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RESALE PRICE MAINTENANCE AND UP-FRONT PAYMENTS: ACHIEVING HORIZONTAL CONTROL UNDER SELLER AND BUYER POWER

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Resale price maintenance and up-front payments: Achieving horizontal control under seller and buyer power.

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Abstract

We consider a setting where an upstream producer and a competitive fringe of producers of a substitute product may sell their products to two differentiated downstream retailers. We investigate two different contracting games; one with seller power and a second game with buyer power. In each game we characterize the minimum set of vertical restraints that make the vertically integrated profit sustainable as an equilibrium outcome, and we also characterize sufficient conditions for having interlocking relationships (i.e. no exclusion). In line with the recent literature, we focus on the performance of simple two-part tariffs, upfront payments and RPM as facilitating devices for reducing competition under both buyer and seller power. With seller power we show that minimum RPM, possibly coupled with a quantity roof, will allow the manufacturer to induce industry wide monopoly prices. With buyer power we show that monopoly prices may be induced if the retailers may use an upfront fee together with a two-part tariff and a minimum RPM.

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1 Introduction

Competition policy enforcers generally treat the use vertical restraints more leniently than horizontal agreements. The main argument for this differential treatments is that vertical restraints may have efficiency enhancing effects while similar positive effects are harder to spot for horizontal restraints. However, competition agencies are more hostile to certain vertical restraints than other. For instance, until recently there was a world-wide consensus that the use of RPM - especially fixed or minimum RPM - should be treated as *per se* illegal. Recent developments in the US seem to suggest a softer approach towards RPM[1]. Also, as noted by Marx and Shaffer (2007) there is scepticism in policy circles against fixed payments in vertical contracts, and the conventional view is that fixed payments are more harmful when offered by the manufacturing side than when similar payments are required by the retailers.

There is a growing literature seeking to identify under which circumstances vertical restraints may be harmful to competition and consumers. Of special focus in this literature is the use of vertical restraints such as fixed fees, RPM, up-front payments and market-share contracts. This is done in triangular settings with either downstream or upstream monopoly (Marx and Shaffer, 2007 and Miklos-Thal et al., 2011), and recently also in settings with competition both at the upstream and downstream level (Inderst and Shaffer, 2011, Rey and Verge, 2010 and Innes and Hamilton, 2009). Part of this literature is also concerned with the effects of whether vertical restraints are imposed by the sellers (Rey and Verge, 2010; Inderst and Shaffer, 2010) or the buyers (Marx and Shaffer, 2007; Miklos-Thal et al., 2011). Buyer imposed vertical restraints is highly relevant under buyer power, a topic that recently has raised considerable concerns for policy makers in many markets. One example where the effects of buyer power is heavily debated is the grocery markets in the EU.

The insights from the recent literature is that some vertical restraints may indeed be a vehicle to monopolize markets. For instance, Inderst and Shaffer (2010) show that market-share contracts imposed by a manufacturer may serve as facilitating devices. Also, in a static setting with two strategic manufacturers and two differentiated retailers Rey and Verge (2010) show that RPM may allow manufacturers to coordinate on the fully integrated monopoly prices.

It is also argued that up-front payments from manufacturers to retailers may have adverse effects for consumers. Miklos-Thal et al. (2011) and Marx and Shaffer (2007)

[1] See *Dr. Miles Medical Co. v. John D. Park and Sons,* 220 U.S. 373 (1911) and *Leegin Creative Leather Products, Inc. v. PSKS, Inc.* Slip Op. no. 06-480.

both analyze a setting in which two differentiated retailers with buyer power make offers to a common manufacturer. The latter considers the case when the retailers may use up-front payments in addition to two-part tariffs in their contract offers to the manufacturer. Marx and Shaffer show that up-front payments will lead to an equilibrium with exclusion where only one retailer buys from the manufacturer, and their result supports the claim from small manufacturers that they are unable to obtain widespread distribution for their products due to similar payments. Marx and Shaffer claim that these results goes against the more conventional view that up-front payments are more harmful when offered by the manufacturing side than when required by powerful retailers; suggesting that buyer power may be harmful to consumer welfare. In an identical setting Miklos-Thal et al. (2011) show that when offers from strong retailers can be made contingent on exclusion or not of the rival retailer, exclusion is no longer inevitable. They also show that there exist equilibria with up-front payments that sustain the industry monopoly outcome. Moreover, they argue that monopoly pricing may be an equilibrium outcome irrespective of whether up-front payments are banned or not, because alternative non-linear contracts exist that may achieve the same outcome. Even though the two papers provide diverging results on the effects of up-front payments, they both seem to suggest that buyer power can be more harmful than seller power in vertical relations.[2] In our view, there is a need to expand the investigation of the effects of different vertical restraints and buyer power to more complex vertical structures. Also, to say something meaningful about the effect of buyer power one need to contrast the results arising from buyer power with its alternative, namely seller power. In this article we pursue this line of research.

In this paper we consider the same setting as in Inderst and Shaffer (2010) and Innes and Hamilton (2009), i.e. where an upstream producer and a competitive fringe of producers of a substitute product may sell their products to two differentiated downstream retailers. We investigate a game with two alternative assumptions. In what we denote as the the offer game, the manufacturer is able to make take-it-or-leave-it contract offers to the retailers. The alternative game, the bidding game, is one where the retailers may make contract bids to the upstream manufacturer. In each game we characterize the minimum set of vertical restraints that make the vertically integrated profit sustainable as an equilibrium outcome, and we also characterize sufficient conditions for having interlocking relationships (i.e. no exclusion). In line with the literature discussed above, we focus on

[2] Contrary to this view is Gabrielsen and Johansen (2012). In a setting similar to Inderst and Shaffer (2010) and this paper, these authors investigate the incentives to both upstream and downstream exclusion under buyer versus seller power. Here, contracts are simple two-part tariffs and it is shown that exclusion occurs when both intra- and interbrand competition is hard, but that there will be more exclusion under seller power than under buyer power.

the performance of simple two-part tariffs, up-front payments and RPM as facilitating devices for reducing competition under both buyer and seller power.

With seller power we first show that simple two-part tariffs are insufficient devices for realizing monopoly prices (as in Inderst and Shaffer, 2011). Our main result is that, as long as there is some degree of substitution between the dominant brand and its competitor, the manufacturer of the dominant brand is always able to induce monopoly prices on both brands by using a minimum RPM contract, possibly coupled with a quantity roof, with its retailers. The result that RPM may monopolize markets is not new, but the mechanism in our model is very different from what is proposed earlier, for instance by Jullien and Rey (2007) and Rey and Verge (2010)[3]. Jullien and Rey (2007) show that RPM may facilitate tacit collusion as RPM makes retail prices less responsive to local shocks. Rey and Verge (2010) show that when there are several strategic manufacturers, all manufacturers may benefit from using RPM and may be able to induce industry-wide monopoly prices. In our model, we focus on how a dominant manufacturer with bargaining power can use RPM to induce industry-wide monopoly prices even when facing a competitive supplied rival product. We show that provided that there is some degree of substitution between the dominant brand and the rival competitive supplied product, monopoly retail prices for both products can always be achieved.

The intuition for our result is as follows. Without RPM, in order to achieve monopoly prices the manufacturer will wish to offer high wholesale prices to dampen intrabrand competition for its own product. At the same time he must ensure that the retailers will have incentives to increase the price of the rival product as well. The only way to increase the rival product's price is to give each retailer an incentive to increase the sale of the manufacturers brand. The latter calls for wholesale prices below producer marginal cost. Because low and high wholesale prices are impossible at the same time monopoly pricing can not be achieved. With RPM on the other hand, the manufacturer may ensure a high price of its own product by imposing a minimum RPM. Secondly he may reduce the sale of the competitive brand (and thereby increasing its retail price) by offering a wholesale price below the cost of the competitive brand. By doing this we show that the manufacturer may induce the monopoly prices on both brands. A quantity roof will be necessary when the required subsidy below cost involves a negative price.

Our result with upstream bargaining power is partly related to what is obtained by Innes and Hamilton (2009) (IH hereafter), but there are also important differences. They study, like us and Inderst and Shaffer (2010), a setting with a dominant manufacturer and

[3] Also Dobson and Waterson (2007) show that RPM may create negative competitive effects, but in a model where only simple linear tariffs can be used.

a competitive fringe that may sell though two differentiated retailers. The focus is how the dominant manufacturer may use the combination of the wholesale price and RPM on its own brand to influence the retail price of the brand produced by the competitive fringe. In their model the consumers' choice between retailers are determined in a Hotelling framework, with the two retailers located at either end of the unit interval, and where each consumer purchases the bundle of both products at one of the retailers (one-stop shopping). Given this, they characterize the equilibrium when upstream products are independent, complements or substitutes. IHs results are valid in a setting with one-stop shopping, i.e. when each consumer is forced to buy both products.

When products are independent, IH show that the dominant manufacturer sets a wholesale price above the fixed (monopoly) retail price. When the retailers incur losses on the dominant good, the retailers' incentives to decrease the price on the competitively supplied good is dampened, resulting in both goods being sold at the vertically integrated prices. When products are substitutes two effects draw in different directions. Narrowing the retailers' margin on the dominant good decreases the incentive each retailer has to attract customers and induces a price increase on the competitive product. On the other hand, a smaller margin also decreases the opportunity cost of shifting sales towards the competitive good, which in turn favors a lower price on the competitive brand. When products are close (strong) substitutes, the second effect dominates and the dominant producer sells it good below marginal cost to induce the retailers to increase the price of the competitive brand, a result that is similar to ours. When products are poor (weak) substitutes the first effect dominates, and the dominant producer again will resort to setting wholesale prices above the fixed price as in the case with independent products. The equilibria in IH that involves the retailers selling the dominant product with a marginal loss is dependent on the one-stop shopping behavior of the customers. Hence, absent this assumption - as in our paper - these equilibria would break down.

With buyer power we first produce a similar result as in Miklos-Thal et al. (2011), saying that simple two-part tariffs are insufficient to induce monopoly pricing, but here extended to a situation with upstream competition. We also show that in this case allowing for either an up-front fee, or minimum RPM, is insufficient to achieve monopoly prices. This result is also different from IH who claim that monopoly prices could be achieved in their model for any division of bargaining power. As with seller power monopoly prices in our model requires that wholesale prices on the manufacturer's brand must be below marginal cost. However, this leaves each retailer with considerable margins, and each retailer will wish to free-ride on these margins by reducing their retail price. However, if the retailers may combine an up-front fee together with a two-part tariff and a minimum

RPM, then the industry monopoly outcome is again restored. The intuition is that given that the manufacturer accept both offers the optimal up-front payment is constructed such that each retailer earns the same whether he trades with the manufacturer or not. If a rival retailer should deviate from the monopoly retail price, each retailer would be better off by avoiding the fixed fee by not trading with the manufacturer. At the same time a deviating retailer would earn less, and this makes marginal deviations unprofitable. We also show that deviations to exclusive contracting is unprofitable, hence monopoly pricing can be sustained.

