# Resale Price Maintenance and Horizontal Cartel*

Patrick Rey† Thibaud Vergé‡

March 11, 2002

**Abstract**

An often expressed idea to motivate the per se illegality of RPM is that it can limit both inter- and intra-brand competition. This paper analyzes this argument in a context where manufacturers and retailers have interlocking relationships. It is shown that even as part of purely bilateral vertical contracts, RPM indeed limits the exercize of both inter- and intra-brand competition and can even generate industry-wide monopoly pricing. The final impact on prices depends on the substituability between retailers and between manufacturers, and on the extent of potential competition at the retail level.

**JEL:** D4, L13, L41, L42

**Keywords:** Resale Price Maintenance, Collusion, Successive duopoly.

*We benefited from helpful comments from Rodolphe Dos Santos Ferreira and Jean Tirole on an earlier draft. We also thank Eric Avenel for his remarks and participants at the Spring School on International Economics and Industrial Organization (Aix-en-Provence), at the $25^{th}$ meeting of the European Association for Research in Industrial Economics (Copenhagen), at the $13^{th}$ meeting of the European Economic Association (Berlin) and $6^{th}$ ENTER Jamboree (Brussels).

†University of Toulouse (I.D.E.I. and GREMAQ)

‡CMPO and Department of Economics, University of Bristol.

# 1 Introduction

The attitude of competition authorities and courts towards vertical restraints varies significantly from one country to another or from one period to another[1]. Still, it emerges a consensus against resale price maintenance (RPM), a particular restraint according to which the manufacturer sets the final price that distributors charge to consumers. This restriction has some variants, including price ceilings, price floors, recommended or advertised prices; competition authorities are more tolerant towards some of those variants but, in its strictest form, resale price maintenance is usually illegal *per se*. For example, the European Commission recently adopted a more open attitude towards nonprice restrictions but maintained RPM on a black list –with only one other restraint. In France, price floors are *per se* illegal under article 34 of the 1986 Ordinance; and in *Lypobar* vs. *La Croissanterie* (1989), the Paris Court of Appeal ruled that RPM was an abuse of franchisees' economic dependence, and insisted that franchisees had to be free to choose their retail prices.

In contrast with the consensus of the jurisprudence against resale price maintenance, the economic analysis of vertical restraints is more ambiguous: it is not straightforward that RPM has a more negative impact on the welfare than other vertical restraints which limit intrabrand competition; instead, both price (e.g. RPM) and non-price restraints (e.g. exclusive territories) have positive and negative effects on economic welfare, depending on the context in which they are used[2]. Moreover, a comparison of the welfare effects of exclusive territories, RPM and exclusive dealing shows that the balance is not clearly in favor of nonprice restrictions[3].

It is clear that minimum prices (a variant of RPM) may be sponsored by distributors to maintain a retail cartel: that is, an illegal horizontal agreement can be disguised as vertical arrangements that restrict prices; that would amount to an horizontal agreement, which is usually *per se* illegal. Less clear is the case of purely vertical contracts, where producers and distributors bilaterally negotiate their own wholesale and retail prices.

A few papers have stressed that RPM can help a manufacturer to better exert its market power. Hart and Tirole (1990) show for example that a producer is tempted to free-ride on its retailers when vertical contracts are privately negotiated and not publicly observed; as a result, downstream competition percolates to the upstream level and prevents the producer from fully exerting its market power.[4] In this context, an industry wide price-floor would prevent the risk of opportunistic behavior and help the manufacturer to exert its market power. O'Brien and Shaffer (1992) further show that bilaterally negotiated price ceilings, too, can prevent opportunism.[5]

Those papers thus stress that RPM can help restore pre-existing market power. Dobson and Waterson (1997) study instead a bilateral duopoly with interlocking relationships. Assuming that manufacturers use (inefficient) linear wholesale prices, they show that the welfare effects of RPM depend on the relative degree of upstream and downstream differentiation as well as on retailers' and manufacturers' bargaining powers; RPM can be socially preferable when retailers are in a weak bargaining position, because the double-marginalization problems generated by the restriction to linear wholesale prices is more severe in such circumstances.

However, one argument often mentioned against RPM, and not yet much formally analyzed, is that RPM can facilitate horizontal agreements – interbrand collusion.[6] A first step in that direction is provided by Jullien and Rey (2000), who stress that, by making retail prices less responsive to local shocks on retail cost or demand, RPM yields more uniform prices that facilitate tacit collusion –by making deviations easier to detect. In contrast, we will focus here on a static bilateral duopoly with interlocking relationships, as in Dobson and Waterson, but will allow for efficient (two-part) wholesale tariffs, in order to eliminate double marginalization problems and focus instead on the impact of RPM on interbrand and intrabrand competition.[7] Our analysis suggests that RPM can prevent *any* effective competition –at the interbrand level as well as at the intrabrand level– and yield instead the monopoly outcome.

This paper is organized as follows. Section 2 presents the general structure of a model with both intrabrand and interbrand competition (duopoly). Section 3 analyzes the welfare effects of resale price maintenance, assuming that the market structure is given and characterized by "double common agency": both manufacturers deal with both retailers (interlocking relationships), who have binding participation constraints. We show that retail prices are lower than the monopoly price in the absence of RPM, whereas in the presence of RPM there exist multiple equilibria, including one in which retail prices and producers' profits are at the monopoly level. We also propose an equilibrium selection process, based on the introduction of a small retail effort, and show that the unique selected equilibrium is the one with monopoly prices and profits. In section 4, we endogenize the market structure. We first assume that there is a competitive supply of potential candidates for each retail outlet and study a retailer selection game in the spirit of Bernheim and Whinston (1985); in that case, there exists an equilibrium leading to double common agency and monopoly prices. We then study the case where there is a unique retailer for each outlet. In that case, manufacturers must leave a rent to distributors to induce them to sell their products; the impact of these rents is not trivial: while there still exists a continuum of equilibria, equilibria with higher prices now involve larger rents and *lower* profits for the manufacturer. In a simple linear model, the welfare effects of RPM then depend on the degrees of substitutability between brands and between retail outlets. Section 5 concludes.

# 2 The Basic Framework

Two manufacturers $A$ and $B$ produce two varieties of a good and market them through two differentiated distributors - 1 and 2. [The retailers could for example differ in the services they provide to consumers, the location of their stores, etc.] If each retailer distributes both products, consumers can thus find two different varieties at two competing stores, and can thus choose among four imperfectly substitute "products", each manufacturer producing two of them ($\{A1, A2\}$ and $\{B1, B2\}$, respectively) and each retailer distributing two of them as well ($\{A1, B1\}$ and $\{A2, B2\}$, respectively).

In order to avoid that one firm - producer or distributor - plays a particular role, we suppose that demand functions are symmetric (this implies that the differentiation between the brands and between the stores is horizontal rather than vertical): for any price vector $\mathbf{p} = (p_{A1}, p_{B1}, p_{A2}, p_{B2})$, any $i \neq h \in \{A, B\}$ and any $j \neq k \in \{1, 2\}$,

$$D_{ij}(\mathbf{p}) = D(p_{ij}, p_{hj}, p_{ik}, p_{hk}),$$

where the demand function $D(.)$ is twice continuously differentiable. The products being (imperfect) substitutes, we will suppose that the demand of one product decreases with the price of this product and increases with the other prices:[8] for any $\mathbf{p} = (p_{A1}, p_{B1}, p_{A2}, p_{B2})$, $i \neq h \in \{A, B\}$ and $j \neq k \in \{1, 2\}$,

$$\begin{aligned}
\varepsilon_{ij}(\mathbf{p}) &\equiv -\frac{\partial D_{ij}}{\partial p_{ij}}(\mathbf{p}) \cdot \frac{p_{ij}}{D_{ij}(\mathbf{p})} &&= \varepsilon(p_{ij}, p_{hj}, p_{ik}, p_{hk}) &&> 0, \\
\varepsilon_{ij}^{P}(\mathbf{p}) &\equiv \frac{\partial D_{ij}}{\partial p_{hj}}(\mathbf{p}) \cdot \frac{p_{hj}}{D_{ij}(\mathbf{p})} &&= \varepsilon^{P}(p_{ij}, p_{hj}, p_{ik}, p_{hk}) &&> 0, \\
\varepsilon_{ij}^{D}(\mathbf{p}) &\equiv \frac{\partial D_{ij}}{\partial p_{ik}}(\mathbf{p}) \cdot \frac{p_{ik}}{D_{ij}(\mathbf{p})} &&= \varepsilon^{D}(p_{ij}, p_{hj}, p_{ik}, p_{hk}) &&> 0, \\
\varepsilon_{ij}^{PD}(\mathbf{p}) &\equiv \frac{\partial D_{ij}}{\partial p_{hk}}(\mathbf{p}) \cdot \frac{p_{hk}}{D_{ij}(\mathbf{p})} &&= \varepsilon^{PD}(p_{ij}, p_{hj}, p_{ik}, p_{hk}) &&> 0,
\end{aligned}$$

Furthermore, we will suppose that direct effects dominate, so that if all prices increase, demands decrease: for any $\mathbf{p}$,

$$E(\mathbf{p}) \equiv \varepsilon(\mathbf{p}) - \varepsilon^{P}(\mathbf{p}) - \varepsilon^{D}(\mathbf{p}) - \varepsilon^{PD}(\mathbf{p}) > 0, \tag{1}$$

where $E$ is the elasticity of the "big DD curve" (i.e. the demand curve generated by a simultaneous decrease in all prices) in Chamberlinian terminology. In what follows, we will drop the arguments in $D_{ij}$ when there is no risk of confusion, and will systematically use indexes $i, h$ for the two manufacturers, and $j, k$ for the two retailers.

We will also assume that both production and distribution costs are symmetric and constant; we respectively denote them by $c$ and $\gamma$. Last, to ensure that reaction functions are well-behaved, we make some regularity assumptions on the revenue functions:[9]

To state our regularity assumptions, we define the following revenue function:

$$\Pi(p_{i1}, p_{h1}, p_{i2}, p_{h2}; w_{h1}, w_{h2}) = \sum_{j \in \{1,2\}} (p_{ij} - c - \gamma) D_{ij} + (p_{hj} - w_{hj} - \gamma) D_{hj}.$$

**Assumption 1:** The monopoly profit function, given by $\Pi(\mathbf{p}; c, c)$, is single-peaked in $\mathbf{p}$.

**Assumption 2:** i) For $w_{h1} = w_{h2} = w_h$ and $p_{h1} = p_{h2} = p_h$, the revenue function $\Pi$ is single-peaked in $(p_{i1}, p_{i2})$ and maximal for symmetric prices, $\hat{p}_{i1} = \hat{p}_{i2} = \hat{p}(p_h, w_h)$;

ii) $\hat{p}(.,.)$.satisfies

$$0 < \frac{\partial \hat{p}}{\partial p_h} < 1$$

and, for any $w$, the function $p \to \hat{p}(p, w)$ has a unique fixed point.

