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Anti-Competitive Effects of Resale-Below-Cost Laws

Marie-Laure Allain[*] and Claire Chambolle[‡]

Abstract

We show that resale-below-cost laws enable producers to impose industry-wide price-floors to retailers. This mechanism suppresses downstream competition but also and more surprisingly dampens upstream competition, leading to higher prices and lower welfare. Price-floor may be more profitable for producers than resale price maintenance contracts and, when a resale price maintenance restraint may have ambiguous effect on welfare, price-floors are always welfare damaging. Retailers' buyer power appears as a key element for a price-floor to work out.

Jel Codes: L13, L41, L42.

Keywords: Price-floor, Resale Price Maintenance, Buyer Power, Competition.

1 Introduction

In most countries, retailers' pricing practices are submitted to the same general competition laws as those of producers. However, during the 1990's, several countries adopted regulations to prevent retailers from engaging in below-cost pricing, or "loss-leading". These resale-below-cost laws (henceforth "RBC laws") prevent retailers

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from setting retail prices below a statutorily mandated level of cost, usually based on the unit price invoiced by the supplier.[1] Yet in the last decade, professional as well as academic studies have denounced the price-raising effects of these laws, thus calling their relevance into question.

Beyond the analysis of the economic and social welfare impact of loss-leading, this article studies an unforeseen but major anticompetitive effect of RBC laws:[2] We argue that the ban of below-cost pricing for retailers enables producers to impose price-floors to their retailers. This induces higher prices on the whole range of products sold and not only on those that would have been sold below cost. Therefore we claim that this price-floor mechanism may explain most of the price effect of RBC laws.

This article provides a theoretical framework to analyze the anticompetitive effects of the price-floors implemented by RBC laws. We focus on the legislation of countries like France, Ireland or Spain for instance, where the conditional or deferred rebates that are not written on the invoice are excluded from the legal minimum price threshold. We consider a vertical chain with upstream and downstream imperfect competition, where two producers sell differentiated products through a duopoly of differentiated retailers. We develop a new setting in order to focus on the real timing of vertical negotiations. In our model, producers first set their wholesale prices (*i.e.* their general terms of sales). These are public and non discriminatory, as required by commercial laws in most countries. Afterwards, producers bargain with retailers over secret rebates. These rebates depict the so called "backroom margins", which gather diverse fees such as slotting allowances, deferred price reductions or payment for commercial services. In most countries, they account for a growing part of the transfers between producers and retailers (cf. Shaffer, 1991). The crucial point is that, according to the law, these deferred rebates cannot be deducted from the threshold that defines the legal minimum retail price: this threshold will thus be the unit wholesale price published in the general terms of sales. After these negotiations, retailers set final prices market: under a RBC law these have to be above the minimum price threshold.

In this setting, a producer sets his unit price at the price-floor level he wants to implement. The law protects this price-floor that is therefore a credible commit-

[1] For a detailed review of RBC laws in OECD countries, see the OECD report "Resale Below Cost Laws and Regulations", DAF, 02/23/2006. Section 2 outlines some RBC laws and presents empirical studies on their price effects.

[2] For an analysis of the *pros and cons* of loss leading, see Walsh and Whelan (1999).

ment. The producer can thereafter negotiate conditional rebates (backroom margins) with his retailers on an individual basis that may reflect their different bargaining powers. The conditional character ensures that the rebates cannot be integrated in the price threshold. Besides, when, as in France or Ireland, the law is combined to antidiscriminatory rules that hinder producers from discriminating between retailers, this price-floor is *de facto* industrywide. In a previous paper (Allain and Chambolle, 2005), we showed that a monopolist producer can use the law in order to suppress downstream competition through an industrywide price-floor: when the upstream firm has not much bargaining power, he can use this mechanism in order to raise final prices and increase his own profit.

In this paper we go further and explore the effect of the price-floor mechanism on upstream competition. We show that this mechanism can dampen upstream competition as well as downstream competition, and lead to a major price increase. Moreover, we study here the robustness of this finding to different tariff schemes, and we show that retail prices increase whether wholesale tariffs are linear or two-part. Besides, we go deeper in the comparison between a price-floor and a resale price maintenance (RPM): we show that when buyer power is large enough, a price-floor works out as a RPM, but when producer's bargaining power is strong, we show that price-floors implement corner solutions which lead to higher retail prices and lower welfare than a RPM restraint would. In some cases, the price-floor proves to be even more profitable than a RPM for producers.[3]

This article fits in the industrial organization literature on competition policy and vertical restraints (Motta, 2004). Although there is a rather large literature on the anticompetitive effects of RPM, few articles have analyzed price-floors (even less with linear tariffs).[4] Here we use both linear and two-part tariffs. As the former

[3]These results illustrate two recent decisions by the French competition authority (Conseil de la Concurrence, 03-D-45, 25/09/2003, on the market for calculators, and 05-D-70, 19/12/2005 on the market for videotapes). Upstream and downstream firms were condemned for having organized a price-floor system relying on falsely conditional rebates that were excluded from the minimum price threshold. Retailers who tried to set prices lower than the price-floor were called to order by their supplier who reminded them not to trespass the resale below-cost law.

[4]With two-part tariffs, O'Brien and Shaffer (1992) show that an upstream monopoly offering take-it-or-leave-it two-part tariff contracts to competing retailers uses a price-floor in order to raise final prices: if contracts are secret, retailers accept only contracts with a marginal part equal to the marginal cost of production. Then, downstream competition drives final prices to a lower level than the monopoly price, and the producer uses a either a price-floor or a RPM in order to restore the monopoly price.

create a double margin effect, a price-floor restraint may appear useless as retail prices are generally too high. Yet we show that, with linear tariffs, if retailers have enough bargaining power, retail prices are still too low and producers may thus use price-floors as a RPM, in order to raise retail prices. Besides, when their bargaining power increases, final prices are too high, but producers may still find profitable to adopt corner-pricing strategies in order to set binding price-floors that drive retail prices even higher than a RPM would, because binding the retailers' pricing strategies enhances their bargaining power. Price-floors in that case are hurting welfare more than a RPM. Furthermore, with two-part tariffs, price floors always lead to higher prices than RPM. In all cases, price-floors enable producers to suppress downstream competition and to relax upstream competition.

Our work is closely related to two papers: Dobson and Waterson (2007) and Rey and Vergé (2004 i). Dobson and Waterson (2007) use a similar bilateral oligopoly framework to analyze the effect of industrywide resale price maintenance depending on the relative bargaining power of the upstream and downstream industries. They show that the social effects of RPM are likely to be adverse when retailer power is strong, but that the use of RPM is not universally undesirable and may be welfare-enhancing when the producers bargaining power is strong. With price-floors instead of RPM we show that final prices rise also when the producers are powerful, and that, contrary to a RPM, a price floor is always damageable to welfare. The other main difference with their paper is that we extend these results in a more general tariff setting (two-part tariffs).

Rey and Vergé (2004 i) show that a RPM enables manufacturers to neutralize both downstream and upstream competition and to reach the monopoly profit. They consider differentiated producers offering publicly observable two-part tariff contracts to differentiated retailers, and assume an exogenous market structure.[5] With two-part tariffs, we corroborate their result in our setting of secret bargaining between producers and retailers, and we endogenize the market structure. We show in addition that the range of equilibrium retail prices sustainable with a RPM widens with retailers' bargaining power, and that a RPM may lead to lower equilibrium prices than a price-floor. Again, comparing to the no restriction case, some RPM equilibria (among a multiplicity of existing equilibria) may be welfare enhancing, but the whole

[5]In their setting, there may exist no equilibrium with double common agency, unless they assume that producers can bypass established retailers and find alternative retailers to distribute their products, or that producers are excluded from the market as soon as one offer is rejected by a retailer.

range of price-floors equilibria are welfare damaging.

Furthermore, this paper fits also in the recent but growing literature on buyer power (for a survey, see Inderst and Mazzarroto, 2006). Most articles in this field analyze the determinants and consequences of buyer power. Our purpose is rather to understand its role on the efficiency and welfare consequences of vertical restraints. We demonstrate that buyer power is a key element in the working of a price-floor. In particular, we show that buyer power facilitates the use of a price-floor by producer. Besides, if competition is not too soft at both levels, the price-raising effect and welfare damage of the price floor are worse when the retailers have all bargaining power.

Our four main contributions to the theoretical literature are as follows. First, we highlight differences between a price-floor and a RPM, and show that the former induces corner equilibria that lead to higher prices than a RPM. Second, we show how a price-floor may neutralize downstream as well as upstream competition, as a RPM, but, although a less restrictive restraint, is more harmful for welfare and may be more profitable for the producers. Third, we underline the role of buyer power in the efficiency of price-floors. Finally, we shed some light on the anticompetitive effects of RBC laws and provide economic policy recommendations on the way to reform them.

This article proceeds as follows. Section 2 outlines some RBC laws and reviews the empirical literature on their price effects. The model is presented in section 3. Section 4 develops the equilibrium analysis in two benchmark cases: first with no legal restriction, second with RPM contracts. Section 5 points out the anticompetitive effects of the law. We discuss the effect of competition on the equilibrium outcomes in section 6. We derive our analysis in the two-part tariff contracts case in section 7. We explore some extensions and the robustness of our model in section 8 and conclude in section 9.

2 RBC laws

2.1 Why RBC laws?

In most countries, RBC laws were adopted in a context of growing retail market concentration, which considerably strengthened the market power of a few large retail chains. The changes in the competitive structure of the retail sector have deeply transformed the balance of power between producers and retailers, and retailer's buyer

power has become a major issue for competition policy.[6] RBC laws were in most cases an answer to the lobbying of producers and small retailers who complained about the adverse effects of loss-leading practices by large retail chains. On the one hand, small retailers argue that below-cost pricing is predatory: Loss-leading would enable large retail chains to drive out smaller competitors and benefit afterwards from a less competitive environment. On the other hand, loss-leading practices are also criticized by producers, as loss-leading by one retailer may toughen the negotiations with other retailers who may require lower wholesale prices in order to match their rival's price.

In theory, anti-predatory legislation should be sufficient to prevent predatory loss-leading practices. Yet competition authorities in most countries deal with predatory pricing without *per se* rules. Generally, the comparison to the firm's average variable cost is not sufficient for a price to be deemed predatory. In the EU, competition authorities must prove that the firm has a dominant position. In the US, the court must prove that the retailer could not recoup the losses incurred by pricing below-cost without the elimination of a competitor.[7] This being very hard to prove, retailers are rarely condemned for predatory pricing practices.[8] RBC laws, as *per se* rules, are easier to enforce: a below-cost price can be condemned without any further condition.

2.2 Legal overview

In Europe, RBC laws are rather widespread. RBC laws exist in Belgium, France, Italy, Luxembourg, Portugal and Spain, as well as in Greece and Ireland for grocery goods and Hungary for agricultural products. In two of the European countries where the legislation seems to be the most restrictive, France and Ireland, these laws are currently under reform. In Germany, there is no specific RBC law, but the antitrust law simplifies the application of anti-predatory regulation to the retail sector.[9]

The French Galland Law, the Spanish Law on Unfair Competition and the Irish Groceries Orders use very close definitions of the cost threshold. The Irish Groceries

[6] For empirical evidence, see OECD (1999) and EC (1999).

[7] Brooke Group vs. Brown & Williamson Tobacco, 509 U.S. 209 (1993).

[8] In 1993 however, Wal-Mart was condemned for having set too low prices on pharmaceutical products in Arkansas.

[9] The German law states that any retailer with "considerable market power" (and no necessary dominant position) must not sell a product below its purchase price, and the rule applies whether or not there is any harm to competition. Deferred rebates are excluded from the cost benchmark. Hence in 2000 the Cartel Office condemned Wal-Mart, Aldi and Lidl, three major supermarket chains, for selling milk and butter at below-cost prices.

Orders, for instance, stipulate that "a retailer shall not sell grocery goods at a price that is less than the net invoice price of the goods [. . .] The net invoice price [...] shall be calculated having regard to an invoice relating to the delivery of like goods by the supplier to the retail store concerned which is of the same date with the sale of goods [and] net of any allowance or refund that is allowable on the return of the goods' container, and no account shall be taken of discounts, rebates or other deductions which are not entered on the invoice in cash terms as deductions from the sum due to the supplier" (art. 11). Note that this "net invoice price" is different from the average variable cost used to identify predatory pricing.

In the US, there is no federal law prohibiting below-cost sales. Many US States however have some type of RBC laws, either applying generally to all retail sales (twenty-five States) or to the sales of products such as gasoline, tobacco, alcohol or dairy products (in thirty-one States). The definition of the cost benchmark varies, but most State laws set it at the acquisition price, possibly plus a required retail margin.[10]

2.3 Adverse effects of RBC laws

In the US, there is no evidence that RBC laws affect market outcomes in a clear way. Studies comparing retail gas prices between States with and without RBC laws conclude in general to a price-raising effect of the laws (Calvani, 1999; Johnson, 1999). Anderson *et al.* (1999) find that gasoline-specific RBC laws are associated with higher retail margins and prices. Yet they also find that these higher margins attract entry and that there are more gasoline retail outlets in the States with gasoline-specific laws. In contrast, Skidmore et al. (2005) find evidence that these laws are associated with lower long-run gasoline prices: these results support the idea that RBC laws help maintain a fair competitive environment by fighting against predatory practices.

In Europe, there is a consensus among empirical studies to conclude to the price-raising effects of RBC laws. In Ireland, the Central Statistics' Office has pointed out that retailers' margins have increased from 15.8% in 1988 to 20.1% in 1993. Moreover, an econometric study by Collins et al. (2001) showed that the 1987 Groceries Order clearly had a significant positive influence on retail gross margins, and weakened retail competition. In France, since the enforcement of the Galland law, supermarket prices

[10]In contrast to the treatment of predatory pricing claims under federal antitrust laws, where plaintiffs must show that the defendant's price cut is likely to harm consumers, a plaintiff can prevail under these laws even if there is no proof of harm to competition.

increased at a significantly larger rate than in other EU countries (Canivet, 2004). Biscourp et al. (2008) show that retail prices have become less sensitive to a variation of the local concentration level (used as a proxi of local retail competition) since the Galland Law has been enacted. They also show that the shops with the lowest prices before the law have increased their prices more than the others. The authors interpret these as symptoms of a reduced retail competition.

