Buyer power, welfare and public policy

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Abstract

This thesis consists of an introductory chapter and three essays that investigate, from a theoretical perspective, the sources and welfare implications of increasing buyer power in vertically related markets. Retail markets have experienced a trend towards increasing consolidation over the past 20-30 years, with the emergence of large retail chains and ever larger retail outlets. The market for grocery retailing, in particular, is a good example. These trends are widely believed to have shifted the bargaining power away from the suppliers towards their retailers. The consolidation process has also enabled large retailers to employ new strategies, such as the development of retailer-owned brands, also called private labels, something which is believed to have strengthened the retailers' bargaining position further. This thesis analyses the competition and welfare implications of some of these recent trends.

The first essay, "Private labels, rent-shifting and consumer welfare", investigates a retailer's decision to introduce a private label, and asks how the retailer's access to a private label may affect the pricing of substitute national brands. We consider a model with two vertically differentiated national brand manufacturers that negotiate sequentially with a monopolist retailer over two-part tariffs. We find that when the retailer decides to introduce a private label, this always generates a price increase for one of the two national brands. Moreover, when we endogenise the order of negotiations, we find that i) the retailer's private label is always introduced, and ii) the private label always causes a price increase for the high-quality national brand only. In our model, this price increase does not occur due to a price discrimination effect, as in Gabrielsen and Sørgard (2007) ["Private labels, price rivalry, and public policy", European Economic Review, (51), 403-424], but as a result of a rent-shifting effect. The welfare implications of private label introduction are discussed.

The second essay, "Buyer power and exclusion in vertically related markets", co-authored with Tommy Staahl Gabrielsen, explore how the incentives for exclusion, both in upstream and downstream vertical markets, are related to the bargaining position of suppliers and retailers. We consider a model with a dominant upstream manufacturer and a competitive fringe of producers of imperfect substitutes offering their products to two differentiated downstream retailers. In this model we contrast the equilibrium outcome in two alternative situations. The first one is when the dominant supplier holds all the bargaining power, and this is compared with the outcome when the retailers have all the bargaining power. We show that exclusion occurs when the degree of interbrand and intrabrand competition (competition between brands and the retailers, respectively) is strong. Moreover, in contrast to the received literature, we find that when retailers have buyer power, this enhances welfare, by offering the consumer more choice at lower prices, compared to when the manufacturer holds all the bargaining power.

The third essay, "The buyer power of multiproduct retailers: Competition with one-stop shopping", illustrates how, in local retail markets, a multiproduct retailer may gain buyer power when some consumers are one-stop shoppers (multi-product shoppers). We consider a model where independent suppliers negotiate terms of trade with a large multiproduct retailer and a group of smaller single product retailers, respectively. We find that an increase in the share of one-stop shoppers intensifies the degree of competition

between the retailers, and hence reduces the overall industry profit – while at the same time enabling the multiproduct retailer to obtain discounts from its suppliers, in the form of lower fixed fees. We also show that the presence of a large retailer may positively affect the suppliers' incentives to invest in product quality or cost reductions.

Contents

Chapter 1

Introduction

Introduction

This thesis presents three essays that analyse from a theoretical viewpoint the competition and welfare effects of increasing buyer power in vertically related markets. In many developed countries, the retailing sector has undergone large-scale transformation over the last 20-30 years. The grocery industry is a prominent example, where the retail market has become more and more concentrated over time. We have seen the emergence of large retail chains and the growth of ever larger store formats, with the success of international big-box retailers such as for example Wal-Mart and Carrefour, many of which stocks tens of thousands of product lines under one roof. In the Norwegian grocery industry, today as much as 99.3 percent of the trade is carried out by four nationwide chains: Norgesgruppen ASA, Ica Norge AS, Coop Norge AS and Rema 1000 AS (The Nordic Competition Authorities, 2005). This is exceptional by European standards, but the general trend of increased concentration is observable in markets all over the EU; the number of shops per inhabitant has been steadily declining, and the size of both supermarkets and retail chains are growing. In addition, many retailers have integrated backwards into supply to develop their own products, also called private labels. Hence, the retailers have effectively become their manufacturers' competitors, in addition to being their customers (Dobson, 2005).

Whilst this development has been driven by large economies of scale in retailing, they still pose a challenge for competition authorities who aim to secure healthy competition in the industry. The changing landscape of retailing has attracted the attention of both practitioners, policy makers, academics and industry commentators. Even though there is disagreement on its welfare effects, and about whether the retail sector commands special attention compared to other sectors, most can agree that the recent trends have shifted the bargaining power away from the suppliers towards their retailers. Some fear that consumers as well as suppliers have become adversely affected.

These concerns have triggered two major inquiries into the UK grocery industry, completed by the British Competition Commission in 2000 and 2008, respectively, as well as several merger inquiries. The 2000 inquiry led to the introduction of a UK Supermarket Code of Practice (SCOP) in 2002, which aimed to secure a more even distribution of power between retailers and manufacturers. In 2010, following the 2008 inquiry, the SCOP was replaced by what was supposed to be a new and stronger "Grocery Supply Code of Practice" (GSCOP), which also came with the proposal for introducing an ombudsman with powers to impose penalties for breaches of the Code.

The retail industry in France has also seen some heavy regulation, through the Galland

Act of 1996, the Dutreil Act of 2005 and Chatel Act of 2007 (the latter two modifies the original Galland Act).[1]

In Norway, the "Norwegian Inquiry Commission for the Power Relations in the Food Supply Chain" was established by the Government of Norway on 18 February 2010. The inquiry commission gave its final report in April 2011 (NOU 2011: 4). They conclude that

> "[I]f the trend in Norway continues at the same pace and in the same direction, where the umbrella chains can more or less unilaterally dictate the terms in agreements, such a development would be detrimental to healthy competition and balanced power relations in the food supply chain." (p. 8 in the English summary)

The committee also proposed to introduce a new law to regulate the negotiations between retailers and suppliers, and to introduce an ombudsman for the grocery sector in Norway, similar to what has been proposed in the UK.

The growing concern for buyer power is also reflected in the international studies conducted by the Organization for Economic Cooperation and Development (OECD, 1999) and the European Commission (1999), and has also been a central issue in several merger investigations conducted by the European Competition Commission.[2]

Despite the great public interest and the regulation which (more or less successfully) has been put in place in several countries already, the formal economic literature on buyer power is still in its infancy. The Industrial Organisation literature has for a long time focused on the suppliers' activities, either ignoring the retail and distribution sector completely, or treating retailers merely as passive recipients of the manufacturers' terms. In particular, some proponents of the Chicago school of thought have treated the retail and distribution sectors as perfectly competitive markets, wholly reflecting the consumers' preferences. See e.g. Posner (1976) and Bork (1978). Clearly, this is not in accord with how retail markets are organised today. As a response to this, the literature has seen a gradual shift in orientation since the middle of the 1990s, and developed game theoretic models that formalise the concept of retailer power and allow us to evaluate its sources and welfare consequences. The rest of this chapter gives a brief introduction to the most

[1] The regulation of the French retail market has been met by heavy criticism from both academics and industry commentators. The Galland Act in particular, by banning below-cost pricing for retailers, has been blamed for causing a significant increase in retail prices over time.

[2] See for example the Kesko/Tuko case (1997), Blokker/Toys "R" Us (1997), Rewe/Meinl (1999), and the Promodès/Carrefour case (2000).

central aspects of and contributions to this literature.[3] I then conclude the chapter in an attempt to place my own work within the literature.

Countervailing Buyer Power and Short-term Welfare

The analysis of buyer power provides a challenge for economists. The main reason being that – unlike the case when modelling interactions between horizontally related firms – there is no single coherent theoretical framework for how transactions are carried out in vertical markets. The models differ both in how prices are set, and in how contracts are formulated.[4] Also, there is no generally accepted definition of what constitutes buyer power; the term has been used in various setting, and bears positive or negative connotations depending on the context. Usually, it refers (very broadly) to the ability of a buyer to obtain more favourable terms of trade from its suppliers, either compared to other buyers, or compared to the terms it would obtain under "normal competitive conditions" (Dobson, 2005).

The term "countervailing power" was first coined by Galbraith (1952) to describe the ability of big buyers to obtain price discounts from their suppliers. According to Galbraith's theory, buyer power has positive welfare consequences, because it may serve to counter the growing market power of powerful suppliers.[5] A critical premise for Galbraith's claim to hold true, is that price concessions obtained by powerful buyers from their suppliers, are passed on to the consumer in form of lower final prices.

Galbraith's theory was controversial at the time it was published (see e.g. Stigler's (1954) critique), and still is today. Not until recently has it been formally investigated: von Ungern-Sternberg (1996) and Dobson and Waterson (1997) formalise Galbraith's argument in two very similar models. Both use the two-person Nash bargaining solution to determine the outcome of the negotiations between the retailers and the supplier, and both find that an increase in concentration in the retail market (through a reduction in

[3]For a more thorough overview, with a discussion of its policy implications, including its empirical parts, see Inderst and Mazarotto (2006, 2008) and Chen (2007). Dobson and Waterson (1999) give an early discussion of the topic, while Inderst and Shaffer (2008) give an assessment of buyer power as a defence in merger cases.

[4]See Inderst (2010) for an overview. There is great contrast, for example, between the standard economic model of monoposony power – a buyer's market power over suppliers, i.e., the "textbook" definition of buyer power – and models of bilateral contracting, where the parties strategically interact in negotiations over (more or less complex) supply terms, and where buyers may obtain individually negotiated discounts.

[5]Galbraith used as examples both the US grocery industry, where nationwide retail chains dealt with large food producers, and the big industrial buyers in the automobile industry, who were buying steel from big steel producers, etc.

the number of buyers) may cause a decrease in consumer prices – but only under certain conditions.

A reduction in the number of retail outlets reduces the number of alternative distribution channels for the manufacturer. In turn, this weakens the manufacturer's bargaining position against the retailers. The remaining retailers therefore receive a discount on the wholesale price in negotiations with the manufacturer. All else equal, this should allow for lower final prices for the consumer. However, with a reduction in the number of retailers comes an increase in market power in the downstream market – which, all else equal, induces a higher price for the consumer. It is only when the former effect outweighs the latter that the retailers' discounts are passed on to the consumer. Hence, according to von Ungern-Sternberg (1996) and Dobson and Waterson (1997), Galbraith's theory holds only when the degree of differentiation between retail outlets is sufficiently small.[6]

Note, that these theories rely on the fact that the supplier and the retailers negotiate over linear tariffs; if price concessions come instead through lump-sum transfers, e.g. through a franchise fee or a slotting allowance, then there would be no incentives for the retailers to pass these concessions on to the consumer. Non-linear tariffs are common in the retail industry, where the contracts frequently include upfront payments, fixed fees, quantity discounts, etc. It is therefore reasonable to expect that the conditions needed for Galbraith's theory often do not hold in reality.[7] Some papers in the literature have sought to address this issue.

Fumagalli and Motta (2008) consider a model where a number of buyers (retailers) collect bids from an incumbent firm and a more efficient entrant, respectively. They show that buyers may suffer from coordination problems, which in turn may prevent entry by the more efficient supplier. The intuition for their result is that, when there are fixed cost of entry, the entrant needs to secure orders from a sufficiently high number of buyers to make entry profitable. When buyers are fragmented, however, miscoordination between the buyers can make entry difficult. Fumagalli and Motta show that more downstream concentration alleviates these coordination problems; in the extreme case, with only a single large buyer, entry is always profitable, because the buyer always prefers to buy from the more efficient supplier. Similar to von Ungern-Sternberg (1996) and Dobson and Waterson (1997), these results suggest that more concentration in the retail market,

[6]Snyder (1996) demonstrate Galbraith's theory in a dynamic setting; by placing large orders, a large buyer may then help to destabilise collusion between the suppliers - which then results in lower prices.

[7]See e.g. Marx and Shaffer (2007) and Miklós-Thal et al. (2011), who show that, when using non-linear tariffs, retailers may want to use their bargaining power to negotiate upfront payments paid by the manufacturer to the retailer(s) – in return for exclusivity in Marx and Shaffer's case – not lower wholesale prices.

with fewer and larger buyers, may lead to lower prices for consumers. Moreover, this result is independent of the type of contracts used. In contrast to the aforementioned papers, however, Fumagalli and Motta find that more concentration is welfare improving only when the degree of differentiation between buyers is sufficiently high. With fierce competition between retail outlets, the entrant would make entry profitable by securing orders from a single retailer, who, in the extreme case captures the whole market (because the entrant is more efficient and hence able to supply the retailer at a lower wholesale price than the incumbent). Coordination failures thus exist only with a sufficient degree of differentiation between the buyers.

Chen (2003) considers a very different setting, where a monopolist manufacturer supplies a retail market with both a dominant retailer and a fringe of perfectly competitive retailers. The manufacturer sets a constant wholesale price for the competitive retailers, and then negotiates a two-part tariff with the dominant retailer. Chen models countervailing power as an increase in the dominant retailer's exogenous bargaining power towards the supplier. Even though the manufacturer and the dominant retailer use a two-part tariff, Chen finds that an increase in the bargaining power of the dominant retailer may cause a reduction in final prices under certain conditions. The strategic effect that Chen identifies is a little subtle, and it does not work through the "expected" channel. Chen finds that when the dominant retailer has more bargaining power, the supplier would like to strategically commit to boost the amount it sells through the competitive retailers (over which the supplier holds complete bargaining power), and reduce the amount it sells through the dominant retailer. The supplier does this by reducing the wholesale price to the competitive retailers, which then translates into a lower final price for the consumer. Again, similar to von Ungern-Sternberg (1996) and Dobson and Waterson (1997), retail competition seems to be important for the result, here by the inclusion of a perfectly competitive fringe of retailers.

More recently, Inderst (2007) and Inderst and Valetti (2011) give an account of the "waterbed effect".[8] The idea behind the term "waterbed effect", is that whenever a manufacturer gives a discount to a powerful buyer, then he may want to "compensate" by raising the price for its less powerful buyers. In turn, this may create a competitive imbalance in the retail market. Inderst and Valetti consider a model where discounts arise from cross-border mergers between buyers (buyers creating a retail chain or a buyer cooperative).[9] Following Katz (1987), they assume that retailers who do not buy from

[8] See also Majumdar (2005). For a discussion of the waterbed effect, see Dobson and Inderst (2008).