Assumption 1 ensures that monopoly profits are well-behaved and monopoly prices uniquely defined, while Assumption 2 ensures that reaction functions are again well-behaved under RPM. This assumption moreover implies that monopoly prices are symmetric: from Assumption 1, the aggregate profits are maximal for a unique price vector $\mathbf{p}^M$; Assumption 2 then ensures that this vector is symmetric: $\mathbf{p}^M = (p^M, p^M, p^M, p^M)$ where $p^M$ is the fixed point of $p \rightarrow \hat{p}(p, c)$, characterized by

$$\frac{p^M - (c+\gamma)}{p^M} = \frac{1}{E(\mathbf{p}^M)}.$$

**Assumption 3:** i) For any wholesale prices $\mathbf{w} = (w_{A1}, w_{B1}, w_{A2}, w_{B2})$, there exists a unique retail price equilibrium, yield the equilibrium retail prices, as a function of wholesale prices:

$$\mathbf{p}^r(\mathbf{w}) = \left(p^r_{A1}(\mathbf{w}), p^r_{B1}(\mathbf{w}), p^r_{A2}(\mathbf{w}), p^r_{B2}(\mathbf{w})\right).$$

We will denote by $D^r_{ij}(\mathbf{w}) = D_{ij}(\mathbf{p}^r(\mathbf{w}))$ the resulting demand for each product.

ii) For symmetric wholesale prices $w_{A1} = w_{A2} = w_A$ and $w_{B1} = w_{B2} = w_B$, equilibrium retail prices are symmetric and given by $p^r_{i1} = p^r_{i2} = \widetilde{p}(w_i, w_h)$, where $\widetilde{p}(.,.)$ satisfies:

$$\frac{\partial \widetilde{p}}{\partial w_i} > \frac{\varepsilon - \varepsilon^D}{\varepsilon^P + \varepsilon^{PD}} \frac{\partial \widetilde{p}}{\partial w_h} \geq 0.$$

**Assumption 4:** For any wholesale prices $\mathbf{w} = (w_{A1}, w_{B1}, w_{A2}, w_{B2})$, the revenue function

$$\Pi^r_i(\mathbf{w}) = \sum_{j \in \{1,2\}} \left(p^r_{ij}(\mathbf{w}) - c - \gamma\right) D^r_{ij}(\mathbf{w}) + (p^r_{hj}(\mathbf{w}) - w_{hj} - \gamma) D^r_{hj}(\mathbf{w})$$

is single-peaked in $(w_{i1}, w_{i2})$.

Assumption 3 asserts that the retail equilibrium is "well-behaved": there exists a unique retail equilibrium for any profile of wholesale prices, which preserves symmetry and such that retail prices respond positively to wholesale prices;[10] it is further assumed that direct effects are larger than indirect ones $\left(\frac{\partial \widetilde{p}}{\partial w_i} > \frac{\partial \widetilde{p}}{\partial w_h} \geq 0\right)$, and sufficiently so as to ensure that, starting from a symmetric situation, an increase in one manufacturer's wholesale price increases the sales of the rival manufacturer:

$$\frac{\partial D^r_{hk}}{\partial w_{ij}} = \left(\varepsilon^P + \varepsilon^{PD}\right) \frac{\partial \widetilde{p}}{\partial w_i} - \left(\varepsilon - \varepsilon^D\right) \frac{\partial \widetilde{p}}{\partial w_h} > 0.$$

Finally, Assumption 4 ensures that manufacturers' profit function are well-behaved in the absence of RPM.

# 3 Intrinsic Double Common Agency

To highlight the main argument in the simplest framework, we assume in this section that the market structure is given and characterized by a double common agency. To capture this in a simple way, we will suppose that the market "breaks down" whenever a retailer refuses to distribute a variety. Assuming that manufacturers have all the bargaining power, we will consider the following game:

1. The two manufacturers simultaneously propose a contract to each retailer. Contracts consist of a wholesale two-part tariff and, if allowed, of a retail price; they are publicly observable.[11]

2. Distributors simultaneously accept or reject the offers.

3. If all offers have been accepted, retailers simultaneously set their retail prices (equal to the price(s) imposed by the manufacturer(s) under RPM), demands are satisfied

and payments made according to the contracts. Otherwise, no product is sold and all firms earn zero profit.

The "break-down" assumption ensures that manufacturers always offer contracts that are acceptable by both retailers; it moreover implies that retailers never obtain more than their reservation utility, which we will normalize to zero. It is relaxed in the following section

## 3.1 Two-Part Tariffs

Let us first suppose that contracts can only consist of two-part tariffs. At the first stage, $A$ chooses the wholesale prices $w_{A1}$ and $w_{A2}$, and the franchise fees $F_{A1}$ and $F_{A2}$ so as to maximize its profit given the retailers' participation constraints. Since retailers can only accept both offers or earn zero profit, given its rival's wholesale prices $(w_{B1}, w_{B2})$, $A$ will offer each retailer $i$ a contract $(w_{Ai}, F_{Ai})$ which maximizes its own profit, subject to being accepted by the retailer:

$$\begin{aligned} \max_{w_{A1},w_{A2},F_{A1},F_{A2}} \quad & (w_{A1}-c)D^r_{A1}(\mathbf{w}) + F_{A1} + (w_{A2}-c)D^r_{A2}(\mathbf{w}) + F_{A2}, \\ s.t. \quad & (p^r_{A1}(\mathbf{w}) - w_{A1} - \gamma)D^r_{A1}(\mathbf{w}) - F_{A1} + (p^r_{B1}(\mathbf{w}) - w_{B1} - \gamma)D^r_{B1}(\mathbf{w}) - F_{B1} \geq 0 \\ & (p^r_{A2}(\mathbf{w}) - w_{A2} - \gamma)D^r_{A2}(\mathbf{w}) - F_{A2} + (p^r_{B2}(\mathbf{w}) - w_{B2} - \gamma)D^r_{B2}(\mathbf{w}) - F_{B2} \geq 0 \end{aligned}$$

Since the participation constraints are clearly binding, this program is equivalent to

$$\begin{aligned} \max_{w_{A1},w_{A2}} \; & (p^r_{A1}(\mathbf{w}) - c - \gamma)D^r_{A1}(\mathbf{w}) + (p^r_{A2}(\mathbf{w}) - c - \gamma)D^r_{A2}(\mathbf{w}) \\ & + (p^r_{B1}(\mathbf{w}) - w_{B1} - \gamma)\, D^r_{B1}(\mathbf{w}) + (p^r_{B2}(\mathbf{w}) - w_{B2} - \gamma)\, D_{B2}(\mathbf{w}). \end{aligned}$$

The solution to this program defines $A$'s reaction to $B$'s wholesale prices, which can then be used to characterize the subgame perfect equilibrium of the entire game. The following proposition offers a partial characterization of symmetric equilibria:

**Proposition 1** *Without Resale Price Maintenance, any symmetric equilibrium of the form* $w_{ij} = w^e$ *and* $p_{ij} = p^e$ *is such that retailers earn zero profit and*

$$c < w^e < p^e < p^M.$$

**Proof.** See Appendix A. ■

The existence of competition at both upstream and downstream levels thus maintains retail prices below the monopoly level. [If there was a monopoly at any level - one producer selling through differentiated retailers or differentiated manufacturers selling their products through a common distributor - (public) two-part tariffs would instead lead to retail prices equal to monopoly prices.]

## 3.2 Resale Price Maintenance

We now suppose that manufacturers can resort to RPM. Imposing retail prices is then always a dominant strategy for the manufacturers: Whatever the strategy adopted by the rival manufacturer, with RPM a producer can always replicate the retail prices that would emerge and the profits it would earn without using RPM. If $B$ imposes retail prices $(p_{B1}, p_{B2})$, $A$ will choose wholesale prices $w_{A1}$ and $w_{A2}$, retail prices $p_{A1}$ and $p_{A2}$ and franchises $F_{A1}$ and $F_{A2}$ so as maximize as before its profit, given the retailers' participation constraints:

$$\max_{w_{A1},w_{A2},p_{A1},p_{A2},F_{A1},F_{A2}} \quad (w_{A1}-c)D_{A1}(\mathbf{p})+F_{A1}+(w_{A2}-c)D_{A2}(\mathbf{p})+F_{A2}$$

$$s.t. \quad \begin{array}{l} (p_{A1}-w_{A1}-\gamma)D_{A1}(\mathbf{p})-F_{A1}+(p_{B1}-w_{B1}-\gamma)D_{B1}(\mathbf{p})-F_{B1}\geq 0, \\ (p_{A2}-w_{A2}-\gamma)D_{A2}(\mathbf{p})-F_{A2}+(p_{B2}-w_{B2}-\gamma)D_{B2}(\mathbf{p})-F_{B2}\geq 0, \end{array}$$

or, since the participation constraints are clearly binding:

$$\max_{p_{A1},p_{A2}} \quad \{(p_{A1}-c-\gamma)D_{A1}(\mathbf{p})+(p_{B1}-w_{B1}-\gamma)D_{B1}(\mathbf{p}) \qquad (2)$$
$$+(p_{A2}-c-\gamma)D_{A2}(\mathbf{p})+(p_{B2}-w_{B2}-\gamma)D_{B2}(\mathbf{p})\}\,.$$

Since a manufacturer can still capture retail profits through the franchise fees and now, moreover, directly set retail prices, its wholesale prices have no direct effect on its profit anymore; however, these wholesale prices have an impact *on the strategic behavior of the competitor*. As a result, there usually exists a continuum of equilibria – one equilibrium for each and every profile of wholesale prices $\mathbf{w}=(w_{A1},w_{B1},w_{A2},w_{B2})$. The following proposition characterizes symmetric equilibrium retail prices, as a function of wholesale prices:

**Proposition 2** *If Resale Price Maintenance is allowed, for each $w^*$, there exist a unique symmetric subgame perfect equilibrium in which retailers earn zero profit and both manufacturers set retail prices to $p^*=p^*(w^*)$, where:*

- *$p^*(w^*)$ is a decreasing function of $w^*$,*
- *$p^*(c)=p^M$.*

**Proof.** See Appendix B. ∎

Under assumption 2, within the set of symmetric equilibria retail prices are inversely related to wholesale prices. The intuition is the following. For symmetric prices, (2) becomes:

$$\max_{p_{A1},p_{A2}} \quad \{(p_{A1} - c - \gamma)D_{A1}(\mathbf{p}) + (p^* - w^* - \gamma)D_{B1}(\mathbf{p}) \\ +(p_{A2} - c - \gamma)D_{A2}(\mathbf{p}) + (p^* - w^* - \gamma)D_{B2}(\mathbf{p})\}.$$

Consider a uniform decrease in wholesale prices and analyze $A$'s pricing behavior. Assuming that $B$ does not change its retail prices, the retail mark-ups on $B$'s variety increases. Since $A$ can capture any profit made by a retailer on its rival's variety, this increase in the retail mark-ups reduces $A$'s incentives to price aggressively its own variety.