In theory, that RBC laws lead to higher prices is not surprising for several reasons. First, there is an immediate positive effect on the prices of the former loss-leaders. This price increase may anyway be compensated by a reduction in the prices of other products. Second, if these laws aim at limiting predatory pricing by large retail chains, their purpose is to relax short term competition in order to protect long term competition: The short term effect may well increase prices. However, the following model puts forward the idea that the main price-raising effect is somewhere else. It may indeed rely on a vertical adverse effect of the law that enables the producers to relax both downstream and upstream competition through a price-floor mechanism.

3 The model

3.1 Assumptions

Two producers, A and B, produce two horizontally differentiated goods, also branded A and B, at zero marginal cost of production. Each producer can market his good through two differentiated retailers, 1 and 2, competing in prices to sell the products to consumers. Apart from the transfer they pay producers, retailers incur a constant marginal retailing cost which we normalize to zero.

We assume that consumers differ in their preferences for retailers as well as products. If each retailer carries both brands, there are in effect four imperfect substitute goods on the market. We denote q_{Ki} the quantity and p_{Ki} the price of good $K \in \{A, B\}$ sold by retailer $i \in \{1, 2\}$ (henceforth good Ki). The inverse demand for good Ki is assumed to be:

$$p_{Ki} = 1 - q_{Ki} - aq_{Li} - bq_{Kj} - cq_{Lj} \text{ with } i \neq j \text{ and } K \neq L. \quad (1)$$

Parameter $a \in [0, 1]$ measures the degree of substitutability between the products (interbrand competition): the brands A and B become closer substitutes when a increases. Similarly, $b \in [0, 1]$ is the degree of substitutability between the retailers

(intrabrand competition). Finally, parameter c measures the degree of substitutability between the two different brands sold by two different retailers. For simplicity, we assume $c = a.b$.[11] Note that when $a = 0$ the demands for the two brands are independent, and so are the demands at the two retailers' when $b = 0$. We denote by $D_{Ki}(p_{Ki}, p_{Kj}, p_{Li}, p_{Lj})$ the demand for good Ki when the four products are sold.

The timing is as follows:

• Stage 1: Producers simultaneously publish non discriminatory wholesale unit prices w_A and w_B.

• Stage 2: Producer K and retailer i ($K \in \{A, B\}$, $i \in \{1, 2\}$) negotiate backroom margins in the form of a unit rebate, i.e they negotiate over the effective wholesale unit price (henceforth "net transfer") t_{Ki}. The four bilateral negotiations are assumed to be secret and simultaneous. We describe the details of the bargaining stage and of the solution concept in section 3.3.

• Stage 3: Retailers simultaneously set prices p_{A1}, p_{A2}, p_{B1}, and p_{B2}.

3.2 Comments

Some comments are in order. With regard to stage 1, our main assumption is that of non discriminatory pricing. As we consider two symmetric retailers, *i.e.* similar firms offering the same service to producers, this assumption is conform with most competition law: Price discrimination is generally lawful if it reflects the different costs of dealing with different customers, but not if it applies to similar ones.[12] In particular,

[11] The underlying assumption is that a representative consumer has a quadratic utility function and a budget of 1: $U(q) = \sum_{K,i} q_{Ki} - \frac{1}{2}\sum_{K,i} q_{Ki}^2 - a\sum_{i} q_{Ai}q_{Bi} - b\sum_{K} q_{K1}q_{K2} - c\sum_{K} q_{K1}q_{L2}$. This fairly standard representation of consumers' preferences takes into account intra- as well as inter-brands competition (Dobson and Waterson, 1996). Assuming $c = a.b$ is sufficient for the utility to be concave; it boils down to assume that the substitutability between a product sold by one retailer and the other product sold by the other retailer is a combination between intrabrand and interbrand substitution. Choosing another value for c such that the utility function is concave would not qualitatively alter our results. Note that parameters a and b are not perfect proxies for the degree of inter- and intrabrand competition. Indeed, given a system of symmetric prices, the demand for each good decreases with both parameters. See Rey and Vergé (2004) for a discussion.

[12] More precisely, in the US, "a seller charging competing buyers different prices for the same commodity [...] may be violating the Robinson-Patman Act" as "this kind of price discrimination may hurt competition by giving favored customers an edge in the market that has nothing to do with superior efficiency" (FTC). Within the EU, price discrimination through which firms "apply dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a

our model fits well the French and Irish situations, where the general terms of sale of any product must be public and non-discriminatory, insofar as retailers offering the same service must be offered the same conditions by a producer. Here we simplify the general terms of sales to a unit price w_K that we assume to be non discriminatory.

Our model's main novelty is the renegotiation in stage 2. We assume that after the producers have published their general terms of sales (stage 1), each retailer can bargain with each supplier over secret backroom margins (stage 2). These renegotiations allow for discriminatory wholesale tariffs, and therefore may lead to opportunism problems (McAfee and Schwartz, 1994). This assumption is in contrast with the standard literature on vertical relationships between producers and retailers (*e.g.* Rey and Tirole, 1986). It is, however, in line with practice in many cases. First, in practice, firms do negotiate rebates. We use the term "backroom margins" to refer to the variety of forms such rebates can take, *i.e.* a complex set of price reductions and transfers, including slotting fees, new product introduction fees, pay-to-stay allowances, and retribution for retailers' sales efforts. Studies on French data suggest that such backroom margins can reach 60% of the unit price invoiced (Canivet, 2004). Second, these rebates are generally compatible with the legal prohibition of discriminatory pricing: Most of them are meant to compensate a retailer for a sales effort, which is difficult to verify. Given this opaqueness, there is widespread suspicion that rebates do not reflect actual services provided by the retailer. Therefore we assume that no service is provided. Third, many rebates are paid to a retailer after some delay, for instance at year end: We model the rebates as deferred reductions in the unit wholesale price and assume that they cannot be accounted for in the loss-leading price threshold.[13] That is, under the RBC law, a retailer must not set the price of good K below w_K, even though the actual unit price paid by retailer i is only t_{Ki}. Thus, the total margin of the retailer (the difference between the unit resale price and the unit price really paid to the producer) may be split up into "observable margin" (the difference between the resale price and the unit wholesale price invoiced) and "backroom margin" (the amount of the rebates paid by the producer to the retailer).

competitive disadvantage" may constitute an abuse of dominant position (Art. 81 of the EC Treaty). For a discussion on the welfare effects of banning price discrimination, see Caprice (2006).

[13] This assumption is crucial. We discuss its role in section 6.2 and show that the price-raising effect of the law would be suppressed were the retailers allowed to integrate negotiated rebates in the price threshold.

3.3 Bargaining assumptions and solution concept

In stage 2, simultaneous and secret bilateral negotiations by four producer-retailer pairs yield four transfers: $t_{A1,}$ $t_{A2,}$ $t_{B1,}$ and t_{B2}. Negotiations within each pair is modeled as a Nash bargaining in which the producer's bargaining power is $\alpha \in [0, 1]$.[14] Note that both producers have the same bargaining power α, and both retailers $1 - \alpha$. Default options correspond to the retailer not distributing the producer's brand. We assume that the outcome of the stage 2 negotiation between two firms is not observable by other firms.[15] However, before the beginning of stage 3, each retailer gathers the information from his two negotiations with the two suppliers. Besides, consumers are perfectly informed about the availability and prices of all the products.

We look for symmetric *Contract Equilibria* in pure strategies (Crémer and Riordan, 1987 ; O'Brien and Shaffer, 1992). In a Contract Equilibrium, each set of net transfers must be immune to profitable bilateral renegotiation by a producer-retailer pair, taking the other three net transfers as given, including those defined by a negotiation in which one of them is involved. In particular, this implies that the firms have passive beliefs, *i.e.* if say a producer received an unexpected offer from a retailer, this would not affect his beliefs about the outcome of the three other negotiations, including those in which he or the retailer in question are involved. Furthermore, this equilibrium concept focuses on pairwise deviations and does not consider multilateral deviations. One way to think about this solution concept is to imagine that each producer and each retailer sends a different agent to each negotiation and that the two agents of a given firm cannot communicate with each other while negotiating.[16]

We will analyze three cases. In section 4, we study two benchmark cases: we solve

[14] For simplicity, we model the negotiations as one stage, but formally the extensive form of each of the four negotiations is the bargaining game of Binmore, Rubinstein and Wolinsky (1986): the two negotiators of a pair alternate making offers to one another until they reach an agreement, and after an offer is rejected there is an infinitesimal probability of a breakdown in the negotiation. It is well known that as the probability of breakdown becomes arbitrarily small, a pair will immediately agree on the Nash bargaining solution. Stage 2 ends when the four negotiations have led to either an agreement or a breakdown. This use of the Nash bargaining game is fairly standard: see de Fontenay and Gans (2005) for another modeling of multilateral negotiations where each pair negotiates also in the manner specified by Binmore et al. (1986).

[15] We discuss the role of this assumption more precisely in section 6.3

[16] This assumption is known as "schizophrenia of the negotiator". Contract Equilibrium concept is a refinement of that of Perfect Bayesian Equilibrium that includes passive beliefs and "schizophrenia of the negotiator". Relaxing the assumption of schizophrenia allows for multilateral deviations which may threaten the existence of equilibria (Rey and Vergé, 2004(i) and (ii) and Segal, 1999).

the game assuming first no legal restriction on pricing, and second assuming that producers can impose resale-price maintenance (RPM) contracts to the retailers. Then in section 5 we consider the effect of a RBC law under which retailers have to set prices p_{K1} and p_{K2} for good K above the wholesale unit price w_K, and we compare this case to the two benchmarks. In sections 4 and 5, we analyze the role of the exogenous bargaining power parameter α. Next we develop in section 6 a comparative statics analysis in order to assess the effects of substitution parameters a and b on all equilibrium outcomes, before studying the two-part tariffs framework in section 7.

4 Benchmarks

4.1 *No restriction* on resale prices

We solve the model first assuming there is neither RBC law, nor any kind of contract or vertical restraint that may restrict the retailers' pricing decisions. We refer to this basic situation as the *no-restriction* case. The characterization of these equilibria is derived formally in appendix $A1$. As the results in both benchmark cases corroborate those obtained by Dobson and Waterson (2007) in a similar framework, we only present here the main intuitions.[17]

Lemma 1 *In any no-restriction equilibrium, net transfers are* $t^*_{Ki} = \frac{2\alpha(1-a)}{4-2a\alpha-b(2-\alpha)}$, *and retail prices are* $p_{Ki} = p^* = \frac{2(1-b)+\alpha(1-2a+b)}{4-2a\alpha-(2-\alpha)b}$.

First, notice that retail prices chosen in stage 3 do not depend on the wholesale prices w_K set in stage 1, but only on the net transfers decided in stage 2. Second, the wholesale prices w_K do not affect the negotiations over the net transfers t_{Ki}. Therefore the wholesale prices chosen in stage 1 are immaterial to the net transfers negotiated in stage 2 and ultimately to the retail prices chosen in stage 3. In that respect, these wholesale prices have no commitment value. A direct implication is that while equilibrium net transfers and retail prices are unique, they correspond to a continuum of wholesale prices. Among this continuum of equilibrium wholesale prices, some involve loss-leading from the retailers, according to the legal definition ($w_K \geq p^*$), and others do not ($w_K \leq p^*$). Here, the practice of loss-leading is neutral with respect to prices, profit sharing and consumers' surplus.

[17] For a more detailed analysis see Allain and Chambolle (2007).

A comparative statics analysis highlights the impact of the producers' bargaining power on the equilibrium outcome.

Proposition 2 *The no-restriction equilibrium net transfers t^*_{Ki} and retail prices p^* strictly increase in α.*

The retail price p_{Ki} set in stage 3 increases with the retailer's unit cost, *i.e.* with the net transfer t_{Ki}. Consider the stage 2 negotiation between producer K and retailer i over t_{Ki}, given the three other net transfers. Increasing t_{Ki} has two effects: it increases the producer's margin, *i.e.* his profit per unit of good Ki sold, but, as it also leads to an increase in the retail price p_{Ki}, it reduces demand for that good. In the neighborhood of the equilibrium, the direct effect on the producer's margin dominates, therefore an increase in the net transfer t_{Ki} raises the incremental profit made by producer K by selling his product to retailer i. Conversely, the incremental profit made by retailer i by dealing with K decreases in t_{Ki}. Yet the larger α, the more weight is applied in the negotiation to the producer's incremental profit, to the detriment of the retailer's. Therefore the equilibrium net transfer strictly increases in the producers' bargaining power α. In turn, the double margin effect implies that the final price p^* increases with retailers' unit costs, *i.e.* with the net transfers, and thus with the producers' bargaining power α.[18]

Notice that the producers' margin and profit go to zero when α goes to zero, but that the retailers' margin and profit remain strictly positive when α goes to 1. This asymmetry stems from the sequential timing of the game. Consider first $\alpha = 0$. The retailers have all the bargaining power, and they also enjoy the follower advantage. As a consequence, stage 2 negotiations lead to zero margins and no profit for the producers: the retailers get all the profit. There is no double margin: This is as if each retailer were vertically integrated with both producers and got both brands at zero cost. However, for α close to 1, the producers cannot extract the full surplus as after the stage 2 negotiations, the retailers can still set strictly positive margins in stage 3, and get strictly positive profit. For $\alpha \in (0, 1]$, both upstream and downstream firms set positive margins and the double margin inefficiency increases in α.

[18] Proposition 1 and all results in the "benchmark" cases hold in a more general setting, and in particular for a broad range of demand functions: a sufficient condition is that demand for good Ki and the net transfers are concave in the final price w_K, and that the derivative of the net transfer w.r.t the final price is positive and decreases in α. (see appendix A.1.4 for a discussion, and Dobson and Waterson 2007 for a closely related analysis).

4.2 RPM contracts

Assume now that the producers are able to use non discriminatory Resale Price Maintenance contracts (RPM), *i.e.* to impose retail prices. This amounts to assuming that retailers must set retail prices $p_{Ki} = w_K$ in stage 3. The characterization of these equilibria is derived formally in appendix $A2$.

Lemma 3 *Under RPM, there is a unique equilibrium: wholesale prices are* $w_K = \widetilde{w} = \frac{1-a^2\alpha-b+\alpha b}{2+a\alpha-a^2\alpha-2(1-\alpha)b}$, *the net transfers are* $t_{Ki} = \widetilde{t} = \frac{\alpha(1-a)(1-a^2\alpha-(1-\alpha)b)}{(\alpha((1-a)a+2b)+2(1-b))(1-b+\alpha(b-a))}$, *and retail prices are* $p_{Ki} = \widetilde{w}$.