[9] Inderst (2007) focus instead on the creation of differences in buyer size, and thus differences in buyer power, either through acquisitions or efficiency improvements. He finds that buyers that are already large,

the manufacturer may use an alternative source of supply, in return for a paying a fixed cost; this constitutes the buyer's outside option in the negotiations with the manufacturer. Because large buyers can spread the fixed cost over a larger number of units, they have more valuable outside options than their smaller rivals. In turn, this enables large buyers to extract discounts from their manufacturers. Inderst and Valetti show that this discount in turn reduces the value of the outside option for the small buyers who are in competition against the large buyer. This further strengthens the supplier's bargaining position towards the small buyers, who therefore have to pay a higher wholesale price (compared to a benchmark situation with only small buyers). This shows that the countervailing power of one large buyer, may be to the detriment for the smaller buyers who are competing against the large buyer. Inderst and Valetti also show that, under certain conditions, the increase (decrease) in the smaller (larger) buyers' wholesale prices may be large enough to cause an overall reduction in welfare.

Note that this theory for the waterbed effect also relies on the assumption that suppliers and retailers use linear wholesale contracts; if the discounts to larger buyers come instead through reductions in fixed fees, then this would not affect the pricing decision of the large buyer – hence, nor would it affect the outside options of smaller buyers.

Buyer power and long-term welfare

There is an increasing concern that when buyers become more powerful, this may weaken the manufacturers' incentives to invest and innovate, and that buyer power therefore may reduce welfare in the long run. Recently, a number of articles have analysed how buyers may obtain discounts due to their size, and how this in turn may impact long-term welfare by affecting the manufacturers' choices of technology or product characteristics prior to entering into negotiations with retailers. This branch of the literature mostly focuses on cross-border mergers between retailers (i.e., the creation of retail chains or buyer groups), similar to in the article by Inderst and Valetti (2011) cited above. See e.g. Inderst and Wey (2003, 2007, 2011), Vieira-Montez (2007) and Inderst and Shaffer (2007).

Inderst and Wey (2003, 2007) consider suppliers who sell to retailers that operate as monopolists in independent markets. They show how a merger between retailers may generate size discounts when the total industry profit is concave in the number of markets supplied by the manufacturer, and hence also concave in the number of buyers served.[10]

have incentives to grow further. It is also shown that the potential negative impact of the increasing buyer power of a few large distributors, is aggravated by the waterbed effect.

[10] Horn and Wolinsky (1988) and Stole and Zwiebel (1996) makes an early account of this argument,

When the total profit is concave, the incremental contribution of each individual retail outlet, taking as given the manufacturer's agreements with all the other retailers, is relatively small. On the other hand, a large buyer – who controls a number of retail outlets – negotiate over a larger number of units, and hence over a production interval where, given the concavity of the industry profit, the average contribution of a retail outlet (to the total profit) is higher (Inderst and Wey, 2007). When the total profit function is concave in the number of markets served, a large buyer therefore pays a lower per-unit price on average compared to a small buyer.[11]

The industry profit can be concave, e.g., due to increasing unit production costs for the manufacturer. Inderst and Wey demonstrate that, for this reason, when facing large buyers, a manufacturer may want to switch to a "more concave" production technology, with lower marginal costs but possibly higher inframarginal costs – since this in turn makes the industry profit "less concave", possibly even convex, in the number of markets served. This switch in technology allows for an expansion in total output. It therefore benefits the consumers, and may increase total welfare. Vieira-Montez (2007) applies this argument to suppliers' capacity choice, and show that a manufacturer may want to expand its capacity when facing larger buyers.

Inderst and Wey (2011) consider a manufacturer who is supplying retail outlets in several independent markets. Moreover, they assume that in each retail market there are two competing retailers. Following Katz (1987), Inderst and Wey assume that a large buyer, who owns retail outlets in a number of markets, can credibly threaten to integrate backwards to use an alternative source of supply. A large buyer therefore potentially holds a stronger bargaining position towards the manufacturer.[12] Inderst and Wey then demonstrate how the presence of a large buyer may strengthen the manufacturer's incentives to reduce its marginal production costs (compared to the situation with only small buyers). By reducing its marginal cost, the manufacturer is able to supply the large retailer's local rivals at a lower per-unit price. This makes the alternative source of supply less attractive

but in models of wage negotiations between firms and their employees. See also Chipty and Snyder (1999) and Raskovich (2003). Similar effects emerge in DeGraba (2003) and Chae and Heidhues (2004), where the surplus function is concave due to either seller's or buyers' risk aversion.

[11] Conversely, a large buyer is disadvantaged relative to smaller buyers when the total surplus function is convex in output (e.g., when the supplier's cost function is concave). Also, Smith and Thanassoulis (2009) and Inderst (2006) show that, under certain conditions, large buyers may be disadvantaged even if suppliers have convex costs.

[12] The set-up is similar to Inderst and Valetti (2011). However, unlike Inderst and Valetti, Inderst and Wey (2011) assume that the outside option constitutes a credible alternative only for sufficiently large buyers. Moreover, in Inderst and Wey (2011), the manufacturer and the retailers use two-part tariffs – hence, the discounts to large buyers are not passed on to final consumers.

for the large retailer, and therefore strengthens the manufacturer's bargaining position. In other words, when facing a large buyer, a reduction in the marginal cost not only increases the overall profit, as under normal conditions; it also increases the manufacturer's share of the total profit by reducing the value of the large buyer's outside option.

Several papers also identify negative long-term welfare effects of increasing buyer power. Battigalli et al. (2007) considers a set-up where a monopolist manufacturer supplies two differentiated retailers. At the contracting stage, the retailers are assumed to make take-it-or-leave-it offers to the manufacturer; in equilibrium, each retailer therefore captures its full incremental contribution to the overall profit. Moreover, the contracts are assumed to be sufficiently flexible to allow for overall profit maximization. Battigalli et al. show that a decrease in retailer substitutability, increases the retailers' share of the total profit. In turn, this increases the hold-up problem for the supplier, because the retailers, unlike in Inderst and Wey (2011), extracts a larger share also of the incremental profit following any investments made by the manufacturer. Hence, the type of buyer power that arises when retailers become more differentiated, may be detrimental to welfare in the long-run. Furthermore, it may not only harm the consumers; Battigalli et al. show that, by preventing the manufacturer from making investments that could have increased the overall industry profit, buyer power may ultimately also harm the retailers themselves.

Retailers may sometimes strengthen their bargaining position towards suppliers by committing to a single-sourcing strategy. Such a strategy removes interbrand competition (competition between the brands in the retailer's store), but in turn increases the competition between the manufacturers to gain access *to* the store. Gabrielsen and Sørgard (1994, 1999) give an early account of this argument.[13] Indert and Shaffer (2007) use a similar argument to explain the formation of retail chains, and then analyse how the creation of a retail chain may affect manufacturers' choice of product characteristics. They consider a model where two differentiated manufacturers are supplying two retail outlets that operate in separate markets. Each retailer can only stock one of the two manufacturers' brands. When the retailers are separated, each outlet optimally stocks the brand that provides the "best fit" to the consumers' local taste. However, following a merger between the retailers, Inderst and Shaffer show that the retailer, who in this case controls both outlets, can further increase its bargaining power towards the manufacturers by committing to stocking the same brand at both stores. In turn, this affects the manufacturers' optimal choice of brand characteristics: Anticipating the retailer's single-sourcing strategy, each manufacturer optimally adjusts its product characteristics so as to

[13]See also O'Brien and Shaffer (1997), Dana (2003) and Marx and Shaffer (2010), who apply the same argument in different settings.

fit the average consumer across both markets – instead of aiming for "maximal differentiation", where each manufacturer accommodates its own brand to "the local clientele", which is optimal when retailers are separated. The resulting loss in product variety may reduce both consumers' surplus and total welfare.[14]

Alongside the growing size of retail chains, we have also seen a significant growth in the size of local retail outlets over the recent years, with the development of hypermarkets and superstores that stock tens of thousands of products lines under one roof. We have also seen a gradual shift in consumer behaviour, where consumers increasingly prefer to do one-stop shopping, i.e., concentrating their purchases to a single weekday and to a single retail location. It is often argued that these trends have contributed to the buyer power of large retailers. This is something which has yet to be formalised in the literature. I address these issues in chapter 4 of this thesis.

Retailers' private labels

The growth of retailer owned brands, also called private labels, is one of the more important, and perhaps striking, developments in retailing over the past 30 years. In Norway, the penetration of private labels is modest but increasing – ranging between 8-9% of the total value sales. In the UK, in contrast, as much as around 50% of the sales in the major UK supermarkets are ascribed to the retailers' own brands.

Since the second half of the 1990s, a relatively small theoretical literature on private labels has emerged. As noted by Gabrielsen and Sørgard (2007), most of the literature has so far focused on how actual introduction of private labels affects the wholesale terms to retailers. It is widely believed that private labels serve as a bargaining tool for retailers, and hence allow them to extract more of the total surplus in negotiations with their national brand manufacturers. A significant part of the literature is concerned with the issue of how private labels affect the distribution of profits between retailers and manufacturers – and, moreover, with the question of how retailers may strategically position their private labels in relation to the manufacturers' national brands in order to maximise profits. See e.g. Narisimham and Wilcox (1998), Scott-Morton and Zetterlmeyer (2004), and Choi and Coughland (2006).

In addition to strengthening the retailers' bargaining position, it is often argued that private labels contribute positively to overall welfare by providing the consumers with

[14] See also Chen (2004), who, in a very different model (building on his 2003 paper), shows that an increase in the (exogenous) bargaining power of a dominant retailer can cause a monopolist manufacturer to produce fewer variants of its product.

more choice at lower prices (see e.g. Steiner (2004)). Mills (1995, 1999) was first to formalise these arguments. He analyses how the introduction of a private label affects both the distribution of profits between retailers and manufacturers, and how this in turn may affect retail prices and overall welfare. The retailer's private label is assumed to be a substitute, although of lower quality, to the national brand, which is produced by a monopolist manufacturer. Mills finds that, by introducing a private label, the retailer helps to alleviate the double marginalisation problem for the national brand, and thus increases the share of the total profit that the retailer extracts in the negotiations with the manufacturer. In turn, this means that, in addition to being offered the retailer's private label, the consumers are able to buy the national brand at a reduced price. Moreover, these positive welfare effects are stronger the closer in quality the retailer's private label is to the national brand.[15]

On the other hand, the empirical literature suggests that the prices of national brands often increase following the introduction of a private label.[16] To address this, Gabrielsen and Sørgard (2007) consider a model where the national brand manufacturer is assumed to have some share of consumers that are loyal to the national brand. In addition, there are the switching consumers, who consider both the quality gap and price difference between the private label and the national brand before making their decisions of which product to purchase. Gabrielsen and Sørgard also allow the national brand manufacturer to offer the retailer an exclusive purchasing contract, in order to induce national brand exclusivity. They find that when the quality of the private label is sufficiently low, the manufacturer optimally offers the retailer a relatively low wholesale price in return for national brand exclusivity. Hence, the mere threat of private label introduction (not actual introduction) may cause a reduction in the price of the national brand in their model. When the quality of the private label is sufficiently high, however, inducing national brand exclusivity becomes too expensive for the manufacturer. In this case the manufacturer will accommodate for private label introduction by increasing its wholesale price to take advantage of its loyal consumers. In this case, the retailer introduces the private label at a lower price to serve the switching segment. Because the private label may serve to either reduce or increase the price of the national brand, depending on the quality level of

[15] See also Bontems et al. (1999). Building on the model of Mills, they derive similar results. Unlike Mills, however, they assume that the retailer's (and the manufacturer's) marginal production costs are higher for higher quality levels of the product. They also assume that the national brand manufacturer has a cost advantage over the retailer at high quality levels. This has the consequence that the private label may not always be introduced by the retailer in equilibrium.

[16] See e.g. Harris et al. (2002), Bonfrer and Chintagunta (2004), Gabrielsen et al. (2006), Bontemps et al. (2005), and Bontemps et al. (2008).

the retailer's brand, Gabrielsen and Sørgard find the welfare implications of private labels to be mixed.

Note, that much of the literature on private labels assumes a bilateral monopoly with one national brand manufacturer and one retailer. Moreover, the literature generally relies on the assumption that retailers and manufacturers use simple linear tariffs. Introducing non-linear tariffs in these models either removes the effects on retail prices (in the case of Mills (1995, 1999) and Bontems (1999)) – or makes national brand exclusivity superfluous (in the case of Gabrielsen and Sørgard, 2007). I address some of these issues in chapter 2 of this thesis.

Buyer power and vertical restraints

There is a large theoretical literature that investigates the various contractual practices often used between vertically related firms. Examples of such practices are non-linear pricing, discounts and royalties, resale price maintenance, exclusivity requirements, quantity forcing, tie-ins, etc. For a very long time, perhaps "the biggest substantive issue facing antitrust", in Posner's words (2005 p. 1), has been the question of how to deal with these practices – commonly referred to as vertical restraints. Traditionally, the literature on vertical restraints has taken the perspective of upstream firms, focusing on the motivations of manufacturers to impose restraints on their buyers – either for "pro-competitive" reasons, to alleviate problems related to vertical coordination – or for anti-competitive reasons, e.g. using exclusivity contracts to foreclose an upstream rival.

The developments in the retail industry, however, have highlighted the need to analyse vertical restraints also from the buyers' perspective; in many situations it is the buyer who dictate the contract terms, and not the supplier. Hence, we need to ask when buyers are likely to adopt potentially harmful vertical restraints, and, moreover, to ask about the buyers' motivations for using vertical restraints, whether in a pro-competitive or anti-competitive manner.[17,18] The literature on the potential impact of buyer power on the

[17] Dobson (2008) distinguishes between seller-led restraints, imposed by suppliers on their buyers – such as for example resale price maintenance, quantity forcing, and exclusive purchasing requirements – and buyer-driven restraints, imposed by the buyers on their suppliers – such as for example slotting allowances and exclusive selling agreements. However, in general there may be incentives for buyers (suppliers) to use both type of restraints, e.g. imposing restraints on itself to commit to a specific type of behaviour. A buyer may for example find it optimal to impose reciprocal restraints, e.g., requiring a manufacturer to pay a slotting allowance in return for the buyer agreeing to purchase exclusively from the manufacturer.

[18] Shaffer (1991) gives an early assessment related to the use of slotting allowances. He finds that retailers who have bargaining power over their suppliers, may benefit by committing to paying higher wholesale prices to their suppliers, in order to dampen downstream competition, and then use negative fixed fees (slotting allowances) to transfer upstream flow payoffs back to themselves.

use of vertical restraints, is still very scarce, however.