The rest of the article is organized as follows. The next section describes our model, specifies our two different contracting games and establishes some preliminaries. In Section 3 we present our main results, and Section 4 concludes.

2 The model

We study a supplier-retailer framework where a dominant manufacturer A, which we refer to as 'the manufacturer', sells its brand through two differentiated retailers, 1 and 2, who compete in the downstream market. The retailers also sell a second brand, denoted B, which is assumed to be an imperfect substitute for the manufacturer's brand. Brand B is assumed to be competitively supplied to the retailers at a price equal to the marginal production cost, which we assume to be constant and equal to $c > 0$ for both brands, A and B. There are no fixed costs.

Our model thus encompass a set Ω of four different "products", or product-service bundles, $\Omega = (A-1, B-1, A-2, B-2)$, where $\{A-1, B-1\}$ are distributed by retailer 1 and $\{A-2, B-2\}$ are distributed by retailer 2. To avoid confusion, in the following we will continue to refer to A and B as 'brands', and to $A-1$, $B-1$, $A-2$, and $B-2$ as 'products'.

We denote consumer demand for brand h, where $h \neq k \in \{A, B\}$, at retailer i, where $i \neq j \in \{1, 2\}$, by q_h^i. Without loss of generality, we will assume that the two brands as well as the two retailers are symmetrically differentiated. Specifically, we make the following two assumptions about demand:

Assumption 1 (competition). *Let* $q_h^i(\mathbf{p}) = q_h^i\left(p_h^i, p_k^i, p_h^j, p_k^j\right)$ *be demand for brand* h *at retailer* i. *Let* $\mathbf{m} = \{\mathbf{p} \geq 0 : q_h^i(\mathbf{p}) > 0,\ \forall\ h \in \{A, B\}\ \wedge\ i \in \{1, 2\}\}$. *Then* $q_h^i(\mathbf{p})$ *is continuously differentiable on* $\mathbf{m}$, *with* $\partial q_h^i / \partial p_h^i < 0$, $\partial q_h^i / \partial p_h^j > 0$, $\partial q_h^i / \partial p_k^i > 0$,

$\partial q_h^i / \partial p_k^j > 0$, *and*

$$-\frac{\partial q_h^i}{\partial p_h^i} > \frac{\partial q_h^i}{\partial p_h^j} + \frac{\partial q_h^i}{\partial p_k^i} + \frac{\partial q_h^i}{\partial p_k^j}.$$

Assumption 2 (symmetry). $q_h^i(\mathbf{p}) = q_k^i(\mathbf{p})$ *when* $p_h^i = p_k^i$ *and* $p_h^j = p_k^j$, *and* $q_h^i(\mathbf{p}) = q_h^j(\mathbf{p})$ *when* $p_h^i = p_h^j$ *and* $p_k^i = p_k^j$, *for all* $h \neq k \in \{A, B\}$ *and* $i \neq j \in \{1, 2\}$.

We will use the convention that $p_A^i \to \infty$ if retailer i does not carry brand A. Hence, in this case, the quantity sold for example of brand B by retailer i, is written $q_B^i\left(p_B^i, \infty, p_B^j, p_A^j\right)$, and so on.

The two retailers are assumed to have no costs other than the prices and fees they pay when ordering products in the upstream market. Overall industry profit with all four products sold can therefore be written

$$\Pi(\mathbf{p}) = \sum_{i \in \{1,2\}} \left\{ \left(p_A^i - c\right) q_A^i + \left(p_B^i - c\right) q_B^i \right\}, \tag{1}$$

which, given our assumptions on demand, reaches its maximum, denoted Π^M, for symmetric prices $\mathbf{p}^M = \left(p^M, p^M, p^M, p^M\right)$. Evaluated at the optimum, the first-order maximizing conditions of the fully integrated firm, for the prices at retailer i (symmetric for retailer j), are

$$\left.\frac{\partial \Pi}{\partial p_A^i}\right|_{\mathbf{p}=\mathbf{p}^M} = \left(p^M - c\right) \sum_{h=A,B} \left\{ \left.\frac{\partial q_h^i}{\partial p_A^i}\right|_{\mathbf{p}=\mathbf{p}^M} + \left.\frac{\partial q_h^j}{\partial p_A^i}\right|_{\mathbf{p}=\mathbf{p}^M} \right\} + q^M = 0, \tag{2}$$

and

$$\left.\frac{\partial \Pi}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M} = \left(p^M - c\right) \sum_{h=A,B} \left\{ \left.\frac{\partial q_h^i}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M} + \left.\frac{\partial q_h^j}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M} \right\} + q^M = 0, \tag{3}$$

where q^M is the quantity sold of each product when all prices are set at the integrated level, i.e. $q^M = q_h^i\left(p^M, p^M, p^M, p^M\right)$ for all $h \in \{A, B\}$ and $i \in \{1, 2\}$. Hence, we can write the fully integrated monopoly profit as $\Pi^M := 4\left(p^M - c\right) q^M$.

2.1 The game

In the following, we will consider two different principal-agent games with complete information. Adopting Segal and Whinston's (2003) terminology, we call the first one the "offer game" and the second one the "bidding game".

In the offer game (denoted by superscript $*$), as in most of the principal-agent literature, at the first stage of the game, which we call the contracting stage, we let the principal, here the manufacturer, make simultaneous take-it-or-leave-it offers to its two agents (the retailers). After having observed the manufacturer's contract terms, the retailers subsequently and simultaneously either accept or reject the offers, before they compete by setting prices in the downstream market.

In the bidding game (denoted by superscript $**$), on the other hand, at the contracting stage we let the two retailers make simultaneous bids or offers to the manufacturer, which in turn either accepts or rejects each offer. The retailers then compete by setting prices in the downstream market.

2.1.1 Contract offers

Contracts are assumed to be either simple two-part tariffs or two-part tariffs combined with an up-front payment (three-part tariffs), and both contracts may be combined with a resale price restraint.

In the offer game ($*$), we will consider two types of contracts offered by the manufacturer: First, we consider the use of simple unrestricted (no price restraint) two-part tariffs (we will later refer to this by subscript $U2$, where U means 'unrestricted, i.e. no price restraints, and 2 refers to two-part tariffs). This contract simply specifies for the retailer his payment to the manufacturer T^i as a function the quantity he buys of good A q_A^i, i.e., $T^i\left(q_A^i\right) = w^i q_A^i + F^i$, where w^i is a per-unit wholesale price and F^i is a fixed fee. Next, we will consider what we refer to as restricted contracts (R). This contract is a two-part tariff with a price restraint, i.e.

$$T^i\left(q_A^i, p_A^i\right) = \begin{cases} w^i q_A^i + F^i & \text{if} \quad p_A^i \geq \underline{p}^i \\ \infty & \text{otherwise} \end{cases}$$

Specifically, the contract specifies the minimum resale price $\underline{p}^i$ that the retailer is allowed to charge for brand A, and we will later refer to this case with subscript $R2$.

In the bidding game ($**$), in addition to restricted and unrestricted two-part tariffs, we follow Marx and Shaffer (2007) and Miklós-Thal et al. (2011) and consider the use of three-part tariffs. An unrestricted three-part tariff ($U3$), $G^i\left(q_A^i\right)$, takes the following form:

$$G^i\left(q_A^i\right) = \begin{cases} S^i & \text{if} \quad q_A^i = 0 \\ S^i + T^i\left(q_A^i\right) & \text{if} \quad q_A^i > 0 \end{cases}$$

This contract consists of an up-front payment S^i which is paid when the contract is signed, plus a two-part tariff $T^i(q_A^i)$ that is contingent on actual trade ($q_A^i > 0$). This means that the retailer can choose not to trade with the manufacturer if she wants to evade the fixed fee F^i. Unlike Marx and Shaffer (2007), Miklós-Thal et al. (2011), however, we will also analyze the use of restricted three-part tariffs (subscript $R3$), that specify a minimum resale price $\underline{p}^i$ for each retailer $i \in \{1, 2\}$:

$$G^i\left(q_A^i, p_A^i\right) = \begin{cases} S^i & \text{if} \quad q_A^i = 0 \\ S^i + T^i\left(q_A^i\right) & \text{if} \quad q_A^i > 0 \wedge p_A^i \geq \underline{p}^i \\ \infty & \text{if} \quad q_A^i > 0 \wedge p_A^i < \underline{p}^i \end{cases}$$

We will assume throughout the analysis that all contracts offered by retailer $i \in \{1, 2\}$ to the manufacturer, or vice versa, are contingent on whether $q_A^j > 0$ or $q_A^j = 0$. I.e., each contract is contingent on whether or not the retailer sells brand A exclusively. Specifically, this means that an unrestricted two-part contract between the manufacturer and retailer i may specify that the retailer pays the manufacturer $T^i(q)$ for q units of brand A when $q_A^j > 0$, and that she pays $T_e^i(q)$ for the same number of units if $q_A^j = 0$, where $T^i(.)$ and $T_e^i(.)$ are not necessarily equal. Throughout the paper we will denote "exclusive offers" with subscript e (or superscript where appropriate). We also make the following assumption specifically about the exclusive offers.

Assumption 3. *All exclusive contract offers are renegotiation proof, in the sense that, given the set of allowable contracts, the exclusive offer maximizes the manufacturer and the retailer's overall joint profit in the subgame where the rival retailer sells zero units of brand A.*

This assumption ensures that no manufacturer-retailer pair is stuck with an inefficient contract in the subgame after a contract offer has been rejected, or in the subgame after one retailer decides not to trade with the manufacturer.[4]

[4] In the bidding game, Assumption 3 can be shown to be an outcome of the retailers' equilibrium behaviour. In the offer game, however, Assumption 3 is not ensured without allowing for a recontracting stage should one of the retailers reject the manufacturer's offer. This follows from the fact that, without a recontracting stage, a manufacturer has an incentive to distort his exclusive offers in order to weaken the retailers' disagreement profits and exctract more of the retailers' rents.