As under *no-restriction*, the net transfers $\widetilde{t}$ increase with α because the producers' margin increases with their bargaining power. However profit sharing is different. When $\alpha = 0$, retailers negotiate maximum rebates so that producers have zero margin and zero profit, as in the *no-restriction case*. When α is strictly positive, however, retailers' share of total profits is less than in the *no-restriction* case. Not being free to choose retail prices in stage 3 reduces their *status-quo* profits in stage 2 negotiations. Besides, once the net transfer is determined, they no longer benefit from a follower advantage, and this further reduces their profits: For $\alpha = 1$, they get zero margin, and the producers get all the profit. Contrary to the *no-restriction* equilibrium, the wholesale prices and net transfers in the RPM equilibrium are uniquely defined: there is now a commitment in stage 1, as the wholesale price $\widetilde{w}$ defines the retail price.

Consider now the retail prices in the RPM equilibrium.

Proposition 4 *Under RPM, the equilibrium retail prices* $p_{Ki} = \widetilde{w}$ *decrease with the producers' bargaining power* α. *For* $\alpha = 0$, *equilibrium retail prices are the monopoly price* $p_{Ki} = 1/2$, *and for* $\alpha = 1$, *the equilibrium retail prices are the prices that would be chosen by vertically integrated producers, each selling two differentiated products :* $p_{Ki} = \frac{1-a}{2-a}$.

The intuition is as follows. Consider the case $\alpha = 1$. The producers have all the bargaining power, so that the net transfers negotiated in stage 2 are equal to the retail price. They behave as two vertically integrated producers, each selling two differentiated products $K1$ and $K2$. Retail prices thus account for the degree of competition between producers, but not for that between the retailers, which is internalized.[19] As α decreases, the retailers claim for a larger share of total profits.

[19] Note that each producer is able to maximize the profit of the vertically integrated structure he would form with his two retailers, but he cannot achieve the industrywide monopoly profit, as the

When producer K sets the retail price w_K in stage 1, he must consider two effects. On the one hand, given w_L, a marginal increase of the retail price w_K increases his margin t_{Ki} (Cf. (4)). On the other hand, this also reduces the total demand for product K. When α is smaller, retailers claim a higher margin at the expense of the producers', so that the positive effect of raising w_K on the producer's margin becomes relatively more important than the negative effect on demand. Producers thus raise retail prices.

Proposition 5 *RPM contracts internalize intra-brand competition irrespective of the firms' bargaining powers. RPM contracts also reduce interbrand competition, and this dampening effect increases in retailers' buyer power.*

Proof: Straightforward from proposition 2. ■

Under RPM, buyer power reduces competition between the producers, who increase their prices towards the collusive price in order to maximize the joint profits. The more buyer power the retailers have, the more they are able to reduce upstream competition. As a consequence, the total profit of the industry decreases with α. For $\alpha = 0$, the outcomes are those of a perfectly collusive industry: the RPM eliminates downstream competition, and buyer power eliminates upstream competition. In that case, producers make zero profits, and retailers extract all the profit.

We now compare the equilibrium retail prices and welfare under RPM to those in the *no-restriction* case.

Corollary 6 *When retailers enjoy a strong bargaining power, retail prices are higher and welfare lower under RPM contracts that in the no-restriction case. When the producers dominate the bargaining, retail prices are lower and welfare higher under RPM contracts that in the no-restriction case.*

Proof: see appendix A2 and A4. ■

When the producers' bargaining power is weak, the *no-restriction* retail price p^*_{Ki} is low because the retailers' bargaining power reduces double-marginalization, whereas the RPM price is high because the reduction of upstream competition is more stringent when buyer power is large. Final prices are thus higher under RPM than in the *no-restriction* case when retailer's bargaining power is strong ($\alpha < \alpha_I$). Finally, welfare is inversely related to final prices (see Appendix A5).

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upstream sector remains competitive: complete collusion prices, or prices chosen by an integrated monopoly owning both products as well as both outlets, would be $p_{Ki} = \frac{1}{2}$.

5 The effects of a RBC law

We turn back here to the framework of RBC laws. As they forbid the retailers to set retail prices below, but not above, the unit price w_K, they enable the producers to use price-floor contracts. In this setting w_K works out as an industrywide price-floor for producer K, as the RBC law imposes the constraint $p_{Ki} \geq w_K$ in stage 3 of the game, for $K \in \{A, B\}$ and $i \in \{1, 2\}$. We first determine in section 5.1 the equilibria of the game when producers may use price-floor contracts, before comparing them to those of the *no-restriction* case in section 5.2 and to the RPM case in section 5.3.

5.1 Price-floor equilibria

We show here that a price-floor implements RPM prices in equilibrium when the retailers enjoy a strong bargaining power, but leads to corner equilibria with higher retail prices when the producers' bargaining power is strong enough.

The price-floor implements the RPM equilibrium When the price-floor set in stage 1 is binding, it works out as a RPM: in stage 3, retailers set prices $p_{Ki} = w_K$, which are perfectly anticipated in stage 2. Therefore the RPM equilibrium is a natural candidate for the price-floor equilibrium. However, a price-floor can fail to be binding, and therefore to implement the RPM equilibrium: deviations may be profitable at each stage of the game. Potential deviations are (1) for a retailer to deviate in stage 3 by setting a retail price above the wholesale price, and (2), for a producer to deviate by setting a lower wholesale price in order to enable the retailers to undercut his rival.

Lemma 7 *The RBC law enables the producers to implement the RPM equilibrium for any α less than a threshold $\widetilde{\alpha} = \frac{1+a^2-2b^2-\sqrt{1+2a^2+a^4-8a^2b+4a^2b^2}}{2(2a^2-b-b^2)}$.*

Proof : see appendix A3.1. ■

Retailers do not deviate as long as the producers' bargaining power is not too high, but for higher values of α they set retail prices above the price floor if it equals the RPM price $\widetilde{w}$. The intuition is as follows. Assume that both producers have set the wholesale price $\widetilde{w}$ in stage 1. For a retailer, increasing a retail price involves a trade-off between margin and quantity sold. First consider the case $\alpha = 0$. Retailers have all the bargaining power, and they negotiate a net transfer $\widetilde{t}_{Ki} = 0$: Their margin is maximum. Furthermore the price-floor is very high: $\widetilde{w} = 1/2$ is at the monopoly level. Therefore, assuming that the transfers are fixed and that her competitor respects the

constrained retail prices, a retailer with no pricing constraint would choose to reduce her retail prices in order to increase her demand and profit: Without the law her best response price would be less than $\widetilde{w}$. The price-floor is thus binding. In contrast, when producers have most of the bargaining power ($\alpha \rightarrow 1$), retailers' margins go to zero, and the price $\widetilde{w}$ is lower. In that case, each retailer prefers to increase retail prices above $\widetilde{w}$, in order to increase her margin and profit, even at the expense of a reduction in demand. The price-floor set at the RPM level is no longer binding. We show in the appendix that there exist a threshold $\widetilde{\alpha}$ such that retail prices will indeed be constrained by a price-floor if and only if $\alpha \leq \widetilde{\alpha}$. Besides, we show that for any $\alpha \leq \widetilde{\alpha}$, there is no profitable deviation from setting $w = \widetilde{w}$ in stage 1 for a producer.

When $\alpha \geq \widetilde{\alpha}$, a price-floor set to $\widetilde{w}$ would no longer be binding, but retailers may still be constrained in stage 3 in two cases: either producers increase the price-floor in stage 1, or the negotiation of the net transfers in stage 2 leads to a corner solution such that retailers' unit costs are low enough for their retail prices to be constrained. We analyze these two scenarii in turn and show that both may happen in equilibrium.

The corner price-floor equilibrium As long as producers' bargaining power is not too high above $\widetilde{\alpha}$, producers may implement a first type of corner solution by increasing the wholesale prices w_A and w_B in stage 1 to the minimum level such that retailers remain constrained in stage 3. Negotiations in stage 2 lead to the net transfers defined by (4) and the stage-3 constraint is binding.

Lemma 8 *For* $\widetilde{\alpha} \leq \alpha \leq \overline{\alpha} = \frac{2-b}{3-b}$, *there exists a price-floor equilibrium where* $w_A = w_B = \overline{w} = \frac{1-a\alpha-b(1-\alpha)}{2-\alpha(1+a-b)-b}$ *and net transfers are defined by (4).*

Proof: see Appendix A3.2. ■

Note that $\overline{w}$ increases with producers' bargaining power: As α increases, the net transfers t_{Ki} increase, so that retailers' costs and best response prices increase and it becomes more difficult to constrain retailers' pricing decision. When the producers' bargaining power is slightly above $\widetilde{\alpha}$, increasing the unit price to $\overline{w}$ is sufficient for the producers to guarantee that retailers will be constrained in stage 3. However, when α further increases ($\alpha \geq \overline{\alpha}$), the price $\overline{w}$ becomes too high and each producer has unilateral incentives to deviate towards a lower wholesale price. Such a deviation leads to a corner solution in stage 2 negotiations such that retail prices are still constrained for both products, and the deviating producer benefits from an increased market share. This deviation becomes profitable for $\alpha \geq \overline{\alpha}$.

The corner transfer equilibrium For $\alpha \geq \overline{\alpha}$, there exists a price-floor equilibrium where the producers keep the wholesale price constant, equal to $\widehat{w} = \overline{w}(\overline{\alpha})$, and stage 2 negotiations lead to a corner solution such that retailers' unit costs are low enough for their retail prices to be constrained in stage 3.

Lemma 9 *For $\overline{\alpha} \leq \alpha \leq \widehat{\alpha} = \frac{4-2b}{4-b}$, there exists a price-floor equilibrium where $w_A = w_B = \widehat{w} = \frac{3-2a-2b+ab}{(2-a)(2-b)}$ and corner-solution transfers $\widehat{t} = \widehat{w}(2-b) - 1 + b$.*

Proof: see Appendix A3.3 ■

These equilibrium outcomes are independent of α. The parameter α nonetheless determines the interval $[\overline{\alpha}, \widehat{\alpha}]$ where the corner transfer defines an equilibrium. For smaller values of α, these strategies do not implement an equilibrium because in stage 2, each pair would be better off deviating towards a lower unit transfer. Conversely, for $\alpha \geq \widehat{\alpha}$, each pair deviates towards a higher unit transfer that releases the stage-3 constraint. Therefore no price-floor equilibrium exists for $\alpha \geq \widehat{\alpha}$.

All price-floor equilibria

Proposition 10 *Under the RBC law, a price-floor equilibrium exists if retailer's bargaining power is strong enough, i.e. for any $\alpha \leq \widehat{\alpha} = \frac{4-2b}{4-b}$.*

Proof: straightforward from lemmas 5 to 7. ■

The bold line in Figure 1 below represents the retail price in the price-floor equilibria $\begin{cases} \widetilde{w} & \text{if } \alpha \leq \widetilde{\alpha} \\ \overline{w} & \text{if } \widetilde{\alpha} < \alpha \leq \overline{\alpha} \\ \widehat{w} & \text{if } \overline{\alpha} < \alpha \leq \widehat{\alpha} \end{cases}$ for $\alpha \in [0,1]$ when $a = b = 0.5$.

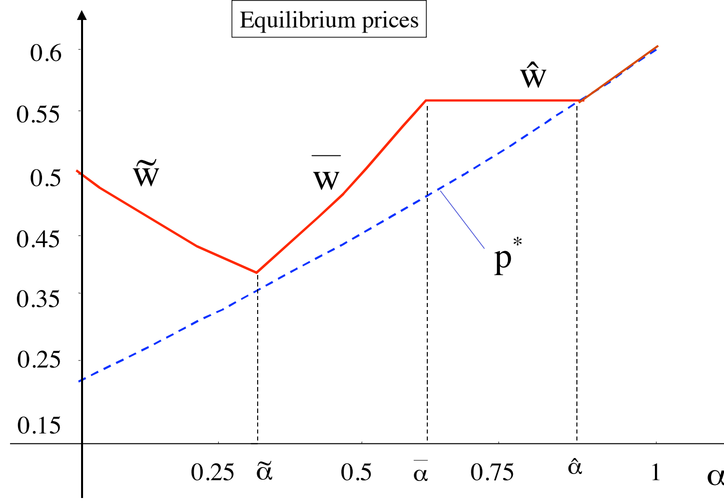


Figure 1

In the next two sections we compare the price-floor equilibrium outcomes to the equilibrium outcomes with *no restriction* and with *RPM* contracts.

5.2 Price-floor *vs no-restriction* equilibria

We study the equilibrium outcomes when the law implements price-floor equilibria, *i.e.* for $\alpha \leq \widehat{\alpha}$.

Proposition 11 *Under the RBC law, retail prices are strictly higher than in the no-restriction equilibrium for any $\alpha \leq \widehat{\alpha}$. A RBC law reduces welfare.*

Proof : See Appendix A4. ■

From Remark 1, the RPM price $\widetilde{w}$ is higher than the *no-restriction* retail price p^* for $\alpha \leq \alpha_I$ with $\widetilde{\alpha} < \alpha_I$ (see Appendix A.3.1). For $\alpha \leq \widetilde{\alpha}$ the RBC law thus leads to a price rise. Furthermore, $\overline{w}$ is also above the unconstrained price p^*. The intuition is simple. For a given retail price, the producers take higher margins when the retailers are constrained, because the retailers' status-quo profits are lower when they are constrained: This implies that, for the same retail price, the net transfer $\overline{t}$ is higher than t^*. Yet $\overline{w}$ is the price the retailers would choose without constraint and with a unit cost of $\overline{t} : \overline{w} = p^e(\overline{t})$, as p^* is the price they would choose without constraint and with a unit cost of $t^* : p^* = p^e(t^*)$. As the retailers' equilibrium prices

$p^e(t)$ increase with the unit cost t, $\overline{w} \geq p^*$. Note that for $\alpha = 0$, producers have no power, the net transfers paid by the retailers are zero in both the constrained and *no-restriction* case, therefore $\overline{w}$ would thus be equal to p^*. Finally, $\widehat{w}$ is constant and above p^* as long as $\alpha \leq \widehat{\alpha}$ since p^* increases in α and $p^* = \widehat{w}$ for $\alpha = \widehat{\alpha}$. This result confirms the pro-collusive effect of price maintenance highlighted by Rey and Vergé (2004).

Note that the retail price increase induced by the RBC law is maximum either in $\alpha = 0$ or in $\alpha = \overline{\alpha}$. When the law implements the RPM equilibrium, as $\widetilde{w}$ decreases in α while the *no-restriction* price increases in α, the price rise is maximum when retailers have all the bargaining power ($\alpha = 0$). When the law implements limit price-floor equilibria, $\widetilde{\alpha} \leq \alpha \leq \overline{\alpha}$, the price rise strictly increases in α, and there is another local maximum in $\overline{\alpha}$. When retail competition is low ($b \leq \overline{b}(a)$ where $\overline{b}$ decreases in a), especially if producers' competition is low too, the global maximum is in $\alpha = \overline{\alpha}$: the RBC law induces a stronger retail price increase than the RPM.