Concerning the use of harmful vertical restraints, there exist a large literature on exclusion in vertical markets. This literature is mostly concerned with upstream exclusion, i.e., a supplier's potential use of exclusive purchasing agreements to exclude an upstream rival.[19] This literature challenges the Chicago doctrine (Bork, 1978; Posner, 1976), which basically states that anti-competitive exclusion can never be profitable.

More recently, however, a small literature has started to emerge that analyses the potential for exclusion in downstream markets when the bargaining power resides with the retailers.[20] Marx and Shaffer (2007) and Miklos-Thal et al. (2011) analyse the case with competing retailers who make offers to a single monopolist manufacturer. Both papers explore the consequences of different contractual instruments under buyer power, specifically the use of two-part versus three-part tariffs, and the use of explicit exclusivity provisions. When three-part tariffs or an exclusive dealing provision are feasible, Marx and Shaffer show that downstream exclusion (exclusive selling) always is an equilibrium outcome. In contrast, Miklos-Thal et al. find that when the retailers use two-part tariffs, and the offers can be made contingent on whether or not the retailer obtains exclusivity, exclusion will occur only when retailers are very close substitutes. Moreover, if the retailers can use contingent offers combined with upfront payments (i.e., three-part tariffs), they find that exclusion never occurs. See also Rey and Whinston (2011). Both of these results suggest that, if anything, there will be more exclusion under buyer power than when manufacturers have the bargaining power. However, this may not hold when there is competition at both levels of the vertical market, which opens up for the possibility that exclusion may occur at either level, upstream or downstream, or potentially both. We address this issue in chapter 3 of this thesis.

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From this short overview, it is clear the existing literature offers sometimes conflicting views on how buyer power may affect welfare, both in the short run and in the long run.

[19] For the case when buyers are final consumers, see Aghion and Bolton (1987), Bernheim and Whinston (1998), O'Brien and Shaffer (1997), Rasmusen et. al. (1991) and Segal and Whinston (2000). The case when buyers compete in a downstream market is analysed by e.g. Fumagalli and Motta (2006), Abito and Wright (2008), and Simpson and Wickelgren (2007).

[20] Above, we have already mentioned some articles that demonstrate impact of buyer power on the potential for upstream exclusion; see Gabrielsen and Sørgard (1994, 1999), O'Brien and Shaffer (1997), Dana (2003), and Indert and Shaffer (2007). This branch of the literature shows that a buyer may sometimes increase its bargaining power towards its suppliers by committing to an exclusive purchasing strategy, which, on one hand, eliminates interbrand competition, but increases competition for the retailer's patronage, on the other hand.

The literature is, perhaps inevitably, very heterogenous – and the policy implications therefore vary considerably with the various sources of buyer power considered, as well as with the specific practice or market structure analysed. When looking more closely, however, some patterns starts to emerge: The presence of downstream rivalry between retail outlets seems to be a common denominator in all models that, in one way or the other, report positive welfare effects of increasing buyer power (whether in the short or long term). Conversely, there is more reason to be concerned for welfare and efficiency if an increase in buyer power is either followed by or caused by an increase in retailers' market power. Preserving competition in the downstream market therefore seems to be the key, both to prevent potential harm as retailers grow stronger, and to reap the potential benefits of increasing buyer power. Hence, a tentative conclusion is that policy makers and antitrust practitioners ought to be particularly concerned with various practices employed by retailers and suppliers to increase the degree of downstream differentiation – such as for example the use of exclusivity agreements.[21]

There is still much work to be done in order to more fully understand the implications and sources of increasing retailer buyer power. The final chapters in this thesis help to complement the literature in differnt ways. In the following I will give a short summary of each of these chapters.

Chapter summaries

Private labels, rent shifting and consumer welfare

Retailers often play suppliers off against each other in order to obtain better terms of trade. A retailer may for example increase its profits by obtaining a steep quantity discount scheme from one manufacturer – e.g., negotiating a lower wholesale price in return for a higher fixed fee – and then use this contract as a bargaining tool in the negotiations with a second manufacturer. This strategy is termed rent shifting in the literature, because it describes a situation where two players, the retailer and the first manufacturer, manipulate their contract terms in order to extract surplus from a third player, the second manufacturer. Marx and Shaffer (1999) illustrate how this rent-shifting effect may cause the first manufacturer to offer its product to the retailer at a wholesale

[21]It has been pointed out by many that the development of retailers' private label programs is just another way for retailers to increase downstream differentiation - since retailers have "exclusive selling rights" to their own brands. See e.g. Battigalli et al. (2007).

price below cost.[22] In turn this may benefit the consumer – as a lower wholesale price makes for a lower price for the manufacturer's product in the store. In this chapter we look at how the decision of a retailer to introduce a private label affects the incentives for national brand manufacturers to offer discounts that allow for this type of rent-shifting. The idea is that private labels on one hand, and discounts that allow for rent shifting on the other, are substitute instruments for the retailer; both are tools to extract rent from manufacturers – yet, they may not be equally effective in doing so.

To gain some more insight, we consider a model with two vertically differentiated national brand manufacturers who negotiate sequentially with a (monopolist) retailer over two-part tariffs. We show that actual private label introduction always generates a price increase for the first manufacturer's brand. This result is perhaps most intuitive in the case when the retailer has a private label that is a very close substitute to the rival manufacturer's brand; the retailer can then extract most of the second manufacturer's surplus without distorting its contract with the first manufacturer.

Moreover, we show that when the retailer obtains a rent-shifting discount from one manufacturer, then this may have the effect of making private label introduction unprofitable for the retailer. This happens because the discount for the national brand may raise the retailer's opportunity cost from selling the private label if the private label and the national brand are competing for the same consumers. To say more about when the retailer will choose to introduce the private label, and to pinpoint the impact of the private label on national brand prices, we therefore endogenise the order of negotiations. Because there is a first-mover advantage for the manufacturers at the negotiation stage, we endogenise the contracting order by allowing each manufacturer to offer the retailer an upfront fee (a "negotiation fee") in return for the right to be first to commit to a contract with the retailer. After solving for the subgame-perfect equilibrium, we find that the retailer always chooses to introduce the private label, and, moreover, that the private label always causes a price increase for the high-quality national brand only. Importantly, this seems to be consistent with some of the recent empirical evidence on private labels impact on national brand prices: Bontemps et al. (2008) present evidence that retailer owned brands have caused an increase in the prices of national brands in France, and that the effect is considerably stronger for leading national brands than for secondary brands. Similar evidence from the Norwegian market is presented in an unpublished paper by Gabrielsen et al. (2006). As mentioned previously, current theories of private labels usu-

[22] Marx and Shaffer call this "predatory accommodation", since the first manufacturer has an interest in keeping the rival manufacturer active, in order to extract some its surplus (rather than trying to exclude the rival).

ally assume a bilateral monopoly situation, with only one national brand manufacturer; they are therefore unable to properly address this issue.

We also show that if upfront payments are not used, then the retailer sometimes chooses not to introduce the private label. Hence, upfront payments are key in facilitating private label introduction in our model.

Finally, we analyse the effect of private label introduction on social welfare. We find that the welfare effect is negative whenever the private label is a close enough substitute to either of the two national brands. Importantly, this contrasts with the common belief that consumers benefit the most when private labels and national brands compete vigorously. This welfare result comes as a consequence of the fact that we allow the retailer and the manufacturers to use two-part tariffs; there is then no double marginalisation problem that can be remedied by the retailer having a private label, unlike, e.g., in Mills (1999). Moreover, the increase in consumers' gross utility is smaller, and the price increase for the high-quality brand is larger, when the private label is a close substitute to the manufacturers' brands. The net effect is therefore negative.

Buyer power and exclusion in vertically related markets

Co-authored with Tommy Staahl Gabrielsen.

In this chapter we explore how the potential for exclusion is related to the allocation of bargaining power between manufacturers and retailers. With differentiated manufacturers and retailers, exclusion can occur at both the upstream and downstream levels. Strong manufacturers may exclude both smaller upstream rivals and downstream retailers. Big retailers with strong bargaining power may also find it profitable to exclude smaller upstream producers and even rival retailers from distributing certain products. To investigate these issues, it is necessary to develop models that encompass all of these potential subcases.

This chapter is most closely related to the recent articles by Marx and Shaffer (2007) and Miklos-Thal et al. (2011), who study the potential for downstream exclusion in a market with a monopolist manufacturer and two differentiated retailers. Instead, we consider a market structure where there is competition at both levels, upstream and downstream. Specifically, regarding the upstream market, we assume that a dominant manufacturer ("the manufacturer") is facing competition from a competitive fringe of suppliers, who sell an imperfect substitute to the manufacturer's brand. In addition, in contrast to both Marx and Shaffer (2007) and Miklos-Thal et al. (2011), we limit our attention to the use of two-part contingent (on exclusion) tariffs.

With competition at both levels of the vertical structure, there is potential for both upstream exclusion (exclusion of a brand) and downstream exclusion (exclusion of a retailer). Moreover, in our model there is scope for both partial and complete exclusion of either a brand or a retailer. We contrast the equilibrium outcome in two alternative situations: First, when the dominant manufacturer holds all the bargaining power, and then this is compared with the outcome when the retailers have all the bargaining power. Bargaining power in our model is the ability to offer take-it-or-leave it contracts to the other party.

By comparing the equilibrium outcomes in these two situations, we are able to gain insight in how such a shift in bargaining power may affect the incentive for exclusion and thereby social welfare and consumer surplus. We find that both non-exclusionary and exclusionary equilibria exist under both seller and buyer power. Exclusion in our model occurs when either product and/or retailer differentiation is weak. More importantly, in contrast to both Marx and Shaffer (2007) and Miklos-Thal et al. (2011), we find that non-exclusionary equilibria can be sustained for a larger set of parameter values for product and retail differentiation when the retailers have buyer power, compared to the situation when the dominant manufacturer has bargaining power. This implies that, unlike in the current literature, retailer buyer power may enhance welfare in our model, by giving the consumers more choice at lower prices compared to when the manufacturer has all the bargaining power.

**The buying power of multiproduct retailers:
competition with one-stop shopping**

Over the recent years we have seen a drastic increase in the size of many retail outlets, with the developments of both superstores and hypermarkst that stock tens of thousands of products. It is often argued that the growing size of retail outlets, together with the trend towards one-stop shopping behaviour, where consumers purchase a whole basket of goods on each shopping trip, has contributed to the buyer power of large retailers' towards their manufacturers (Inderst and Mazarotto, 2005). In this chapter we investigate this argument more formally.

The claim that the mere size of retail outlets contributes to the bargaining power of retailers, is contentious. For example, it is well known from the economic literature that it is primarily the degree of rivalry between the manufacturers' brands that creates bargaining power for the retailer – not the number of brands or product lines that the retailer sells, as such. However, we show that consumers' preferences for one-stop shopping

– whereby consumers purchase an increasing number of goods on each shopping trip – may give some validation to the argument.

Larger retail formats have in part replaced and in part come in addition to smaller convenience stores and specialised corner shops, who offer a more limited variety. However, in many countries, public policy puts restrictions on both the number and size of large outlets, in the form of planning restrictions that sometimes intentionally seek to protect smaller retailers. In line with this, we consider a model where a number of independent manufacturers negotiate terms of trade with a large multiproduct retailer and a group of smaller single product retailers, located at separate ends of a Hotelling line, respectively. The multiproduct retailer is assumed to be large enough to stock all of the manufacturers' products. We also assume that there is a sufficient number of single-product retailers, so that consumers, in equilibrium, can obtain all of the manufacturers' products at either retail location. On the demand side, we consider two types of consumers; one-stop (multiproduct) shoppers, who buy all products, and top-up (single product) shoppers, each buying one specific product only.

We find that an increase in the share of one-stop shoppers intensifies the degree of competition between the retailers – hence, reducing the overall industry profit – while at the same time enabling the multiproduct retailer to extract discounts from its suppliers (in the form of lower fixed fees): When some consumers are one-stop shoppers, the flow profit of the multiproduct retailer becomes concave in the number of products sold. The intuition is that, for each additional product in the retailer's store, the multiproduct retailer reduces prices for *all* products, in order to internalise the demand externalities created by the one-stop shoppers. For each new product, the multiproduct retailer therefore earns less revenue per-unit sold of its other products. A product's marginal contribution to the multiproduct retailer's flow profit, is therefore decreasing in the overall number of products that the retailer sells. Moreover, since each individual manufacturer negotiates "on the retailer's margin", taking as given the retailer's contracts with all the other manufacturers, a manufacturer captures a smaller portion of the overall profit when the retailers flow profit becomes concave – hence, generating a discount for the multiproduct retailer. This effect is analogous to the effect we identified in the discussion of the papers by Inderst and Wey (2003, 2007) above.

We also find that, even if manufacturers earn lower profits, a manufacturer can sometimes counteract the power of the large retailer by making an effort to become more efficient or to improve the quality of its product. By offering its product at lower costs (or higher quality), the manufacturer may be able to "tempt" more one-stop shoppers to switch shopping location in the event that the large retailer delists its product. Since one-stop shoppers are extra valuable to the multiproduct retailer, this undermines the value of the retailer's disagreement profit in the negotiations with the manufacturer, hence increasing the amount that the manufacturer can extract in the negotiations. The presence of a multiproduct retailer therefore sometimes positively affects the manufacturers' incentives in our model.

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Chapter 2

Private Labels, Rent Shifting and Consumer Welfare

Private Labels, Rent Shifting and Consumer Welfare*

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Abstract

This paper investigates a retailer's decision to introduce a private label and asks how the retailer's access to a private label may affect the pricing of substitute national brands. We consider a model with two vertically differentiated national brand manufacturers that negotiate sequentially with a monopolist retailer over two-part tariffs. We find that when the retailer decides to introduce a private label, this generates a price increase for one of the two national brands. Moreover, when we endogenise the order of negotiations, we find that i) the retailer's private label is always introduced, and ii) the private label always causes a price increase for the high-quality national brand only. In our model, this price increase does not occur due to a price discrimination effect, as in Gabrielsen and Sørgard (2007) ["Private labels, price rivalry, and public policy", European Economic Review, (51), 403-424], but as a result of a rent-shifting effect. The welfare implications of private label introduction are discussed.