2.2 Some preliminaries

2.2.1 Retail equilibria with all products sold

Suppose unrestricted contracts (U) are used. Given that all contracts are accepted, and both retailers sell both brands at the final stage of the game, retailer i's variable profits (profit gross of any fixed payments) can be written

$$\pi_r^i(\mathbf{p}) = \left(p_A^i - w^i\right) q_A^i(\mathbf{p}) + \left(p_B^i - c\right) q_B^i(\mathbf{p}) \tag{4}$$

Assuming an interior solution, this yields the following two first-order maximizing conditions for retailer $i \in \{1,2\}$:

$$\frac{\partial \pi_r^i}{\partial p_A^i} = \left(p_A^i - w^i\right)\frac{\partial q_A^i}{\partial p_A^i} + \left(p_B^i - c\right)\frac{\partial q_B^i}{\partial p_A^i} + q_A^i = 0 \tag{5}$$

and

$$\frac{\partial \pi_r^i}{\partial p_B^i} = \left(p_A^i - w^i\right)\frac{\partial q_A^i}{\partial p_B^i} + \left(p_B^i - c\right)\frac{\partial q_B^i}{\partial p_B^i} + q_B^i = 0, \tag{6}$$

and symmetric for the rival. We let $\widehat{p}_A^i\left(w^i, w^j\right)$ and $\widehat{p}_B^i\left(w^i, w^j\right)$ be the prices that solve (4) and (5) simultaneously for both retailers, $i \in \{1,2\}$, let $\widehat{\mathbf{p}}(\mathbf{w})$ denote the vector of equilibrium retail prices, and let $\widehat{q}_h^i = q_h^i\left(\widehat{\mathbf{p}}(\mathbf{w})\right)$ denote the resulting demand for brand h at retailer i. We can then write retailer i's equilibrium variable (gross of fixed fees) profit as $\widehat{\pi}_r^i\left(w^i, w^j\right) := \pi_r^i\left(\widehat{\mathbf{p}}(\mathbf{w})\right)$, and the overall industry profit as $\Pi_U\left(w^i, w^j\right) := \Pi\left(\widehat{\mathbf{p}}(\mathbf{w})\right)$.

Assumption 4. $\frac{\partial \widehat{p}_A^i\left(w^i,w^j\right)}{\partial w^i} > \frac{\partial \widehat{p}_B^i\left(w^i,w^j\right)}{\partial w^i} \geq 0.$

Assumption 4 says first that an increase in the price w^i that retailer i pays per unit of brand A, results in an increase in retailer i's optimal price for brand A. Next, it says that an increase in w^i also has a non-negative but smaller impact on retailer i's optimal price for brand B.[5]

Suppose instead that restricted contracts (R) are used. The retailer's maximization problem at the final stage is then

$$\frac{\partial \pi_r^i}{\partial p_B^i} = \left(p_A^i - w^i\right)\frac{\partial q_A^i}{\partial p_B^i} + \left(p_B^i - c\right)\frac{\partial q_B^i}{\partial p_B^i} + q_B^i = 0 \tag{7}$$
$$\text{s.t. } p_A^i \geq \underline{p}^i \wedge p_A^j \geq \underline{p}^j$$

[5] In particular, these assumptions are satisfied with a linear demand system.

Hence, retailer i's best response function is implicitly defined by

$$p_B^i = \frac{q_B^i + \left(\underline{p}^i - w^i\right) \dfrac{\partial q_A^i}{\partial p_B^i}}{-\dfrac{\partial q_B^i}{\partial p_B^i}} + c \tag{8}$$

assuming of course the price restraints bind.

We let $\widetilde{p}_B^i\left(\underline{p}^i, w^i, \underline{p}^j, w^j\right)$ and $\widetilde{p}_B^j\left(\underline{p}^j, w^j, \underline{p}^i, w^i\right)$ denote the prices for brand B that simultaneously solves the first-order condition (8) for both retailers, and let $\widetilde{q}_A^i = q_A^i\left(\underline{p}^i, \widetilde{p}_B^i, \underline{p}^j, \widetilde{p}_B^j\right)$ and $\widetilde{q}_B^i = q_A^i\left(\widetilde{p}_B^i, \underline{p}^i, \widetilde{p}_B^j, \underline{p}^j\right)$ be the resulting demand at retailer i.

From (8), it is easy to see that $\partial \widetilde{p}_B^i / \partial w^i < 0$ has to hold as long as the price restraint $p_A^i \geq \underline{p}^i$ strictly binds. I.e., the retailer should reduce her price for brand B as her unit wholesale price for brand A goes up. Hence, we can also infer that $\partial \widetilde{p}_B^j / \partial w^i < 0$ as long as prices are strategic complements. Similarly, both $\partial \widetilde{p}_B^i / \partial \underline{p}^i > 0$ and $\partial \widetilde{p}_B^j / \partial \underline{p}^i > 0$ have to hold as long as the price restraints bind and prices are strategic complements.

We denote retailer i's equilibrium variable profit in the situation with price restraints as $\widetilde{\pi}_r^i\left(\underline{p}^i, w^i, \underline{p}^j, w^j\right) := \pi_r^i\left(\underline{p}^i, \widetilde{p}_B^i, \underline{p}^j, \widetilde{p}_B^j\right)$, and the overall industry profit as $\Pi_R\left(\underline{p}^i, w^i, \underline{p}^j, w^j\right) := \Pi\left(\underline{p}^i, \widetilde{p}_B^i, \underline{p}^j, \widetilde{p}_B^j\right)$.

2.2.2 Exclusivity subgames

Let w_e^i be retailer i's unit wholesale price in the subgame where $q_A^j = 0$. Suppose an unrestricted contract is used. In the exclusivity subgame, retailer i then maximizes

$$\max_{p_A^i, p_B^i} \left\{ \left(p_A^i - w_e^i\right) q_A^i\left(p_A^i, p_B^i, \infty, p_B^j\right) + \left(p_B^i - c\right) q_B^i\left(p_B^i, p_A^i, p_B^j, \infty\right) \right\}, \tag{9}$$

at the final stage, whereas retailer j maximizes

$$\max_{p_B^j} \left(p_B^j - c\right) q_B^j\left(p_B^j, \infty, p_B^i, p_A^i\right) \tag{10}$$

Let $p_A^e\left(w_e^i\right)$ and $p_B^e\left(w_e^i\right)$ for retailer i, and $p_B^d\left(w_e^i\right)$ for retailer j, be the retail prices that simultaneously maximizes (9) and (10). According to Assumption 3, when unrestricted contracts are used, w_e^i is chosen so as to maximize the overall joint surplus for the manufacturer and retailer i in the subgame where $q_A^j = 0$. I.e., w_e^i will be set equal to

$$w_e^U := \arg\max_{w_e^i} \Big\{ \left(p_A^e\left(w_e^i\right) - c\right) q_A^i \left(p_A^e\left(w_e^i\right), p_B\left(w_e^i\right), \infty, p_B^d\left(w_e^i\right)\right) + \left(p_B^e\left(w_e^i\right) - c\right) q_B^i \left(p_B^e\left(w_e^i\right), p_A^e\left(w_e^i\right), p_B^d\left(w_e^i\right), \infty\right) \Big\} \tag{11}$$

We can then make the following definition.

Definition 1. *Suppose unrestricted contracts are used, and that* $w_e^i = w_e^U$. *In the subgame where* $q_A^j = 0$, V_U *is the joint profit of the manufacturer and retailer* i, *and* π_U^d *is the profit of retailer* j. *We define* $\Pi_U^e := V_U + \pi_U^d$ *as the overall industry profit realized in this subgame.*

Suppose instead that restricted contracts are used, and let $\underline{p_e^i}$ and w_e^i be the minimum resale price and the unit wholesale price for retailer i in the subgame where $q_A^j = 0$. Retailer i then maximizes

$$\max_{p_B^i} \left\{ \left(p_A^i - w_e^i\right) q_A^i \left(p_A^i, p_B^i, \infty, p_B^j\right) + \left(p_B^i - c\right) q_B^i \left(p_B^i, p_A^i, p_B^j, \infty\right) \right\} \quad \text{s.t. } p_A^i \geq \underline{p_e^i} \tag{12}$$

whereas retailer j maximizes

$$\max_{p_B^j} \left(p_B^j - c\right) q_B^j \left(p_B^j, \infty, p_B^i, p_A^i\right) \tag{13}$$

Let $p_B^e\left(\underline{p_e^i}, w_e^i\right)$, for retailer i, and $p_B^d\left(\underline{p_e^i}, w_e^i\right)$, for retailer j, be the prices that simultaneously maximizes (12) and (13), assuming of course that the price restraint $p_A^i \geq \underline{p_e^i}$ binds. Again, according to Assumption 3, when restricted contracts are used, both $\underline{p_e^i}$ and w_e^i are chosen so as to maximize the overall joint surplus for the manufacturer and retailer i in the subgame where $q_A^j = 0$. I.e. $\underline{p_e^i}$ and w_e^i will be set equal to

$$\left\{\underline{p_e^R}, w_e^R\right\} := \arg\max_{\underline{p_e^i}, w_e^i} \Big\{ \left(\underline{p_e^i} - c\right) q_A^i \left(\underline{p_e^i}, p_B^e\left(\underline{p_e^i}, w_e^i\right), \infty, p_B^d\left(\underline{p_e^i}, w_e^i\right)\right) + \left(p_B^e\left(\underline{p_e^i}, w_e^i\right) - c\right) q_B^i \left(p_B^e\left(\underline{p_e^i}, w_e^i\right), \underline{p_e^i}, p_B^d\left(\underline{p_e^i}, w_e^i\right), \infty\right) \Big\} \tag{14}$$

We can make the following definition.

Definition 2. *Suppose restricted contracts are used, and that* $\underline{p_e^i} = \underline{p_e^R}$ and $w_e^i = w_e^R$. *In* *the subgame where* $q_A^j = 0$*,* V_R *is the joint profit of the manufacturer and retailer* i *and* π_R^d *is the profit of retailer* j*. We define* $\Pi_R^e := V_R + \pi_R^d$ *as the overall industry profit realized in this subgame.*

In addition, it will be useful to make the following definition:

Definition 3. *Let* $\underline{\pi}$ *be each retailer's equilibrium profit in the situation where neither of the retailers sells brand A. Formally, we have that if* $p^c := \arg\max_p (p - c)\, q_B^i (p, \infty, p^c, \infty)$*, then* $\underline{\pi} := (p^c - c)\, q_B^i (p^c, \infty, p^c, \infty)$*.*

As will become clearer, these values will play a role in determining whether or not all products are sold in our subgame perfect equilibria. This is intuitively straightforward, as V_U or V_R is the joint value for the manufacturer and a retailer to deviate to exclusivity, whereas, depending on the situation, either π_U^d, π_R^d or $\underline{\pi}$ is the value of a retailer's disagreement profit (her reservation profit) when signing a contract with the manufacturer.