In the particular case where wholesale prices reflect marginal costs, $A$ actually fully internalizes the impact of its retail prices on aggregate profits, and thus sets its prices at the monopoly level if $B$ does so: that is, there exists a symmetric subgame perfect equilibrium in which manufacturers set wholesale prices to $c$ and retail prices to the monopoly level, and share monopoly profits. RPM can thus prevent the exercise of both inter- and intrabrand competition, thereby allowing firms to restore a monopoly power that would otherwise be eroded by competition.

## 3.3 Effort and Equilibrium Selection

The multiplicity of equilibria stressed above comes from the fact that manufacturers have more control variables than needed. For given wholesale prices, its retail prices allow a manufacturer to monitor the joint profits earned together with the two retailers, while both the franchise fees and the wholesale prices can be used to share these profits. The multiplicity of equilibria then derives from the fact that a manufacturer is indifferent with respect to its wholesale prices, which however drive its rival's decisions.

The multiplicity of equilibria generates various types of problems. In particular, it may be difficult to draw policy implications against or in favor of RPM, since some equilibria can be better and others worse than the equilibrium that would emerge in the absence of RPM.[12] To circumvent this issue, we now introduce a (non contractible) retail effort variable which affects the demand and is chosen by the retailers at the same time as they set prices. The level of this effort will be affected by wholesale prices, so that there are no longer more control variables (retail price, franchise and marginal wholesale price) than targets (industry profits, profit sharing and effort level); as a consequence, the multiplicity disappears.

To fix ideas, suppose that the demand for a given product depends on both the retail prices and a retail effort $e$, as follows

$$Q_{ij}(\mathbf{p}, e) = D_{ij}(\mathbf{p}) + \eta.\phi(e),$$

where $\eta > 0$ is a scaling parameter and $\phi$ is a twice continuously differentiable, strictly increasing, concave function satisfying $\phi(0) = 0$. The effort $e$ is costly for the retailer and we denote $\eta.\psi(e)$ this cost. We suppose that $\psi(0) = 0$, and that $\psi$ is a twice continuously differentiable, strictly increasing, strictly convex function. The last stage of the previous sequential game is then modified as follows:

- If all offers have been accepted, retailers simultaneously set their retail prices (equal to the price(s) imposed by the manufacturer(s) under RPM) and choose their effort levels (one for each product they sell); demands are satisfied and payments made according to contracts. Otherwise, no product is sold and both manufacturers and retailers earn zero profit.

Under RPM, in this last stage retailer $j$ chooses its levels of effort $e_{ij}$ and $e_{hj}$ so as to maximize:

$$(p_{ij} - w_{ij} - \gamma)Q_{ij}(\mathbf{p}, e_{ij}) - F_{ij} + (p_{hj} - w_{hj} - \gamma)Q_{hj}(\mathbf{p}, e_{hj}) - F_{hj} - \eta.\psi(e_{ij}) - \eta.\psi(e_{hj}).$$

This leads to an effort level $e_{ij}$ which depends on the retail price $p_{ij}$ and on the wholesale price $w_{ij}$, and which we denote by $e^r_{ij} \equiv e^r_{ij}(p_{ij}, w_{ij})$.

We assume that $\eta$ is small enough, so that the assumptions 1 and 2 are still valid for the adjusted monopoly profit (for $w_{ij} = c$ and $e^r_{ij} = e^r_{ij}(p_{ij}, c)$):

$$\widetilde{\Pi} = \sum_{\substack{i\in\{A,B\} \\ j\in\{1,2\}}} \left[(p_{ij} - c - \gamma)\, Q_{ij} - \eta\psi\left(e^r_{ij}\right)\right],$$

and denote by $p^M(\eta)$ the adjusted monopoly price.

In contrast with the previous situation, manufacturers are no longer indifferent as to the choice of their wholesale prices, since they affect the level of retail effort chosen. In order to provide adequate incentives to their retailers, they must make them residual claimant for their efforts, which requires setting wholesale prices to marginal cost. As a result:

**Proposition 3** *When Resale Price Maintenance is allowed, for any $\eta > 0$ there exists a unique symmetric equilibrium where manufacturers use RPM, and it is such that $w^* = c$ and $p^* = p^M(\eta)$.*

**Proof.** See Appendix C. ■

The proposition establishes that, whatever the impact of the effort (even infinitesimal), in equilibrium the wholesale prices are always equal to the marginal cost. Moreover, the only equilibrium which is robust to the introduction of retail efforts is the one that leads to the monopoly outcome (in particular, $p^* \to p^M$ when $\eta \to 0$). This result reinforces the presumption that RPM has a negative impact on welfare, by allowing firms to eliminate any competition that might otherwise prevail.

# 4 Endogenous Market Structure

The analysis presented in the previous section presumes that double common agency is the equilibrium market structure and that manufacturers extract all profits. We now relax the assumption that the market "breaks down" as soon as one contract is refused by a retailer. Market structure is then endogenous –double common agency is not necessarily the equilibrium market structure; furthermore, manufacturers may have to leave some profit to the retailers to induce them to carry both varieties. We address those two issues in turn.

## 4.1 Competitive Retailers

We first maintain the assumption that manufacturers are able to extract all profits, while making the market structure endogenous. For that purpose, we assume that there is competitive supply of potential retailers and consider a selection game close to that studied by Bernheim and Whinston (1985) for situations of single common agency.

Specifically, we will suppose here that there exist not two differentiated distributors but, rather, two different types of retailers, type "1" and type "2", with the same characteristics as the retailers 1 and 2 presented in the previous section, and we further assume that there exist at least four retailers of each type, namely, retailers 1, $1'$,$1''$, $1'''$, and retailers 2, $2'$, $2''$ and $2'''$ (as we will see, "four" is enough in our framework to generate a perfectly competitive supply of retailers and rule out peculiar strategies based on a scarcity of retailers). One interpretation is that there are two retail outlets, and four candidate retailers for each outlet. This leads to adapt the competitive game as follows (game $G$):

1. The two manufacturers simultaneously propose contracts to retailers. As before, each contract consists of a wholesale two-part tariff and, if allowed, of an imposed retail price, and are publicly observable.

2. Retailers simultaneously accept or reject the offers; they can condition their acceptation on the final structure of the distribution sector, so that each retailer can choose among five strategies:

   - $(r, r)$: refusing both offers.

   - $(a, r)$: accepting $A$'s offer but rejecting $B$'s one.

   - $(r, a)$: accepting $B$'s offer but rejecting $A$'s one.

   - $(a, a)$: accepting both offers.

   - $(a, a)^c$: accepting both offers, but only if chosen as a common retailer by the manufacturers.

3. The manufacturers simultaneously select at most one retailer of each type, among those that have accepted the contracts.

4. The selected retailers compete in prices on the final market or charge the retail prices imposed by the manufacturers, and the corresponding contracts are enforced.

We have:

**Proposition 4** *Assume*

$$\max_{p}\left[(p-c-\gamma)D\left(p,c+\gamma,p,c+\gamma\right)\right]\leq\frac{1}{4}\pi^{M} \tag{C1}$$

*and*

$$\max_{(p_1,p_2)}\left[(p_1-c-\gamma)D\left(p_1,p^M,p_2,c+\gamma\right)+(p^M-c-\gamma)D\left(p^M,p_1,c+\gamma,p_2\right)\right.$$
$$\left.+(p_2-c-\gamma)D\left(p_2,c+\gamma,p_1,p^M\right)\right]\leq\tfrac{3}{4}\pi^M \tag{C2}$$

*Then there exists an equilibrium of game (G) where manufacturers use RPM, choose two common retailers (double common agency), set wholesale prices to marginal cost* ($w^c=c$) *and retail prices to the monopoly level* $\left(p^c=p^M\right)$*, and achieve monopoly profits (that is, retail profits are zero).*

**Proof.** The proof is constructive and based on the following candidate equilibrium path:

1. Both manufacturers propose the following RPM contracts:

   - to retailers 1, 1′, 2 and 2′: $C=\left(w=c,p=p^M,F=(p^M-c-\gamma)D(\mathbf{p}^M)\right)$;

   - to retailers 1″, 1‴, 2″ and 2‴ : $\hat{C}=(w=c,p=c+\gamma,F=0)$.

2. All retailers accept both manufacturers' contracts (strategy $(a,a)$) – and are willing to accept any contract that gives them a non-negative profit..

3. Both manufacturers select retailers 1 and 2 as common agents.

Since all proposed wholesale mark-ups are zero, at the last stage the manufacturers are willing to select the maximum number of retailers, and prefer $C$ to $\hat{C}$. Hence, given retailers' behavior at stage 2, there is no profitable deviation at stage 3.

$\hat{C}$ is such that retailers $1''$, $1'''$, $2''$ and $2'''$ earn zero profit, whatever the market structure and the strategies played by the other retailers. These retailers are thus willing to accept $\hat{C}$.

Similarly, at stage 2 retailers 1, $1'$, 2 and $2'$ are willing to accept the contract $C$ (and get zero profit) offered by the two manufacturers. In particular, by refusing one or both contracts, retailer 1 would not affect the other players' equilibrium profits and market structure (double common agency) in the continuation game: the manufacturers would still want to select two retailers (one of each type) among those who have accepted their contracts, and it would still be possible for them to select two retailers who have accepted contract $C$. Therefore, retailer 1 has no incentive to deviate.

Let us finally check that there is no profitable deviation for $A$ in the first stage. The maximum profit that $A$ can earn by deviating depends on the final structure of the market. But it is impossible to exclude the rival manufacturer from the market, since it always exists an equilibrium of the continuation game in which retailers $1''$, $2''$, $1'''$and $2'''$ accept to distribute the rival's good. On $B$'s side, the final structure therefore only depends on the type of retailers selected by $B$ (contract $C$ or $\hat{C}$).