Proposition 12 *In the price-floor equilibria, intra-brand competition is internalized and interbrand competition reduced.*

We have shown in Proposition 4 that a RPM would internalize downstream competition and dampen upstream competition. Under *RBC* law this holds for $\alpha \leq \widetilde{\alpha}$. For $\alpha \geq \widetilde{\alpha}$, the corner solutions (either in price or in transfer) also saturate the retailers pricing constraint, thus suppressing retail competition. Besides, the corner price-floor strategy fosters some collusion between the producers. The mechanism is as follows: As each producer anticipates that his competitor will integrate the constraint that no retailer deviates in stage 3, it allows them to set higher wholesale price. The same pro-collusive mechanism holds for the limit transfer equilibrium.

Proposition 13 *The law shifts the sharing of profits in favor of producers. Producers are better off under the RBC law than in the no-restriction case, whereas retailers' profits are higher under the law only when their bargaining power is high (α low).*

First, the effect of the law on total industry profits is ambiguous and depends on the balance of power between producers and retailers. When $\alpha \leq \widetilde{\alpha}$, total industry profit is higher with a RPM equilibrium than in the *no-restriction* case, as $p^* \leq \widetilde{w} \leq \frac{1}{2}$ where $1/2$ is the monopoly price that maximizes industry profits. However, the price floor equilibria implemented by the law may reduce total industry profit. Indeed, in the corner price-floor equilibria, the equilibrium retail price may be too high ($\overline{w} > \frac{1}{2}$

if $\alpha > \frac{b}{1-a+b}$) and the total industry profit smaller than in the *no-restriction* situation. Second, when retailers' pricing strategies are constrained, producers manage to extract a greater share of joint profits because they reduce retailers' latitude by preventing them from setting their prices freely. With a price-floor, retailers loose here the follower advantage they had in the *no-restriction* situation. This positive effect on producers' share of total profit dominates the potential loss of total profit, and producers always benefit from a RBC law. In contrast, retailers may benefit from the law only if they have a very strong bargaining power: When α is less than α^d (where $\alpha^d < \widetilde{\alpha}$), retailers manage to extract some of the total surprofit generated by the price-floor strategy. In that case, all the firms are better off with the price-floor strategy. However, when the producers' bargaining power increases, they become able to keep the whole surprofit at the upstream level, and retailers' profits are lower than in the *no-restriction* case. Finally, producers' profit under RBC laws increase with their bargaining power α, except for $\alpha \in [\overline{\alpha}, \widehat{\alpha}]$, where it is constant.

5.3 Price-floor equilibria *vs* RPM equilibrium

We compare the price-floor equilibrium outcomes to the RPM equilibrium outcomes.

Proposition 14 *Retail prices are higher and welfare lower under RBC law than with RPM contracts.*

Proof : see Appendix A4 ■

First, when the price floor does not implement the RPM equilibrium ($\alpha \geq \widetilde{\alpha}$), retail prices are higher in the corner price-floor equilibria than in the RPM equilibrium: For $\alpha = \widetilde{\alpha}$, $\overline{w} = \widetilde{w}$, and $\overline{w}$ increases whereas $\widetilde{w}$ decreases in α ($\widehat{w}$ is constant). The gap between a price-floor and a RPM widens when producers have more bargaining power. Second, total welfare is inversely related to the retail prices. Therefore welfare is lower under the law than with RPM contracts.

Proposition 15 *Producers' share of total profit is weakly higher with a RPM than with a price-floor but producers may have a larger profit under RBC law than with a RPM.*

Proof : straightforward from Appendix A2 and A3. ■

The proposition may seem counterintuitive since a RPM is a stronger vertical restraint than a price-floor and therefore could appear as a more sophisticated tool

bringing higher profits. This is not the case however, and the reason is that the total industry profit may be higher with a price-floor than with a RPM. For $\alpha = \widetilde{\alpha}$, total industry profit is the same in the two cases. When α increases, on the one hand, producers' competition gradually drives the RPM price down and the total industry profit decreases with α. On the other hand, when $\alpha \in [\widetilde{\alpha}, \overline{\alpha}]$, the corner price-floor $\overline{w}$ increases with α and unless α becomes too high ($\alpha > \frac{b}{1-a+b}$), the total industry profit also increases with α. Thus for intermediary values of α total industry profit may clearly be higher with a price-floor than with a RPM restraint: when producers have a large bargaining power, upstream competition is more softened by a price-floor than by a RPM. Besides, the share of joint profit captured by producers is exactly the same in the RPM equilibrium than in the corner price-floor equilibrium. Indeed, retail prices differ, but the bargaining game leads for a given α to exactly the same sharing of profit between producers and retailers either with RPM or corner price-floor strategy. Finally, in the corner transfer equilibrium, producers have a strictly lower share of profits than with a RPM, as they reduce the transfers in order to maintain the stage-3 constraint binding.

Proposition 16 *The reduction of upstream competition is stronger with a price-floor than with a RPM. Although a RPM may sometimes be welfare-enhancing, a price floor is always welfare-damaging.*

Proof : straightforward from Propositions 14 and 15. ■

Dobson and Waterson (2007) show in a similar setting that a RPM may be either welfare-enhancing or welfare-decreasing according to the firms bargaining power. Here we show that, contrary to a RPM, a price-floor is always damaging for welfare. We have shown in section 4.2 that a RPM may enhance welfare, compared to the *no-restriction* case, when α is rather large: Yet in that case a price-floor no longer implements the RPM equilibrium, it leads to higher prices that hurt welfare. Under the law, welfare is maximum when the retail price is minimum, *i.e.* for $\alpha = \widetilde{\alpha}$. In contrast, the welfare loss is the largest when the retail price increase is maximum, either in $\alpha = 0$ or in $\alpha = \overline{\alpha}$. In this section we have shown that the pro-collusive, price-raising and welfare-damaging effects of a price-floor are worse than those of a RPM.

6 The effect of competition

A comparative statics analysis on the substitution parameters a and b highlights some interesting properties.

Remark 1 *In all equilibria, retail prices strictly decrease with* a *and* b *; The transfers increase in* b *and decrease in* a*.*

In all equilibria, retail prices decrease in a and b. Intuitively, upstream as well as downstream competition lowers prices. The role of a and b on the net transfers is more contrasted. The net transfers decrease in a, which reflects the substitution between the producers: When a goes to 1, the net transfers go to zero irrespective of α, as upstream competition drives producers' profits towards zero. Conversely, the transfers increase in b, the substitution between the retailers. The only exception is the corner transfer equilibrium, where $\widehat{t}$ is independent from b by construction.

Furthermore, producers' profits decrease in a and retailers' profits decrease in b. These properties highlight the role of a and b on the balance of power between producers and retailers. A strong interbrand competition strengthens the retailers' position *vis-à-vis* the suppliers, thus increasing their equilibrium profits and reducing the producers'. In contrast, a strong intrabrand competition weakens the retailers' position and leads to lower downstream and higher upstream profits. In particular, a firm's status-quo profit is higher when it faces a more differentiated competitor: In our model, buyer power stems from both the exogenous bargaining power parameter α and the variations of the status-quo profits with competition.

We now turn to the influence of a and b on the existence of price-floor equilibria.

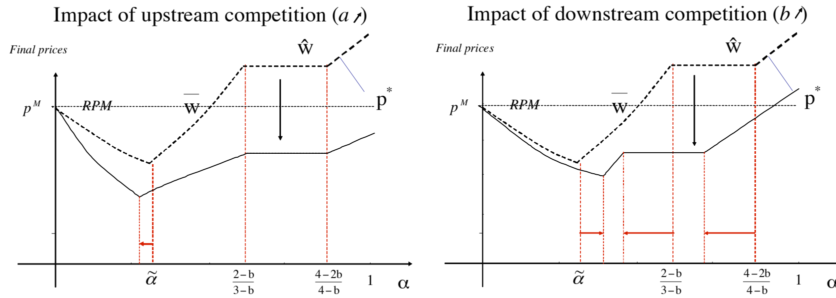
Remark 2 *The threshold* $\widehat{\alpha}$ *strictly decreases with* b*.*

The interval of bargaining power α for which price-floor equilibria exist shrinks when retail competition becomes tougher: If $b = 0$, there is always a price-floor equilibrium for $\alpha \leq 1$, whereas if $b = 1$, there is no price-floor equilibrium when $\alpha > \frac{1}{2}$. The intuition is simple. For $\alpha > \widehat{\alpha}$, price-floor equilibria no longer exist because producers prefer to deviate towards a *no-restriction* equilibrium. Yet the *no-restriction* equilibrium transfers, and therefore producers' profits, are higher when downstream competition is tougher, thus producers switch to the *no-restriction* equilibrium earlier (*i.e.* for lower α) when b is higher. Note that by construction, $\widehat{\alpha}$ is independent of a.

Consider now the influence of a and b on the nature of price-floor equilibria.

Remark 3 *The threshold $\widetilde{\alpha}$ decreases in a and increases in b.*

As downstream competition lowers the *no-restriction* best response price of a retailer $p^{BR}(w_A, w_B)$, but increases the RPM price, it is likely that if b increases the price-floor will implement the RPM equilibrium for higher α, therefore $\widetilde{\alpha}$ increases with b. When $b = 0$, the price-floor never implements the RPM equilibrium ($\widetilde{\alpha} = 0$)[20]. If $b > 0$, $\widetilde{\alpha}$ decreases with a : the *no-restriction* best response price of a retailer and the optimal RPM price-floor $\widetilde{w}$ decrease with a, but the latter is steeper than the former. In the price-floor equilibria, since downstream margins are zero, competition between producers on the price-floor is fiercer than in the *no-restriction* case, where retailers' positive margins absorb some of the variations of wholesale prices, thus dampening upstream competition (cf. Rey and Stiglitz, 1995). The following figure summarizes these comparative statics results.



7 Two-Part tariff

So far we have assumed that tariffs were linear, and that negotiations determined unit net transfers. We extend here our analysis with two-part tariff contracts.[21] We assume that stages 1 and 3 of the game are unchanged, but that the stage 2 negotiations now define, for each pair of producer K and retailer i, a unit wholesale price t_{Ki} and a fixed fee F_{Ki}, both positive: The total transfer retailer i pays producer K for the quantity q_{Ki} is now $t_{Ki}q_{Ki} + F_{Ki}$. Although it is almost impossible to exhibit equilibria in an interlocking vertical relationships framework if producers offer public

[20] Note that if $b = 0$ and a goes to 1, as in the *no-restriction* case, the price-floor goes to $\frac{1}{2}$ and retailers get all the monopoly profit for all α. By contrast, in that case, a RPM would go to zero when α goes to 1, and all firms would get zero profits. This example highlights fundamental differences between the price-floor mechanism and the RPM.

[21] A few recent econometric studies test for the prevalence of non-linear or linear pricing, see for instance Bonnet *et al.* (2004) and Villas-Boas (2004).

two-part tariff contracts to retailers (Rey and Vergé, 2004), our secret contracting environment allows us to exhibit a unique equilibrium in the no restriction case. Section 8.2 presents a discussion about the role of the secret contract assumptions.

Proposition 17 *In the no-restriction case, when producers and retailers bargain over secret two-part tariff contracts, the equilibrium wholesale tariff is the marginal cost of production and the equilibrium retail price corresponds to downstream competition among two vertically integrated multi-product retailers.*

Proof. The proof is derived for a broad class of demand functions in Appendix $A5.1$. In our linear demand setting, $t_{Ki}^{TP} = 0$, $F_{Ki}^{TP} = ((a(1-a)(1-b))/((1+a)(1+b)(2-b))))$ and $p_{Ki}^{TP} = ((1-b)/(2-b))$. ■

Two-part tariffs suppress double margin: the unit wholesale price is zero, so that each retailer, facing zero marginal cost, behaves as a vertically integrated retailer selling the two differentiated products. Retail prices are then independent of α, and are equal to the equilibrium retail price for $\alpha = 0$ with linear tariffs. Without restraint, retail prices are thus lower with two-part tariffs than with linear unit prices. Two-part tariffs internalize interbrand competition, but retail prices still account for intrabrand competition (p_{Ki}^{TP} only depends on b): the full monopoly profit is not achieved, as final prices are lower than the full collusion price (1/2). Note that two-part tariffs reduce total profits, unless competition is low at both levels and producers have a high bargaining power: the reduction of retail prices induced by these tariffs most often drives prices further away from the joint-profit maximizing price 1/2.[22]

Consider now that the producers can either use RPM contracts or that the law allows them to impose a price-floor.

Proposition 18 *With two-part tariffs, with a RPM or a price-floor, there exists a continuum of equilibria where retail prices are* $w^{\circ}(t) = \frac{1}{2}(1 - t\frac{b+\alpha(a-b)}{\alpha(1-a)})$, *with* $0 \leq t \leq t_{RPM} = \frac{\alpha(1-a)}{b+\alpha(2-a-b)}$ *for RPM contracts,* $0 \leq t \leq t_{PF} = \frac{\alpha b(1-a)}{b(2-b)+\alpha(2-b(2+a-b))}$ *for price-floors, and* $t_{PF} \leq t_{RPM}$.

Proof. See Appendix $A5.2$ and $A5.3$. ■

In both cases, there exists a continuum of equilibria. For any α, there exists an equilibrium where $t = 0$ and the firms achieve the monopoly price $p^M = 1/2$: in that case, competition is neutralized at both level. Given α, among the continuum of

[22] Except for α very close to 1 (see Appendix A.5.1).

equilibria, the retail price $w^{\circ}(t)$ decreases in the unit wholesale price t, and so does the joint profit. Figure 2 represents the equilibrium price in the no restriction case and the range of existing equilibria with RPM and price-floors for $a = b = 0.5$.