2.2.3 Two-part tariffs and contracting equilibria

Before describing our results, it will be useful to note the following characteristics about our 'contract equilibria' when simple two-part tariffs are used: First, note that in the offer game, a retailer who turns down the manufacturer's offer, earns a profit equal to either π_U^d (no price restraints) or π_R^d (with price restraints), according to our Definitions 1 and 2. We will refer to π_U^d and π_R^d as the retailers' disagreement profits. Hence, given that the manufacturer wants both retailers to accept his contract terms, he should ensure that the fixed fees are adjusted so that each retailer earns no less (and no more) than her disagreement profit. This means that, in every equilibrium with all products sold, the manufacturer's maximization problem can be written

$$\max_{w^i, w^j} \Pi_{U2} \left(w^i, w^j\right) - 2\pi_U^d \tag{15}$$

without price restraints, or

$$\max_{w^i, w^j, \underline{p}^i, \underline{p}^j} \Pi_{R2} \left(\underline{p}^i, w^i, \underline{p}^j, w^j\right) - 2\pi_R^d \tag{16}$$

with price restraints. If this was not the case, either the manufacturer could marginally increase his fixed fees and still have both retailers accept, or at least one retailer would reject the manufacturer's offer. In the offer game, the manufacturer therefore always seeks to maximize the overall industry profit – given the allowable contractual restraints available to him. Note however, that this does not imply that the overall industry profit necessarily equals the fully integrated profit Π^M.

In the bidding game, on the other hand, after the retailers have made their offers, the relevant alternatives for the manufacturer are to either accept both offers or accept the best exclusive offer (or to reject both). To simplify the exposition and using (11), we therefore let

$$\theta_{U2}^i := \left(w_e^U - c\right) q_A^i \left(p_A^e \left(w_e^U\right), p_B \left(w_e^U\right), \infty, p_B^d \left(w_e^U\right)\right) + F_e^i \tag{17}$$

be the profit of the manufacturer when accepting retailer i's exclusive offer, without price restraints, and let $\overline{\theta}_{U2} := \max\{\theta_{U2}^1, \theta_{U2}^2\}$ denote the best (for the manufacturer) exclusive offer of the two.

Similarly, when price restraints are allowed, we let θ_{R2}^i be the the manufacturer's profit when accepting retailer i's exclusive offer, and let $\overline{\theta}_{R2} = \max\{\theta_{R2}^1, \theta_{R2}^2\}$ denote the best exclusive offer. Hence, in every equilibrium with all products sold, each retailer should ensure that the manufacturer earns no more (and no less) than what he would earn by accepting the best exclusive offer instead. Otherwise, either the manufacturer would not accept both offers, or at least one retailer could marginally *reduce* her fixed fee and still have the manufacturer accept both offers.

Hence, in every equilibrium of the bidding game with all products sold, the following has to hold in the situation without price restraints

$$\overline{\theta}_{U2} = \left(w^i - c\right) \widehat{q}_A^i + \left(w^j - c\right) \widehat{q}_A^j + F^i + F^j, \tag{18}$$

and the following has to hold in the situation with restraints

$$\overline{\theta}_{R2} = \left(w^i - c\right) \widetilde{q}_A^i + \left(w^j - c\right) \widetilde{q}_A^j + F^i + F^j \tag{19}$$

Using (18) and (19) to solve for retailer i's optimal fixed fees in the two situations, we can write her maximization problem at the contracting stage as

$$\max_{w^i} \left\{ \Pi_{U2}\left(w^i, w^j\right) - \widehat{\pi}_r^j\left(w^j, w^i\right) \right\} + F^j - \overline{\theta}_{U2}, \tag{20}$$

in the situation without price restraints, or

$$\max_{w^i, \underline{p}^i} \left\{ \Pi_{R2}\left(\underline{p}^i, w^i, \underline{p}^j, w^j\right) - \widetilde{\pi}_r^j\left(\underline{p}^j, w^j, \underline{p}^i, w^i\right) \right\} + F^j - \overline{\theta}_{R2} \tag{21}$$

in the situation when price restraints are used. Hence, unlike in the offer game, in every equilibrium of the bidding game with all products sold, each retailer maximizes the overall industry profit minus the downstream (variable) profit earned by her rival. I.e., each retailer maximizes *her joint profit with the manufacturer.* As we will see, this has implications for the retailers' ability to induce the fully integrated outcome when using two-part tariffs.

3 Main results

3.1 The offer game

We start out by analyzing the situation where the manufacturer dictates the contract terms for the retailers. As note above we consider the cases where the manufacturer may use unrestricted two-part tariffs and compare this to the case where the manufacturer may use a price restraint on brand A.

3.1.1 Unrestricted two-part tariffs

As mentioned above, in this case the manufacturer optimally adjusts his unit wholesale prices so as to maximize the overall industry profit, and adjusts his fixed fees so that each retailer earns no more than her disagreement profit π_U^d in equilibrium. Given our assumptions on demand, $\Pi_{U2}\left(w^i, w^j\right) = \Pi\left(\widehat{\mathbf{p}}\left(\mathbf{w}\right)\right)$ is maximized for a pair of symmetric wholesale prices, which we denote by $\mathbf{w}_{U2}^* = \left(w_{U2}^*, w_{U2}^*\right)$. Hence, in equilibrium we have

$$\left.\frac{\partial \Pi_{U2}\left(w^i, w_{U2}^*\right)}{\partial w^i}\right|_{w^i = w_{U2}^*} = \left.\frac{\partial \Pi\left(\widehat{\mathbf{p}}\left(w^i, w_{U2}^*\right)\right)}{\partial w^i}\right|_{w^i = w_{U2}^*} = 0 \tag{22}$$

Let $p_h^* = \widehat{p}_h^i\left(w_{U2}^*, w_{U2}^*\right) = \widehat{p}_h^j\left(w_{U2}^*, w_{U2}^*\right)$ be the resulting equilibrium retail price for brand $h \in \{A, B\}$ in this situation, and let $\Pi_{U2}^* := \Pi_{U2}\left(w_{U2}^*, w_{U2}^*\right)$ denote the resulting overall profit.

Note that even if the manufacturer seeks to maximize the overall industry profit, he is not able to induce the fully integrated profit Π^M in this situation without price restraints. This is shown in Proposition 1 below.

Proposition 1. *In the offer game with unrestricted two-part tariffs, the manufacturer is unable to induce the integrated outcome, i.e.* $\Pi_{U2}^* < \Pi^M$.

Proof: See the appendix.

Proposition 1 is a restatement of Proposition 7 in Inderst and Shaffer's (2011) paper on market-share discounts (see pp.721-723 for the case of price competition). The intuition is as follows. To achieve the integrated price of brand A the manufacturer needs to set its wholesale price above its marginal cost in order to dampen intrabrand competition on brand A. However, in order to achieve the monopoly price on brand B the manufacturer needs to give the retailers an incentive to reduce the sale of brand B. The only way to do this here is by giving an increased incentive to sell brand A. Since brand B is procured at marginal cost, this will call for a subsidy for brand A, i.e. $w^i < c$. Both things cannot be achieved at the same time, hence the integrated profit cannot be achieved with unrestricted two-part tariffs.

Hence, prices will tend to be lower than p^M in equilibrium. To see this, let $w^M > c$ be the wholesale price that yields the integrated price for brand A, implicitly defined by $\widehat{p}_A\left(w^M, w^M\right) := p^M$. We know that w^M has to be above the marginal production cost c in order to dampen the price competition between the retailers on brand A. It follows then that if the wholesale prices are equal to w^M, then we have $\widehat{p}_B\left(w^M, w^M\right) < p^M$ in the continuation equilibrium[6]. Hence, retail prices for at least one of the two brands will be below the price of the fully integrated monopolist.

In optimum, of course, the manufacturer will have to adjust his wholesale prices so as to balance two considerations: 1) Softening the competition between the retailers on brand A, which suggests a relatively high wholesale price, and 2) competing for consumer demand against brand B, which suggests a lower wholesale price. This means that $c < w^*_{U2} < w^M$, and that all product prices therefore are strictly below the fully integrated level in equilibrium, i.e., $p^*_B < p^*_A < p^M$. In particular, we know that this holds for linear demand systems.

Inderst and Shaffer (2011) do not specify whether an equilibrium with all products exists, however. This is covered in the following proposition:

Proposition 2. *In the offer game with unrestricted two-part tariffs, an equilibrium with all products exists and where the outcome Π^*_{U2} is induced, and where $\Pi^*_{U2} < \Pi^M$. For this to hold, it is sufficient that $\Pi^*_{U2} \geq \Pi^e_U$ and $\underline{\pi} \geq \pi^d_U$.*

Proof: See the appendix.

Proposition 2 says that, for an equilibrium with all products to exist in the offer game with unrestricted contracts, it is sufficient 1) that the overall profit is higher when all

[6] These considerations follow from inspection of (27) an (28) in proof of Proposition 1 in the appendix.

products are sold, compared to the situation when only one of the retailers sell brand A, and 2) that a retailer who sells brand B only, is weakly worse off when the rival sells both brands, A and B, compared to when the rival sells only B as well. Since retailers at most earn their reservation profit, $\underline{\pi} - \pi_U^d$ *is how much more the retailers earn* when the manufacturer sells to only one of them, compared to when he sells to both. If $\underline{\pi} > \pi_U^d$, then the retailers jointly earn a higher profit when the manufacturer sells to only one of them, and this makes deviating to exclusivity *less attractive* for the manufacturer. In the following we will assume that both of these conditions hold.[7]

Assumption 5. $\Pi_{U2}^* \geq \Pi_U^e \wedge \underline{\pi} \geq \pi_U^d$.

3.1.2 Restricted two-part tariffs

Now we show that if the manufacturer is allowed to use price restraints, specifically minimum or fixed RPM provisions, then it is straightforward for the manufacturer to restore the fully integrated monopoly outcome. At first glance this may not seem obvious, as the price restraint only applies to the sales of the manufacturer's brand (we do not allow the contracts to be contingent on the prices of rival brands). Hence, given that the manufacturer fixes the resale price for brand A at p^M, this in itself does not prevent a retailer from charging a lower price for B, if she wants to. However, note that by fixing the retail price for brand A at p^M, the manufacturer can safely reduce his unit wholesale price below w_{U2}^*, to induce the retailers to choose a higher price for brand B, without worrying that they will respond also by lowering her price for brand A. Then we can show the following result:

Proposition 3. *In the offer game with restricted two-part tariffs, the manufacturer is able to induce the fully integrated outcome Π^M. The manufacturer may induce this outcome by choosing a wholesale price $w^I < c$ and fixing the retail price of brand A to p^M and such an equilibrium always exists. If the degree of interbrand competition is weak, and the unit production cost c is sufficiently low, the manufacturer may have to use a quantity ceiling as well as resale price maintenance to induce the integrated outcome.*

Proof: See the appendix.

The intuition for this result is straightforward: By fixing the price for brand A, the only way for a retailer to increase her sales of brand A is to *increase* her price for brand B.

[7] This holds for example in a linear demand system.