Suppose that $B$ ends-up with two retailers having accepted contract $C$ (for example 1 and 2). Then, since $A$ cannot earn more than the industry profit, the maximal profit he can earn is equal to

$$\max_{(p_1,p_2)} \quad \left[(p_1-c-\gamma)D\left(p_1,p^M,p_2,p^M\right)+(p^M-c-\gamma)D\left(p^M,p_1,p^M,p_2\right)\right.$$
$$\left.+(p_2-c-\gamma)D\left(p_2,p^M,p_1,p^M\right)+(p^M-c-\gamma)D\left(p^M,p_2,p^M,p_1\right)\right] \quad = \tfrac{1}{2}\pi^M$$

Assume now that $B$ ends-up with two retailers having accepted contract $\hat{C}$ (let say $1''$ and $2''$). Then, $A$ cannot earn more than

$$\max_{(p_1,p_2)}\left[(p_1-c-\gamma)D\left(p_1,c+\gamma,p_2,c+\gamma\right)+(p_2-c-\gamma)D\left(p_2,c+\gamma,p_1,c+\gamma\right)\right]$$

Under assumption 2, this maximum is reached for symmetric price; hence, using condition $(C1)$:

$$\max_p\left[(p-c-\gamma)D\left(p,c+\gamma,p,c+\gamma\right)\right]\leq\frac{1}{4}\pi^M$$

Suppose finally that $B$ ends-up with one retailer having accepted contract $C$ and contract $\hat{C}$ (for example 1 and $2''$). The maximum profit that $A$ can obtain is then the industry profit less the franchise that retailer 1 has to pay to manufacturer $B$:

$$\max_{(p_1,p_2)} \quad \left[(p_1-c-\gamma)D\left(p_1,p^M,p_2,c+\gamma\right)+(p_2-c-\gamma)D\left(p_2,c+\gamma,p_1,p^M\right)\right.$$
$$\left.+(p^M-c-\gamma)\left(D\left(p^M,p_1,c+\gamma,p_2\right)-D(\mathbf{p}^M)\right)\right]$$

This deviation cannot be profitable under condition $(C2)$.

Therefore, under conditions $(C1)$ and $(C2)$, there is no profitable deviation for $A$ at the first stage. ■

## 4.2 Retail Market Power

We now consider the impact of retail market power. To fix ideas, we return to the case where there is only one retailer of each type but assume that a retailer is free to refuse a contract, and that the market does not break down anymore when one retailer refuses a contract. We will thus consider the following game:

[1] Manufacturers propose contracts to the two retailers; each contract consists of a wholesale two-part tariff $(w_{ij}, F_{ij})$ and, if allowed, of an imposed retail price $p_{ij}$.

[2] The two retailers observe all contracts and decide whether to accept them; each retailer can accept both contracts, accept only one, or refuse both;

[3] The two retailers compete in prices, or charge the retail prices imposed by the manufacturers, for the products they have accepted to carry; demand is served and payments made according to accepted contracts.

Two issues arise in this context. First, a manufacturer can now more easily exclude its rival, by inducing one of both retailers to carry its brand only; as a result, double common agency equilibria may not exist anymore. Second, in a double common agency situation, manufacturers must give each retailer at least the profit it could obtain by selling exclusively the rival brand; as we will see, this implies that manufacturers must leave a rent to retailers –that is, they cannot extract all the industry profits, even if they can make take-it-or-leave-it offers.[13]

The existence of these rents –and the fact that they must be evaluated for asymmetric structures, too– somewhat complicates the analysis. We could provide a partial characterization of double common agency equilibria for general demand structures but it is difficult to assess the existence of these equilibria and to compare the impact of allowing RPM on equilibrium prices and profits. In order to shed some light, we will therefore restrict attention in this section to a linear model where costs are normalized to zero:

$$c = \gamma = 0,$$

and demand is given by [14]

$$D_{ij}(\mathbf{p}) = 1 - p_{ij} + \alpha p_{hj} + \beta p_{ik} + \delta p_{hk},$$

with $\alpha, \beta, \delta \geq 0$. The parameter $\alpha$ measures the degree of interbrand rivalry (or producers' substitutability); the two brands are independent when $\alpha = 0$ and become closer substitutes as $\alpha$ increases. Similarly, $\beta$ measures the degree of intrabrand rivalry (or retailers' substitutability). Last, the $\delta$ reflects the effect of an increase in the price of a product on the demand for the rival brand, sold by the competing retailer. It seems reasonable to assume that this parameter is related to and lower than both $\alpha$ and $\beta$. For simplicity we will furthermore assume

$$\delta = \alpha\beta.$$

Finally, to ensure that all the previous assumptions are satisfied, we suppose:[15]

$$\alpha + \beta + \alpha\beta < 1.$$

#### 4.2.1 Two-Part Tariffs

Starting with the case where RPM is not allowed, we first show that retailers' market power ensure that they earn positive rents whenever they carry both brands.

Given wholesale prices $\mathbf{w} = (w_{ik})_{i,k}$ (with the convention $w_{ij} = \emptyset$ if retailer $j$ does not carry brand $i$), at the last stage retail competition leads to equilibrium prices $\mathbf{p}^r(\mathbf{w}) = \left(p^r_{ij}(\mathbf{w})\right)_{i;j}$ (with $p^r_{ij} = \bar{p}_{ij}$ if $w_{ij} = \emptyset$ – see footnote 4.2) and quantities $D^r_{ij}(\mathbf{w}) = D\left(p^r_{ij}, p^r_{hj}, p^r_{ik}, p^r_{hk}\right)$. At the second stage, retailer 1, say, will accept to carry both brands if, by doing so, it earns profits that are not only nonnegative, but also higher than the profit it could derive from selling only one brand. Therefore in any equilibrium where both retailers carry both products, the contract between $A$ and 1 must satisfy the following three constraints:

$$(p^r_{A1} - w_{A1})D^r_{A1} - F_{A1} + (p^r_{B1} - w_{B1})D^r_{B1} - F_{B1} \geq 0, \quad (3)$$

$$'' \geq (\tilde{p}_{B1} - w_{B1})\tilde{D}_{B1} - F_{B1}, \quad (4)$$

$$'' \geq (\hat{p}_{A1} - w_{A1})\hat{D}_{A1} - F_{A1}, \quad (5)$$

where $\tilde{p}_{B1} = p^r_{B1}(\emptyset, w_{B1}, w_{A2}, w_{B2})$ and $\tilde{D}_{B1} = D^r_{B1}(\emptyset, w_{B1}, w_{A2}, w_{B2})$ (respectively $\hat{p}_{A1}$ and $\hat{D}_{A1}$) denote the prices and quantities that result from retail competition when 1 carries only brand $B$ (respectively, brand $A$).

Since removing one brand from one store eliminates one of the "products" available, it leads to higher per-product profits; retailer 1 can therefore guarantee itself a positive profit:

**Lemma 5** *Whenever a retailer carries both brands, this retailer earns positive profits.*

**Proof.** Suppose, say, that retailer 1 refuses to carry brand $A$ and consider the impact on the profits achieved by 1 on $B$. First, removing product $A1$ increases the demand for all other products. Keeping the prices for the other products fixed, this gives each retailer

$j$ an incentive to raise the price for product $ij$. The nature of the retail price equilibrium in this linear model (strategic complementarity of prices, stability of the equilibrium) then implies that, in the new equilibrium, all retail prices are higher. Finally, in the new equilibrium, retailer 1 faces a higher demand for product $B1$ (both because of the report from product $A1$ and from the increase in the price for the other products) and therefore achieves a greater profit on this product.

This implies $(\tilde{p}_{B1} - w_{B1})\tilde{D}_{B1} > (p^r_{B1} - w_{B1})D^r_{B1}$; therefore (4) implies

$$(p^r_{A1} - w_{A1})D^r_{A1} - F_{A1} > 0. \quad (6)$$

The same argument shows that $(\hat{p}_{A1} - w_{A1})\hat{D}_{A1} > (p^r_{A1} - w_{A1})D^r_{A1}$, and thus (5) implies

$$(p^r_{B1} - w_{B1})D^r_{B1} - F_{B1} > 0. \quad (7)$$

Combining (6) and (7) implies that retailer 1 gets positive rents and that (3) is not binding. ■

The next Proposition shows that, due to retailers' market power, it may be the case that no symmetric equilibrium exists where both retailers carry both brands.

**Proposition 6** *For $\alpha = 0.1$ and $\beta = 0.3$, without Resale Price Maintenance there exists no symmetric equilibrium with double common agency.*

**Proof.** See Appendix D. ■

#### 4.2.2 Resale Price Maintenance

When manufacturers impose retail prices, in any symmetric equilibrium where both retailers carry both brands, $i$ must meet the following two constraints $(D\left(p_{A1}, \emptyset, p_{A2}, p_{B2}\right)$

denoting the demand for brand $A$ at retailer 1 when this retailer carries only that brand):

$$
\begin{aligned}
(p-w)D - F + (p-w)D - F &\geq 0 && (8)\\
'' \qquad &\geq (p-w)D\left(p,\emptyset,p,p\right) - F && (9)
\end{aligned}
$$

Since removing a product increases the demand for the remaining ones, the second constraint is relevant, and thus retailers earn a positive rent, whenever the imposed retail price is higher than the wholesale price. The next proposition shows that such equilibria exist and describe some of their properties:

**Proposition 7** *There exist ranges of values for $\alpha$ and $\beta$ such that, with Resale Price Maintenance, there exist a continuum of symmetric equilibria with double common agency, of the form $w_{ij} = w^*$, $p_{ij} = p^*$ and such that:*

- $p^* \in \left[\underline{p}\left(\alpha,\beta\right), \overline{p}\left(\alpha,\beta\right)\right]$;
- $w^* \in \left[\underline{w}\left(\alpha,\beta\right), \underline{p}\left(\alpha,\beta\right)\right]$ *and is inversely related to* $p^*$:

$$p^* = \frac{1-\alpha(1-\beta)w^*}{2(1-\alpha-\beta)},$$

*so that $p^*$ decreases from $\overline{p} > p^M$ for $w^* = \underline{w}$ to $p^* = \underline{p} < p^M$ for $w^* = \underline{p}$;*

- *retailers' profits are equal to $(p^* - w^*)\left[D\left(p^*,\emptyset,p^*,p^*\right) - D^*\right]$, increase in $p^*$ as long as $p^* \leq p^M$;*
- *manufacturers' profits are a decreasing function of $p^*$.*

**Proof.** See Appendix E. ■

Note that the Proposition only provides sufficient conditions for the existence of symmetric equilibria with double common agency. There may exist other equilibria, including other symmetric, double common agency equilibria. The following Figure represents the range of values for which the existence result of the Proposition applies.