JEL classifications: L11, L12, L40, L42

Keywords: private labels, national brands, rent shifting, public policy

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1 Introduction

The market shares of retailer-owned brands, also called private labels, have grown tremendously in grocery industries all around the world during the last few decades. In Europe, the penetration of private labels has ranged from a modest 4 percent of the value sales in Greece, to an astonishing 45 percent in Switzerland, according to a 2005 study by ACNielsen. Typically, private labels are sold at lower prices than their national brand counterparts, which means that their volume shares are even higher.[1] Furthermore, there are strong variations in private label penetration across product categories, with generally higher shares in refrigerated food, paper, plastic and wraps, and frozen food (ACNielsen, 2005). Yet, the variation across categories also varies *across countries*.[2]

The recent growth in private labels, and the variation in penetration both across countries and across categories, raises important questions as to why and under which conditions retailers choose to introduce their own brands. Secondly, and more importantly, what are the welfare effects of private label development? Does private label introduction affect the pricing of national brands? Should we expect consumer welfare to be higher when private labels and national brands are close competitors or when they are more differentiated? The present article offers a theory to try to answer some of these questions.

Our paper contributes to a growing literature on private labels. This literature may be divided into several branches.[3] The papers perhaps closest to our work are the ones focusing on the welfare and price effects of private label introduction: A common view in this literature is that private labels benefit both retailers and consumers; they may be useful to retailers as a bargaining tool against manufacturers, and they may benefit consumers by offering more choice and lower prices.[4] The seminal paper in the literature is Mills (1995), which analyses the effects of private label introduction in a model with two firms; a national brand manufacturer and a monopolist retailer. Mills assumes that

[1] On average the prices of private labels is 31% lower than their national brand counterparts, according to ACNielsen (2005).

[2] For some recent private label development trends, see Whelan's (2007, 2008) reports on the third and forth annual symposia on retail competition, arranged by the Centre for Competition Law & Policy at the University of Oxford.

[3] Some papers analyse how the introduction of private labels affects the sharing of profits in the vertical structure (Narasimhan and Wilcox, 1998; Mills, 1999; Scott Morton and Zettelmeyer, 2004), or investigate the retailer's decision about where to locate its private label in the product space (Scott Morton and Zettelmeyer, 2004; Choi and Coughlan, 2006). Sometimes we see that national brand manufacturers supply their retailers with private labels, and some authors also investigate the rationale for this. See, e.g., Wu and Wang (2005) and Bergès-Sennou (2006).

[4] For a broader discussion regarding the welfare effects of private label introduction, see Dobson (1998), Bergès-Sennou et al. (2004) and Steiner (2004).

the manufacturer uses a linear wholesale contract, and he shows that when the retailer is selling a private label, the manufacturer is forced to reduce its wholesale price to compete against the retailer for in-store market shares. The private label therefore reduces the double marginalisation problem and improves consumer welfare. These welfare gains are larger the higher the quality of the retailer's private label.[5]

The view that private labels lead to lower retail prices and increased welfare has been challenged by several empirical investigations. In particular, some recent studies indicate that national brand manufacturers respond to private label introduction by increasing their prices.[6] Gabrielsen and Sørgard (2007) extend Mills's model by assuming that there are two groups of consumers, "switchers" and "loyals", where the latter group is assumed to be loyal to the national brand. They also allow the national brand manufacturer to offer the retailer an exclusive dealing contract. Gabrielsen and Sørgard find that private label introduction may cause an increase in the price of the national brand. This happens when the quality of the private label is high and when there is a sizeable number of loyal consumers; the national brand manufacturer then finds it more profitable to exploit its loyal consumers than to compete against the private label in the switching segment. They also find that the private label is not always introduced, since the national brand manufacturer may profitably induce exclusive dealing by offering the retailer a lower wholesale price in return for exclusivity when private label quality is low. The effects on consumer and total welfare are therefore mixed.[7]

In reality, there is often more than one national brand manufacturer in any particular product category. These manufacturers often supply brands of different (perceived) quality levels. Some empirical studies also suggest that different manufacturers respond differently to private label introduction, and that the price responses may vary with the

[5] Bontems et al. (1999) extends the model of Mills: They assume that marginal costs are increasing in quality, and allow the national brand to have a cost advantage over the private label at high quality levels. Unlike Mills, they find that the wholesale price of the national brand is a non-monotonic function of private label quality. The effect on consumer welfare is still positive, but because of the non-monotonic price response, the effect is stronger for intermediate quality levels of the private label.

[6] Putsis (1997) and Chintagunta et al. (2002) find that national brand manufacturers respond to the private label invasion by reducing their prices. On the other hand, Harris et al. (2002), Bonfrer and Chintagunta (2004), Gabrielsen et al. (2006), Bontemps et al. (2005), and Bontemps et al. (2008) all find that private labels may cause an increase in the prices of national brands.

[7] Note that Gabrielsen and Sørgard's results rely on a particular demand function. Specifically, the result that private label introduction causes an increase in the price of the national brand, rests on the assumption that the demand from the loyal consumers is perfectly inelastic as long as the price of the national brand is below some reservation price. Furthermore, the result that private labels are not always introduced, rests on the assumption that the manufacturer use a linear contract; a two-part tariff would allow for total profit maximisation and would make exclusive dealing superfluous.

type of private label introduced (Gabrielsen et al., 2006; Bontemps et al., 2008). Because the national brand manufacturer is often assumed to be a monopolist, the current literature is unable to properly address this issue. Furthermore, we know that the contracts used between manufacturers and retailers may include both upfront payments and quantity discounts. Hence, the contracts are typically non-linear, in contrast to what is often assumed in the literature. We present a model that incorporates both of these features. We assume that a monopolist retailer negotiates terms of trade sequentially with two manufacturers of substitute brands, where one is a high-quality manufacturer and the other is a low-quality manufacturer. The retailer subsequently decides whether to introduce a private label.[8] Building on a model by Marx and Shaffer (1999), we show that private label introduction may cause a price increase for national brands through a rent-shifting effect. This result does not rely on a particular demand function; instead it rests on the assumption that the retailer negotiates sequentially with the national brand suppliers and that bilateral efficient two-part tariffs are used: When using non-linear tariffs, a retailer and a manufacturer (the first manufacturer) may want to use their contract as a rent-shifting device – to extract more surplus from a second manufacturer. For example, by offering the retailer a larger quantity discount, the first manufacturer is able to increase the retailer's opportunity cost of buying from the second manufacturer (given that the two manufacturers are competitors). This forces the second manufacturer to give up more of its surplus in the negotiations with the retailer. The retailer and the first manufacturer are jointly better off as a result. When the discount from the first manufacturer comes with a reduction in the wholesale price, as when using a two-part tariff[9], this also results in a reduction in the retail price of the first manufacturer's brand, which, ceteris paribus, causes the consumers' surplus to increase.

We show that when the retailer introduces a private label that is a substitute for the two manufacturers' brands, this reduces the incentives of a manufacturer-retailer pair to use their contract as a rent-shifting device. Simply put, because access to a private label provides an efficient means for the retailer to extract rent from its manufacturers, it reduces the incentives to use supply contracts as a rent-shifting device, which is inefficient

[8]We assume that the quality of the private label (exogenous) is inferior to the high-quality national brand. This assumption is not critical to our results. It simply serves to restrict the number of cases to consider. The assumption is, however, also supported empirically. Even though we have seen an increase in the development of private labels that are premium brands in their own right, the general perception is still that most private labels are inferior to or, at best, on a par with their high-quality national brand counterparts. This view is supported by ACNielsen (2005), which report that the prices of private labels are on average 31% lower than the prices of national brands.

[9]Combining a higher fixed fee with a wholesale price below cost.

(creates price distortions). Private label introduction therefore results in an increase in the retail price of the first manufacturer's brand in our model.

When negotiations occur sequentially, there may be an advantage for each manufacturer to move first at the contracting stage. Hence, there is an incentive for the manufacturers to try to influence the order of the negotiations. We therefore endogenise the contracting order by having the manufacturers compete for the first-mover rights. Manufacturers can do this by offering the retailer an upfront payment (a "negotiation fee" or a slotting allowance) in exchange for the right to move first at the contracting stage (Marx and Shaffer, 2001, 2008).[10] We show that when upfront payments are used, the retailer always chooses the contracting order that generates the highest overall profit, and the retailer's private label is always introduced in equilibrium. Moreover, in equilibrium it is always the price of the high-quality brand that is affected by the retailer's private label. The price response is also stronger the higher the quality of the private label. These results seem to be consistent with the findings in recent empirical studies on private labels.[11]

In our model, the effect of private label introduction on social welfare can be either positive or negative. If there are no price distortions, e.g. as in the case where the manufacturers negotiate simultaneously with the retailer, private label introduction always causes some consumers to switch products. If the private label is of lower quality, it may also attract new consumers with low willingness to pay. This implies that the private label contributes positively to consumers' surplus, ceteris paribus, as long as it is strictly differentiated from both national brands. When the manufacturers negotiate sequentially, however, this positive effect may be more than offset by the price increase for the high-quality brand. The price increase is larger when the retailer introduces a private label with a quality identical to either of the national brands, sometimes termed a "me-too" strategy in the literature. At the same time, when the private label simply mimics an existing brand, it is not adding any real value to consumers. The net effect on social

[10] We know for example that in the Norwegian grocery sector, retailers often charge (non-refundable) negotiation fees. These are fees that manufacturers have to pay up front in exchange for the right to negotiate with the retailer. These fees may be used to deter less profitable manufacturers from approaching the retailer – which may be efficient in situations where retailers face many manufacturers and when retailers have imperfect information about the value of the manufacturers' brands. We make the point here that these fees, or any other fees that the manufacturers have to pay up front, such as for example slotting allowances, could be used to determine the order of negotiations in cases where there is a first-mover advantage for manufacturers.

[11] Gabrielsen et al. (2006) study the Norwegian market and find that highly distributed and ranked products are more influenced by private label introduction. They also find that more successful private labels, measured by private label market share, cause a stronger price response than less successful private labels. Similarly, Bontemps et al. (2008) find that private labels have less effect on the prices of second-tier brands than on the prices of the leading brand.

welfare is therefore negative when the private label is positioned close enough to either of the national brands. This contrasts with the common belief that consumers benefit the most when private labels and national brands compete vigorously.[12]

We also investigate what happens if upfront payments are not used. In this case the retailer does not always introduce the private label. The reason is the following: When the quality of the private label is sufficiently close to the first manufacturer's brand, then there is a trade-off for the manufacturer between i) setting the wholesale price high to accommodate the retailer's private label and ii) setting the wholesale price low, which may prevent private label introduction, but allows for more rent to be extracted from the second manufacturer. The retailer and the first manufacturer sometimes therefore find it profitable to choose rent-shifting over private label accommodation. This also implies that there is more private label introduction when the retailer's bargaining power against the manufacturers is high, since there is then less distortion to the first manufacturer's wholesale price in the first place. The latter result is interesting, since it suggest that factors commonly associated with buyer power, such as the use of upfront payments and the ability of retailers to dictate the terms of trade, yields more private label introduction.

In addition to the literature on private labels cited above, our paper is related to the literature that investigates the use of contracts to engage in rent shifting and opportunism, where the seminal paper is Aghion and Bolton (1987). See Marx and Shaffer (1999, 2001, 2008) for an introduction to this literature. We also offer some modifications to the results of Marx and Shaffer (1999): They show how below-cost pricing can be used by a manufacturer in an intermediate goods market as a means to extract rent from a competitor, without aiming to drive the rival out of the market. They term this "below-cost pricing without exclusion", or "predatory accommodation", since the manufacturer has an interest in the competitor staying active. We show that, when the retailer is selling a third substitute product (for example a private label), then "predatory accommodation" may lead to exclusion. In our model, it is the retailer's own brand that is excluded, but we conjecture that this may hold more generally – i.e., if the product is produced by an independent manufacturer with bargaining power.

The rest of the paper is organized as follows: Section 2 presents the model and the timing of the game. Section 3 solves the model and presents the main results. Section 5 provides some welfare results and discusses our main assumptions and possible extensions

[12]See e.g. Steiner (2004). This view seems to rely on the assumption that retailers and manufacturers use linear tariffs: The retailer can then eliminate the problem of double marginalisation by positioning its private label close to the national brand. This benefits consumers, since they are able to buy a high-quality brand at a lower price.

to the model. Section 6 gives a conclusion.

2 The model

We consider a vertical structure where two vertically differentiated national brand manufacturers, h and l, negotiate terms of trade with a common retailer. Manufacturer h is assumed to be producing the higher quality brand. For simplicity we normalise the quality of the high-quality brand to one ($s_h = 1$), and denote $s_l \leq 1$ the quality of brand l.

In addition to selling the national brands, the retailer may choose to distribute a private label with the quality $s_r \leq 1$. The retailer's private label is assumed to be produced either by the retailer himself, through backwards integration, or by a fringe of competitive private label manufacturers, who in turn are selling the product to the retailer at the marginal cost of producing the good.[13] The quality of the retailer's brand is exogenous in the model, as are the qualities of the two national brands.

On the demand side, we assume that there is a continuum of consumers of different types, each buying only one unit and one product. The net utility of a consumer of type θ buying product i, is

$$u(\theta, s_i) = \theta s_i - p_i, \tag{1}$$

where $\theta \sim U[0,1]$ is the consumer's "taste" for quality and p_i is the price of product i.[14] The consumers utility when not buying any of the products is normalised to zero. We assume that there is a unit mass of consumers.

From this we can denote by $\theta_r^h = (p_h - p_r) / (1 - s_r)$ the consumer type indifferent between buying the private label or brand h, by $\theta_r^l = (p_l - p_r) / (s_l - s_r)$ the type indifferent between the private label or brand l, and by $\theta_l^h = (p_h - p_l) / (1 - s_l)$ the type indifferent between the the two branded products h and l. Finally, we denote by $\theta_i^0 = s_i / p_i$ the type indifferent between buying product i or not buying any product. The resulting (direct)

[13] The two assumptions are equivalent. The critical assumptions here are that the retailer is paying the marginal production cost per unit it sells of the private label, and that there is no fixed fee negotiated to obtain the private label. These are standard assumptions in the literature.