Hence, by giving retailer i an appropriately high markup on brand A, $p^M - w^i > p^M - c$, the manufacturer can induce the retailer to increase p_B^i above the level achieved in our benchmark, p_B^*. In the appendix we show that the fully integrated price for brand B is achieved in both stores when $w^i = w^j = w^I < c$, where[8]

$$w^I := c - \frac{(p^M - c) \displaystyle\sum_{h \in A,B} \left.\frac{\partial q_h^j}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M}}{\left.\dfrac{\partial q_A^i}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M}} \tag{23}$$

If this implies that $w^I < 0$, e.g. when the degree of substitution between the two brands is sufficiently low, the retailers have an incentive to order more units of brand A than they are able to sell. This opportunistic behavior by the retailers can be mitigated, however, by also imposing a quantity ceiling $\overline{q} = q^M$ on brand A for each retailer. Given this, the integrated outcome is again restored, and the manufacturer can easily adjust its fixed fees so that each retailer earns no more than its disagreement profit in equilibrium, which in the case with restricted contracts is equal to π_R^d.

Relating this result to IH, it is noteworthy that while these authors obtain a similar result only for the case where products are very close substitutes, our result prevails for any degree of substitution between the dominant brand and the competitive product. Moreover, we show that as the marginal subsidy needed to induce the vertically integrated prices increases, so as to make the the wholesale price negative, there will be a need to limit the retail purchases with a quantity roof. This is not considered in IH. Moreover, our result above do not rely on consumers bundling their purchases ("one-stop shopping"), an assumption that is crucial for IH in the case where the retailers must sell the dominant brand with a loss.

Our result in Proposition 1 has policy consequences, since it implies that, by imposing a minimum resale price on its own brand, the manufacturer can simultaneously dampen competition on a substitute brand. However, our result also shows that a minimum price may not be enough, and that RPM provisions therefore may be more anti-competitive when coupled with a maximum quantity, for example.

[8] See also the appendix and conditions (29)-(31) in the proof of Proposition 3.

3.2 The bidding game

3.2.1 Unrestricted two-part tariffs

We turn now to the bidding game, and start out by analyzing the case of two-part tariffs without price restraints. In this situation, given that the retailers would like the manufacturer to accept both offers, at the contracting stage each retailer $i \in \{1,2\}$ chooses w^i so as to maximize (20), which yields the following first-order condition

$$\frac{\partial \Pi_{U2}\left(w^i, w^j\right)}{\partial w^i} = \frac{\partial \widehat{\pi}_r^j\left(w^j, w^i\right)}{\partial w^i} \tag{24}$$

Let $w^i = w^j = w_{U2}^{**}$ be the wholesale prices that simultaneously solves (24) for both retailers $i \neq j \in \{1,2\}$.

Given our assumptions, the right-hand side of (24) is positive, i.e. retailer j's profit is increasing in the price that retailer i pays per unit of brand A[9]. This means that $w_{U2}^{**} < w_{U2}^{*}$, i.e. the retailers will choose wholesale prices that are lower than the level w_{U2}^{*} from the offer game with the same contracts. We define $\widehat{\mathbf{p}}\left(\mathbf{w}_{U2}^{**}\right) = \mathbf{p}^{**}$ as the vector of prices and $\Pi_{U2}^{**} := \Pi\left(\mathbf{p}^{**}\right)$ as the overall industry profit achieved in this candidate equilibrium. We then have the following result.

Proposition 4. *In the bidding game with unrestricted two-part tariffs, the retailers are unable to induce the fully integrated outcome. Moreover, in any equilibrium with unrestricted two-part tariffs in which all products are sold, the overall industry profit is smaller in the bidding game than in the offer game,* $\Pi_{U2}^{**} < \Pi_{U2}^{*} < \Pi^{M}$.

This result is similar to the one obtained by Miklos-Thal et al. (2011), but here extended to a market where the retailers also sell a second substitute brand. The intuition is simple: In any equilibrium with unrestricted two-part tariffs, and where both retailers sell both brands, each retailer adjusts her unit wholesale price so as to maximize *her joint profit with the manufacturer*. Hence, when setting her wholesale price, she ignores the downstream margins earned by the rival retailer. This means that retailer $i \in \{1,2\}$ has an incentive to free-ride on the rival's downstream margins, by buying brand A at a lower wholesale price than in the offer game, $w^i < w_{U2}^{*}$.

Note that, because the overall profit is smaller when the retailers make the offers, an equilibrium with all products sold may not always exist in the bidding game. The

[9] This is seen by inspection of $\frac{\partial \widehat{\pi}_r^j\left(w^j, w^i\right)}{\partial w^i} = \left(\widehat{p}_A^j - w^j\right)\left(\frac{\partial \widehat{p}_A^i}{\partial w^i}\frac{\partial q_A^j}{\partial p_A^i} + \frac{\partial \widehat{p}_B^i}{\partial w^i}\frac{\partial q_A^j}{\partial p_B^i}\right) + \left(\widehat{p}_B^j - c\right)\left(\frac{\partial \widehat{p}_B^i}{\partial w^i}\frac{\partial q_B^j}{\partial p_B^i} + \frac{\partial \widehat{p}_A^i}{\partial w^i}\frac{\partial q_B^j}{\partial p_A^i}\right) > 0$

following proposition shows this.

Proposition 5. *In the bidding game with unrestricted two-part tariffs, an equilibrium where all products are sold exists where the outcome* Π_{U2}^{**} *is induced, if and only if* $\Pi_{U2}^{**} \geq \Pi_U^e$. *Otherwise, the only equilibrium entails the manufacturer selling brand A exclusively to one retailer.*

Proof: See the appendix.

Whether an equilibrium with all products exists in the bidding game, generally depends on the degree of substitution between the two retailers: We know that $\Pi_U^e < \Pi_{U2}^{**} = \Pi_{U2}^{*} = \Pi^M$ when the retailers are local monopolists, while $\Pi_{U2}^{**} < \Pi_{U2}^{*} < \Pi^M$ when the retailers compete. Hence, for a sufficient degree of substitution between the retailers, the condition $\Pi_{U2}^{**} \geq \Pi_U^e$ may not be satisfied, even if $\Pi_{U2}^{*} \geq \Pi_U^e$ holds (as per assumption).

3.2.2 Restricted two-part tariffs

Recall that in the offer game with restricted two-part tariffs (Proposition 3) the manufacturer was able to restore the fully integrated monopoly outcome by fixing the retail prices for brand A (and, if necessary, restricting the quantities retailers can order). In contrast to what is claimed by Innes and Hamilton (2009), we now show that in the bidding game the retailers are unable to induce the same outcome with the same type of contracts.

Proposition 6. *In the bidding game with restricted two-part tariffs, the retailers are unable to induce the fully integrated outcome* Π^M .

Proof: See the appendix.

The intuition for this result is as follows. Given a pair of fixed resale prices equal to p^M for brand A, and wholesale terms $w^i = w^j = w^I$, we know from Proposition 3 that the fully integrated outcome is achieved at the final stage of the game (given that all contracts are accepted and implemented). Because $w^I < c$, each retailer then earns substantial variable downstream profits – i.e., we have $\widetilde{\pi}_r^i = \widetilde{\pi}_r^j > \Pi^M/2$ in equilibrium at the final stage of the game. However, when making an offer to the manufacturer, each retailer takes the rival's contract offer to the manufacturer as given. Hence, there is an incentive for retailer i to free-ride on the downstream margins earned by the rival j, and vice versa. One way to do this, is for the retailer to charge a lower price for brand B, $p_B^i < p^M$, which is achieved by increasing her unit wholesale price w^i, as illustrated by condition (38) in the proof of Proposition 6. Another way is for retailer i to charge a lower price for brand A,

$p^i_A < p^M$, which can be achieved by reducing the price $\underline{p}^i$ that she is obliged by contract to charge for brand A, as illustrated by condition (39) in the appendix. Both deviations serve to shift some of the downstream profits away from retailer j towards retailer i and the manufacturer.

Note that Proposition 6 holds both when the retailers choose the price restraints at the contracting stage, as we have assumed, but also if one assumes that the manufacturer may choose the price restraints (for example at a stage prior to our contracting stage). This holds because, given that $\underline{p}^i = \underline{p}^j = p^M$, at the contracting stage each retailer optimally chooses a wholesale price different from w^I.[10]

The following proposition characterizes the condition for the existence of an equilibrium where all products are sold.

Proposition 7. *In the bidding game, an equilibrium exists with restricted two-part tariffs where the outcome* Π^{**}_{R2} *is induced, where* $\Pi^{**}_{R2} < \Pi^M$*, if and only if* $\Pi^{**}_{R2} \geq \Pi^e_R$*. Otherwise the only equilibrium entails the manufacturer selling brand A exclusively to one retailer.*

Proof: See the appendix.

It proves cumbersome to show how the use of restricted two-part tariffs affect the overall equilibrium profit achieved in the bidding game. We know that the retailers are unable to induce the fully integrated outcome, as covered by Proposition 6 above. However, it is more difficult to say generally whether the players are better or worse off overall compared to the outcome with unrestricted two-part tariffs.

We may note, however, that when using price restraints that bind, the strategic effect of delegating the pricing decisions for brand A to the retailers at the final stage of the game, disappears. With unrestricted contracts, a marginal increase in w^i translates into a higher p^i_A, which in turn induces the rival to respond by increasing her price, p^j_A. With restricted contracts, on the other hand, marginal changes in w^i or $\underline{p}^i$ do not affect the rival's price for brand A, p^j_A. Instead, an alternative strategic affect is achieved: Because retailer i's mark-up on brand A, $\underline{p}^i - w^i$, directly affects her optimal price for brand B $\widetilde{p}^i_B$ at the final stage, it indirectly also affects the rival's optimal price for brand B, $\widetilde{p}^j_B$. Hence, given that prices are strategic complements, by reducing her wholesale price, $w^i < c$, and thus increasing her mark-up on brand A, the retailer is able to soften the competition on brand B. Because A and B are imperfect substitutes, however, it seems reasonable to conjecture that this alternative effect is less valuable to the retailers than the competition

[10] According to (36) and (38) in the proof of Proposition 6 in the appendix,

dampening effect achieved when using unrestricted contracts. To gain some additional insight, we consider the following linear demand system,

$$p_h^i(\mathbf{q}) = 1 - q_h^i - bq_k^i - dq_h^j - bdq_k^j,$$

for $i \neq j \in \{1,2\}$ and $h \neq k \in \{A,B\}$, where $b \in (0,1)$ is the degree of interbrand substitution and $d \in (0,1)$ is the degree of intrabrand substitution. When inverted, this becomes equal to

$$q_h^i(\mathbf{p}) = \alpha - \beta p_h^i + b\beta p_k^i + d\beta p_h^j - bd\beta p_k^j$$

where $\alpha := (1+b+d+bd)^{-1}$ and $\beta := (1+b^2d^2-d^2-b^2)^{-1}$. Using this, we obtain the following result.