**Figure 1 here**

Despite the presence of retail rents, the equilibrium retail price is still a decreasing function of the equilibrium wholesale price. Two effects are now at work. First, as in the absence of retail rents, raising $B$'s wholesale prices reduces $A$'s incentives to increase $B$'s sales, thereby inducing $A$ to lower its retail prices. However, increasing $B$'s wholesale prices also reduces each retailer's rent, which is given by

$$(p_B - w_B)D\left(p_B, \emptyset, p_B, p_A\right) - F_B.$$

This second effect tends to mitigate $A$'s incentives to keep low prices in order to reduce retail rents, but is dominated by the first one in this linear model.

Because of this second effect, however, the equilibrium retail price is below the monopoly level when wholesale prices are equal to marginal cost: for $w^* = 0$,

$$p^*\left(0\right) = \frac{1}{2(1-\alpha-\beta)} < p^M.$$

However, since $\bar{p} > p^M$, there exists $w^M \in [\underline{w}, 0]$ such that $p^*\left(w^M\right) = p^M$: manufacturers can sustain monopoly prices, but to do so they must set wholesale prices below their marginal cost of production.

Subsidizing wholesale prices increases retail rents, however. In equilibrium, this rent (per retailer and per brand) is equal to:[16]

$$\begin{aligned}\pi_R^* &= (p^* - w^*)\left[D\left(p^*, \emptyset, p^*, p^*\right) - D\left(p^*, p^*, p^*, p^*\right)\right] \\ &= \alpha(p^* - w^*)D^*.\end{aligned}$$

Therefore,

$$\frac{1}{\alpha}\frac{d\pi_R^*}{dp^*} = \frac{d\left(p^* - w^*\right)}{dp^*}D^* + \left(p^* - w^*\right)\frac{dD^*}{dp^*}.$$

Given the inverse relationship between $p^*$ and $w^*$, the mark-up $(p^* - w^*)$ increases with $p^*$ and this effect dominates when $p^*$ is small (namely here, as long as $p^*$ remains below the monopoly level), since then $(p^* - w^*)$ is small and $D^*$ is large.

Producers' profits (per retailer) are of the form:

$$\pi_P^* = \underbrace{p^* D^*}_{\text{Industry Profit}} - \underbrace{\pi_R^*.}_{\text{Rent to be left to the retailer}}$$

Hence, starting from $p^* = \underline{p}$, producers face a trade-off between increasing industry profit (by raising retail prices to the monopoly level) and reducing retail rents (by maintaining low retail prices). Proposition 7 shows that in this linear model, the rent effect dominates; therefore:

**Corollary 8** *Among the equilibria with double common agency described in proposition 7, the most profitable one for the manufacturers is the equilibrium with the lowest retail price (and thus the highest wholesale price)*

*In contrast, the most profitable candidate equilibrium for the retailers entails a retail price exceeding the monopoly level –and if only lower prices can actually be sustained in* *equilibrium, retailers will prefer the equilibrium with the highest price.*

# 5 Conclusion

This paper provides a basis for competition authorities' tough attitude towards $RPM$. In a context of interlocking relationships where competing retailers carry several competing brands, and as long as competition among retailers eliminates their rents, $RPM$ allows firms to maintain monopoly prices and thus defeat both upstream and downstream competition. This is the case even when retail prices are set independently for each retailer, and vertical contracts are negotiated bilaterally and independently from each other (purely "vertical" $RPM$).

The situation is however more complex when imperfect competition among retailers generate rents downstream. First, equilibria where competing retailers carry competing brands may no longer exist, even if demand conditions would make this outcome desirable; $RPM$ may still allow firms to generate prices closer to the monopoly level – as well as lower than without $RPM$. Second, which price level will prevail depends on how firms coordinate their equilibrium behavior; retailers favor high prices while manufacturers prefer low prices in order to minimize retailers' rents.

# A Proof of Proposition 1

At a symmetric equilibrium of the form $p_{ij} = p^e$ and $w_{ij} = w^e$, manufacturer $i$ must find it optimal to choose $(w_{i1}, w_{i2}) = (w^e, w^e)$ when its rival adopts $(w_{j1}, w_{j2}) = (w^e, w^e)$; since the retail equilibrium preserves symmetry (Assumption 3), and denoting by

$$\widetilde{D}(p_i, p_h) = D(p_i, p_h, p_i, p_h)$$

the demand for "product" $(i, j)$ when retail prices are symmetric for both manufacturers ($p_{i1} = p_{i2} = p_i$ for $i = A, B$), it must therefore be the case that:

$$\begin{aligned} w^e \in \arg\max_w \Big\{ & 2(\widetilde{p}(w, w^e) - c - \gamma)\widetilde{D}(\widetilde{p}(w, w^e), \widetilde{p}(w^e, w)) \\ & + 2(\widetilde{p}(w^e, w) - w^e - \gamma)\widetilde{D}(\widetilde{p}(w^e, w), \widetilde{p}(w, w^e)) \Big\}. \end{aligned} \tag{10}$$

Since this profit function is single-peaked (Assumption 4), $w^e$ and $p^e = \widetilde{p}(w^e, w^e)$ must satisfy the first-order condition (with $D$ and the derivatives evaluated at $\mathbf{p}^e = (p^e, p^e, p^e, p^e)$):

$$(1 + \theta)\left(\widetilde{D}(p^e, p^e) - (p^e - c - \gamma)(\lambda - \mu)\right) - (w^e - c)(\mu - \lambda\theta) = 0, \tag{11}$$

where

$$\lambda \equiv -\partial_1 \widetilde{D}(p^e, p^e), \; \mu \equiv \partial_2 \widetilde{D}(p^e, p^e) \text{ and } \theta = \frac{\partial_2 \widetilde{p}}{\partial_1 \widetilde{p}}.$$

But at a symmetric equilibrium, the retail equilibrium is characterized by the first-order condition:

$$\widetilde{D}(p^e, p^e) - \lambda (p^e - w^e - \gamma) = 0. \tag{12}$$

Using (12), (11) rewrites as

$$(1+\theta)(p^e - w^e - \gamma)\mu - (w^e - c)(\lambda - \theta\mu) = 0,$$

and this implies $w^e > c$ since $\lambda > \mu > 0$, and, from assumption 3, $\theta \geq 0$and $\mu - \lambda\theta > 0$.

- Let us now prove that $p^e < p^M$. Given $w^e > c$, (11) implies:

$$\widetilde{D}(p^e, p^e) - (p^e - c - \gamma)(\lambda - \mu) > 0,$$

which in turn implies that, starting from $\mathbf{p} = \mathbf{p}^e$, a uniform increase in all prices on the monopoly profit is positive. By assumption the monopoly profit is single-peaked at $\mathbf{p^M}$ and thus, $p^e < p^M$. ■

# B Proof of Proposition 2

If its rival adopts wholesale prices $(w_{B1}, w_{B2}) = (w^*, w^*)$ and retail prices $(p_{B1}, p_{B2}) = (p^*, p^*)$, manufacturer $A$ will choose its wholesale prices $w_{A1}$ and $w_{A2}$, retail prices $p_{A1}$

and $p_{A2}$ and franchises $F_{A1}$ and $F_{A2}$ so as to solve (with $\mathbf{p} = (p_{A1}, p^*, p_{A2}, p^*)$):

$$\max_{w_{A1},w_{A2},p_{A1},p_{A2},F_{A1},F_{A2}} \quad (w_{A1} - c)D_{A1}(\mathbf{p}) + F_{A1} + (w_{A2} - c)D_{A2}(\mathbf{p}) + F_{A2}$$

$$s.t. \quad \begin{array}{l} (p_{A1} - w_{A1} - \gamma)D_{A1}(\mathbf{p}) - F_{A1} + (p^* - w^* - \gamma)D_{B1}(\mathbf{p}) - F_{B1} \geq 0, \\ (p_{A2} - w_{A2} - \gamma)D_{A2}(\mathbf{p}) - F_{A2} + (p^* - w^* - \gamma)D_{B2}(\mathbf{p}) - F_{B2} \geq 0, \end{array}$$

or, since the participation constraints are clearly binding:

$$\max_{p_{A1},p_{A2}} \quad \{(p_{A1} - c - \gamma)D_{A1}(\mathbf{p}) + (p^* - w^* - \gamma)D_{B1}(\mathbf{p}) \\ +(p_{A2} - c - \gamma)D_{A2}(\mathbf{p}) + (p^* - w^* - \gamma)D_{B2}(\mathbf{p})\}. \tag{13}$$

Note that manufacturer $A$ is indifferent as to the choice of wholesale prices and is thus willing to adopt $(w_{A1}, w_{A2}) = (w^*, w^*)$ (together with franchise fees that recover retailers' profits). And from assumption 2 the above objective function is single-peaked in $(p_{A1}, p_{A2})$ and maximal for $p_{A1} = p_{A2} = \hat{p}(p^*, w^*)$; furthermore, for any $w^*$ there is a unique $p^*$ satisfying $p^* = \hat{p}(p^*, w^*)$. Therefore, for any $w^*$, there exists a unique symmetric equilibrium with $w_{ij} = w^*$ and $p_{ij} = p^*$, where $p^*$ is the unique solution to $p^* = \hat{p}(p^*, w^*)$.

For $p_{A1} = p_{A2} = p$, the objective function in (13) can be rewritten as $2f(p, p^*, w^*)$, with:

$$f(p, p^*, w^*) \equiv (p - c - \gamma) D(p, p^*, p, p^*) + (p^* - w^* - \gamma)D(p^*, p, p^*, p),$$

so that $p^* = \hat{p}(p^*, w^*)$ is characterized by the first-order equation:

$$\frac{p^* - c - \gamma}{p^*} = \frac{1}{E(\mathbf{p}^*)} - \frac{w^* - c}{p^*} \frac{\varepsilon^P(\mathbf{p}^*) + \varepsilon^{PD}(\mathbf{p}^*)}{E(\mathbf{p}^*)}. \tag{14}$$

For $w^* = c$, (14) yields:

$$\frac{p^* - c - \gamma}{p^*} = \frac{1}{E(\mathbf{p}^*)} = \frac{p^M - c - \gamma}{p^M},$$

and thus the solution is $p^* = p^M$. To establish that $p^*$ decreases when $w^*$ increases, note first that

$$\frac{\partial^2 f}{\partial w^* \partial p} = \frac{\partial}{\partial p}\left[-D(p^*, p, p^*, p)\right] = -\left(\varepsilon^P + \varepsilon^{PD}\right) \frac{D(\mathbf{p}^*)}{p^*} < 0.$$

Therefore, a standard revealed preference argument leads to $\frac{\partial \hat{p}}{\partial w^*} < 0$. Since $0 < \frac{\partial \hat{p}(p,w^*)}{\partial p} < 1$ from assumption 2, the fixed point to $p \to \hat{p}(p, w^*)$ then decreases when $w^*$ increases.