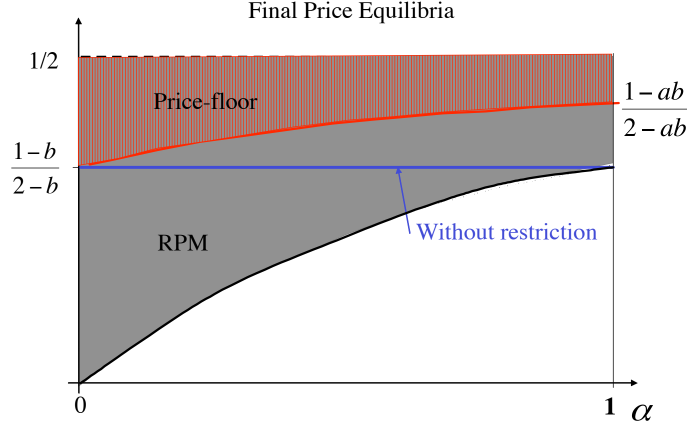


Figure 2

The range of equilibria sustainable with RPM includes the equilibria sustainable with price-floors. In both cases, the set of equilibrium retail prices shrinks when producers' bargaining power increases. Consider the RPM case. If the retailers have all bargaining power ($\alpha \to 0$), all prices from 0 to the monopoly price are sustainable in equilibrium, but when α goes to 1, producers do not impose a RPM price lower than $\frac{1-a}{2-a}$, the price that would be chosen by vertically integrated producers. Similarly, with price-floors, the lowest equilibrium price-floor for $\alpha = 0$ is $w^{\circ}_{PF}(\alpha = 0) = \frac{1-b}{2-b}$, the same than with two-part tariffs and no restriction; for $\alpha = 1$, it is higher: $w^{\circ}_{PF}(\alpha = 1) = \frac{1-ab}{2-ab}$. With RPM, the set of equilibrium prices is the interval $[w(t_{RPM}), 1/2]$. Yet price-floors do not implement all RPM equilibria, as the lowest prices are not binding and retailers deviate in stage 3: Therefore with price-floors, given α, the set of equilibrium prices is the interval $[w(t_{PF}), 1/2]$ where $t_{PF} \leq t_{RPM}$, $w(t_{RPM}) \leq w(t_{PF})$ and RPM allows for equilibria with lower prices than price-floors.

Consider now the welfare effects of the price-floors mechanism.

Proposition 19 *With two-part tariffs, all price-floors equilibria are welfare damaging.*

Proof : In any price-floor equilibrium, retail prices are higher than in the *no-restriction* equilibrium ($w_{PF} \geq \frac{1-b}{2-b}$). ■

The price-raising effect of price-floors allowed by RBC laws is thus robust to the introduction of two-part tariffs. Note that under the law, with two-part tariffs, the highest welfare is attained for $\alpha = 0$ where the minimum retail price is attained. This contrasts with the linear tariff case where the welfare was minimum for $\alpha = 0$.

Besides, as with linear tariffs, producers are better off with price-floors, which relax completely downstream competition and partially upstream competition.[23] As a consequence, joint profits are also higher with price-floors. Note that producers' profit is always higher with a price floor than without restriction.

All RPM or price-floor equilibria are not equivalent in terms of profit sharing: Producer K's profit increases with t_K, whereas retailers' decreases with t_K. The reason is that the variable part of the two-part tariff influences the status-quo profits: in particular, if t_{Kj} is zero, in case of a breach in negotiation between K and i, producer K does not benefit from the increase of demand for product Kj, but the retailer does benefit from the increase of demand for product Li: this tends to reduce the producer's status-quo profit. This effect is reduced by an increase of t_K, so that even if joint profit decreases with t_K, producers' profit increase. A direct consequence is that given a, b and α, the Pareto criterion would select, among the continuum of existing equilibria, the equilibrium which gives the highest profit to the producers, *i.e.* the maximum variable part $t = t_{PF}$ and the minimum retail price $w(t_{PF})$. This allows us to highlight a major difference on the welfare consequences of the use of a RPM and a price-floor restraint:

Corollary 20 *Under the Pareto selection criterion, RPM is welfare enhancing while a price-floor is welfare damaging.*

Rey and Vergé (2004) show that a RPM may sustain the collusive outcomes in an interlocking relationship with two-part tariffs.[24] We confirm that a price-floor, as well as a RPM, may foster collusion on the upstream as well as downstream markets. Besides, we go further in the differentiation of these two vertical restraints by showing that price-floors are always welfare-damaging, whereas RPM may be either positive or negative for welfare.

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[23]However, under RBC laws, producers are better off with linear transfers than with two-part tariffs.

[24]Their framework does not however allow welfare comparison, as equilibria may not exist in the no-restriction case.

8 Robustness and extensions

8.1 Individual price-floors

Both the assumptions that unit prices set in stage 1 are non discriminatory and that net transfers negotiated in stage 2 cannot enter in the legal definition of the price-floors imply that producers impose industrywide price-floors. Here, we relax this assumption and discuss the issue of possible discriminatory or individual price-floors.

Assume that in stage 2, producers and retailers are allowed to bargain over two unit transfers, one included in the definition of the price-floor and the other not. Price-floors are now negotiated by each pair. Let $t_{Ki}- f_{Ki}$ denote the total unit net transfer that results from the bargaining between producer K and retailer i, where t_{Ki} is now the legal price-floor but not $t_{Ki} - f_{Ki}$. Under the law, in stage 3, retailers have to set prices above t_{Ki}. We show that, in equilibrium, the legal constraint is never binding: Since the price-floor is now individual instead of industrywide, each pair has a unilateral incentive to set a lower price-floor than the other pairs. Finally, the optimal price-floor is always too low and retailers always set higher prices.

Proposition 21 *There is no price-floor equilibrium when producers and retailers bargain over the price-floor level.*

Proof: see appendix $A6.1$. ■

This result suggests a reform that would reduce the anticompetitive effect of RBC laws. Without renouncing to the very principle of the law, changing the definition of the price threshold would be sufficient to eliminate the price-floor mechanism, and thus most of the price effect of the law. The example of Spain gives a good illustration. The Spanish RBC law is very similar to the French law since the deferred rebates cannot be included in the threshold of cost. However, the law does not require the general terms of sales to be published by the producers. Thus producers and retailers can bargain over the unit price as well as the deferred rebates. Inflationary effects have proved to be rather limited.[25]

8.2 Secret vs. Public Contracts

Irrespective of the structure at the upstream level, secret contracts have different effects with linear or two-part tariffs. We analyse here a framework where producers

[25] See Canivet, p68.

offer take-it or leave-it contracts to retailers. The insight would be the same in a bargaining setting.

With linear tariff contracts, the difference between public and secret contract equilibria boils down to the comparison between equilibria with and without ex-post observability of contracts (or, in the case of negotiations, observability of the outcome of stage 2 before the beginning of stage 3). With linear tariffs, the producers cannot capture the whole industry profit. However they capture an even lower share of joint profits if contracts are observable ex-post. To discuss this assumption of no ex-post observability (EPO), consider the simple case of an upstream monopoly ($a = 0$). After stage 2, the issue of the contracting stage are made public, so that each retailer knows which products are sold by her competitors and at which cost. This involves a reduction of the producer's status-quo profit in case she rejects his offer: the other retailer is aware of being a monopoly in stage 3, and increases her price, which reduces demand and the producer's status-quo profit. Everything happens as if ex-post observability of the contracting outcomes increased retailers' buyer power. Therefore, with no restriction, EPO leads to lower equilibrium net transfers and retail prices. In contrast, the price-floor is higher with EPO: As the issue of contracting stage is less favorable to the producer, his margin is lower and he thus has an incentive to increase the retail price. Furthermore, the price-floor strategy is chosen by the producer for a wider interval of α than without EPO. The price-raising effect of the price-floor mechanism is thus even worse with EPO (see Appendix A6-2 for the proofs).

With two-part tariff contracts, the producer is able to capture the whole industry profit, but as shown by Hart and Tirole (1990), secret contracts raise a commitment problem which prevent the upstream monopoly to get the monopoly profit. As long as the fixed fee is not optional (which means it is paid before the retailer orders to the upstream firm, cf. Fontenay and Gans, 2005), there is only one contract that can be accepted by the retailers and this contract is such that the wholesale price is equal to the marginal cost of production and the fixed fee equivalent to the downstream competition equilibrium profit. This is indeed the only contract that cannot be profitably and bilaterally renegotiated between the producer and the rival retailer. Here, secrecy of contracts may thus have two effects : (1) an effect through the commitment problem and (2) an effect through the non ex-post observability of contracts.

With upstream competition, the comparison between public and secret contracts

is still missing in the literature. Rey and Vergé (2004), in the case of interlocking relationships where upstream firms offer public take-it or leave-it two-part tariff contracts to retailers, show that in most cases there is no equilibrium. Indeed, there exists often a multilateral deviation by a manufacturer leading to a partial or a total exclusion of her rival. In this paper, we use the simplifying framework of contract equilibria (with secret two-part tariffs) which exclude multilateral renegotiations. This framework enables us to exhibit an equilibrium in both cases, with and without a restriction on prices, and thus to generalize the results we obtain with linear tariff to the two-part tariff case.

9 Conclusion

This article highlights the impact of a price-floor restraint in a vertical structure with imperfect upstream and downstream competition and negotiation over secret contracts in the intermediate market.

The main result is that price-floors suppress downstream competition but also dampen producers' competition. Moreover, as a price-floor reduces retailers' latitude, it pares buyer power and enables producers to get a larger share of joint profits. Producers thus always benefit from price-floors and, when their buyer power is high enough, retailers may also benefit from a price-floor. Furthermore, the comparison of price-floor and RPM shows that if both restraints have similar anticompetitive effects, a price-floor may be more profitable for producers, leads to higher retail prices and is worse for total welfare than a RPM. These results hold with linear as well as two-part tariff contracts.

In the linear tariffs case, this article also puts forward that retailers' buyer power is a key factor to enforce a price-floor mechanism. Since retailers keep the freedom to set their price above the price-floor, a price-floor may not always work out. If producers have most of the bargaining power, a RPM still works out while a price-floor is useless.

Finally, our results contribute to the debate on the price effects of RBC laws. The model shows how, paradoxically, RBC laws combined to anti-discrimination rule provide roundabout means for producers to impose industrywide price-floors, a vertical restraint that is banned *per se* in the EU competition laws. We thus provide a theoretical explanation for some price-raising effects of RBC laws where no predatory pricing is involved, and which is independent from loss-leading practices. Moreover, we prove that this price effect relies only on the definition of the threshold of cost

adopted in RBC laws. This article shows how integrating backroom margins in the threshold definition would be sufficient to prevent most of the inflationary effects of the law. This result has been the basis of the RBC law reform adopted in 2006 in France (see Canivet, 2004).

This article also brings some new elements to the debate on the ban on RPM practices in the US. Indeed, both RPM and price-floor were banned *per se* in the US until the recent Supreme Court Leegin decision[26] which went back on the jurisprudence and replaced the *per se* ban with a rule of reason.[27] The large economic literature about the pros- and cons- of resale price maintenance (RPM) does not conclude clearly about the dominant effect. Many papers, including ours, support the view that RPM may on occasion have a beneficial impact on competition and welfare. However, we show that a clear distinction should be made between price-floors and *RPM* : if the latter may sometimes have pro-competitive effects, a price-floor appears more damaging to welfare, even in a framework with upstream and downstream imperfect competition.

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A Appendix[28]

A.1 No restriction on resale prices

We solve the game by backward induction. We look only for symmetric equilibria where the four goods are sold.

[28] A more detailed version of the proofs is available in Allain and Chambolle (2007), Anticompetitive Effects of Resale Below Cost Laws, CREST Working Paper.

A.1.1 Stage 3

Consider the stage-3 subgame, where net transfers t_{Ki}, $K \in \{A, B\}$, $i \in \{1, 2\}$, and both wholesale prices w_A and w_B are fixed. Retailer i knows the public values of the wholesale prices w_A and w_B set by producers in stage 1 and the issue of stage 2, that is the true values of the unit transfers t_{Ai} and t_{Bi} if her negotiations with both suppliers have succeeded. However, she ignores the issue of the negotiations of her competitor j with both suppliers. Let us denote p^a_{Kj} the value of the retail price for product Kj anticipated by retailer i in stage 2, and t^a_{Kj} her anticipation of the transfer agreed between her competitor j and supplier K.

In stage 3, retailer i maximizes her concave profit:

$$\underset{p_{Ai},p_{Bi}}{Max}\,\Pi_i = (p_{Ai} - t_{Ai})D_{Ai}(p_{Ai}, p^a_{Aj}, p_{Bi}, p^a_{Bj}) + (p_{Bi} - t_{Bi})D_{Bi}(p_{Ai}, p^a_{Aj}, p_{Bi}, p^a_{Bj})$$

The sufficient first-order conditions determine the best responses of the retailers: $p^{BR}_{Ki}(t_{Ki}, t_{Li}, p^a_{Kj}, p^a_{Lj}) = \frac{1+t_{Ki}-b(1-p^a_{Kj})}{2}$, for $\{K, L\} = \{A, B\}, \{i, j\} = \{1, 2\}$.[29] The intersection of the best responses, denoted $p^e_{Ki}(t_{Ki}, t_{Kj}, t_{Li}, t_{Lj})$, gives the subgame equilibrium. It increases in t_{Ki} and t_{Kj} and is independent from t_{Li} and t_{Lj}.

A.1.2 Stage 2

The stage 2 of the game is the Nash-bargaining over the net transfers. The Nash program of the negotiation between producer K and retailer i is as follows:

$$\underset{t_{Ki}}{Max}(\Pi_K - \Pi^3_K)^\alpha(\Pi_i - \Pi^3_i)^{1-\alpha}$$

where Π_K (resp. Π_i) is the profit of producer K (resp. retailer i) and Π^3_K (resp. Π^3_i) is the status-quo profit earned by producer K (resp. retailer i) if the negotiation breaks, *i.e.* if producer K only deals with retailer j (resp. retailer i only deals with producer L), all other negotiations being successful. As they have passive beliefs, producer K and retailer i keep constant anticipations over the other pairs' negotiations outcome while negotiating in stage 2. In equilibrium, these anticipations will be the equilibrium

[29]Note that p^{BR}_{Ki} depends only on the anticipated final price of the same brand sold by the other retailer, p^a_{Kj} : all the effect of interbrand competition is absorbed by the price p^{BR}_{Li}, set simultaneously by retailer i. This stems from the linearity of demand and the assumption $c = a.b$.

outcomes. More precisely, we have:

$$\begin{aligned}
\Pi_K &= t_{Ki}D_{Ki}(p_{Ki}^{BR}(T^a), p_{Kj}^a, p_{Li}^{BR}(T^a), p_{Lj}^a) + \\
&\quad t_{Kj}D_{Kj}(p_{Kj}^a, p_{Ki}^{BR}(T^a), p_{Lj}^a, p_{Li}^{BR}(T^a)) \\
\Pi_i &= (p_{Ki} - t_{Ki})D_{Ki}(p_{Ki}^{BR}(T^a), p_{Kj}^a, p_{Li}^{BR}(T^a), p_{Lj}^a) + \\
&\quad (p_{Li} - t_{Li})D_{Li}(p_{Li}^{BR}(T^a), p_{Lj}^a, p_{Ki}^{BR}(T^a), p_{Kj}^a)
\end{aligned}$$

where $T^a = (t_{Ki}, t_{Li}, p_{Kj}^a, p_{Lj}^a)$.