[14] This is the classic Mussa-Rosen (1978) utility function.

demand system is then:

$$q_h = \begin{cases} 1 - \theta_l^h & \text{if} \quad s_l > s_r \\ 1 - \theta_r^h & \text{if} \quad s_l \leq s_r \end{cases}$$
$$q_l = \begin{cases} \theta_l^h - \theta_r^l & \text{if} \quad s_l > s_r \\ \theta_r^l - \theta_l^0 & \text{if} \quad s_l \leq s_r \end{cases} \tag{2}$$
$$q_r = \begin{cases} \theta_r^l - \theta_r^0 & \text{if} \quad s_l > s_r \\ \theta_r^h - \theta_r^l & \text{if} \quad s_l \leq s_r \end{cases}$$

Inverting this demand system gives us the following indirect demand functions:

$$p_h = 1 - q_h - s_l q_l - s_r q_r$$
$$p_l = \begin{cases} s_l (1 - q_l - q_h) - s_r q_r & \text{if} \quad 0 \leq s_r \leq s_l \\ s_l (1 - q_l - q_r - q_h) & \text{if} \quad 1 \geq s_r > s_l \end{cases} \tag{3}$$
$$p_r = \begin{cases} s_r (1 - q_r - q_l - q_h) & \text{if} \quad 0 \leq s_r \leq s_l \\ s_r (1 - q_r - q_h) - s_l q_l & \text{if} \quad 1 \geq s_r > s_l \end{cases}$$

where simply $q_i = 0$ if the retailer is not selling product i.

For each product $i \in \{h, l, r\}$, the marginal cost of production, $c_i(s_i)$, is assumed to be constant for the quantity produced, but increasing for the quality level s_i of the product. We are going to use the explicit function $c_i = s_i^2/4$ when solving the model.[15]

Timing of the game To demonstrate that a retailer's private label may affect manufacturers' incentives to offer discounts to facilitate rent-shifting, we are going to assume that the retailer's negotiations with the national brand manufacturers occur sequentially. A feature of sequential negotiations is that the specific order may affect both the retailer's and the manufacturers' payoff when the manufacturers are asymmetric. At first, we endogenise the order by assuming that the retailer is able to capture some of the manufacturers' gains from moving first. The retailer can do this by making the manufacturers compete for the first-mover rights (Marx and Shaffer, 2001, 2008), or simply by charging a "negotiation fee" in exchange for the right to move first. In either case, the retailer

[15] Most important, this cost function assures that it is efficient to sell all of the products. If marginal costs were independent of (or proportional to) the quality level, then, depending on relative marginal costs, sometimes only one of the products would be supplied. These are not very interesting cases. The function also guarantees that the high-quality national brand offers the highest stand-alone profit of the three products. We could have picked a slightly more general form, such as $c_i = ks_i^2$. However, as long as we assume that h is the more profitable product (which implies that k is not too high), the specific level of k does not matter qualitatively for the results.

collects an upfront fee from the manufacturer that has more to gain from being first to commit to a contract with the retailer.[16]

If upfront payments are not allowed, then the retailer is confined to pick the order that maximises his profit at the negotiation stage.[17] It turns out that this may affect both the equilibrium order of negotiations and the retailer's decision of whether to introduce its private label. We return to this issue in Section 3.1.

Our model has four-stages: At stage 0, the manufacturers make simultaneous offers, S_h and S_l, for the right to be first at the contracting stage (where $S_h = S_l = 0$ if upfront payments are not used). The retailer accepts one of the offers. In the following, we let $i \in h, l$ denote the winner at stage 0 – and let $j \in h, l$, $j \neq i$ denote the loser. At stage 1, the retailer and manufacturer i negotiate a two part tariff $T_i(q_i) = F_i + w_i q_i$, where w_i is the wholesale price and F_i is a fixed fee paid to the manufacturer. This simple contract has the necessary ingredients to facilitate rent shifting, and also captures the defining feature of a simple quantity discount.

At stage 2, the retailer and manufacturer j negotiate a two-part tariff $T_j(q_j)$, before the retailer finally makes its quantity choices $q = (q_h, q_l, q_r)$ at stage 3. Hence, the retailer's decision whether or not to sell the private label is delayed to the last stage.

We use the generalised Nash bargaining solution to determine the outcome of the negotiations at stage 1 and 2. When the parties use two-part tariffs, the Nash solution prescribes that the retailer and the manufacturer set the wholesale price so as to maximise their joint profit, and then use the fixed fee to divide their incremental gains from reaching an agreement. More specifically, the Nash solution dictates that the division of the surplus should be such that the retailer (supplier) receives its disagreement payoff, which is the amount it earns if not reaching an agreement, plus a share $\lambda \in (0, 1)$ (and $1 - \lambda$ to the supplier) of the total incremental gain from reaching an agreement, where λ is the level of the retailer's bargaining power.[18] We may also interpret λ as the level of the retailer's buyer power against the manufacturers.

To illustrate, let Δ_r^i be the incremental gain to the retailer's flow profit when reaching

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[16] Marx and Shaffer (2001) argue that in this way we may view the widespread use of slotting allowances as another form of rent shifting, but from the manufacturers to the retailer.

[17] Marx and Shaffer (2007) study the optimal order of negotiations for a monopolist retailer negotiating with two differentiated manufacturers. They assume contracts that are sufficiently general to allow for total equilibrium profit maximisation. In contrast, we assume contracts that induce price/ quantity distortions in equilibrium. We also show how their results are slightly modified when the retailer has access to a private label.

[18] To reduce the number of cases to consider, we assume that both manufacturers have the same bargaining power against the retailer.

an agreement with manufacturer i, and let Δ_i^r be the incremental gain to the manufacturer's flow profit. Then the Nash bargaining solution prescribes the following fixed fee:

$$F_i^* = \arg\max \left(\Delta_r^i - F_i\right)^\lambda \left(\Delta_i^r + F_i\right)^{1-\lambda}, \tag{4}$$

which we can solve for F_i to find

$$F_i^* = (1-\lambda)\,\Delta_r^i - \lambda\Delta_i^r. \tag{5}$$

Taking $w_i = w_i^*$ as given, the solution says that a share $1-\lambda$ of the gain to the retailer's flow profit should go to the manufacturer, and a share λ of the gain to the manufacturer's flow profit should go to the retailer – all through the fixed fee F_i^*.

We proceed by solving the game backwards, starting with stage 3.

3 Equilibrium analysis

Stage 3 In the event that the negotiations with both h and l were successful, the retailer takes the contracts $T_h(q_h)$ and $T_l(q_l)$ as given, and chooses quantities $q = (q_h, q_l, q_r)$ so as to maximize its profit. We let υ^* denote the retailer's equilibrium flow profit (profit gross of fixed fees) when all products are sold:

$$\begin{aligned} \upsilon^* &= \max_q \upsilon(q_h, q_l, q_r) \\ &= \max_q \left\{[p_h(q) - w_h]\,q_h + [p_l(q) - w_l]\,q_l + [p_r(q) - c_r]\,q_r\right\}, \end{aligned} \tag{6}$$

Let $q^* = (q_h^*, q_l^*, q_r^*)$ be the quantities that maximise this program. In the same fashion, the retailer maximises

$$\upsilon_{-l}^* = \max_{q_h, q_r} \upsilon(q_h, q_r, 0), \tag{7}$$

if negotiations have failed with manufacturer l, and

$$\upsilon_{-h}^* = \max_{q_l, q_r} \upsilon(q_l, q_r, 0), \tag{8}$$

if negotiations have failed with manufacturer h. Let q_{-l}^h and q_{-l}^r be the quantities of h and r respectively that maximises (7), and let q_{-h}^l and q_{-h}^r be the quantities of l and r that maximizes (8). Finally, we have

$$\upsilon_r^* = \max_{q_r} \upsilon(q_r, 0, 0) \tag{9}$$

which is the retailer's profit if the negotiations have failed with both national brand manufacturers. Note that, depending on w_h and w_l, and the quality of the private label, we may get the corner solution $q_r = 0$ (no private label introduction) from any of these maximisation problems – except in (9), which yields $q_r > 0$ and $\upsilon_r^* > 0$ as long as $s_r > 0$.

Given the demand system derived above, the retailer will adjust quantities so as to return the same prices $p^* = (p_h^*, p_l^*, p_r^*)$ in all the subgames where the respective goods are sold, where

$$p_h^* = \frac{1 + w_h}{2},\ p_l^* = \frac{s_l + w_l}{2},\ p_r^* = \frac{s_r + c_r}{2} \tag{10}$$

As a point of reference, let $p^M = \left(p_h^M, p_l^M, p_r^M\right)$ be the price schedule that maximises the profit of the fully integrated firm:

$$p_h^M = \frac{1 + c_h}{2},\ p_l^M = \frac{s_l + c_l}{2},\ p_r^M = \frac{s_r + c_r}{2}. \tag{11}$$

Stage 2 At stage 2, the retailer and national brand manufacturer $j \in h, l$ negotiates a two-part tariff $T_j(q_j)$, taking as given the retailer's and manufacturer i's choice of contract at stage 1 and the retailer's equilibrium strategies at stage 3. The retailer and manufacturer j will choose w_j so as to maximise their joint profit, which, if the retailer succeeded in its negotiations with i at stage 1, is equal to

$$\upsilon^* + (w_j - c_j)\, q_j^* - F_i \tag{12}$$

Similarly, if the negotiations failed between the retailer and i at stage 1, the joint profit of r and j is equal to

$$\upsilon_{-i}^* + (w_j - c_j)\, q_{-i}^j \tag{13}$$

Maximising (12) and (13) with respect to w_j, and using the envelope theorem, gives the first-order conditions

$$\frac{\partial q_j^*}{\partial w_j}(w_j - c_j) = 0,\ \frac{\partial q_{-i}^j}{\partial w_j}(w_j - c_j) = 0 \tag{14}$$

which says that the wholesale price w_j should be set equal to the manufacturer's marginal cost c_j in both subgames. This result is well known in the literature. Since F_i appears as a constant in the retailer's and manufacturer j's maximisation problem at stage 2, they agree on the wholesale price $w_j^* = c_j$ that maximises *total* channel profit and which makes the retailer the residual claimant to all sales of brand j.

Given $w_j^* = c_j$, the retailer and manufacturer j then divide the incremental gains from trade according to the Nash solution (4), with a share $\lambda \in (0,1)$ going to the retailer, and a share $1-\lambda$ going to the supplier. In the event that the retailer succeeded in its negotiations with i, the incremental gains from trade between the retailer and j are simply $\upsilon^* - \upsilon^*_{-j}$. On the other hand, if there was disagreement between the retailer and i at stage 1, then the incremental gains from trade between the retailer and j are $\upsilon^*_{-i} - \upsilon^*_r$. This proves the following result.

Lemma 1. *If the retailer succeeds in its negotiations with manufacturer $i \in h, l$ at stage 1, then we have $w^*_j = c_j$ and $F^*_j = (1-\lambda)\left(\upsilon^* - \upsilon^*_{-j}\right)$ for the subgame equilibrium at stage 2. If the retailer fails in its negotiations with manufacturer i at stage 1, then we have $w^j_{-i} = c_j$ and $F^j_{-i} = (1-\lambda)\left(\upsilon^*_{-i} - \upsilon^*_r\right)$ for the subgame equilibrium at stage 2.*

Stage 1 At stage 1, the retailer and national brand manufacturer $i \in h, l,\ i \neq j$, negotiate the two-part tariff $T_i(q_i)$, taking as given the retailer's and manufacturer j's equilibrium strategies at stages 2 and 3. Similar to the case at stage 2, the object of the retailer and manufacturer i is first to agree on the wholesale price w_i that maximises their joint profit. After substituting in the fixed fee F^*_j (Lemma 1), we can write the joint profit of the retailer and manufacturer i as

$$\Pi_{r-i} = \upsilon^* + (w_i - c_i)\, q^*_i - \underbrace{(1-\lambda)\left(\upsilon^* - \upsilon^*_{-j}\right)}_{F^*_j} \tag{15}$$

If the negotiations between the retailer and i should fail, then, according to Lemma 1, the retailer's profit will be equal to $\upsilon^*_{-i} - F^j_{-i} = \lambda \upsilon^*_{-i} + (1-\lambda)\, \upsilon^*_r$, and manufacturer i's profit is zero.[19] The incremental gain from trade between the retailer and manufacturer i is therefore

$$\begin{aligned} &\upsilon^* - F^*_j - \left(\upsilon^*_{-i} - F^j_{-i}\right) + (w_i - c_i)\, q^*_i \\ &= \lambda\left(\upsilon^* - \upsilon^*_{-i}\right) + (1-\lambda)\left(\upsilon^*_{-j} - \upsilon^*_r\right) + (w_i - c_i)\, q^*_i. \end{aligned} \tag{16}$$

According to the Nash solution (4), we then get the following fixed fee in equilibrium.

$$F^*_i = (1-\lambda)\left[\lambda\left(\upsilon^* - \upsilon^*_{-i}\right) + (1-\lambda)\left(\upsilon^*_{-j} - \upsilon^*_r\right)\right] - \lambda\left(w^*_i - c_i\right) q^*_i. \tag{17}$$

Maximising (15) with respect to w_i, and applying the envelope theorem, gives the following

[19] Here we do not consider the upfront payment S_i paid at stage 0. Since this payment is already "sunk", it should not affect maximisation at stages 1-3. It can therefore be safely ignored.

first-order condition for joint profit maximisation:

$$\frac{\partial q_i^*}{\partial w_i}(w_i - c_i) = (1-\lambda)\left(q_{-j}^i - q_i^*\right) \geq 0 \tag{18}$$

The right-hand side of eq. (18) is the strategic rent-shifting effect identified by Marx and Shaffer (1999). By distorting the unit price w_i, there is a potential for the parties to affect the fixed fee paid to manufacturer j at stage 2. The condition states that, when considering a reduction in the wholesale price, $w_i < c_i$, the manufacturer and the retailer should balance the gain that comes from reducing the second manufacturer's fixed fee F_j^* (the right-hand side) against the loss to the total profits that comes from selling brand i at a price $p_i < p_i^M$ (the left-hand side). The loss to total profits is higher, the higher $|\partial q_i^*/\partial w_i|$ is. Which means that, ceteris paribus, below-cost wholesale pricing is more costly when manufacturer i faces more interbrand competition. More interbrand competition means that any reduction in the wholesale price of brand i will cause a larger increase in the number of units that the manufacturer has to sell below cost.