■

# C Proof of Proposition 3

At the last stage, retailer $j$ chooses $e_{ij}$ and $e_{hj}$ so as to maximize its profit:

$$(p_{ij} - w_{ij} - \gamma)\left[D_{ij} + \eta\phi\left(e_{ij}^r\right)\right] - F_{ij} + (p_{hj} - w_{hj} - \gamma)Q_{hj}(\mathbf{p}, e_{hj}) - F_{hj} - \psi(e_{ij} + e_{hj})$$

This profit function is concave in the effort levels; the adopted effort level $e^r_{ij} \equiv e^r_{ij}(p_{ij}, w_{ij})$ is thus characterized by the first order condition:

$$\psi'(e^r_{ij}) = (p_{ij} - w_{ij} - \gamma)\phi'(e^r_{ij}). \tag{15}$$

This reaction function $e^r_{ij}$ really depends on the wholesale price $w_{ij}$:

$$\frac{\partial e^r_{ij}}{\partial w_{ij}} = \frac{\phi'(e^r_{ij})}{(p_{ij} - w_{ij} - \gamma)\phi''(e^r_{ij}) - \psi''(e^r_{ij} + e^r_{hj})} < 0.$$

Manufacturer $i$ chooses marginal wholesale price $(w_{i1}, w_{i2})$ and retail prices $(p_{i1}, p_{i2})$ so as to maximize its profit:

$$\begin{aligned}\widetilde{\Pi}_i &= \sum_{j=1,2} \left[(p_{ij} - c - \gamma)\left[D_{ij} + \eta\phi\left(e^r_{ij}\right)\right] - \eta\psi\left(e^r_{ij}\right)\right. \\ &\qquad \left. +(p_{hj} - w_{hj} - \gamma)\left[D_{hj} + \eta\phi\left(e^r_{hj}\right)\right] Q_{hj}\left(\mathbf{p}, e^r_{ij}\right) - \eta\psi\left(e^r_{hj}\right)\right]\end{aligned}$$

The wholesale price $w_{ij}$ affects this profit through only its impact on $e^r_{ij}$; furthermore, this profit is concave in $e^r_{ij}$ and maximal for $e^r_{ij}$ such that:

$$\psi'(e^r_{ij}) = (p_{ij} - c - \gamma)\phi'(e^r_{ij}).$$

Given the retailers' behavior, as given by (15), the manufacturer will thus optimally choose:

$$w_{ij} = c.$$

Thus, in equilibrium all wholesale prices are set to the marginal cost. Taking into account (15), this implies that manufacturer's variable profit coincides with the monopoly profit $\left(\widetilde{\Pi}_i = \widetilde{\Pi}\right)$. Hence, under our assumptions on $\widetilde{\Pi}$, there exists a unique symmetric equilibrium, which is such that $w_{ij}^* = c$ and $p_{ij}^* = p^M(\eta)$. ■

# D Proof of Proposition 6

Set $\alpha = 0.1$ and $\beta = 0.3$. First, if there exist a symmetric equilibrium with double common agency (with $w_{ij} = w, F_{ij} = F(w)$, then retail prices and quantities are respectively given by (with $\mathbf{w} = (w, w, w, w)$):

$$
\begin{aligned}
p^r(\mathbf{w}) &= 0.6802 + 0.6122w, \\
q^r(\mathbf{w}) &= D(\mathbf{p}^r(\mathbf{w})) = 0.6122 - 0.3489w = 0.3489\,(1.7544 - w)\,.
\end{aligned}
$$

Therefore, necessarily, $w \leq 1.7544$.

We only sketch the proof here; a more detailed proof is available upon request. First, it is shown that the relevant participation constraint is indeed binding in equilibrium. Second, it is shown that eliminating profitable deviations rules out all values $w \leq 1.7544$.

## Determination of $F(w)$

**Lemma 9** *In any symmetric, double common agency equilibrium, of the form $(w, F(w))$:*

$$F(w) = 2(p^r(\mathbf{w}) - w)q^r(\mathbf{w}) - (p^r_{B1}(w, \emptyset, w, w) - w)D^r_{B1}(w, \emptyset, w, w).$$

**Proof.** We have already shown in lemma 5 that the only relevant participation constraint is

$$F \leq 2(p^r(\mathbf{w}) - w)q^r(\mathbf{w}) - (p^r_{B1}(w, \emptyset, w, w) - w)D^r_{B1}(w, \emptyset, w, w). \quad (16)$$

It thus suffices to show that the constraint is indeed binding in equilibrium.

Note first, that if both producers offer $(w, F)$ satisfying (16)to both retailers, it is a continuation equilibrium for the two retailers to accept both offers. This is actually the only continuation equilibrium: clearly, whenever one retailer refuses to carry one or both brands, the other retailer becomes more profitable and is thus willing to carry both brands rather than none; in addition, it can be checked that the other retailer still prefers to carry both brands rather than only one.

Since double common agency is the only continuation equilibrium following any offer of the form $(w_{ij} = w, F_{ij} = F)$ with $F$ satisfying (16), it is now easy to show that there exists a profitable deviation for the manufacturers, if the condition (16) is not binding. If this constraint is not binding, it suffices for manufacturer $A$, say, to increase the franchise fees

$$F_{A1} = F_{A2} = F(w) + \varepsilon, \text{ with } \varepsilon > 0 \text{ and sufficiently small.}$$

This deviation does not modify the continuation equilibrium and strictly increases manufacturer $A's$ profits. ■

Under our hypothesis that $\alpha = 0.1$ and $\beta = 0.3$, this condition writes as:

$$F(w) = 0.1179\,(1.7544 - w)^2$$

If there exists a symmetric, double common agency equilibrium of the form $(w, F(w))$, manufacturers' profits are equal to:

$$\begin{aligned}\pi_A\left[(a,a),(a,a)\right](w) &= \pi_B\left[(a,a),(a,a)\right](w) = 2\left(wq^r(\mathbf{w}) + F(w)\right) \\ &= 2\left(0.3489w(1.7544-w) + 0.1179(1.7544-w)^2\right) \\ &= 0.4621\,(1.7544-w)\,(0.8953+w)\end{aligned}$$

This profit being necessarily positive, such an equilibrium may exist only if $w \in [-0.8953, 1.7544]$.

## Profitable Deviations for the Manufacturers

To show that there exists no symmetric, double common agency equilibrium, we build, for any value of $w \in [-0.8953, 1.7544]$, a profitable deviation for one of the manufacturers, say $A$.

**Lemma 10** *There exists no symmetric, double common agency equilibrium for* $w < \underline{w} = 0.2435$.

**Proof.** To show this, we find a profitable symmetric deviation for manufacturer $A$ (it offers the same contract $(v,G)$ to both retailers), which does not modify the continuation equilibrium (both retailers carry both brands). This deviation must thus satisfy the following three constraints, ensuring that double common agency is a continuation equilibrium:

$$\left(p^r(v,w,v,w)-v\right)D^r(v,w,v,w) - G + \left(p^r(w,v,w,v)-w\right)D^r(w,v,w,v) - F(w) \geq ...$$

$$... \geq 0 \tag{17}$$

$$... \geq \left(p^r_{B1}\left(w, \emptyset, w, v\right) - w\right) D^r_{B1}\left(w, \emptyset, w, v\right) - F(w) \tag{18}$$

$$... \geq \left(p^r_{A1}\left(v, \emptyset, v, w\right) - v\right) D^r_{A1}\left(v, \emptyset, v, w\right) - G \tag{19}$$

We then assume, that manufacturer $A$ sets a franchise fee $G(v, w)$ saturating condition (18), that is:

$$\begin{aligned} G(v,w) &= \left(p^r\left(v,w,v,w\right) - v\right) D^r\left(v,w,v,w\right) + \left(p^r\left(w,v,w,v\right) - w\right) D^r\left(w,v,w,v\right) \\ &\quad - \left(p^r_{B1}\left(w,\emptyset,w,v\right) - w\right) D^r_{B1}\left(w,\emptyset,w,v\right) \end{aligned}$$

Suppose finally that manufacturer $A$ chooses the wholesale price $v^*(w)$ that maximizes its profit, that is:

$$v^*(w) = \arg\max\left[vD^r\left(v,w,v,w\right) + G(v,w)\right].$$

We then check that this strategy is profitable for any $w < \underline{w} = 0.2435$ (notice that $\underline{w}$ is such that $v^*(\underline{w}) = \underline{w}$), and that double common agency is the unique continuation equilibrium (since the deviation is symmetric, if it is optimal to accept both offers when the competitor accepts both, it is a dominant strategy for each retailer to accept both offers). This shows that there exists no symmetric, double common agency equilibrium for $w < 0.2435$. ■

**Lemma 11** *There exists no symmetric, double common agency equilibrium for* $w > \overline{w} = 0.6423$.

**Proof.** Let us again consider a symmetric deviation of the form $(v, G)$. We now look for profitable deviation for, say, manufacturer $A$, such that manufacturer $B$ is completely excluded from the market, that is, such that the continuation equilibrium is of the form $((a, r), (a, r))$.

The deviation must therefore satisfy:

$$\left(p^r_{A1}\left(v, \emptyset, v, \emptyset\right) - v\right) D^r_{A1}\left(v, \emptyset, v, \emptyset\right) - G \geq ...$$

$$\begin{aligned} ... &\geq 0 & (20) \\ ... &\geq \left(p^r_{B1}\left(w, \emptyset, \emptyset, v\right) - w\right) D^r_{B1}\left(w, \emptyset, \emptyset, v\right) - F(w) & (21) \\ ... &\geq \left(p^r_{A1}\left(v, w, v, \emptyset\right) - v\right) D^r_{A1}\left(v, w, v, \emptyset\right) - G \\ &\quad + \left(p^r_{B1}\left(w, v, \emptyset, v\right) - w\right) D^r_{B1}\left(w, v, \emptyset, v\right) - F(w) & (22) \end{aligned}$$

Suppose now that manufacturer $A$ chooses the wholesale price $v^*(w)$ and the franchise fee $G^*(w)$ such that constraints (21) and (22) are binding.