To define the status-quo profits, assume that negotiation between producer A and retailer 1 breaks. As the outcome of the negotiations is not observable ex-post, *i.e* between stages 2 and 3, firms B and 2 ignore this failure and behave according to their anticipations. Therefore while negotiating, firms 1 and A anticipate that the negotiation between producer B and retailer 2 is not affected and will lead to the equilibrium value t_{B2}^*. Furthermore, the "schizophrenia of the negotiator" assumption implies that firms 1 and A anticipate that their own negotiations with their other partners will not be affected and will lead to the equilibrium transfers t_{A2}^* and t_{B1}^*, and that, as retailer 2 will have no information about the failure in negotiation, he will set the equilibrium prices $p_{A2}^a = p_{A2}^*$ and $p_{B2}^a = p_{B2}^*$ in stage 3. However, firms 1 and A also anticipate that, at the beginning of stage 3, retailer 1 will be aware of the absence of product A on her shelves, and that she will thus set the optimal price p_{B1}^3 anticipating the real final demand when good $A1$ is not distributed[30], denoted D^3:

$$\begin{aligned}
D_{B1}^3(p_{A2}, p_{B1}, p_{B2}) &= \tfrac{1-b-p_{B1}+bp_{B2}}{1-b^2} \\
D_{A2}^3(p_{A2}, p_{B1}, p_{B2}) &= \tfrac{1-a-p_{A2}+ap_{B2}}{1-a^2}
\end{aligned}$$

The optimal price for good $B1$, set by retailer 1 in stage 3, would thus be $p_{B1}^3 = \frac{1-b(1-p_{B2}^a)+t_{B1}^a}{2}$. Note that $p_{Ki}^3 = p_{B1}^{BR}$: given the prices chosen by retailer j, the optimal price for product Ki is the same whether i sells L or not. This property holds for any linear demand function with symmetric cross-price derivatives.[31] A change in

[30] In case of a failure in the bargaining between A and 1, the consumers are aware that only three goods are available on the market to purchase, and therefore the demand for $A1$ is divided between the three other goods. We determine the inverse demand for the three other goods by setting $q_{A1} = 0$ and invert them in order to derive the demands in that case.

[31] This property also holds for general demand functions if cross-price derivatives are symmetric and $\varepsilon_{AA}^3 = \varepsilon_{AA} + \varepsilon_{AB}$ where ε_{AA}^3 is the direct-price elasticity of the demand for product A when only A is sold, and ε_{AA} and ε_{AB} respectively the direct-price and cross-price elasticities of the demand when both products are sold.

the demand function could raise a difference between p^3_{B1} and p^{BR}_{B1} but this would not change qualitatively our results. The status-quo profits anticipated by the negotiating firms are finally:

$$\begin{aligned}\Pi^3_A &= t^a_{A2} D^3_{A2}(p^3_{B1}, p^a_{A2}, p^a_{B2}) \\ \Pi^3_1 &= (p^3_{B1} - t^a_{B1}) D^3_{B1}(p^3_{B1}, p^a_{A2}, p^a_{B2})\end{aligned}$$

The subgame equilibrium outcome of the negotiations is given by the resolution of the four Nash programs under the condition that the anticipated retail prices are the stage 3 subgame equilibrium prices $p^a_{Ki} = p^e_{Ki}(t_{Ki}, t_{Li}, t_{Kj}, t_{Lj})$. There exists a unique symmetric solution, irrespective of the wholesale prices:

$$t_{Ki} = t^* = \tfrac{2\alpha(1-a)}{4-2a\alpha-b(2-\alpha)} \tag{2}$$

A.1.3 Stage 1

There exists a continuum of equilibria : In stage 1, any pair of wholesale prices (w_K, w_L) may be chosen in equilibrium as long as the rebates negotiated in stage 2 lead to the net transfers t^*. These transfers increase in α and in b, and decrease in a.

Symmetric equilibrium retail prices are then (for the four goods):

$$p^* = \tfrac{2(1-b)+\alpha(1-2a+b)}{4-2a\alpha-(2-\alpha)b}$$

This retail price increase in α and decrease in a and b.

A.1.4 Discussion: robustness of the result to changes in the demand function

The coexistence of four different products, resulting from intra- and inter-brands differentiation, makes the solving in the general case tedious (see for instance a discussion in Shaffer, 1991, with only two products). However, we claim that proposition 2 would hold under fairly standard assumptions. We provide some intuitions.

First, each retail price p^{BR}_{Ki} increases with the four net transfers t_{Kj} under fairly standard assumptions : by totally differentiating the stage-3 retailers' first-order conditions, one can determine $\frac{\partial p^{BR}_{Ki}}{\partial t_{Ki}}$ and $\frac{\partial p^{BR}_{Ki}}{\partial t_{Li}}$. For instance

$$\frac{\partial p^{BR}_{A1}}{\partial t_{A1}} = \frac{\frac{\partial^2 \Pi_1}{\partial p^2_{B1}} \frac{\partial D_{A1}}{\partial p_{A1}} - \frac{\partial^2 \Pi_1}{\partial p_{A1} \partial p_{B1}} \frac{\partial D_{A1}}{\partial p_{B1}}}{\frac{\partial^2 \Pi_1}{\partial p^2_{A1}} \frac{\partial^2 \Pi_1}{\partial p^2_{B1}} - (\frac{\partial^2 \Pi_1}{\partial p_{A1} \partial p_{B1}})^2} \tag{3}$$

where the denominator of (3) is positive if the retailer's profit function is concave. Assuming the positivity of the numerator is then sufficient to ensure that the final price p^{BR}_{A1} increases in t_{A1}.

Each net transfer is also increasing with the producer's bargaining power α for a broad range of demand functions. The negotiation between K and i leads to the net transfers maximizing the following Nash condition:

$$\underset{t_{Ki}}{Max}(\Pi_K - \Pi^3_K)^{\alpha}(\Pi_i - \Pi^3_i)^{1-\alpha}$$

Assuming the concavity of the Nash condition, the sufficient first-order condition is as follows:

$$CPO(t_{Ki}) = \alpha \frac{\partial(\Pi_K - \Pi^3_K)}{\partial t_{Ki}}(\Pi_i - \Pi^3_i) + (1-\alpha)(\Pi_K - \Pi^3_K)\frac{\partial(\Pi_i - \Pi^3_i)}{\partial t_{Ki}} = 0$$

where $\frac{\partial CPO}{\partial t_{Ki}} \leq 0$ by concavity. We have:

$$\frac{\partial t_{Ki}}{\partial \alpha} = -\frac{\frac{\partial CPO}{\partial \alpha}}{\frac{\partial CPO}{\partial t_{Ki}}}$$

A sufficient condition for each net transfer to increase with the producer's bargaining power α is that given the three other net transfers, in the neighborhood of the equilibrium net transfer, the additional profit gained by a producer if his negotiation with a retailer succeeds (e.g. $\Pi_K - \Pi^3_K$) increases in the net transfer t_{Ki}, whereas the additional profit for the retailer decreases in this net transfer. In that case, $\frac{\partial CPO}{\partial \alpha} = \frac{\partial(\Pi_K - \Pi^3_K)}{\partial t_{Ki}}(\Pi_i - \Pi^3_i) - (\Pi_K - \Pi^3_K)\frac{\partial(\Pi_i - \Pi^3_i)}{\partial t_{Ki}} \geq 0$, thus $\frac{\partial t_{Ki}}{\partial \alpha} > 0$.

Finally, as retail prices increase in the net transfers, and as long as direct effects dominate indirect effects, Proposition 2 will hold with a broad range of standard demand functions.

A.2 The RPM equilibrium

If producers impose RPM contracts, the retailers have to set prices $p_{Ki} = w_K$ in stage 3. In stage 2, the status-quo profits are slightly different. Consider the negotiation between A and 1. In case of a failure, the two negotiators anticipate now that the price of product $B1$ set in stage 3 will be constrained by the RPM: $p_{B1} = w_B$. The status-quo profits are thus:

$$\Pi_A^3 = \frac{t_{A2}(1-a-w_A+aw_B)}{(1-a^2)}$$
$$\Pi_1^3 = \frac{(1-w_B)(w_B-t_{B1})}{(1+b)}$$

The resolution of the four Nash conditions gives the following optimal net transfers[32]:

$$\widetilde{t}_{Ki}(w_K, w_L) = \alpha \frac{(1-a^2\alpha-(1-\alpha)b)w_K - a(1-\alpha)(1-b)w_L}{(1-(1-\alpha)b)^2-a^2\alpha^2} \quad (4)$$

Note that, given w_L, $\frac{\partial \widetilde{t}_{Ki}}{\partial w_K} \geq 0$: producer $K's$ margin now increases in w_K.

In stage 1, producer K sets the wholesale price that maximizes his profit:

$$\underset{w_K}{Max}\ \widetilde{t}_{Ki}(w_K, w_L).(D_{K1}(w_K, w_L) + D_{K2}(w_K, w_L))$$

The optimal wholesale prices are then:

$$w_K = \widetilde{w} = \frac{1-a^2\alpha-b+\alpha b}{2+a\alpha-a^2\alpha-2(1-\alpha)b}$$

The net transfers negotiated in stage 2 are:

$$\widetilde{t}_{Ki} = \widetilde{t} = \frac{\alpha(1-a)(1-a^2\alpha-(1-\alpha)b)}{(\alpha((1-a)a+2b)+2(1-b))(1-b+\alpha(b-a))}$$

The producers' profits are:

$$\widetilde{\Pi}_K = \frac{2\alpha(1-a)(1+a\alpha-(1-\alpha)b)(1-a^2\alpha-(1-\alpha)b)}{(1+a)(1+b)\left[2+a\alpha(1-a)-2(1-\alpha)b\right]^2(1-b+\alpha(b-a))}$$

The comparison of the retail prices $\widetilde{w}$ to the equilibrium prices in the unconstrained case p^* is straightforward: $\widetilde{w} \geq p^* \Leftrightarrow \alpha \leq \alpha_I$ where

$$\alpha_I = \frac{2(1+a^2)-b-3b^2-\sqrt{4a^2+8a(1-b)^2b+(2-b+b^2)^2+4a^2(2-7b+3b^2)}}{6a^2-2a(1-b)-2b(2+b)}.$$

A.3 Price-floor equilibria

A.3.1 The price-floor implements the RPM equilibrium

We determine the conditions under which the price floor is a sufficient tool to implement the RPM equilibrium outcomes, by checking that no deviation occurs.

[32]Defined by continuity, for $\alpha = 1$ and $a = 1$: $t_{Ki}(w_K, w_L) = w_K$; and for $\alpha = 0$ and $b = 1$, $t_{Ki}(w_K, w_L) = 0$.

No deviation by a retailer in stage 3 Assume that the producers have set the price-floor $\widetilde{w}$ in stage 1, and that the stage 2 negotiations have determined the RPM equilibrium transfers $\widetilde{t}$. In stage 3, if retailer i anticipates that her rival sets price $p_{Kj} = \widetilde{w}$, she can still set a price p_{Ki} above the price-floor $\widetilde{w}$. Appendix A1 gives the best response prices of retailer i : $p_{Ki}^{BR}(\widetilde{t}, \widetilde{w}) = \frac{1+\widetilde{t}-b(1-\widetilde{w})}{2}$. No deviation occurs in stage 3 if $p_{Ki}^{BR}(\widetilde{t}, \widetilde{w}) \leq \widetilde{w}$, or:

$$\widetilde{t} \leq \widetilde{w}(2-b) - 1 + b \tag{5}$$

This condition is monotonous in α, therefore this defines a threshold $\widetilde{\alpha}$ such that retail prices will indeed be constrained by a price-floor if and only if:

$$\alpha \leq \widetilde{\alpha} = \frac{1+a^2-2b^2-\sqrt{1+2a^2+a^4-8a^2b+4a^2b^2}}{2(2a^2-b-b^2)} \tag{6}$$

Note that $\widetilde{\alpha} \leq \alpha_I$.

No deviation in stage 2 Assume that the producers have set the price-floor $\widetilde{w}$ in stage 1, and that $\alpha \leq \widetilde{\alpha}$. Consider the negotiation between producer A and retailer 1 in stage 2 given that the three other pairs negotiate the transfer $\widetilde{t}$.

First, if the negotiation fails, the downstream price p_{B1}^3 may not remain constrained by the price-floor. Retailer 1's optimal price is $p_{B1}^{BR} = \frac{1-b(1-\widetilde{w})+t_{B1}}{2}$, with $p_{B1}^{BR} \leq \widetilde{w}$ if and only if $t_{B1} \leq \widetilde{w}(2-b) - 1 + b$: yet $t_{B1} = \widetilde{t}$ satisfies this condition by (5). So even if a negotiation fails, all final prices remain constrained, and the status-quo profits are those of the RPM case.

Second, A and 1 may deviate by negotiating a higher transfer t_{A1}^d such that the retail price p_{A1} will be unconstrained in stage 3. Given that the three other retail prices are $\widetilde{w}$, retailer 1 maximizes his profit by setting $p_{A1}^d = \frac{1}{2}((1-a)(1-b(1-\widetilde{w}))+ t_{A1}^d - a(2w-\widetilde{t}))$, and $p_{A1}^d \geq \widetilde{w} \Longleftrightarrow t_{A1}^d \geq t_c = a\widetilde{t} - (1-a)(1-b(1-\widetilde{w}) - 2\widetilde{w})$. Under price-floors, the Nash condition is defined by segments: for $t_{A1}^d \geq t_c$, both firms' profits correspond to the unconstrained price p_{A1}^d, and for $t_{A1}^d \leq t_c$ both firms' profits correspond to the constrained price $p_{A1} = \widetilde{w}$. If $\alpha \leq \widetilde{\alpha}$, the maximum of this Nash condition is in $t_{A1} = \widetilde{t} \leq t_c$ and leads to constrained retail prices.