Proposition 8. *In the bidding game, using our linear demand system, the overall industry profit with all products sold is smaller when retailers use restricted two-part tariffs compared to when they use unrestricted two-part tariffs. Specifically, we have*

$$\Pi_{U2}^{**} - \Pi_{R2}^{**} = \frac{(4b+(1-b)d^2)(1-b)(1-c)^2 d^4}{8(1+d)(2-d)^2 b^2} \geq 0.$$

We have also checked alternative linear demand systems, and they all yield the same result. It therefore seems that, in the bidding game with two-part tariffs, and without additional contractual restraints, competition becomes more fierce when allowing retailers to use price restraints.

3.2.3 Unrestricted and restricted three-part tariffs

We now turn to the situation where the retailers use three-part tariffs. Hence, in her contract with the manufacturer, a retailer is now allowed to combine an up-front (unconditional) payment with a two-part tariff that is conditional on actual trade.

To ensure that a pure strategy equilibrium actually exists, we now make the following assumption about the timing of the various payments, after the retailers have made their offers to the manufacturer: First, the manufacturer makes his acceptance decisions, and then immediately the up-front payments S^i and S^j are paid. Second, each retailer independently decides whether she wants to trade with the manufacturer, and, given that she decides to trade, immediately pays the required fixed fee F^i. Finally, the retailers compete by setting prices.

In a model where a monopolist manufacturer sells to two competing retailers, Miklos-Thal et al. (2011) show that these types of contracts can help retailers fully restore the monopoly outcome. In our setting, however, because the retailers also sell a substitute to the manufacturer's brand, introducing three-part tariffs alone is not enough to achieve the monopoly outcome. This follows directly from Proposition 1 above. Without price restraints, in any equilibrium with all products sold at the last stage of the game, each retailer sets her prices according to the first-order conditions (5) and (6), in which case prices will be equal to $\widehat{p}_A^i(w^i, w^j)$ and $\widehat{p}_B^i(w^i, w^j)$ for $i \in \{1, 2\}$. The overall industry profit in this situation is equal to $\Pi_{U2}(w^i, w^j)$, which reaches it maximum $\Pi_{U2}^* < \Pi^M$ for wholesale prices equal to w_{U2}^*, as covered by Proposition 1. Hence, the introduction of three-part tariffs alone, is not enough to sustain the fully integrated outcome. However, as in Miklos-Thal et al. (2011), the retailers are able to induce a higher overall profit with three-part tariffs compared to the outcome when using unrestricted two-part tariffs. Then we can show:

Proposition 9. *In the bidding game with unrestricted three-part tariffs, an equilibrium where all four products are sold exists and where the outcome $\Pi_{U3}^{**} = \Pi_{U2}^* < \Pi^M$ is induced. A sufficient condition for this is that $\Pi_{U2}^* \geq \Pi_U^e$. Otherwise, the only equilibrium entails the manufacturer selling brand A exclusively to one retailer.*

Proof: See the appendix.

The intuition for this result is the following: When using two-part tariffs, each retailer earns positive variable downstream profits. This creates an incentive for each retailer $i \in \{1, 2\}$ to "cheat" on the rival by offering to the manufacturer a lower wholesale price than what is overall jointly optimal, $w^i < w_{U2}^*$. When using three-part tariffs, on the other hand, each retailer can protect herself against such deviations, because the contract allows her to waive the fixed fee $\overline{F}$ and not trade with the manufacturer whenever the rival retailer deviates to a lower wholesale price. The up-front payments can then be used to redistribute profits. In the bidding game, the use of three-part tariffs therefore helps to induce a higher overall industry profit, $\Pi_{U3}^{**} = \Pi_{U2}^* > \Pi_{U2}^{**}$.

By using the same logic, we can infer that when combining three-part tariffs and price restraints, the retailers *will* be able to induce the fully integrated outcome Π^M:

Proposition 10. *In the bidding game, the retailers are able to induce the fully integrated outcome Π^M with restricted three-part tariffs. If the degree of interbrand competition is weak, and the unit production cost c is sufficiently low, the retailers may have to use quantity ceilings as well as resale price maintenance to induce the integrated outcome.*

Whereas both restricted and unrestricted two-part tariffs as well as unrestricted three-part tariffs proved insufficient to induce monopoly prices in the bidding game, the combination of three-part tariffs and RPM enables the retailers to induce the integrated outcome. This result contradicts the claim by IH saying that restricted two-part tariffs would be sufficient. The divergence is due to the fact that IH did not explicitly model the bidding game. To achieve monopoly prices when the retailers make the contract offers, the contracts need to ensure that each retailer can not make profitable marginal deviations by changing wholesale or retail prices.

Moreover, contracts must ensure that no retailer can make a profitable deviation by contracting exclusively with the manufacturer. This is achieved in the following way. First, the retailers set the retail price of brand A equal to the monopoly price and wholesale prices equal to w^I to induce the monopoly prices for brand B. Conditioning the fixed fees on actual trade taking place, gives the retailers a possibility to opt out and thereby protecting them against the rival's opportunistic behavior. The conditional fixed fees is set to extract the retailer's variable profit given w^I and monopoly prices on both products minus their reservation profit they get when refusing to trade with the manufacturer. This coupled with an up-front payment makes each retailer indifferent between trading with the manufacturer or not, as she would earn the outside option plus the up-front payment in any case. Moreover, constructing the contract in this way also makes any marginal deviation on the wholesale price and/or the fixed retail price by a retailer unprofitable, as this would only serve to reduce the retail variable profit. Finally the *size* of the up-front payment is set so as to render a deviation to exclusivity unprofitable.

The result above is in some sense similar in spirit to what is obtained in Miklos-Thal et al (2011). However, we show that when adding a competitive supplied product to the model, an additional contract instrument is needed to obtain monopoly prices. In Miklos-Thal et al (2011), with a monopolist upstream manufacturer, the retailers can obtain monopoly prices with unrestricted (conditional) three-part tariffs. In their model wholesale prices are set to induce monopoly prices, up-front payments are set to provide protection from opportunistic free-riding and contingent contracts prevents deviations to exclusion. With a competitive supplied product in addition, the retailers will need RPM also to be able to induce monopoly prices on both products as shown above.

With a monopolist upstream manufacturer Miklos-Thal et al (2011) show that each retailer earns its incremental contribution to the vertically integrated profit, a mirror image of the results obtained by Bernheim and Whinston (1998) and O'Brien and Shaffer (1997) in a model with a downstream monopolist and two differentiated manufacturers with bargaining power. Both these results offers good economic intuition. When contracts are sufficiently sophisticated, the parties should be able to make the cake as big as possible and share the cake based on incremental contributions. An interesting feature of our result in Proposition 10 is that a similar intuition goes through also in our model. In equilibrium, each retailer earns the difference between the aggregate monopoly profit Π^M and the maximal profit the manufacturer and the rival retailer could earn from excluding a retailer from selling A, i.e. $\Pi^M - V_R$, given that this is less than or equal to $\Pi^M/2$. However, when the degree of inter- and intrabrand substitution is sufficiently high, it may be the case that $\Pi^M - V_R > \Pi^M/2$, i.e., the sum of the retailers' incremental contributions is higher than the fully intragrated profit. Obvisously the retailer cannot together earn a profit higher than Π^M, hence they earn exactly $\Pi^M/2$ each in this case, as demonstrated in the proof of Proposition 10 in the appendix.

4 Concluding remarks

In this paper we have analyzed a setting with a dominant upstream manufacturer and a competitive fringe of producers selling their products to differentiated downstream retailers. We have shown that industry-wide monopoly pricing may be an equilibrium outcome irrespective of whether the manufacturer or the retailers have the power to propose wholesale contracts. In each setting we have characterized the set of vertical restraints that are needed to sustain monopoly prices.

In an identical setting Inderst and Shaffer (2010) (IS) have shown similar results when the manufacturer may use market-share contracts. Our analysis differs from IS in two important respects. First and in contrast to IS we focus on wholesale contracts that are purely bilateral in nature, or what we can denote as own-sale contracts. I.e., the contracts are not (explicitly or implicitly) conditional on the prices or quantitites of the rival retailer. More specifically we consider how simple two-part tariffs, possibly coupled with up-front payments, quantity ceilings and vertical price fixing may be used to induce monopoly pricing. Second, whereas IS limit their attention to the case when the manufacturer may propose contracts, we also consider the equilibrium outcome when the retailers are the ones that propose the wholesale terms.

With seller power we show that the dominant manufacturer may obtain industry-wide monopoly pricing with vertical restraints involving two-part tariffs and a minimum RPM provision, and possibly coupled with a maximum quantity to each retailer. The use of RPM as a facilitating practice to monopolize markets have been studied before. Jullien and Rey (2007) formalize a model where RPM yields more uniform prices that facilitate tacit collusion. Rey and Verge (2010) argue that even in the absence of repeated interaction, RPM may induce monopoly prices. In the latter article RPM coupled with two-part tariffs may induce monopoly prices where two strategic producers may sell their products with two differentiated retailers. In this setting each manufacturer may wish to charge high wholesale prices to control for intrabrand competition, but at the same time charge low wholesale prices to avoid interbrand competition. Simple two-tariffs then prove insufficient. However, if both manufacturer can use RPM to eliminate intrabrand competition, the conflict is removed, and monopoly prices can be achieved.

In our setting this mechanism will not work because we assume that the competitive brand is supplied to the retailers at marginal cost. Hence, the mechanism proposed here differs from the ones above. In our model the monopoly price on its own brand is trivially obtained with RPM. The monopoly price on the brand provided by the upstream competitive fringe is obtained by providing each retailer with a larger margin on the dominant brand than on the competitive brand. Hence, since the competitive brand is provided at marginal cost the manufacturer needs to offer the retailers a marginal subsidy on the dominant brand. If so, the retailers will wish to sell more of the dominant brand, and since they cannot reduce its price, the only way of achieving this is by increasing the price of the competitive brand. By offering the retailers the appropriate marginal subsidy on its own brand, the manufacturer may induce monopoly retail prices on both brands.