However, some substitution between the two national brands is necessary for there to be any gain from below-cost pricing. This is reflected in the right-hand side of eq. (18): A marginal reduction in the wholesale price w_i increases the retailer's disagreement payoff at stage 2 by $q_{-j}^i > 0$, and hence strengthens the retailers position when negotiating with manufacturer j. This effect calls for a reduction in the fixed fee F_j^*. At the same time, a marginal reduction in w_i increases the retailer's joint profit with j by $q_i^* > 0$, which calls for an increase in F_j^*. As long as the two national brands are direct substitutes, the first effect dominates, and we get $q_{-j}^i - q_i^* > 0$. In this case the manufacturer's wholesale price should be below the manufacturer's marginal cost, $w_i^* < c_i$.

Note that, for below-cost wholesale pricing to arise in equilibrium, manufacturer j also has to possess some degree of bargaining power against the retailer, i.e. $\lambda < 1$, which we have assumed; if not, then there is no surplus rent for the retailer and manufacturer i to extract from manufacturer j; when $\lambda = 1$, the retailer extracts all of manufacturer j's surplus, irrespective of the level of the wholesale price w_i.

From eq. (18), it is easy to analyse how private label sales affect the incentives for below-cost pricing. Suppose that the retailer negotiates with manufacturer h first ($i = h$). If we solve eq. (18) for w_h, we then obtain

$$\overline{w_h} = \begin{cases} \dfrac{1}{4} - \dfrac{(1-\lambda)(s_l - s_r)(1-s_l)(1-s_r)}{4(1-s_r+(1-\lambda)(s_l-s_r))} & \text{if} \quad s_r < s_l \\ c_h & \text{if} \quad s_r \geq s_l \end{cases}, \tag{19}$$

where we have both $\overline{w_h} < c_h$ and $\partial \overline{w_h}/\partial s_r > 0$ as long as $s_r < s_l$. Note that $\overline{w_h}$ is the optimal wholesale price only as long as private label introduction is optimal at stage 3 ($q_r > 0$). In this case, the private label softens the effect that a reduction in w_h has on the retailer's disagreement profit with manufacturer l. This is reflected in $(1-\lambda)\left(q^h_{-l} - q^*_h\right)$, which is falling in s_r up to $s_r = s_l$ and zero for $s_r \geq s_l$: When $s_r < s_l$, a lower wholesale price w_h increases the sales q^*_h of brand h, which is positive. But an increase in q^*_h also cannibalises some of the retailer's (out-of-equilibrium) private label sales, q^r_{-l}, and this dampens the overall positive effect for the retailer of obtaining a lower w_h. The equilibrium wholesale price is therefore higher if it is optimal for the retailer to introduce the private label. When $s_r > s_l$, private label introduction breaks the substitution between h and l, and hence eliminates the strategic rent-shifting effect all together.[20] We therefore get $w_h = c_h$ in this case.

Similarly, if the retailer negotiates with manufacturer l first, we can solve eq. (18) to obtain the optimal w_l, again given that private label introduction is profitable at stage 3:

$$\overline{w_l} = \begin{cases} \dfrac{s_l^2}{4} - \dfrac{(1-\lambda)(s_l - s_r)(3 - s_l)(1 - s_l)}{4(1 - s_r + (1-\lambda)(s_l - s_r))} & \text{if} \quad s_r < s_l \\ c_l & \text{if} \quad s_r \geq s_l \end{cases}, \tag{20}$$

where $\overline{w_l} < c_l$ and $\partial \overline{w_l}/\partial s_r \geq 0$ if $s_r < s_l$. In the same way as when manufacturer h negotiates first, we have a situation where the private label breaks the substitution between h and l when $s_r > s_l$, and we therefore get $\overline{w_l} = c_l$ in this case.[21]

Furthermore, let $\underline{w_i}$ denote the optimal wholesale price on brand $i \in h, l$ when $q_r = 0$ (or $s_r = 0$), where

$$\underline{w_h} = \frac{1}{4} - \frac{(1-\lambda)(1-s_l)s_l}{4(1+(1-\lambda)s_l)}, \; \underline{w_l} = \frac{s_l^2}{4} - \frac{(1-\lambda)(3-s_l)(1-s_l)s_l}{4(1+(1-\lambda)s_l)} \tag{21}$$

We can see that both $\underline{w_h} < \overline{w_h}$ and $\underline{w_l} \leq \overline{w_l}$.[22] Since the optimal wholesale price is (weakly)

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[20] This is a result of the Mussa-Rosen utility and demand specification, where products are only vertically differentiated (no horizontal differentiation). With some horizontal differentiation between the products as well, there could still be *some* substitution between products h and l even when $s_l < s_r < 1$.

[21] When the retailer negotiates with manufacturer l first, the private label does not affect the strategic rent-shifting effect $(1-\lambda)\left(q^l_{-h} - q^*_l\right)$ as long as $s_r < s_l$, unlike the situation when negotiating with manufacturer h first. The reason is the fact that the private label and brand h are not direct substitutes. Instead the effect of private label introduction works through $\partial q^*_l/\partial w_l$: Private label introduction implies that manufacturer l faces more interbrand competition, since the private label and brand l are competing for the same consumers. It is therefore more costly for manufacturer l to offer a low wholesale price when the retailer is also selling a private label.

[22] Notice in (21) that we have $\underline{w_l} < 0$ for certain parameter values. If one wishes to rule out negative

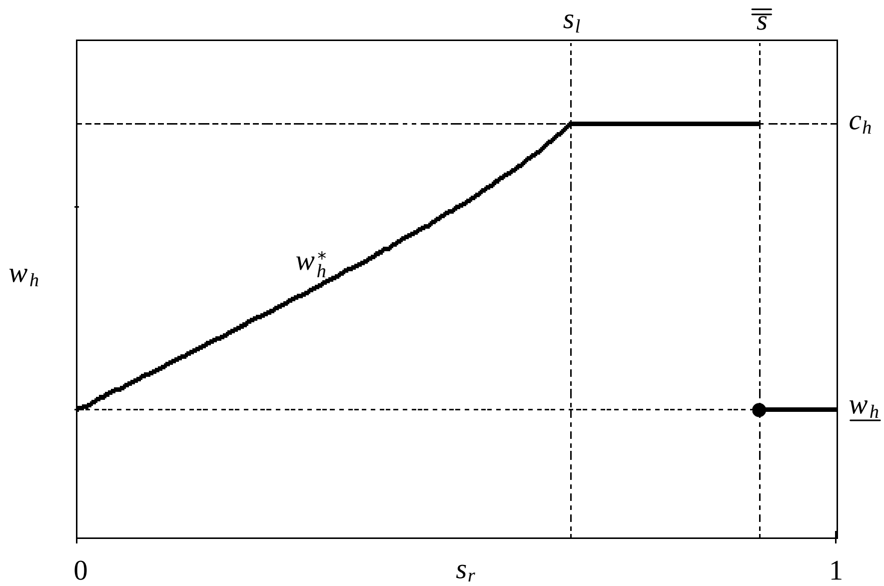

Figure 1: The optimal wholesale price w_h^* when the retailer negotiates with the high-quality manufacturer first.

higher when the private label is sold, there may also be a trade-off for the retailer and the manufacturer at stage 1 between i) accommodating for private label introduction and ii) shifting rent from the second manufacturer: A higher wholesale price may cause an increase in the fixed fee that the retailer has to pay to manufacturer j. In this case, actual private label introduction (as opposed to using the private label as a mere threat) comes at a cost. This cost is higher the more w_i increases under private label introduction, i.e. the larger is the difference $\overline{w_i} - \underline{w_i} \geq 0$. The real trade-off appears when the private label is located close to manufacturer i's brand. To see this, take the extreme case when $s_r = s_i$. If manufacturer i and the retailer wants to accommodate the private label, they have to set $w_i = \overline{w_i} = c_i$. Any lower wholesale price yields $q_r = 0$ at stage 3. However, when $w_i = c_i$, consumers are indifferent between buying the private label or brand i, and hence the retailer is also indifferent between setting $q_r > 0$ and $q_r = 0$. Furthermore, if $q_r = 0$, we know that $w_i = c_i$ is not optimal, since manufacturer i and the retailer can then agree to set $w_i = \underline{w_i} < c_i$ to shift rent from manufacturer j. Hence, private label introduction can not be profitable in this case.

Of course, private label introduction is always optimal as long as $q_r^* \left(\underline{w_i}\right) > 0$, in which case $w_i = \overline{w_i}$ is the optimal wholesale price. We also have $\partial q_r^* \left(\underline{w_l}\right) / \partial s_r < 0$ when $s_r < s_l$,

wholesale prices, then one could put a lower bound on s_l and/ or λ. Otherwise, one would have to study corner solutions, i.e. where $w_l = 0$.

and $\partial q_r^*\left(\underline{w_l}\right)/\partial s_r > 0$ and $\partial q_r^*\left(\underline{w_h}\right)/\partial s_r < 0$ when $s_r > s_l$. This implies that when the private label and manufacturer i's brand are *weaker* substitutes, there is also a higher chance that private label introduction is optimal. The discussion above is summarized in the following lemmas.

Lemma 2. *Our subgame equilibrium at stage 1 has $w_i^* \leq c_i$, where $w_i^* = \overline{w_i} \leq c_i$ whenever private label accommodation is jointly optimal for the retailer and manufacturer i at stage 1, and $w_i^* = \underline{w_i} < c_i$ otherwise, where $\overline{w_i} \geq \underline{w_i}$. It is a necessary condition for private label introduction that the retailer's private label is sufficiently differentiated from the first manufacturer's brand, i.e. $|s_r - s_i| > 0$.*

Proof. See appendix.

Lemma 3. There exist thresholds $\underline{s}$, $\overline{s}$ and $\overline{\overline{s}}$ satisfying $\underline{s} < s_l < \overline{s} < \overline{\overline{s}} < 1$ such that the private label is always introduced if $s_r < \underline{s}$ or $\overline{s} < s_r < \overline{\overline{s}}$. *Furthermore:*

- *If $\underline{s} \leq s_r \leq \overline{s}$, the private label is introduced only when the retailer negotiates with manufacturer h first.*
- *If $\overline{\overline{s}} \leq s_r \leq 1$, the private label is introduced only when the retailer negotiates with manufacturer l first.*

Proof. See appendix.

Lemmas 2-3 are illustrated in Figure 1 for the case when h moves first, and in Figure 2 for the case when l moves first. Our results show that when it is jointly optimal for the retailer and the first manufacturer to introduce the private label, then the manufacturer will accommodate for private label introduction by offering a higher wholesale price $w_i = \overline{w_i}$. We can see from Figure 1 and 2 that private label introduction is profitable only when the private label is sufficiently differentiated from the first manufacturer's brand.[23]

Stage 0 At stage 0, the manufacturers offer the retailer upfront payments, S_h and S_l, to compete for the right to move first at the contracting stage. Let $\pi_i^1 - S_i$ and π_j^2 be the profit of the manufacturer moving first and second at the contracting stage, respectively, where $\pi_i^1 = F_i^* + (w_i^* - c_i)\, q_i^*$ and $\pi_j^2 = F_j^*$. We let ω_h and ω_l denote the manufacturer's

[23] In Lemma 3, we have assumed a tie-breaking rule where, if the retailer and the first manufacturer are indifferent between $w_i = \overline{w_i}$ and $w_i = \underline{w_i}$, then they set $w_i = \underline{w_i}$ (i.e., no private label accommodation in this case).

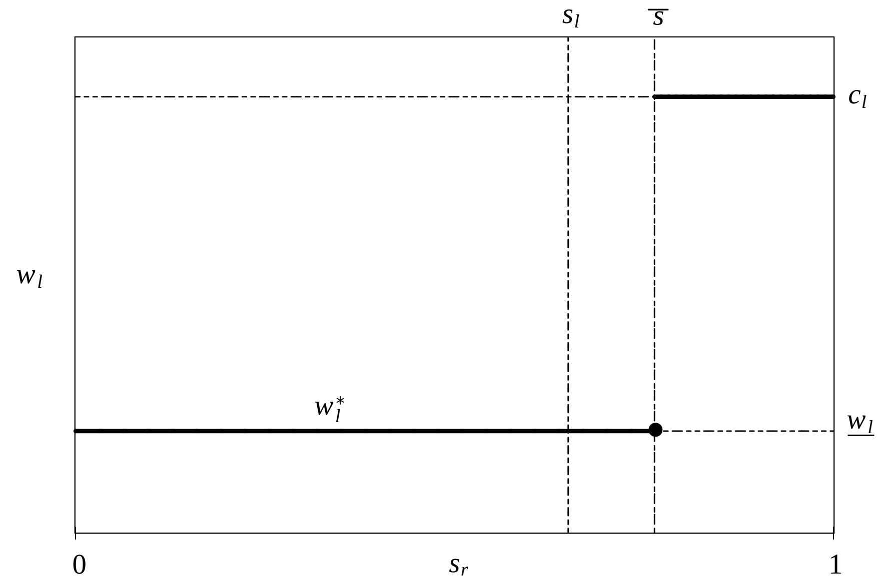

Figure 2: The optimal wholesale price w_l^* when the retailer negotiates with the low-quality manufacturer first.

willingness-to-pay for the first-mover right: $\omega_h = \pi_h^1 - \pi_h^2$ and $\omega_l = \pi_l^1 - \pi_l^2$, where $\omega_h > 0$ and $\omega_l > 0$ as long as $s_r \notin (\overline{s}, \overline{\overline{s}})$.[24] We can then write the retailer's profit as

$$\pi_r = \Pi^h + S_h - \pi_h^1 - \pi_l^2 \tag{22}$$

when accepting h's offer S_h, and

$$\pi_r = \Pi^l + S_l - \pi_h^2 - \pi_l^1 \tag{23}$$

when accepting l's offer S_l, where $\Pi^i = \Pi(w_i^*, c_j)$ is the total industry profit when manufacturer $i \in h, l$ moves first. In equilibrium, manufacturer j, whose offer is rejected by the retailer at stage 0, always offers its full willingness to pay for the first-mover rights: $S_j^* = \pi_j^1 - \pi_j^2$. Whereas manufacturer i, whose offer is accepted, offers *at most* its willingness to pay: $S_i \in [0, \pi_i^1 - \pi_i^2]$. The following condition then has to hold for the retailer to accept manufacturer i's offer.

$$\Pi^i + S_i - \pi_i^1 - \pi_j^2 \geq \Pi^j + S_j^* - \pi_i^2 - \pi_j^1 \Longleftrightarrow S_i \geq \omega_i - (\Pi^i - \Pi^j) \equiv S_i^* \tag{24}$$

[24] It is easy to very that $\omega_h = \omega_l = 0$ when $s_r \in (\overline{s}, \overline{\overline{s}})$. From Lemma 2 and Assumption 1, we then have $w_h = c_h$ and $w_l = c_l$ in equilibrium (i.e., no distortions to prices), irrespective of the order of negotiations.