No deviation in stage 1 Consider now possible deviations in stage 1. Assume that producer B sets the wholesale price $\widetilde{w}$. First, it is obvious that producer A would not deviate by increasing his wholesale price: as p_{A1} and p_{A2} would remain constrained the deviation would not be profitable, whether retail prices for B were constrained

or not. But it could be profitable for A to deviate by setting in stage 1 a wholesale price w_A sufficiently low to relax the stage-3 constraint and allow the retailers to set p_{Ai} above w_A but below $\widetilde{w}$.

Consider that producer A chooses such a wholesale price w_A. As this price is non-committing, due to the renegotiations in stage 2, we can assume that $w_A = 0$ (t_{Ai} positive). As the outcome of stage 1 is public, all the firms are aware of producer $A's$ deviation and adapt their strategies in stages 2 and 3. The retail price of product A is lower, so both retailers wish to reduce the price of brand B, which thus remains constrained: $p_{Bi} = \widetilde{w}$. We consider two *scenarii* in turn. First, if p_{Ai} is not too low, there may still be a positive demand for B. Second, if p_{Ai} is low enough, product B may be excluded from the market.

Deviation of producer A without exclusion of product B Assume that product B still faces a positive demand: the four goods are carried, $p_{Bi} = \widetilde{w}$ and retailers' best response prices for brand A are $p_{Ai} = \frac{(1-a)(1-b)-\widetilde{w}-t_{Ai}+a(2-b)\widetilde{w}-at_{Bi}+bp_{Aj}}{2}$.

Assuming symmetry across the retailers and denoting t_K^d the net transfers agreed with producer K, final demand for good B is indeed positive iff $t_B^d \leq t_{Bdem}^d$ (i).

Given t_B^d, stage-2 negotiations with A lead to the optimal transfers $t_A^d = \frac{2\alpha(1-a(1-t_B^d))}{4-(2-\alpha)b}$.

Producer A gets a deviation profit $\Pi_A^D = \frac{4\alpha(2-\alpha)\left(1-a\left(1-t_B^d\right)\right)^2}{(1-a^2)(1+b)(4-(2-\alpha)b)^2}$ where $\frac{d\Pi_A^D}{dt_B^d} > 0$. The deviation is profitable, *i.e.* $\Pi_A^D \geq \widetilde{\Pi}_A$, iff t_B^d is higher than a threshold t_{Bpro}^d (ii).

Finally, we have to check that, given the transfers negotiated in stage 2, each retailer does not deviate by stopping selling brand B in stage 3. This implies a condition on the transfers: $t_{BPC1}(\alpha) \leq t_{Bi}^d \leq t_{BPC2}(\alpha)$ (iii).

We show that if $b \geq \frac{2}{2+\sqrt{1-a^2}}$ and $\alpha \leq \alpha_1$ (with α_1 such that $t_{BPC1}(\alpha_1) = t_{BPC2}(\alpha_1)$), conditions (i), (ii) and (iii) are incompatible. Otherwise, these three conditions are compatible, but the Nash condition of the negotiation between B and i is maximum for a transfer less than $\widetilde{t_{Bi}}$, therefore the transfer t_B^d negotiated in the subgame equilibrium following the deviation of A is such that this deviation is not profitable. This rules out any deviation without exclusion of the rival brand.

Deviation of producer A with exclusion of product B Note first that if producer B anticipates that his product is going to face zero demand, he fights back by negotiating in stage 2 the lowest possible margin $t_{Bi} = 0$.

Consider stage 3. Anticipating zero demand for product B,retailers set the following optimal prices: $p_{Ai}^2 = \frac{2-b-b^2+2t_{Ai}+bt_{Aj}}{4-b^2}$.

Demand for product $B$is indeed zero at both retailers' if and only if:

$$\frac{-1+b+p_{A2}}{b}+\frac{(1-b)(1-\widetilde{w})}{ab}\leq p_{A1}\leq 1-b(1-p_{A2})-\frac{(1-b)(1-\widetilde{w})}{a}. \tag{7}$$

Besides, no retailer wishes to deviate by selling product B as well iff

$$t_{Ai}\leq t^{D}(t_{Aj}) \tag{8}$$

In other words, the only way for producer A to induce an equilibrium with exclusion of B is to set a unit price sufficiently low for both conditions (7) and (8) to hold. Whenever these two conditions hold, there exists a downstream subgame equilibrium with exclusion of product B. If the deviation by A led to this subgame equilibrium, it would be profitable for A, for some values of the parameters, and destroy the RPM equilibrium in that zone.[33] Yet whenever this subgame equilibrium exists, there exists also another downstream equilibrium without exclusion of product B, where both retailers sell both goods and set the following prices for product A: $p^{4}_{Ai}=\frac{(1-a)(2-b(1+b))+2t_{Ai}+t_{Aj}+a(4-b^{2})\widetilde{w}}{4-b^{2}}$.[34] In that case, producer $A's$ profit is less than in the RPM equilibrium, as shown in the previous section.

Formally, we have proved that the following strategies and beliefs form a symmetric contract equilibrium for $\alpha\leq\widetilde{\alpha}$: in stage 1, both producers set the unit wholesale price $\widetilde{w}$; in stage 2, the four pairs negotiate the transfers $\widetilde{t}$; in stage 3 , both retailers set retail price $\widetilde{w}$ for both products; all firms believe that in any subgame where one producer (say B) has chosen the unit wholesale price $\widetilde{w}$ and the other one (say A) has deviated to $w_{A}=0$, and the issue of the negotiations in stage 2 leads to net transfers $t_{Bi}=0$ and t_{Ai} such that $t_{Ai}\leq t^{D}(t_{Aj})$ where $\{i,j\}=\{1,2\}$, then each retailer will choose to sell both products with prices p^{4}_{Ai} and $p_{Bi}=\widetilde{w}$.

A.3.2 The corner price-floor equilibrium

For $\alpha\geq\widetilde{\alpha}$, the producers have to increase the price-floors above $\widetilde{w}$ in order to saturate the constraint (5). As long as this leads to the optimal negotiated transfers (4), the minimum symmetric wholesale price which satisfies this constraint is $\overline{w}=\frac{1-a\alpha-b(1-\alpha)}{2-\alpha(1+a-b)-b}$.

[33] Tedious calculations show that the deviation is profitable for α less than a threshold lower than $\alpha_{d}(a,b)$.

[34] Comparing the retailers' profits in the two subgame equilibria shows that both retailers are better off if the four products are carried than if B is excluded. The subgame equilibrium with exclusion of B is therefore Pareto-dominated by the one without exclusion of B.

We show that setting this price in stage 1 sustains an equilibrium for $\widetilde{\alpha} \leq \alpha \leq \overline{\alpha} = \frac{2-b}{3-b}$, with producers' equilibrium profits $\overline{\Pi_K} = \frac{2(1-a)\alpha(1-\alpha)}{(1+a)(1+b)(2-\alpha(1+a-b)-b)^2}$.

Assume that B sets $w_B = \overline{w}$ and A deviates by setting $w_A \leq \overline{w}$. If the transfers are such that $t_{Ki} \leq t_{Kil} = (2-b)w_K - 1 + b$, all retail prices are constrained in stage 3, even in case of a failure in one negotiation, and producer A anticipates the profit $\Pi_A^d = \frac{2(1-a(1-\overline{w})-w_A)((2-b)w_A-1+b)}{(1-a^2)(1+b)}$, which is maximum for $w_A^d = 1 - \frac{1}{2(2-b)} - \frac{a(1-\alpha)}{2(2-\alpha(1+a-b)-b)}$. If $\alpha \leq \overline{\alpha}$, $w_A^d \geq \overline{w}$ and no deviation of this type is profitable for A. However if $\alpha \geq \overline{\alpha}$, $w_A^d \leq \overline{w}$. If A sets w_A^d in stage 1, the resolution of the Nash condition between producer A and his retailers leads to a corner solution. The unique subgame equilibrium of the game is as follows: each pair (A, i) negotiates the corner transfer $t_{Ail} = (2-b)w_A^d - 1 + b$, each pair (B, i) negotiates the interior transfers $t_{Bi}^* = \frac{\alpha(\overline{w}+a((1-b)w_A^d-1+b))}{1-(1-\alpha)b}$, and the retail prices set in stage 3 are $p_{Ai} = w_A^d$ and $p_{Bi} = \overline{w}$. Producer $A's$ profit is then larger than $\overline{\Pi_K}$: this deviation is profitable for any $\alpha \geq \overline{\alpha}$.

Yet if $\alpha \leq \overline{\alpha}$, no deviation is profitable. First, if both producers set the unit price $\overline{w}$, and second stage negotiations lead to the transfers (4), the four retail prices will be constrained and equal to $\overline{w}$. Second, if both producers set the unit price $\overline{w}$, the only subgame equilibrium outcome defines the transfers (4). Third, it cannot be profitable for A to set a higher unit price, as retail prices would remain constrained and $A's$ profit would be lower than $\overline{\Pi_K}$. Finally, using the same method as in section $A3.1$ we show that it is not profitable to deviate by setting a lower wholesale price such that transfers are set to (4) and retail prices for A are not constrained. Here excluding B would never be possible, and the deviation without exclusion of B would give A a profit lower than $\overline{\Pi_K}$ for $\widetilde{\alpha} \leq \alpha \leq \overline{\alpha}$.

A.3.3 The corner transfer equilibrium

The unit price $w_A = w_B = \widehat{w}$ sustains an equilibrium for $\overline{\alpha} \leq \alpha \leq \widehat{\alpha} = \frac{2(2-b)}{4-b}$ where each pair negotiates limit transfers $\widehat{t} = (2-b)\,\widehat{w} - 1 + b$. First, if both producers have set the unit price $\widehat{w}$ in stage 1, and all other pairs' negotiations outcomes in stage 2 are the optimal transfer $\widehat{t}$, the unique solution of the Nash condition of the negotiation for the last pair is the corner solution $\widehat{t}$ as long as $\alpha \leq \widehat{\alpha}$. Second, we show that if producer B chooses $\widehat{w}$ in stage 1, the best response of A is to set the same unit price.

A.4 Welfare effects

Consumer surplus is $S(q) = U(q) - \sum_{K,i} p_{Ki} q_{Ki}$. As the firms' costs are normalized to zero, total welfare is thus $W = U(q) = \sum_{K,i} q_{Ki} - \frac{1}{2}\sum_{K,i} q_{Ki}^2 - a\sum_i q_{Ai}q_{Bi} - b\sum_K q_{K1}q_{K2} - c\sum_K q_{K1}q_{L2}$: if the four prices are equal, it increases in the total quantity sold, *i.e.* decreases in the retail price. Comparisons across different equilibria are straightforward.

A.5 Two-Part Tariffs

With two-part tariffs, profits are, with P the vector of retail prices:

$$\begin{aligned}
\Pi_K &= t_{Ki}D_{Ki}(P) + F_{Ki} + t_{Kj}D_{Kj}(P) + F_{Kj} \\
\Pi_i &= (p_{Ki} - t_{Ki})D_{Ki}(P) - F_{Ki} + (p_{Kj} - t_{Kj})D_{Kj}(P) - F_{Kj}
\end{aligned}$$

A.5.1 *No restriction*

We solve the game in the no restriction case with a general demand before considering our linear demand case. The demand function is denoted $D_{Ki}(P)$. We assume that the demand is symmetric with $\frac{\partial D_{Ki}}{\partial p_{Ki}} = \frac{\partial D_{Kj}}{\partial p_{Kj}} < 0$ and $\frac{\partial D_{Ki}}{\partial p_{Kj}} = \frac{\partial D_{Kj}}{\partial p_{Ki}} > 0$. Besides, we assume that direct effects dominate cross-price effects:

$$\left|\frac{\partial D_{Ki}}{\partial p_{Ki}}\right| > \left|\frac{\partial D_{Ki}}{\partial p_X}\right| \text{where } X \in \{Kj, Li, Lj\}. \tag{9}$$

Finally, we assume that, when a retailer sets his pair of final prices, the transfer he pays to one producer only affects the final price of his product, as with a linear demand (see footnote 29): $\frac{\partial p_{Li}^{BR}}{\partial x_{Ki}} = 0$.

We examine successively the two polar cases where $\alpha = 1$ and $\alpha = 0$.

- Producers offer take-it-or-leave-it contracts to retailers: $\alpha = 1$

  In the last stage, the maximisation of retailer i's profit $(i = 1, 2)$, yields two first order conditions (for $K, L = A, B$)

  $$(p_{Ki}^{BR} - t_{Ki})\frac{\partial D_{Ki}(P)}{\partial p_{Ki}} + D_{Ki}(P) + (p_{Li}^{BR} - t_{Li})\frac{\partial D_{Li}(P)}{\partial p_{Ki}} = 0 \tag{10}$$

  and defines the couple of best response final prices $(p_{Ai}^{BR}, p_{Bi}^{BR})(\overline{p_{Kj}}, \overline{p_{Lj}})$. We denote $P = (p_{Ki}^{BR}, p_{Li}^{BR}, \overline{p_{Kj}}, \overline{p_{Lj}})$.

In the first stage, producer K offers a secret contract to each retailer. The outcome of the negotiation between producer K and retailer i will be observed neither by any of the three other negotiating pairs during the contracting stage, nor be observed by j before the third stage. Thus producer K maximizes his profit in (t_{Ki}, F_{Ki}) given (t_{Kj}, F_{Kj}) and anticipating the prices $(\overline{p_{Kj}}, \overline{p_{Lj}})$:

$$\underset{t_{Ki},F_{Ki}}{Max}\,(t_{Ki}-c)D_{Ki}(P)+F_{Ki}+(t_{Kj}-c)D_{Kj}(P)+F_{Kj}$$
$$s.t.\Pi_i \geq \Pi_i^{SQ}$$

where $\Pi_i^{SQ} = (p_{Li}^3 - t_{Li})D_{Li}^3(p_{Li}^3, \overline{p_{Kj}}, \overline{p_{Lj}}) - F_{Li}$ is the outside option profit of the retailer.