This result is similar to one obtained by Innes and Hamilton (2009). However, there are important differences to our model. Whereas IH study the same setting as us, their modelling approach differs. IH assume that each consumer buys a consumption bundle consisting of both upstream products from a single retailer, and that consumers are distributed on a Hotelling line. In their model, the need for the dominant producer to offer its retailers a marginal subsidy - which is similar to our result - only arises when the retail goods are strong substitutes. When retail goods are weaker substitutes or independent IH claim that the dominant manufacturer should impose fixed retail prices on its brand that are lower than the marginal wholesale price, and thereby inducing a marginal loss on each retailer. Obviously, the one-stop shopping behavior assumed by IH is crucial for this type of equilibrium to exist. For instance, if retail products are independent (or even weak substitutes) and consumers may one-stop shop or not, a manufacturer could not achieve monopoly prices on both brands by forcing its retailers to buy from him with a marginal loss. In contrast to this, our results show that some degree of substitution between products is needed, and that the equilibrium contract always involves a marginal subsidy irrespective of the degree of substitution between the products. Moreover, in our model when substitution is very weak the marginal subsidy needed may be so large as to involve a negative wholesale price, in which case the manufacturer would need a quantity roof to prevent retailers from ordering too much.

Also, IH claims that their result prevails for any distribution of bargaining power between the manufacturer and the retailers. We model buyer power on the retail side explicitly, and we show that the retailers only can achieve industry-wide monopoly pricing when they have access to an additional vertical restraint. In our model this additional vertical restraint is an up-front fixed payment from the manufacturer to each retailer. Hence, even though industry-wide monopoly prices can be achieved both under sell and buyer power, there is a fundamental difference between the two games. Even though we have showed that three-part tariffs with RPM is sufficient to obtain industry-wide monopoly prices in the bidding game, there might be alternative ways to obtain the same outcome. As noted by Miklos-Thal et al. (2011) the essential issue is that each retailer must deter its rival from free-riding on its downstream margin, and each retailer therefore need a drastic response to such an attempt. They argue that slotting allowances (up-front payments) are not necessary to sustain monopoly pricing in their bidding game with an upstream monopolist, and that alternative ways exist to induce the monopoly outcome. This might also be true in our case with upstream competition, but this is left for future research.

Our results have implications for competition policy. First, minimum or fixed RPM may be a vehicle to totally monopolize markets for a dominant producer with bargaining power even when facing significant interbrand competition from a competitive brand. With buyer power, wholesale contracts involving RPM and where retailers may make drastic responses to free-riding attempts by rivals, will enable retailers to monopolize markets.

5 Appendix: proofs

Proof of proposition 1:
To achieve the integrated outcome, for each retailer $i \in \{1, 2\}$, the conditions

$$\left.\frac{\partial \Pi(\mathbf{p})}{\partial p_A^i}\right|_{\mathbf{p}=\mathbf{p}^M} - \left.\frac{\partial \pi_r^i}{\partial p_A^i}\right|_{\mathbf{p}=\mathbf{p}^M} = 0 \tag{25}$$

and

$$\left.\frac{\partial \Pi(\mathbf{p})}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M} - \left.\frac{\partial \pi_r^i}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M} = 0 \tag{26}$$

both have to hold. When inserting conditions (2) and (5) from the text in (25), we find that to achieve the integrated price for brand A, the manufacturer has to ensure that

$$w^i - c = \frac{\left(p^M - c\right) \sum_{h \in A,B} \left.\frac{\partial q_h^j}{\partial p_A^i}\right|_{\mathbf{p}=\mathbf{p}^M}}{-\left.\frac{\partial q_A^i}{\partial p_A^i}\right|_{\mathbf{p}=\mathbf{p}^M}} > 0 \tag{27}$$

I.e., he should charge a unit wholesale price above the marginal production cost. On the other hand, inserting (3) and (6) in (26), we find that, to achieve the integrated price for brand B, the manufacturer has to ensure that

$$w^i - c = \frac{\left(p^M - c\right) \sum_{h \in A,B} \left.\frac{\partial q_h^j}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M}}{-\left.\frac{\partial q_A^i}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M}} < 0 \tag{28}$$

which says that he should charge a unit wholesale price *below* the marginal production cost. Obviously the manufacturer cannot satisfy both of these conditions simultaneously.

Proof of proposition 2:
Assume that the manufacturer offers a contract to one of the retailers, say retailer 2, that she cannot accept – e.g., the manufacturer lets F^2 and F_e^2 tend to infinity. Given this offer to retailer 2, if retailer 1 rejects the manufacturer's offer, each of the retailers earns a profit equal to $\underline{\pi}$ in the continuation equilibrium. Hence, to get retailer 1 to accept, the manufacturer has to choose F_e^1 such that retailer 1 earns (at least) $\underline{\pi}$. As an alternative to making a pair of offers that both retailers will accept, and that yield an overall profit equal to Π_{U2}^*, the manufacturer could offer a pair of contracts that a) induces only one of the retailers to accept, and b) such that the retailers earn net profits equal to $\underline{\pi}$ and π_U^d, respectively, while the manufacturer earns the residual, $\Pi_U^e - \underline{\pi} - \pi_U^d = V_U - \underline{\pi}$. An equilibrium with all products therefore exists if and only if $\Pi_{U2}^* - 2\pi_U^d \geq V_U - \underline{\pi}$, which we can rewrite $\Pi_{U2}^* + \underline{\pi} \geq \Pi_U^e + \pi_U^d$. Hence, as long as both $\Pi_{U2}^* \geq \Pi_U^e$ and $\underline{\pi} \geq \pi_U^d$, an equilibrium with all products always exists in the offer game.

Proof of Proposition 3:
Suppose the manufacturer sets the unit wholesale price to retailer i according to (28), i.e. equal to

$$w^I := c - \frac{\left(p^M - c\right) \sum_{h \in A,B} \left.\frac{\partial q_h^j}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M}}{\left.\frac{\partial q_A^i}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M}} < c \tag{29}$$

Given that the retail prices for brand A are fixed at p^M, taking the derivative of retailer

i's profit wrt. her price for brand B, p_B^i, yields

$$\left.\frac{\partial \pi_r^i}{\partial p_B^i}\right|_{w^i=w^I} = \left(p^M - c\right) \left.\frac{\partial q_A^i}{\partial p_B^i}\right|_{p_A^i=p_A^j=p^M} + \left(p_B^i - c\right) \left.\frac{\partial q_B^i}{\partial p_B^i}\right|_{p_A^i=p_A^j=p^M} + q_B^i\left(p_B^i, p^M, p_B^j, p^M\right)$$
$$+\frac{\left(p^M - c\right) \sum_{h\in A,B} \left.\frac{\partial q_h^j}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M}}{\left.\frac{\partial q_A^i}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M}} \times \left.\frac{\partial q_A^i}{\partial p_B^i}\right|_{p_A^i=p_A^j=p^M} \tag{30}$$

Given that $p_B^j = p^M$, (30) becomes equal to zero when $p_B^i = p^M$:

$$\left.\frac{\partial \pi_r^i}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M \wedge w^i=w^I} = \left(p^M - c\right) \sum_{h=A,B} \left\{ \left.\frac{\partial q_h^i}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M} + \left.\frac{\partial q_h^j}{\partial p_B^i}\right|_{\mathbf{p}=\mathbf{p}^M} \right\} + q^M = 0 \tag{31}$$

Hence, when the manufacturer fixes the retail prices for brand A to p^M, and both retailers pay a unit wholesale equal to w^I, the fully integrated outcome Π^M is induced. When $w^I < 0$, the manufacturer may impose a quantity ceiling at q^M for each retailer.

Proof of Proposition 5.
In any equilibrium with all products sold, the following three conditions have to hold for each retailer $i \neq j \in \{1, 2\}$:

$$2\left(w_{U2}^{**} - c\right) q_A^{**} + F^i - \overline{\theta}_U = -\,F^j \tag{I}$$
$$\widehat{\pi}_r\left(w_{U2}^{**}, w_{U2}^{**}\right) - F^j \geq V_U - \overline{\theta}_U \tag{II}$$
$$\widehat{\pi}_r\left(w_{U2}^{**}, w_{U2}^{**}\right) - F^j \geq \pi_U^d \tag{III}$$

where $q_A^{**} = q_A^i\left(\mathbf{p}^{**}\right) = q_A^j\left(\mathbf{p}^{**}\right)$. Condition (I) is just retailer j's profit maximizing condition, which says that she should choose her level of the fixed fee such that the manufacturer is just indifferent between accepting her offer and taking the best exclusive offer. Otherwise, either the manufacturer will reject one of the offers, or the retailer could marginally reduce her fixed fee and still have the manufacturer accept both offers. Condition (II) says that the retailer should prefer the manufacturer to accept both offers to the situation where she obtains brand A exclusively. Otherwise, she could profitably deviate by offering θ^j marginally higher than $\overline{\theta}_U$, to have the manufacturer reject the rival's offer and accept her exclusive offer. By substituting (I) into (II) and rearranging, we find that, in every equilibrium with all products sold, the following has to hold

$$\underline{F} = V_U + \widehat{\pi}_r\left(w_{U2}^{**}, w_{U2}^{**}\right) - \Pi_{U2}^{**} \leq F^i, \tag{32}$$

for $i \in \{1, 2\}$. $\underline{F}$ constitutes (for both retailers) the minimum fixed fee needed to sustain an equilibrium with all products. The intuition is that, for each reduction of the fixed fee paid by retailer i, it becomes easier for retailer j to induce the manufacturer to sell to her exclusively, and vice versa. Hence, the fixed fees have to be high enough to make deviations to exclusivity unprofitable. However, the fixed fee cannot be too high, as we also have to ensure that each retailer earns a net profit greater than or equal to π_U^d, which is condition (III). Hence, we have an upper bound on the fixed fees equal to

$$\overline{F} = \widehat{\pi}_r \left(w_{U2}^{**}, w_{U2}^{**} \right) - \pi_U^d \geq F^i \tag{33}$$

If the fixed fee is higher than this, a retailer could profitably deviate by making an offer that she knows the manufacturer will reject. Suppose therefore that each retailer pays the minimum fixed fee, $\underline{F}$. Then they earn a net profit equal to $\Pi_U^{**} - V_U$ each. Together with the condition (III) that this cannot be smaller than π_U^d and Definition 1, we obtain the result.