If we assume a tie-breaking rule, then the best thing manufacturer i can do, and still obtain the first-mover right, is to adjust its offer S_i so that the condition holds with equality. Since the manufacturer is not willing to offer more than ω_i, manufacturer i can win the right to negotiate first if and only if $\Pi^i \geq \Pi^j$ – i.e., only as long as the overall profit is (weakly) higher when i moves first. This partially proves the following result.

Lemma 4. *The following three cases depict the equilibrium at stage 0.*

- $s_r \leq \overline{s}$. *The manufacturers make the offers* $S_h^* = \omega_h - \left(\Pi^h - \Pi^l\right)$ *and* $S_l^* = \omega_l$. *The retailer accepts the offer* S_h^* *to negotiate with h first, and earns the profit* $\pi_r = \Pi^l - \pi_h^2 - \pi_l^2$ *in equilibrium.*
- $\overline{s} < s_r < \overline{\overline{s}}$. *The manufacturers make the offers* $S_h^* = S_l^* = 0$. *The retailer may accept either offer and earns the profit* $\pi_r = \Pi\left(c_h, c_l\right) - \pi_h^2 - \pi_l^2$ *in equilibrium.*
- $s_r \geq \overline{\overline{s}}$. *The manufacturers make the offers* $S_h^* = \omega_h$ *and* $S_l^* = \omega_l - \left(\Pi^l - \Pi^h\right)$. *The retailer accepts the offer* S_l^* *to negotiate with l first, and earns the profit* $\pi_r = \Pi^h - \pi_h^2 - \pi_l^2$ *in equilibrium.*

Proof. The subcase $s_l \leq s_r \leq 1$ follows from the fact that the industry profit is maximised for wholesale prices equal to marginal costs, i.e. $\Pi\left(c_h, c_l\right) > \Pi\left(w_i, c_j\right)$ for all $w_i \neq c_i$ and $i \neq j \in h, l$. The subcase $s_r < s_l$ can be proved by showing that $\Pi\left(\overline{w_h}, c_l\right) > \Pi\left(c_h, \overline{w_l}\right)$. (See the appendix for this last case).

Lemmas 2-4 provide us with our key result:

Proposition 1. *When the national brand manufacturers offer the retailer upfront payments, the retailer's private label is always introduced in equilibrium. Only the price of the high-quality national brand is affected by the retailer's private label. We have two regimes:*

- *If* $s_r < s_l$, *then* $p_l^* = p_l^M$ *and* $p_h^* < p_h^M$, *where* $\partial p_h^* / \partial s_r \geq 0$. *Furthermore:* $\lim\limits_{s_l \to 1} \partial p_h^* / \partial s_r = 0$ *and* $\lim\limits_{s_l \to s_r} \partial p_h^* / \partial s_r = \frac{1}{8}\left(1 - \lambda\right)\left(1 - s_r\right).$
- *If* $s_r \geq s_l$, *then* $p_l^* = p_l^M$ *and* $p_h^* = p_h^M$.

When the manufacturers are able to offer the retailer upfront payments for the right to negotiate first, then the retailer chooses the order that generates the highest overall profit. This implies that the retailers private label is always introduced in equilibrium, since the industry profit is maximised when all products are sold. When $s_r < s_l$, total profit is maximised by negotiating with the high-quality manufacturer first, and we have $p_h^* < p_h^M$ and $p_l^* = p_l^M$. When $s_r \geq s_l$, the retailer's private label breaks the rivalry between the two national brands and there are no incentives to distort prices to shift rent. We therefore have $p_h^* = p_h^M$ and $p_l^* = p_l^M$ in this case. Our result also shows that the relative "success" of the high-quality brand matters: As the two national brands become closer (weaker) substitutes, the effect of the private label becomes smaller (stronger).

3.1 Role of upfront payments in facilitating private label introduction

The result above fits in well with some of the existing empirical evidence on private labels' impact on national brand prices.[25] However, our results also seem to suggests that all types of private labels will be introduced in equilibrium, and that private label penetration therefore should not depend on factors such as the degree of differentiation between national brands, or on the ability of the retailer to dictate the contract terms (buyer power). This stands in contrast to the real-life observation that private label penetration varies considerably both between and within stores (across product lines).[26]

At the same time, we know that the use of upfront payments, for example slotting allowances, varies between product categories. Given our results, it is therefore natural to ask what is the role of upfront payments in facilitating private label introduction in our model?[27] To answer this, we now assume that upfront payments are not used. This has the immediate consequence of limiting the retailer's ability to extract rent from its manufacturers. Without upfront payments ($S_h = S_l = 0$), the retailer's profit when

[25] Bontemps et al. (2008) present evidence that retailer owned brands have caused an increase in the prices of national brands in France – and that the effect is considerably stronger for leading national brands than for secondary brands. Similar evidence from the Norwegian market is presented in an unpublished paper by Gabrielsen et al. (2006). Current theories of private labels usually assumes a bilateral monopoly with one national brand manufacturer and are therefore unable to address this issue.

[26] This may of course in part be due to fixed costs in product development, and differences in marginal production costs between private labels and national brands. Also, it is likely that i) the size of retail chains (how many markets they operate in) and ii) the intensity of competition in local retail markets, both affect the profitability of private label development for the retailers. These are factors that we have ignored in our model.

[27] Questions have been raised by commentators about the role of slotting allowances in either decreasing or promoting the penetration of private labels in the retail grocery industry. See for example the note made by Jeffrey Schmidt, former Director of the Bureau of Competition at the Federal Trade Commission: "United States competition law policy – the private label experience", in the Report on the fourth annual Symposium on Retail Competition held in Oxford in May 2008

negotiating with manufacturer i first, is

$$\pi_r = \Pi^i - \pi_i^1 - \pi_j^2, \tag{25}$$

which is optimal for the retailer only as long as

$$\Pi^i - \pi_i^1 - \pi_j^2 \geq \Pi^j - \pi_j^1 - \pi_i^2 \Longleftrightarrow \omega_j \geq \omega_i - \left(\Pi^i - \Pi^j\right) \equiv S_i^*. \tag{26}$$

This condition is the opposite of condition (24) that we found for the case when upfront payments are used. This means that the retailer now chooses the order that generates the smallest industry profit in equilibrium. This proves the following result.

Lemma 5. *If upfront payments are not used ($S_h = S_l = 0$), then the retailer has strict preferences over the order of negotiations as long as $s_r \leq \overline{s}$ or $s_r \geq \overline{\overline{s}}$. The following three cases then covers the retailer's optimal choice at stage 0.*

- *The retailer negotiates with manufacturer l first if $s_r \leq \overline{s}$.*
- *The retailer is indifferent between the order of negotiations when $\overline{s} < s_r < \overline{\overline{s}}$.*
- *The retailer negotiates with manufacturer h first if $s_r \geq \overline{\overline{s}}$.*

Lemma 5 shows that, in the absence of upfront offers from the manufacturers, the retailer has strict preferences for the order of negotiations as long as either manufacturer has strict incentives to engage in rent-shifting at the contracting stage – which, according to Lemmas 2-3, happens when $s_r \leq \overline{s}$ and $s_r \geq \overline{\overline{s}}$. Our result is similar to the result reported in Marx and Shaffer (2007). In a model without upfront payments, they find that a buyer does best by negotiating with its "weakest" manufacturer first, which allows him to extract more rent from the "stronger" manufacturer at the next stage. They also show that if the two manufacturers have equal bargaining powers, as in our model, then the stronger manufacturer is simply the one offering the highest stand-alone profit.

Our result is similar, but somewhat modified: The retailer in our model has access to a private label, and the "strength" of a manufacturer is therefore partially determined by the quality gap between the manufacturer's brand and the retailer's private label.[28] Hence, the retailer may consider manufacturer h to be the "weaker" one when

[28] Another difference from our model, is the fact that, in Marx and Shaffer (2007), the contracts between the retailer and the manufacturers are assumed to be sufficiently general to allow for maximisation of total profits and complete extraction of the second manufacturer's rent, which implies that prices are not distorted in equilibrium.

the quality-gap between brand h and the retailer's private label is small ($s_r \geq \overline{\overline{s}}$), even if manufacturer l offers a strictly lower stand-alone profit (as per assumption). Hence, it is the manufacturers' *contributions* to the total profit that determines the retailer's preferences, not their stand-alone profits.

Our second key result follows from Lemmas 2-3 and 5.

Proposition 2. *When upfront payments are not used ($S_h = S_l = 0$), the private label is introduced only when $s_r < \underline{s}$ or $\overline{s} < s_r < \overline{\overline{s}}$. It then follows that there is more private label introduction when the retailer has high bargaining power ($\lambda \to 1$) and when the degree of differentiation between national brands is small ($s_l \to 1$).*

Proof. It follows from the proof of Lemmas 2-3 that there is more private label introduction when $\lambda \to 1$ and $s_l \to 1$ (see the appendix).

Propositions 1 and 2 suggest that upfront payments to the retailer are key in facilitating private label introduction.[29] When upfront payments are not used, manufacturers are unable to induce the retailer to pick the order that maximises overall profits. Instead, the retailer strategically picks the order that gives him a larger share of a (sometimes) strictly smaller total profit. This may result in the retailer choosing rent-shifting over private label accommodation, and using the private label as a mere threat. In this case there will be more private label introduction when the retailer's bargaining power is high ($\lambda \to 1$), and/ or when the degree of differentiation between national brands is small. The reason for this is the fact that the wholesale prices are less distorted when the retailer has more bargaining power and when the degree of differentiation between national brands is small (see (19)-(21)). Ceteris paribus, less distortion to wholesale prices leaves more room for private label introduction.

4 Discussion and welfare analysis

The competition for rent that is created under sequential bargaining over non-linear contracts helps to alleviate some of the efficiency loss of the retailer's monopoly power. In

[29] Sudhir and Rao (2006) find that the number of private labels is higher in categories with slotting allowances than in categories where such fees are not used. They interpret this as evidence for the hypothesis that slotting allowances arise as means for the efficient allocation of scarce shelf space (Sullivan, 1997). If the retailer's access to private labels increases, then this would certainly increase the scarcity of the retailer's shelf space, ceteris paribus, and slotting allowances could arise as a result. However, this does not explain why there are more private labels in these categories in the first place. Given our results, we may conjecture that there is a two-way causality.

our model the retail price of the high-quality brand is always below the monopoly price, $p_h(\underline{w_h}) < p_h^M$, as long as the private label is not introduced, whereas the price of the low-quality brand is $p_l(c_l) = p_l^M$ (assuming upfront payments are used). Hence, since private label introduction also causes an increase in the price of the high-quality brand, $p_h^M \geq p_h(\overline{w_h}) > p_h(\underline{w_h})$, consumers' surplus may go either up or down. Producers' surplus (total industry profit) always increases as a result of private label introduction.[30] Total welfare may therefore go either way. However, it is easy to show that when there is only a small degree of differentiation between the private label and either national brand ($s_r \to s_l$ or $s_r \to 1$), then both the consumers' surplus and total welfare decreases as a result of private label introduction. The reason is the fact that, when the private label "mimics" either national brand, private label introduction causes a larger increase in the price of the high-quality brand (monopoly pricing is restored), without adding any real choice to the consumer. We have the following result:

Proposition 3. *A ban on private labels may increase consumers' surplus, but only when the quality of the private label is sufficiently close to the quality of either national brand. Moreover, a ban on private labels always increases social welfare when either $s_r = s_l$ or $s_r = 1$.*

Proof. See appendix.

Proposition 3 stands in contrast to the common belief that consumer (and social) welfare improves when private labels and national brands compete vigorously. The key to our result is the fact that we allow the retailer and the manufacturers to use two-part tariffs: When only linear tariffs are allowed, competition between national brands and private labels reduces the problem of double marginalisation and causes a reduction in the prices of national brands. Consumer welfare may increase as a result, because, even though there is less variety (less differentiation), the consumers are able to buy high quality products at lower prices.[31] This is not the case in our model. When we allow for two-part tariffs, strong competition between private labels and national brands causes both an increase in prices and less choice for the consumer – and both contributes to a reduction in consumer surplus.

Figure 3 and 4 give an illustration of the potential loss in consumer surplus from private label introduction for the case $s_r = s_l$ or $s_r = 1$ (Figure 3) and the case $s_r \leq s_l$

[30] With a private label, there is a new product, which contributes positively to industry profits ceteris paribus, and less distortion to prices, which also increases industry profits.

[31] Note that with the Mussa-Rosen utility function, consumers' and total welfare depend not only on total output, but also on the quality level of each product.

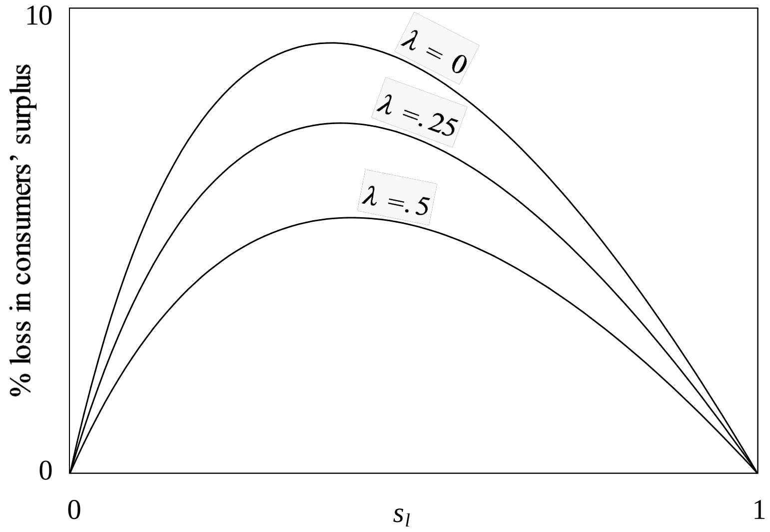

Figure 3: The percentage loss in consumer surplus plotted against s_l, when either $s_r = s_l$ or $s_r = 1$.