The binding participation constraint of the retailer determines F_{Ki}. Reintegrating into the programme of the producer, with $\frac{\partial p_{Ki}^{BR}}{\partial t_{Ki}}$ strictly positive, yields the following first order condition:

$$D_{Ki}(P) + (p_{Ki}^{BR} - c)\frac{\partial D_{Ki}}{\partial p_{Ki}}(P) + (p_{Li} - t_{Li})\frac{\partial D_{Li}}{\partial p_{Ki}}(P) + (t_{Kj} - c)\frac{\partial D_{Kj}}{\partial p_{Kj}}(P) = 0$$

The producer chooses his optimal tariff (t_{Ki}, F_{Ki}) as if he were vertically integrated with downstream retailer i. Using the retailer's first order condition (10) and reintegrating, we have:

$$(t_{Ki} - c)\frac{\partial D_{Ki}(P)}{\partial p_{Ki}} + (t_{Kj} - c)\frac{\partial D_{Kj}(P)}{\partial p_{Ki}} = 0$$

the same applies for the pair (K, j). Under (9) the only equilibrium is such that: $t_{Ki} = t_{Kj} = c$. For $c = 0$, the equilibrium final price is thus such that:

$$p_{Ki}^{BR}\frac{\partial D_{Ki}(P)}{\partial p_{Ki}} + D_{Ki}(P) + p_{Li}^{BR}\frac{\partial D_{Li}(P)}{\partial p_{Ki}} = 0$$

- Retailers offer take-it-or-leave-it contracts to producers: $\alpha = 0$.

Similarly, in the contracting stage, producer K's participation constraint is binding: $\Pi_K \geq \Pi_K^{SQ}$ where $\Pi_K^{SQ} = (t_{Kj-c})D_{Kj}^3(p_{Li}^3, \overline{p_{Ki}}, \overline{p_{Lj}})$, and determines the fixed fee F_{Ki}. The maximization of retailer $i's$ profit yields the same wholesale and final equilibrium prices.

- A bargaining with a balanced sharing of power $(\alpha, 1-\alpha)$ boils down to a linear combination of theses two programmes, therefore this result extends to any α.

In our linear framework, $t_{Ki}=0$ and franchise fees are $F^{TP}_{Ki}=\frac{\alpha(1-a)(1-b)}{(1+a)(1+b)(2-b)^2}$. The symmetric equilibrium retail prices are $p^{TP}_{Ki}=\frac{1-b}{2-b}$ and the profits are as follows:

$$\begin{aligned}\Pi_K &= 2F_{Ki}\\ \Pi_i &= \tfrac{2(1-b)(1-\alpha(1-a))}{(1+a)(1+b)(2-b)^2}\end{aligned}$$

Total profit is lower with two-part tariffs than with linear tariffs, except for $\alpha\in[\frac{2b(2-b)}{2-b^2-2a(1-b)},1]$ (this interval exists only for low values of a and b): Two-part tariffs suppress double margin; yet when α is not too high, double margin increases joint profits by relaxing competition at both levels and increasing retail prices towards the joint-profit maximizing price 1/2. Therefore suppressing double margin hurts joint profit, except when double margin drives prices too high, which happens when a and b are low and α is high. Producers' share of total profit is $\alpha(1-a)$: it increases in their bargaining power α and decreases in the intensity of upstream competition a.

A.5.2 RPM equilibria

Assume that producers impose RPM prices w_A and w_B in stage 1. Solving the eight Nash conditions of stage-2 negotiations assuming symmetry across the retailers gives the following optimal franchise fees:

$$F^{\circ}_K(w_K,w_L,t_K,t_L)=\frac{(1-a-w_K+aw_L)(\alpha(w_K-aw_L-b+at_L)-(1-b)t_K)}{(1-a^2)(1+b)} \tag{11}$$

For each pair (w_A,w_B) there exists a continuum of equilibria of the subgame. Among these, the joint profit of each pair (K,i) is constant, but its sharing differs. In stage 1, the producers anticipate one of the subgame equilibria. For each (t_A,t_B), there exists a unique (w_A,w_B) such that if the producers anticipate the subgame equilibrium outcomes $(t_A,t_B,F^{\circ}_A,F^{\circ}_B)$, then setting the RPM prices (w_A,w_B) in stage 1 is an equilibrium strategy. Finally, there is a continuum of symmetric equilibria of the game. Equilibrium final prices are defined as a function of t, the symmetric variable part of the wholesale tariff for $\alpha>0$:

$$w^{\circ}(t)=\tfrac{1}{2}(1-t\tfrac{b+\alpha(a-b)}{\alpha(1-a)}) \tag{12}$$

with t such that $0\le t\le w^{RPM}$, *i.e.* for $0\le t\le t_{RPM}$, with $t_{RPM}=\frac{\alpha(1-a)}{b+\alpha(2-a-b)}$. Note that $w^{\circ}(t)$ decreases in the variable part of the net transfer t (as $\frac{b+\alpha(a-b)}{\alpha(1-a)}\ge 0$).

Joint profit is maximum when retail prices are at the monopoly price $p^M=1/2$, and decreases in t. Furthermore, given α, the different equilibria are not equivalent

in terms of profit sharing: producers' profits increase in t, whereas retailers' profits as well as joint profits decrease in t. Producers' profits are

$$\Pi_K = \frac{(\alpha(1-a)+t(a\alpha+b(1-\alpha))^2}{2\alpha(1-a^2)(1+b)} \tag{13}$$

The fact that the equilibrium with two-part tariffs does not necessary maximize joint profit is original. The intuition is as follows. Consider stage 1. If the producers anticipate that the stage 2 negotiations will lead to $t = 0$ and the matching fixed fees, they are going to be paid through the fixed fee only and the best the can do is to maximise the joint profit, and the equilibrium RPM price is therefore $w = 1/2$. Yet if they anticipate a positive variable part of the transfer, then each producers' status quo profit decreases with its RPM price, whereas the retailers' status quo profits increase with it: Totally differentiating producer $A's$ status quo profit given (t_A, t_B) and w_B gives, in $w_A = w_B = w$ and $t_A = t_B = t$

$$\begin{aligned} \frac{d\Pi_A^{sq}}{dw_A} &= \frac{\partial \Pi_A^{sq}}{\partial w_A} + \frac{\partial \Pi_A^{sq}}{\partial F_A}\frac{\partial F_A}{\partial w_A} \leq 0 \\ &\Leftrightarrow \quad t \geq \frac{\alpha(1-a)(1-2w)}{2+\alpha(a-b)} \end{aligned}$$

yet inverting (12) yields $t = \frac{\alpha(1-a)(1-2w)}{b+\alpha(a-b)}$ QED.

This explains why when both producers anticipate positive t_K, then the equilibrium RPM price does not maximize total industry profit. Note that this is not only a consequence of upstream competition, as it would also happen with an upstream monopoly (or in our case with $a = 0$) : there would also exist a continuum of equilibria with different RPM prices that would not always maximise the joint profit.

As t_{RPM} decreases with α, the set of equilibrium retail prices shrinks when producers' bargaining power increases.

Note that the RPM equilibrium with linear tariffs $\widetilde{w}$ is always sustainable as an equilibrium retail price under RPM with two-part tariffs. In that equilibrium, joint profit is the same than with linear tariffs, but retailers get more and producers less.

A.5.3 Price-floor equilibria

Consider now that $w^\circ(t)$ is only a price-floor. In stage 3, if her competitor sets prices p_{Kj} and if the issue of stage 2 negotiations with her two suppliers led to unit prices t_K, retailer i's best response prices are $p_{Ki} = \frac{1-b+t_K+bp_{Kj}}{2}$. This price is below the price-floor, which will be binding indeed, if and only if $t \leq t_{PF}$, with

$$t_{PF} = \frac{\alpha b(1-a)}{b(2-b)+\alpha(2-b(2+a-b))}$$

Therefore the minimum price that is sustainable with price-floor is

$$w^{\circ}\left(t_{PF}\right)=\frac{1}{2}(1-\tfrac{b(b+\alpha(a-b))}{(2-b)b+\alpha(2-b(2+a-b))})$$

The interval of equilibrium retail prices with two-part tariffs and a price-floor is $[w^{\circ}\left(t_{PF}\right), 1/2]$. It is smaller than under RPM. As t_{PF} increases in α, this interval shrinks when α increases. For $\alpha=0$, the lowest price in equilibrium is $w^{\circ}\left(t_{PF}\right)=\frac{1-b}{2-b}$, whereas it is $w^{\circ}\left(t_{PF}\right)=\frac{1-ab}{2-ab}$ for $\alpha=1$. Note that for all α, $w^{\circ}\left(t_{PF}\right)\geq\frac{1-b}{2-b}$: retail prices are higher than in the *no-restriction* equilibrium. Finally, retail prices of the linear tariff price-floor equilibria are sustainable as price-floor equilibria with two-part tariffs as long as they are below 1/2.

Producers' profit is given by (13). It is lower with two-part tariffs than with linear tariffs (even for $t=t_{PF}$). However, with two-part tariffs, producers' profit is always higher with price-floor than without. Retailers' situation is more ambiguous: the price-floor equilibrium with $t_K=0$ gives them higher profit than the *no-restriction* equilibrium with two-part tariffs, but the equilibrium with $t_K=t_{PF}$ gives them lower profits.

A.5.4 Upstream deviations

We check here that producers do not deviate from the price-floor strategies. The only deviation that has not been ruled out by the RPM analysis is one where a producer (say A) deviates by setting a lower price-floor such that retail prices are unconstrained in stage 3, and these deviations are equivalent to setting $w_A=0$ in stage 1 (see a detailed analysis in the linear tariffs case).

In that case, prices remain constrained at w_B for B in stage 3 but not for product A; Solving the corresponding Nash conditions gives the optimal tariffs in stage 2: $t_{Ki}=0$. The deviation profit for A is thus $\Pi_A^d=\frac{2\alpha(1-b)(1-a(1-t_B^d))^2}{(1-a^2)(1+b)(2-b)^2}$ where t_B^d is the transfer negotiated between B and a retailer in stage 2. There is a continuum of subgame equilibria where the negotiation outcomes for B are given by $F_B^d=g(w_B,t_B^d)$. Among these, the subgame equilibrium with $t_B^d=0$ leads to $\Pi_A^d=\frac{2\alpha(1-b)(1-a)}{(1+a)(1+b)(2-b)^2}$ less than $\underline{\Pi_K^{PF}}(t=0)$, the minimum profit A gets in the price-floor equilibrium: the deviation is not profitable. Consequently, the strategies defined implement an equilibrium with price-floors.

A.6 Robustness and extensions

A.6.1 Discrimination

Consider that producers and retailers now negotiate in stage 2 over a total transfer $t_{Ki} - f_{Ki}$, where the price-floor is t_{Ki}.

Assume that retail prices are constrained. In stage 2, each pair negotiates over two variables t_{Ki} and f_{Ki} so that eight first-order conditions determine the equilibrium outcomes: $t^{\diamond}_{Ki} = 1 - \frac{1}{2-\alpha a-(1-\alpha)b}$ and $f^{\diamond}_{Ki} = \frac{(1-\alpha)(1-b)}{2-\alpha a-(1-\alpha)b}$. In stage 3, retailer $i's$ best response prices are p^{BR}_{Ki}. This price is always larger than the individual price-floor $t^{\diamond}_{Ki}$ which is therefore not binding.

Producers thus have to raise the price-floor in order to constrain the retailers. The minimum binding price-floor is $\overline{t^{\diamond}_{Ki}} = \frac{1-a\alpha-b(1-\alpha)}{2-\alpha(1+a-b)-b}$, such that $p^{BR}_{Ki} = \overline{t^{\diamond}_{Ki}}$ for both retailers. The corresponding $\overline{f^{\diamond}_{Ki}}$ is inferred from the first-order conditions of stage 2 negotiations: $\overline{f^{\diamond}_{Ki}} = \frac{(1-a)\alpha}{2-\alpha(1+a-b)-b}$. This does not define an equilibrium as there is always a unilateral incentive for a pair (K, i) to deviate towards a higher price-floor. Furthermore, any price-floor above this level will also fail to sustain an equilibrium.

As there is renegotiation in stage 2, no binding price-floor can sustain an equilibrium. Therefore there is no constrained equilibrium.

A.6.2 Ex-post observability of the bargaining outcome

Assume that $a = 0$ (upstream monopoly) and the outcome of each negotiation is published at the end of stage 2. Without legal restriction, in stage 3, each retailer knows the issue of all negotiations, so that the retail prices are given by $p_i = \frac{2-b(1+b)+2t_i+bt_j}{4-b^2}$. In stage 2, if there is a failure in negotiation between the producer and retailer 1, retailer 2 sets the monopoly price $\frac{1+t_2}{2}$ which is larger than the price he sets without EPO. Quantity sold thus decreases, as does the producer's status-quo profit which is now $\frac{(1-t_2)t_2}{2}$; retailer 1's status-quo profit is still 0. As a consequence, the transfers negotiated are lower than with secret contracts and retail equilibrium prices as well.

Under the law and without EPO, the producer would choose $\widetilde{w} = \frac{1}{2}$ for $\alpha \leq \widetilde{\alpha} = \frac{b}{(1+b)}$. EPO leads to different status-quo profits in stage 2: If the unit price set in stage 1 is w, when negotiation breaks with retailer i, the other retailer may set his price above w. There exists $\{\underline{w^o}, \overline{w^o}\}$ such that

(i) if $w \leq \underline{w^o}$, retailers' pricing strategies are not constrained in stage 3 ($p_i \geq w$);

(ii) if $\underline{w^o} \leq w \leq \overline{w^o}$, retailers' pricing strategies are constrained in stage 3 but not if one negotiation breaks: If negotiation breaks between A and 1, retailer 2 will

set the optimal monopoly price $p_2^1 = \frac{1+t_2}{2} \geq w$, and the producer's status-quo profits is $\Pi_P^1 = t_2(\frac{1-t_2}{2})$. The negotiations determine optimal net transfers such that the producer's profit is concave in w.

(iii) if $w \geq \overline{w^o}$ retailers' pricing strategies are constrained in stage 3 and in the status-quo; the optimal net transfers are thus $t_i = \frac{\alpha w}{1-b(1-\alpha)}$ and the producer's profit decreases in w for $w \geq \overline{w^o}$.

We show that $0 \leq \underline{w^o} \leq \overline{w^o} \leq 1$ and $\overline{w^o} \geq 1/2$. Furthermore $\underline{w^o} \leq 1/2$ for all $\alpha \leq \alpha_{\lim} = \frac{b(2-b-b^2)}{2-b^2-b^3}$, with $\alpha_{\lim} \geq \widetilde{\alpha}$.

For all $\alpha \leq \alpha_{\lim}$, if the producer sets the wholesale price $w = 1/2$, retailers are constrained in equilibrium but not in the status-quo case. The producer's profit is thus larger than his unconstrained profit. Furthermore, it increases in w for $w \leq \frac{1}{2}$, so that the optimal binding wholesale price is in $]\frac{1}{2}, \overline{w^o}]$. The producer is better off with a binding wholesale price larger than $\widetilde{w} = \frac{1}{2}$ and in a wider zone than without EPO (at least for $\alpha \leq \alpha_{\lim}$ which is larger than $\widetilde{\alpha}$).