We then check that this deviation is profitable for manufacturer $A$ and that $((a, r), (a, r))$ is the unique continuation equilibrium, therefore showing that there exists no symmetric, double common agency equilibrium, for $w > 0.6423$. ■

**Lemma 12** *There exists no symmetric, double common agency equilibrium for* $w \in [\underline{w}, \widehat{w}]$, *where* $\widehat{w} = 0.4973$.

**Proof.** To show this, we consider an asymmetric deviation such that the continuation equilibrium is of type $((a, a), (a, r))$, that is, manufacturer $B$ is partially excluded. We analyze the following deviation: $w_{A1} = 0.4$ and $w_{A2} = 0$, and the franchise fees ($F_{A1}$ and

$F_{A2}$) are such that:

$$\pi_1\left[(a,a),(a,r)\right] = \max\left(\pi_1\left[(r,r),(a,r)\right],\pi_1\left[(r,a),(a,r)\right]\right)$$
$$\pi_2\left[(a,a),(a,r)\right] = \max\left(\pi_2\left[(a,a),(r,r)\right],\pi_2\left[(a,a),(r,a)\right]\right)$$

where all profits are evaluated at $\mathbf{w} = (0.4, w, 0, w)$.

We then check that $((a,a),(a,r))$ is the unique continuation equilibrium and that this deviation increases manufacturer $A's$ profits for any $w$ between 0.2435 and 0.4973. ■

**Lemma 13** *There exists no symmetric, double common agency equilibrium for* $w \in [\widehat{w},\overline{w}]$.

**Proof.** The proof is identical to the proof of lemma 12, but we now consider $w_{A1} = 0.6$ and $w_{A2} = 0$. ■

This shows that, for $\alpha = 0.1$ and $\beta = 0.3$, there exists no symmetric, double common agency equilibrium.

# E Proof of Proposition 7

We look for sufficient conditions on $w^*$ to ensure that $C^* = (w^*, p^*, F^*)$, where

$$p^* = \frac{1-\alpha(1-\beta)w^*}{2(1-\alpha-\beta)} \text{ and } F^* = (1-\alpha)(p^*-w^*)D\left(\mathbf{p}^*\right),$$

is the equilibrium wholesale contract of a symmetric, double common agency equilibrium. We only sketch the proof here; a more detailed proof is available upon request.

First notice that we have constrained the retail price $p^*$ to be higher than the marginal wholesale price $w^*$, therefore imposing $w^* \leq w^{\max} = \frac{1}{2-\alpha-2\beta-\alpha\beta}$. Moreover, quantities must be positives, thereby constraining $w$ to be such that:

$$q^* = D(\mathbf{p}^*) \geq 0 \Leftrightarrow w^* \geq w^{\min} = -\frac{1-\alpha}{\alpha(1-\alpha-\beta-\alpha\beta)}.$$

The idea of this proof is now to analyze any possible deviation for manufacturer $A$ and find sufficient conditions to ensure that these deviations are never profitable. Depending on the contracts $C_{A1}$ and $C_{A2}$ offered by $A$, the equilibrium market structure (that is the contracts accepted by the retailers) differs. We therefore analyze the effect of a deviation on manufacturer $A's$ profits depending on the type of the continuation equilibrium. 16 different structures are possible, but a symmetry argument reduces this number to 10. However, three of them can easily be removed: it is indeed never profitable for manufacturer $A$ to induce a continuation equilibrium in which its contracts are both rejected. Structures $(\emptyset)$, $(B1)$ et $(B1 - B2)$ are therefore excluded. We then have 7 possible structures to analyze.

## Structure $0$ : $(A1 - A2 - B1 - B2)$, all the offers are accepted (Double-common agency)

In order to obtain a continuation equilibrium where both retailers carry both brands, manufacturer $A$ has to propose contracts $C_{A1}$ and $C_{A2}$ such that:

$$(p_{A1} - w_{A1})D(p_{A1}, p^*, p_{A2}, p^*) - F_{A1} + (p^* - w^*)D(p^*, p_{A1}, p^*, p_{A2}) - F^* \geq ...$$

$$\begin{aligned} \ldots &\geq 0 & (23) \\ \ldots &\geq (p^* - w^*)D\left(p^*, \emptyset, p^*, p_{A2}\right) - F^* & (24) \\ \ldots &\geq (p_{A1} - w_{A1})D\left(p_{A1}, \emptyset, p_{A2}, p^*\right) - F_{A1} & (25) \end{aligned}$$

and

$$(p_{A2} - w_{A2})D\left(p_{A2}, p^*, p_{A1}, p^*\right) - F_{A2} + (p^* - w^*)D\left(p^*, p_{A2}, p^*, p_{A1}\right) - F^* \geq \ldots$$

$$\begin{aligned} \ldots &\geq 0 & (26) \\ \ldots &\geq (p^* - w^*)D\left(p^*, \emptyset, p^*, p_{A1}\right) - F^* & (27) \\ \ldots &\geq (p_{A2} - w_{A2})D\left(p_{A2}, \emptyset, p_{A1}, p^*\right) - F_{A2} & (28) \end{aligned}$$

If we only consider constraints (24) and (27), the maximal franchises $A$ can impose are:

$$\begin{aligned} F_{A1} &= (p_{A1} - w_{A1})D\left(p_{A1}, p^*, p_{A2}, p^*\right) + (p^* - w^*)\left(D\left(p^*, p_{A1}, p^*, p_{A2}\right) - D\left(p^*, \emptyset, p^*, p_{A2}\right)\right), \\ F_{A2} &= (p_{A2} - w_{A2})D\left(p_{A2}, p^*, p_{A1}, p^*\right) + (p^* - w^*)\left(D\left(p^*, p_{A2}, p^*, p_{A1}\right) - D\left(p^*, \emptyset, p^*, p_{A1}\right)\right), \end{aligned}$$

and its maximal profit is therefore:

$$\begin{aligned} \pi_A(p_{A1}, p_{A2}) &= p_{A1}D\left(p_{A1}, p^*, p_{A2}, p^*\right) + (p^* - w^*)\left(D\left(p^*, p_{A1}, p^*, p_{A2}\right) - D\left(p^*, \emptyset, p^*, p_{A2}\right)\right) \\ &\quad + p_{A2}D\left(p_{A2}, p^*, p_{A1}, p^*\right) + (p^* - w^*)\left(D\left(p^*, p_{A2}, p^*, p_{A1}\right) - D\left(p^*, \emptyset, p^*, p_{A1}\right)\right) \end{aligned}$$

However, this profit is maximized for $p_{A1} = p_{A2} = p^*$ Such a deviation can never be strictly profitable for manufacturer $A$.

**Structure** $1 : (A1 - A2 - B1)$, **Contract** $C_{B2}$ **is rejected.**

In order to ensure that this structure can be one of the continuation equilibria, contracts $C_{A1}$ and $C_{A2}$ must satisfy the following constraints:

$$(p_{A1} - w_{A1})\, D(p_{A1}, p^*, p_{A2}, \emptyset) - F_{A1} + (p^* - w^*)D(p^*, p_{A1}, \emptyset, p_{A2}) - F^* \geq ...$$

$$... \geq 0 \tag{29}$$

$$... \geq (p^* - w^*)D(p^*, \emptyset, \emptyset, p_{A2}) - F^* \tag{30}$$

$$... \geq (p_{A1} - w_{A1})\, D(p_{A1}, \emptyset, p_{A2}, \emptyset) - F_{A1} \tag{31}$$

and

$$(p_{A2} - w_{A2})\, D(p_{A2}, \emptyset, p_{A1}, p^*) - F_{A2} \geq ...$$

$$... \geq 0 \tag{32}$$

$$... \geq (p^* - w^*)D(p^*, \emptyset, p^*, p_{A1}) - F^* \tag{33}$$

$$... \geq (p_{A2} - w_{A2})\, D(p_{A2}, p^*, p_{A1}, p^*) - F_{A2} + (p^* - w^*)D(p^*, p_{A2}, p^*, p_{A1}) - F^* \tag{34}$$

Wholesale prices $w_{A1}$ and $w_{A2}$ can be used to satisfy constraints (31) and (34). If manufacturer $A$ sets the maximal possible fixed fees, its profit is:

$$\begin{aligned}\pi_{S1}(p_{A1},p_{A2}) &= p_{A1}D(p_{A1},p^*,p_{A2},\emptyset)-\max\left[0,(p^*-w^*)\left(D(p^*,\emptyset,\emptyset,p_{A2})-(1-\alpha)q^*\right)\right] \\ &+p_{A2}D(p_{A2},\emptyset,p_{A1},p^*)-\max\left[0,(p^*-w^*)\left(D(p^*,\emptyset,p^*,p_{A1})-(1-\alpha)q^*\right)\right] \\ &+(p^*-w^*)\left[D(p^*,p_{A1},\emptyset,p_{A2})-(1-\alpha)q^*\right]\end{aligned}$$

It is now sufficient to compare the maximal value of this profit with $\pi_P^*(w^*)$, that is, consider the sign of the expression:

$$\Delta_1(w^*)=\max_{p_{A1},p_{A2}}\pi_{S1}(p_{A1},p_{A2})-\pi_P^*(w^*)$$

We then check that there exists two critical values $\underline{w}_1(\alpha,\beta)$ and $\overline{w}_1(\alpha,\beta)$ such that

$$w^{\min}<\underline{w}_1(\alpha,\beta)<\overline{w}_1(\alpha,\beta)<w^{\max}$$

and $\Delta_1(w^*)\leq 0$ for $w^*\in\left[\underline{w}_1(\alpha,\beta),\overline{w}_1(\alpha,\beta)\right]$. This type of deviation is therefore never profitable for $w^*\in\left[\underline{w}_1(\alpha,\beta),\overline{w}_1(\alpha,\beta)\right]$.

