 80 percent of the firms collude.

[4] One other way to interpret this assumption is that in average the maximum profit of an industry composed either by a monopolist or by competitive firms is always higher than the average profit of an oligopolistic industry.

for every $i, -i = 1, 2$ $(i \neq -i)$.

Suppose that $\delta = 1$. The Assumption 3 then implies that condition (6) is satisfied, however condition (7) is not. If we suppose $\delta = 0$ from Assumption 4 we obtain that condition (7) holds and condition (6) is violated. From Assumptions 2–4 then follows that for every reasonable c_i (c_{-i}) there is a $\underline{\delta_i}$ $(\underline{\delta_{-i}})$ for which if $\delta \leq \underline{\delta_i}$ $(\delta \leq \underline{\delta_{-i}})$ condition (6) is satisfied for every i. Respectively, for every c_i (c_{-i}) there is a $\underline{\underline{\delta_i}}$ $(\underline{\underline{\delta_{-i}}})$ for which if $\delta \leq \underline{\underline{\delta_i}}$ $(\delta \leq \underline{\underline{\delta_{-i}}})$ condition (7) holds.

Then if $\delta \leq \underline{\delta} \equiv \min\{\underline{\delta_i}, \underline{\delta_{-i}}, \underline{\underline{\delta_i}}, \underline{\underline{\delta_{-i}}}\}$ the manufacturers offer exclusive contracts to the retailers. This equilibrium is unique if Assumptions 1 holds. ■

Proposition 2 *If products are close substitutes the unique perfect equilibrium when manufacturers sell their product without exclusivity and retailers accept these non-exclusive contracts.*

Proof: The existence of non-exclusive contracts equilibrium requires the following two conditions to be satisfied for every $i, -i = 1, 2$, $i \neq -i$

$$2\pi_i^*(2, 1, \delta, c_i, c_{-i},) > \pi_i^*(1, 1, \delta, c_i, c_{-i}) \tag{8}$$

$$2\pi_i^*(2, 2, \delta, c_i, c_{-i}) > \pi_i^*(1, 2, \delta, c_i, c_{-i}) \tag{9}$$

The proof is much along the same lines as the one above. If $\delta = 0$ we know from the Assumption 4 that these conditions are violated, while if $\delta = 1$ from the Assumption 3 follows that they are satisfied. Thus, these assumptions together with the Assumption 2 imply that for every c_i, c_{-i} exist $\overline{\delta_i}$, $\overline{\delta_{-i}}$, $\overline{\overline{\delta_i}}$, $\overline{\overline{\delta_{-i}}}$ such that for every $\delta \geq \overline{\delta} \equiv \max\{\overline{\delta_i}, \overline{\delta_{-i}}, \overline{\overline{\delta_i}}, \overline{\overline{\delta_{-i}}}\}$ manufacturers are better off if they sell through both of the retailers rather than offering an exclusive contracts to one of them.

The Assumption 1 assures that this equilibrium is unique. ■

It is easy to show that supposing symmetric manufacturers there is no equilibrium in which one of the manufacturer unilaterally would offer an exclusive contract to one of the retailers. This follows directly from the Assumption 5, which contradicts the required conditions, namely

$$\pi_i^*(1, 2, \delta, c, c,) > 2\pi_i^*(2, 2, \delta, c, c) \tag{10}$$

$$2\pi_{-i}^*(2, 1, \delta, c, c) > \pi_{-i}^*(1, 1, \delta, c, c) \tag{11}$$

where $i \neq -i$. This result is stated in the following proposition.

Proposition 3 *Supposing symmetric manufacturers* $(c_i = c_j = c)$ *there is no* δ *for which unilateral exclusive contracts would emerge in equilibrium.*

Our findings regarding the existence of asymmetric exclusive contract equilibria crucially changes if we introduce asymmetric manufacturers. To see this consider the following.

For asymmetric exclusive contract equilibrium we need

$$\pi_i^*(1,2,\delta,c_i,c_{-i},) > 2\pi_i^*(2,2,\delta,c_i,c_{-i}) \tag{12}$$

$$2\pi_{-i}^*(2,1,\delta,c_i,c_{-i}) > \pi_{-i}^*(1,1,\delta,c_i,c_{-i}) \tag{13}$$

where $i \neq -i$. If $\delta = 0$, Assumption 4 implies that (12) holds, while (13) is violated. On the other hand, using Assumption 3, if $\delta = 1$ (13) is satisfied, while (12) is not.

For any given c_i, c_{-i}, define $\hat{\delta}_i(c_i, c_{-i})$ the degree of product differentiation, when manufacturer M_i is indifferent between offering an exclusive contract to a retailer or selling its product non-exclusively, supposing that the other manufacturer using non-exclusive contracts, that is when $\pi_i^*(1,2,\hat{\delta}_i,c_i,c_{-i},) = 2\pi_i^*(2,2,\hat{\delta}_i,c_i,c_{-i})$. Similarly, we can define $\hat{\delta}_{-i}(c_i,c_{-i})$ as a degree of product differentiation when $2\pi_{-i}^*(2,1,\hat{\delta}_{-i},c_i,c_{-i},) = \pi_{-i}^*(1,1,\hat{\delta}_{-i},c_i,c_{-i})$. For an asymmetric exclusive contract equilibrium we need $\hat{\delta}_i > \hat{\delta}_{-i}$ to be hold for any given (c_i, c_{-i}) pair. To assure this, we impose the following assumption:

Assumption 6 *A low cost manufacturer is more likely to engage in exclusive contracting, than a high cost manufacturer, that is* $\frac{d\delta(c_i,c_{-i})}{dc_i} < 0$ *for every* $i, -i = 1, 2$.

Our main result is stated in the following proposition.

Proposition 4 *Let Γ be a game satisfying Assumptions 1–6. Supposing asymmetric manufacturers ($c_i < c_j$) unilateral exclusive contract will emerge in equilibrium, if the product differentiation is moderate. In this case the low cost manufacturer will offer an exclusive contract to one of the retailers, while the other manufacturer will sell its products offering non-exclusive contracts to the retailers.*

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