Proof of Proposition 6.
Given that the retailers use restricted two-part tariffs, assuming the price restraints bind, each retailer $i \in \{1, 2\}$ will choose her price for brand B according to (8) at the final stage of the game. Hence, the retailers then charge the prices $\underline{p}^i$ and $\underline{p}^j$ for brand A, and $\widetilde{p}_B^i(.)$ and $\widetilde{p}_B^j(.)$ for brand B, at the final stage, and the overall industry profit is equal to $\Pi_R \left(\underline{p}^i, w^i, \underline{p}^j, w^j \right)$. By definition, we have that $\Pi_R \left(p^M, w^I, p^M, w^I \right) = \Pi^M$, and hence

$$\left. \frac{\partial \Pi_R \left(p^M, w^i, p^M, w^I \right)}{\partial w^i} \right|_{w^i = w^I} = 0 \tag{34}$$

and

$$\left. \frac{\partial \Pi_R \left(\underline{p}^i, w^I, p^M, w^I \right)}{\partial \underline{p}^i} \right|_{\underline{p}^i = p^M} = 0 \tag{35}$$

Consider now retailer i's choice of wholesale terms at the contracting stage. According to (21), retailer i should optimally adjust $\underline{p}^i$ and w^i such that

$$\frac{\partial \Pi_R \left(\underline{p}^i, w^i, \underline{p}^j, w^j \right)}{\partial w^i} = \frac{\partial \widetilde{\pi}_r^j \left(\underline{p}^j, w^j, \underline{p}^i, w^i \right)}{\partial w^i} \tag{36}$$

and

$$\frac{\partial \Pi_R \left(\underline{p}^i, w^i, \underline{p}^j, w^j \right)}{\partial \underline{p}^i} = \frac{\partial \widetilde{\pi}_r^j \left(\underline{p}^j, w^j, \underline{p}^i, w^i \right)}{\partial \underline{p}^i} \tag{37}$$

Note that, in the same way as with (24), the right-hand sides of (36) and (37) are generally not equal to zero. This implies that, given $w^i = w^j = w^I$ and $\underline{p}^i = \underline{p}^j = p^M$, retailer i would like to deviate. Formally, we can show this by evaluating the right-hand side of

(36) at $w^i = w^j = w^I$ and $\underline{p}^i = \underline{p}^j = p^M$, which gives

$$\frac{\partial \widetilde{\pi}_r^j \left(p^M, w^I, p^M, w^i\right)}{\partial w^i} = \frac{\partial \widetilde{p}_B^i}{\partial w^i} \left(\left(p^M - w^I\right) \frac{\partial q_A^j}{\partial p_B^i} + \left(p^M - c\right) \frac{\partial q_B^j}{\partial p_B^i} \right) < 0 \tag{38}$$

and similarly the right-hand side of (37), which gives

$$\begin{aligned}\frac{\partial \widetilde{\pi}_r^j \left(p^M, w^I, \underline{p}^i, w^I\right)}{\partial \underline{p}^i} = &\left(p^M - w^I\right) \left(\frac{\partial q_A^j}{\partial p_A^i} + \frac{\partial \widetilde{p}_B^i}{\partial \underline{p}^i} \frac{\partial q_A^j}{\partial p_B^i} \right) \\ &+ \left(p^M - c\right) \left(\frac{\partial q_B^j}{\partial p_A^i} + \frac{\partial \widetilde{p}_B^i}{\partial \underline{p}^i} \frac{\partial q_B^j}{\partial p_B^i} \right) > 0\end{aligned} \tag{39}$$

The fact that (38) is negative, implies that retailer i should deviate by setting $w^i > w^I$. Similarly, because (39) is positive, she should deviate by setting $\underline{p}^i < p^M$.

Proof of Proposition 7.
Let $w^i = w^j = w_R^{**}$ and $\underline{p}^i = \underline{p}^j = \underline{p}^{**}$ be the arguments that simultaneously solve the first order conditions (36) and (37) in the proof of proposition 6 above for both retailers, $i \neq j \in \{1, 2\}$, and define $\Pi_R^{**} := \Pi_R \left(\underline{p}^{**}, w_R^{**}, \underline{p}^{**}, w_R^{**}\right)$ as the overall profit in our candidate equilibrium. Similar to the case with unrestricted two-part tariffs, in every equilibrium with all products sold, the following three conditions have to hold for each retailer $j \in \{1, 2\}$ when using price restraints

$$2 \left(w_R^{**} - c\right) \widetilde{q}_A^{**} + F^i - \overline{\theta}_R = - F^j \tag{I}$$
$$\widetilde{\pi}_r^j \left(\underline{p}^{**}, w_R^{**}, \underline{p}^{**}, w_R^{**}\right) - F^j \geq V_R - \overline{\theta}_R \tag{II}$$
$$\widetilde{\pi}_r^j \left(\underline{p}^{**}, w_R^{**}, \underline{p}^{**}, w_R^{**}\right) - F^j \geq \pi_R^d \tag{III}$$

where $\widetilde{q}_A^{**} = \widetilde{q}_A^i \left(\underline{p}^{**}, w_R^{**}, \underline{p}^{**}, w_R^{**}\right) = \widetilde{q}_A^j \left(\underline{p}^{**}, w_R^{**}, \underline{p}^{**}, w_R^{**}\right)$. Again, the first condition is just the retailer's profit maximizing condition, whereas (II) and (III) are conditions that secure that there are no incentives for the retailer to deviate to exclusivity. Rearranging these conditions, we obtain our result.

Proof of Proposition 9.
Suppose that each retailer offers to the manufacturer a wholesale price equal to w_U^* and a fixed fee (conditional on trade) equal to $\overline{F} = \widehat{\pi}_r \left(w_U^*, w_U^*\right) - \pi_U^d$. In this case, 1) given that the contract between the manufacturer and retailer i is contingent on whether $q_A^j > 0$ or $q_A^j = 0$ (i.e., contingent on the retailer obtaining exclusivity or not), as per assumption, and b) given that the manufacturer accepts both offers, retailer j earns a profit equal $\pi_U^d - S^j$ in the continuation equilibrium, whether or not she chooses to trade with the manufacturer. I.e., she is indifferent between selling (and hence paying $\overline{F}$) and not selling brand A (hence waiving the fixed fee). Suppose also that $S^j < 0$, i.e., the manufacturer compensates retailer j up-front. Consider now retailer i's choice of wholesale price w^i.

For any $w^i < w_U^*$, we have that

$$\widehat{\pi}_r^j\left(w_U^*, w^i\right)|_{w^i<w_U^*} - \overline{F} + S^j < \pi_U^d + S^j \\ \Updownarrow \\ \widehat{\pi}_r^j\left(w_U^*, w^i\right)|_{w^i<w_U^*} < \widehat{\pi}_r\left(w_U^*, w_U^*\right) \tag{40}$$

This means that for every $w^i < w_U^*$, the unique continuation equilibrium has retailer j selling zero units of brand A. In this case, because the manufacturer trades exclusively with i, they jointly earn a profit equal to $V_U + S^j$. However, because $V_U + S^j < V_U$, it would be better for retailer i to deviate not by lowering the wholesale price w^i but by increasing her exclusive offer – hence having the manufacturer reject retailer j's offer (and thus not paying $-S^j > 0$ up-front).

From this we know that, given that both retailers offer a contract with a wholesale price equal to w_U^* and a fixed fee equal to $\overline{F} = \widehat{\pi}_r\left(w_U^*, w_U^*\right) - \pi_U^d$, there are no incentive for either retailer to deviate to a lower wholesale price – and, given that the manufacturer accepts, an overall profit equal to Π_U^* is then achieved at the final stage of the game. For this to constitute an equilibrium, however, the following three conditions now have to be satisfied for each retailer $j \in \{1, 2\}$:

$$\Pi_U^* - 2\pi_U^d + S^i - \overline{\theta}_U = - S^j \tag{I}$$

$$\pi_U^d - S^j \geq V_U - \overline{\theta}_U \tag{II}$$

$$\pi_U^d - S^j \geq \pi_U^d \tag{III}$$

The first condition is the retailer's profit maximizing condition, which says that the retailer should adjust her up-front fee S^j such that the manufacturer is indifferent between accepting both offers and accepting the best exclusive offer. Conditions (II) and (III) ensure that there are no incentives for the retailer to deviate to exclusivity. Conditions (I) and (II) together give us the minimum S^i needed to ensure that a deviation to exclusivity by retailer j is unprofitable:

$$\underline{S} = \Pi_U^e - \Pi_U^* \leq S^i \tag{41}$$

Note that $\underline{S}$ is negative. Given that each retailer offers the minimum up-front fee, $\underline{S}$, they then earn a net profit equal to $\Pi_U^* - V_U$ each. This therefore constitutes the maximum profit that each retailer may earn in an equilibrium with all products sold. With the condition (III), which says that a retailer's profit cannot be smaller than π_U^d in equilibrium, we obtain the result.

Proof of Proposition 10.
Suppose that each retailer offers a contract to the manufacturer with a wholesale price equal to w^I, a fixed (or minimum) retail price equal to p^M, and a fixed fee equal to $\overline{F} = \left(p^M - w^I\right) q^M + \left(p^M - c\right) q^M - \pi_R^d > 0$. Given that the manufacturer accepts both offers, each retailer $i \in \{1, 2\}$ then earns a profit equal to $\pi_R^d - S^i$ in the continuation equilibrium – whether or not she decides to trade with the manufacturer. However, should retailer i deviate, e.g., by choosing a lower fixed price for brand A, $\underline{p}^i < p^M$, retailer j would

be strictly better off by waiving the fixed $\overline{F}$ and thus not trading with the manufacturer at the final stage. If so, the manufacturer and retailer i will earn a joint profit equal to $V_R + S^j < V_R$, given that $S^j < 0$. (The same would happen if retailer i deviates to a higher w^i.)

Hence, again we can rule out deviations on the margin, and focus instead on deviations to exclusive contracting. To sustain our candidate equilibrium, the following conditions now have to hold for each retailer $j \in \{1, 2\}$:

$$\Pi^M - 2\pi_R^d + S^i - \overline{\theta}_R = - S^j \tag{I}$$

$$\pi_R^d - S^j \geq V_R - \overline{\theta}_R \tag{II}$$

$$\pi_R^d - S^j \geq \pi_R^d \tag{III}$$

Conditions (I) and (II) together give us the minimum S^i needed to ensure that a deviation to exclusive contracting by retailer j is unprofitable:

$$\underline{S} = \Pi_R^e - \Pi^M \leq S^i \tag{42}$$

Note again that $\underline{S}$ is clearly negative. Given that each retailer offers the minimum up-front fee, $\underline{S}$, each of them earns a net profit equal to $\Pi^M - V_R$ in equilibrium, while the manufacturer earns $2V_R - \Pi^M$. Note in this case that the manufacturer's profit becomes negative if $V_R \leq \Pi^M/2$, which may be the case if the degree of both inter- and intrabrand competition is sufficiently strong. In this case, the up-front payments have to be increased to sustain the equilibrium (the manufacturer cannot earn negative profits). Suppose therefore that the up-front payments are chosen so that the manufacturer breaks even, i.e., $S^i = S^j = \pi_R^d - \Pi^M/2$. In this case, each retailer earns a profit equal to $\Pi^M/2$, and given that $V_R \leq \Pi^M/2$, this is higher than what the she would obtain by inducing the manufacturer to sell to her exclusively. Hence, an equilibrium always exists with restricted three-part tariffs in which each retailer receives an up-front payment equal to

$$-S^* := \max\left\{\Pi^M - \Pi_R^e, \frac{\Pi^M}{2} - \pi_R^d\right\}, \tag{43}$$

and the fully integrated outcome Π^M is achieved.

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