## Structure $2:(A1-B2)$, Contracts $C_{A1}$ and $C_{B2}$ are accepted

A comparable analysis leads to consider the sign of the expression:

$$\Delta_2(w^*)=\max_{p_{A1}\geq p^{\max}(w^*)}\pi_{S2}(p_{A1})-\pi_P^*(w^*),$$

where

$$\pi_{S2}(p_{A1})=p_{A1}D(p_{A1},\emptyset,\emptyset,p^*)-(p^*-w^*)\left[D(p^*,\emptyset,p^*,\emptyset)-(1-\alpha)q^*\right]$$

We then check that there exists a critical value $w_2(\alpha, \beta)$ such that $\Delta_2(w^*) \leq 0$, for $w^* \in \left[w^M, w_2(\alpha, \beta)\right]$. This type of deviation is never profitable for $w^* \in \left[w^M, w_2(\alpha, \beta)\right]$.

## Structure $3 : (A1 - A2)$, Contracts $C_{A1}$ and $C_{A2}$ are accepted

A comparable analysis leads to consider the sign of the expression:

$$\Delta_3(w^*) = \max_{p_{A1}, p_{A2}} \pi_{S3}(p_{A1}, p_{A2}) - \pi_P^*(w^*),$$

where

$$\begin{aligned}
\pi_{S3}(p_{A1}, p_{A2}) &= p_{A1} D(p_{A1}, \emptyset, p_{A2}, \emptyset) - \max\left[0, (p^* - w^*)\left(D(p^*, \emptyset, \emptyset, p_{A2}) - (1-\alpha)q^*\right)\right] \\
&\quad + p_{A2} D(p_{A2}, \emptyset, p_{A1}, \emptyset) - \max\left[0, (p^* - w^*)\left(D(p^*, \emptyset, \emptyset, p_{A1}) - (1-\alpha)q^*\right)\right].
\end{aligned}$$

We then check that there exists two critical values $\underline{w}_3(\alpha, \beta)$ and $\overline{w}_3(\alpha, \beta)$ such that

$$w^{\min} < \underline{w}_3(\alpha, \beta) < \overline{w}_3(\alpha, \beta) < w^{\max}$$

and $\Delta_3(w^*) \leq 0$ for $w^* \in \left[\underline{w}_3(\alpha, \beta), \overline{w}_3(\alpha, \beta)\right]$. This type of deviation is therefore never profitable for $w^* \in \left[\underline{w}_3(\alpha, \beta), \overline{w}_3(\alpha, \beta)\right]$.

## Other Structures

Doing the same analysis for the other structures (that is, $(A1)$, $(A1 - B1)$ and $(A1 - B1 - B2)$), we check that these types of deviation are never profitable for $w^* \in \left[w^M, w^{\max}\right]$.

## Conclusions

Let us now define the following values:

$$\begin{aligned} \underline{w}(\alpha,\beta) &= \max\left[w^M, \underline{w}_1(\alpha,\beta), \underline{w}_3(\alpha,\beta)\right] \\ \text{and } \overline{w}(\alpha,\beta) &= \min\left[\overline{w}_1(\alpha,\beta), w_2(\alpha,\beta), \overline{w}_3(\alpha,\beta)\right] < 0 < 0 \end{aligned}$$

We then verify that, for the values of the parameters $\alpha$ and $\beta$ given by Figure 1, we have:

$$\underline{w}(\alpha,\beta) = w^M \leq \overline{w}(\alpha,\beta) \Leftrightarrow \underline{p}(\alpha,\beta) \leq p^M \leq \overline{p}(\alpha,\beta),$$

and the contract $C^* = (w^*, F^*; p^*)$ is the equilibrium contract of a symmetric, double common agency equilibrium.

# Footnotes

[1] For an overview of the legal frameworks regarding vertical restraints, see OECD (1994) or the European Commission's *Green Paper on Vertical Restraints* (1996). Comanor-Rey (1996) also relates the recent evolution of the attitudes of the U.S. competition authorities and within the European Community.

[2] The arguments that courts have given to justify territorial restraints could actually often be used as well in favor of RPM.

[3] See Caballero-Sanz and Rey (1996).

[4] The idea is that, when secretly contracting with one retailer, the manufacturer has an incentive to free-ride on the others and ends-up selling more than the monopoly quantity. This idea, which is reminiscent of the Coasian pricing problem for durable goods – or of a franchisor's incentive to sell too many franchises – has further been explored by McAfee and Schwartz (1994) and O'Brien and Schaffer (1992). Rey and Tirole (1997) provides an overview of this literature.

[5] O'Brien and Shaffer use a concept of "contract equilibrium" which concentrates on pairwise deviations; therefore, they do not consider multilateral deviations which can indeed be profitable, thereby generating existence problems for standard Nash equilibria in contracts – see Rey and Vergé (2002).

[6] For example, in *Continental T.V.* vs. *GTE Sylvania* the US Supreme Court mentioned that a clear distinction had to be made between price and nonprice restraints, since price restrictions seemed to limit interbrand competition, thus facilitating cartellization –see 433 U.S. (1977) at 55.

[7] Another difference concerns the equilibrium concept. To reflect different bargaining power, Dobson and Waterson assume that wholesale prices are determined by simultaneous pairwise bargaining; this supposes that a manufacturer has two independent divisions,

each of them negotiating with one retailer and not taking into account the impact of its own negotiation on the other division.

[8] This assumption seems reasonable but is not always maintained. For example, Dobson and Waterson (1997) consider a linear model where (considering inverse demand functions) the price of one product decreases when the quantity of *any* product increases; in that case, the demand for one variety in one store necessarily decreases when the price of the competing variety increases in the competing store $\left(\varepsilon^{PD} < 0\right)$.

[9] All those assumptions are satisfied when demand is linear, as in the simple model studied in Section 4.

[10] This would be the case, for example, when retail prices are strategic complement and the retail equilibrium is stable.

[11] The observability assumption is made for simplicity, to avoid technicalities such as a the definition of reasonable conjectures in the event of unexpected offers, and equilibrium existence problems –see Rey and Vergé (2002).

[12] The range for the equilibrium price $p^*$ depends on the domain of validity of assumptions 1-4. When for example the demand is linear, any price from $c + \gamma$ up to the maximal price for which quantities are 0 can be sustained.

[13] They may be able to reduce retailers' rents by making exclusive offers; we will rule out this possibility in order to better assess the impact of retail market power.

[14] The expression of the demand is valid as long as all four products are effectively sold. When product $(i, j)$ is not sold (e.g., when the above demand would be negative, or when retailer $j$ refuses to carry brand $i$), the demand for the other products must be evaluated by replacing the price of that product with a virtual price $\bar{p}_{ij}$, computed by equating $D_{ij}$ to zero (i.e., $\bar{p}_{ij} = 1 + \alpha p_{hj} + \beta p_{ik} + \delta p_{hk}$).

[15] This specification may appear restrictive since it rules out the case of high degrees of

substituability for both brands and retailers. However, if for example the retailers are close substitutes, it may not be optimal to have two retailers selling the two products. Since we are interested in the situation in which both retailers sell both brands, we have to limit our attention to cases where inter- and intra-brand degrees of substitution are not simultaneously high.

[16] By definition,

$$D\left(p^*, \emptyset, p^*, p^*\right) = D\left(p^*, \tilde{p}, p^*, p^*\right),$$

where $\tilde{p}$ is such that $D\left(\tilde{p}, p^*, p^*, p^*\right) = 0$, that is, $\tilde{p} = 1 + (\alpha + \beta + \alpha\beta)\, p^*$. Hence

$$\begin{aligned} D\left(p^*, \emptyset, p^*, p^*\right) &= 1 - p^* + \alpha\tilde{p} + \beta p^* + \alpha\beta p^* \\ &= (1+\alpha)\, D\left(p^*, p^*, p^*, p^*\right). \end{aligned}$$

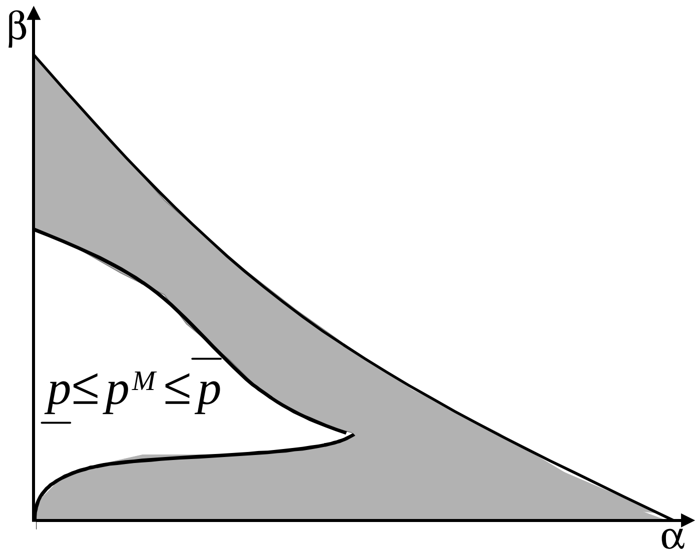


Figure 1: Existence of a symmetric, double common agency equilibria

# References

[1] Bernheim, Douglas and Michael D. Whinston (1985), "Common Agency as a Device for Facilitating Collusion", *Rand Journal of Economics* 16(2), 269-281.

[2] Caballero-Sanz, Francesco and Patrick Rey (1996), "The Policy Implications of the Economic Analysis of Vertical Restraints", *Economic Papers* n° 119, European Commission.

[3] Comanor, William S. and Patrick Rey (1997), "Competition Policy towards Vertical Restraints in the US and Europe", *Empirica* 24(1-2), 37-52.

[4] Dobson, Paul and Michael Waterson (1997), "The Competition Effects of Resale Price Maintenance", mimeo.

[5] European Commission (1996), *Green Paper on Vertical Restraints.*

[6] Hart, Oliver and Jean Tirole (1990), "Vertical Integration and Market Foreclosure", *Brookings Papers on Economic Activity: Microeconomics*, 205-276.

[7] Jullien, Bruno and Patrick Rey (2000), "Resale Price Maintenance and Collusion", mimeo.

[8] McAfee, R. Preston and Marius Schwartz (1994), "Opportunism in Multilateral Vertical Contracting: Nondiscrimination, Exclusivity and Uniformity", *American Economic Review* 84(1), 210-230.

[9] O'Brien, Daniel P. and Greg Shaffer (1992), "Vertical Control with Bilateral Contracts", *Rand Journal of Economics* 23(3), 299-308.

[10] OECD (1994), *Competition Policy and Vertical Restraints:Franchising Agreements*, Paris.

[11] Rey, Patrick and Jean Tirole (1997), "A Primer on Foreclosure", forthcoming in *Handbook of Industrial Organization,* Vol III, North-Holland..

[12] Rey, Patrick and Thibaud Vergé (2002), "Vertical Contracts with Bilateral Negotiations", mimeo.