(Figure 4). We can see that the loss in consumer surplus varies greatly, both with the degree of differentiation between national brands, with the degree of retailer bargaining power, and with the degree of differentiation between the private label and the low-quality national brand.[32]

We now give a brief discussions of the robustness of our results. Since our theory builds on Marx and Shaffer (1999), our model is also subject to the same criticism: First and foremost, for any of our results to go through, we need the retailer to negotiate sequentially with the manufacturers. With simultaneous bargaining, the equilibrium yields (efficient) marginal cost wholesale pricing both before and after private label introduction.[33] However, it can be shown that, if given the choice, the retailer strictly prefers sequential contracting (with upfront payments) over simultaneous contracting. Furthermore, we know that each manufacturer (weakly) prefers to commit to a contract *before* its rival. Sequential contracting could therefore very well arise endogenously.

We also require the second manufacturer to know the outcome of the negotiations at

[32]The effect on consumer surplus is restricted in our model, due to the assumption that there is only vertical differentiation between products (no horizontal differentiation). With both vertical and horizontal differentiation between products, we would be able to increase the market share of the low-quality national brand (more quality) without affecting the intensity of competition (by adding more horizontal differentiation). We conjecture that this would cause more distortion to the price of the high-quality brand ceteris paribus, which would increase the loss in consumer surplus from private label introduction.

[33]See e.g. Bernheim and Whinston (1998) and O'Brien and Shaffer (1997).

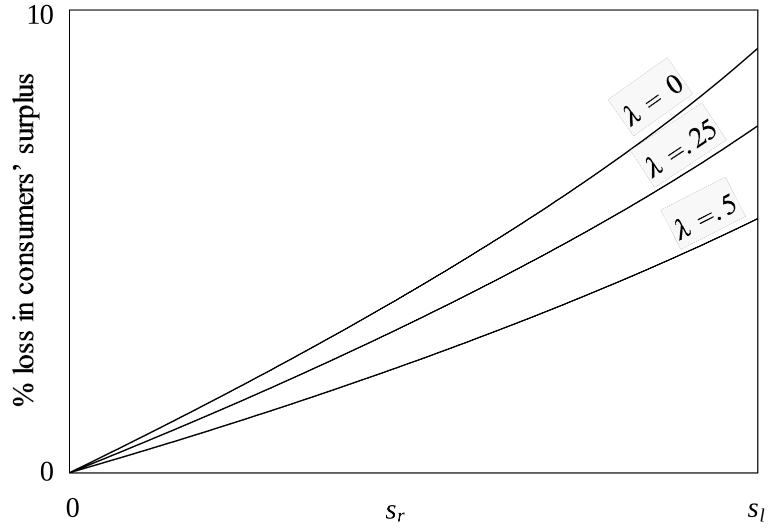

Figure 4: The percentage loss in consumer surplus plotted against s_r over the interval $(0, s_l)$, when $s_l = .43$.

stage 1 before entering into its negotiations with the retailer at stage 2. If the contract terms were unobservable to the second manufacturer, it would introduce problems of asymmetric information: While the retailer knows the outcome of the first negotiation, the second manufacturer does not. It remains an open question what happens in this case. Marx and Shaffer (1999) conjecture that wholesale prices would be equal to marginal cost in this case. However, we make the point here that the problem of sequential contracting with unobservable contracts (asymmetric information) appear, at least initially, to be different from the problem of simultaneous contracting (with symmetric information).[34] To say something about the outcome in the sequential contracting model when contracts are secret, we would need to make additional assumptions.[35]

We do not allow the retailer to renegotiate its contract with a manufacturer. Since sequential negotiations create distortions, there is always an incentive for the retailer and the first manufacturer to correct the distortion ex post. However, as noted by Marx and

[34] In simultaneous contracting models, it is usually assumed that the retailer has a number of agents, each negotiating with a manufacturer on the retailer's behalf. Hence, there is no problem of asymmetric information in this case, as each manufacturer and agent holds the same information.

[35] First, we would need to specify a strategic or non-cooperative model of bargaining. Second, we would need make some assumptions about the second manufacturers beliefs (about the outcome of the first negotiation), and how the manufacturer updates its beliefs after its contract offer is unexpectedly rejected by the retailer. E.g., if the retailer rejects an offer, could this serve as a credible signal of the type of contract the retailer has with the first manufacturer? And if so, in which situations is the signal not credible?

Shaffer (1999), allowing for one renegotiation (after stage 2) is not sufficient to remove all the distortion, since the retailer and the second manufacturer then have incentives to distort their contract at stage 2, to shift rent from the first manufacturer at the next stage (when the renegotiation takes place). To remove all distortions, after every successful negotiation there would therefore have to be an opportunity for renegotiation. Marx and Shaffer (1999) also demonstrate that if one allows the first manufacturer to renegotiate its contract, but only if the negotiations break down between the retailer and the second manufacturer, then the distortion actually increases.

Finally, we have treated the quality of the private label (and the national brands) as exogenous in our model. We argue that this is often a natural assumption; the quality of products in the grocery industry is often more influenced by the consumers' perception, hence product "quality" is perhaps more precisely described as *perceived* quality than actual quality. However, it would be interesting to investigate what happens if the retailer has the possibility to influence the positioning of the private label, for example by spending resources on product development and advertising. Would the retailer differentiate its private label from the national brand, or would it perhaps be more profitable to position close to one of the national brands?[36] The exact outcome would depend on both the retailer's bargaining power, on the degree of differentiation between national brands, and on the timing of the retailer's product development (before or after contracts are negotiated). Some insight is provided by Lemma 4. A look at the retailer's equilibrium profit indicates that the retailer often prefers higher quality levels ($s_r \geq s_l$) – assuming that the retailer have to make its decision prior to the contracting stage.[37] A comprehensive investigation of this problem is beyond the scope of this paper. We therefore leave this question for future research.

5 Conclusion

This paper analyses a retailer's decision to introduce a private label and asks how the private label may affect the prices of national brands and social welfare. In most of the received literature, the national brand manufacturer is assumed to be a monopolist. We

[36]The issue of private label positioning in product space is investigated by Scott Morton and Zettelmeyer (2004) in a model with non-linear tariffs, and by Choi and Coughland (2006) in a model with linear tariffs. Both consider an industry with two national brand manufacturers, as in our model.

[37]If the retailer makes its decision after the contracting stage, the question becomes more complicated. But we conjecture that the retailer's incentive would then be to differentiate the private label from both national brands.

consider rather a model with two vertically differentiated national brand manufacturers that negotiate terms of trade sequentially with the retailer. The retailer subsequently decides whether to introduce its private label. We find that private label introduction may increase the price of the high quality national brand, through a rent-shifting effect, while the low-quality brand is unaffected by the retailer's private label. The effect on social welfare is therefore unclear.

The reason for our results are the following: We allow the manufacturers to use bilateral efficient (two-part) tariffs in negotiations with the retailer. Without the private label, the high-quality manufacturer has an incentive to offer the retailer a discount on its wholesale price (below-cost), in return for a higher fixed fee. This allows the retailer to extract more surplus from the rival manufacturer, who produces a lower quality brand at a lower cost. The retailer and the high-quality manufacturer are jointly better off as a result. We show that when the retailer introduces a private label, this rent-shifting effect is either softened or completely eliminated, and this causes the high-quality manufacturer to increase its wholesale price and reduce its fixed fee. The retail price of the high-quality brand increases as a result.

Empirical evidence suggests that private label introduction affects the prices of national brands differently. Importantly, it often seems to be the case that private labels cause an increase in the price of successful brands (brand leaders with high market share), while the effect on the prices of second tier brands is often smaller or non-existent. Our results are consistent with this observation. First, we find that there is no effect on the price of the low-quality brand. Second, we show that the effect on the high-quality brand is larger when the manufacturer has some success (higher quality) than when the two national brands are close to each other in product space (no quality gap).

There are strong variations in private label penetration both across product categories and across stores. We show that the retailer may sometimes find it optimal not to introduce its private label: When upfront payments (negotiation fees / slotting allowances) are not used (not feasible), the retailer is limited in its ability to extract rent from the manufacturers – and even more so when the retailer's bargaining power is low. In this case, the retailer may seek to increase its rent by accepting an offer to purchase the national brand that is closest to the private label at a unit price below cost. In doing so, the retailer strengthens its bargaining power vis-a-vis the "stronger" manufacturer, whose national brand is more differentiated from the private label. Moreover, when the retailer buys a close substitute to the private label at a price below cost, then it may not be profitable to sell the private label. Hence, private label introduction may not occur in this case. Upfront payments therefore play an important role in facilitating private label introduction in our model. When upfront payments are not used, there is more private label introduction when i) the retailer has a higher bargaining power, ii) when there is low degree of differentiation between the two national brands, and iii) when there is high degree of differentiation between the private label and the national brands.

Our model suggests that ownership of the product is important, even though the retailer is a monopolist and that private labels therefore are distinct from other (independent) low-quality brands. For example, by taking as our benchmark an upstream monopoly with only the high-quality manufacturer, we can use our model to compare entry of the low-quality national brand manufacturer with the introduction of an identical private label. In this case, private label introduction allows the retailer and the high-quality manufacturer to maximise total profits. Hence, there would be no change in the price of the high-quality brand. On the other hand, if the low-quality manufacturer were to enter instead, total profit maximisation would not be possible, as there would be an incentive for rent-shifting. In this case, the price of the high-quality brand would decrease.

Our results show that welfare may increase or decrease as a result of private label introduction. Moreover, we find that there is no clear-cut connection between private label quality and social welfare. The reason is the fact that, when manufacturers use two-part tariffs, there is no downward pressure on national brand prices as the quality of the private label increases. Instead, there may be an upward pressure on the price of the high-quality brand, due to possible rent-shifting effects. In this case, consumers are better off when the private label is differentiated from both national brands. This contrasts with the common view that consumers are better off when private labels and national brands compete fiercely. The conclusion is that one should be careful when assessing the welfare effects of private labels. In particular, the conclusion will rely both on the degree of competition between the products and on the type of contracts that are used.

Appendix

Proof of Lemmas 2-3 We have four cases to consider, depending on which manufacturer the retailer negotiates with first, l or h, and depending on whether $s_r < s_l$ or $s_r > s_l$. We consider each case in turn.

I Suppose the manufacturer negotiates with manufacturer l first and that $s_r < s_l$. The negotiations between the retailer and manufacturer h at stage 2 yields $w_h^* = c_h$ (Lemma

1). The retailer's flow payoff at stage 3 is

$$\begin{aligned}\upsilon\left(q_h,q_l,q_r\right) &= \left(1-q_h-s_lq_l-s_rq_r-c_h\right)q_h+\left(s_l\left(1-q_l-q_h\right)-s_rq_r-w_l\right)q_l \\ &\quad +\left(s_r\left(1-q_r-q_l-q_h\right)-c_r\right)q_r \end{aligned} \tag{27}$$

if the negotiations with manufacturer h at stage 2 are successful ($q_h>0$), and

$$\upsilon_{-h}\left(q_l,q_r,0\right)=\left(s_l\left(1-q_l\right)-s_rq_r-w_l\right)q_l+\left(s_r\left(1-q_r-q_l\right)-c_r\right)q_r \tag{28}$$

if the negotiations with h are not successful ($q_h=0$). Maximising (27) w.r.t. q_h, q_l and q_r yields

$$\begin{aligned} q_h^* &= \frac{3+4w_l-4s_l}{8\left(1-s_l\right)} \\ q_l^* &= \min\left\{\frac{\left(s_ls_r+s_l-s_r-4w_l\right)\left(1-s_r\right)}{8\left(s_l-s_r\right)\left(1-s_l\right)},\frac{s_l-4w_l}{8s_l\left(1-s_l\right)}\right\} \\ q_r^* &= \max\left\{\frac{4w_l-s_ls_r}{8\left(s_l-s_r\right)},0\right\} \end{aligned} \tag{29}$$

Maximising (28) w.r.t. q_l and q_r, yields

$$\begin{aligned} q_l &= q_{-h}^l=\min\left\{\frac{4s_l+s_r^2-4w_l-4s_r}{8\left(s_l-s_r\right)},\frac{4s_l-4w_l}{8s_l}\right\} \\ q_r &= q_{-h}^r=\max\left\{\frac{4w_l-s_ls_r}{8\left(s_l-s_r\right)},0\right\}\left(=q_r^*\right) \end{aligned} \tag{30}$$

In this case $q_r^*>0$ only as long as $w_l>s_ls_r/4$, which implies that private label introduction at stage 3 is profitable only as long as w_l is strictly positive. The condition for joint profit maximisation between the retailer and manufacturer l at stage 1 is (see eq. (18))

$$\frac{\partial q_l^*}{\partial w_l}\left(w_l-c_l\right)=\left(1-\lambda\right)\left(q_{-h}^l-q_l^*\right) \tag{31}$$

In solving this condition for w_l, given $q_r^*>0$, we obtain

$$w_l=\overline{w_l}=\frac{s_l^2}{4}-\frac{\left(1-\lambda\right)\left(s_l-s_r\right)\left(3-s_l\right)\left(1-s_l\right)}{4\left(1-s_r+\left(1-\lambda\right)\left(s_l-s_r\right)\right)} \tag{32}$$

where $\overline{w_l}<s_l^2/4=c_l$ as long as $s_r<s_l<1$ and $\lambda<1$, and $\overline{w_l}\rightarrow s_l^2/4$ when $s_r\rightarrow s_l$. We can see that $\overline{w_l} > s_l s_r/4$, and hence $q_r^* > 0$, only as long as

$$s_l > \frac{3(1-\lambda)}{5-4\lambda-2s_r+\lambda s_r} \equiv \beta(s_r) \tag{33}$$

where $\partial\beta/\partial s_r > 0$. I.e., (even) at the wholesale price $w_l = \overline{w_l}$, private label introduction at stage 3 is profitable for the retailer only as long as the degree of vertical differentiation between the private label and brand l is sufficienly high. Suppose instead that private label introduction is not optimal, i.e. $q_r^* = 0$. Solving the condition for joint profit maximisation in this case, yields

$$w_l = \underline{w_l} = \frac{s_l^2}{4} - \frac{(1-\lambda)(3-s_l)(1-s_l)s_l}{4(1+(1-\lambda)s_l)} = \lim_{s_r\to 0}\overline{w_l} < \overline{w_l} \tag{34}$$

$\underline{w_l}$ is strictly is positive only as long as $s_l > 3(1-\lambda)/(5-4\lambda)$. The joint profit of the retailer and manufacturer l, given that private label accommodation is (jointly) optimal, is

$$\begin{aligned}\Pi_{r-l}(\overline{w_l}) &= \lambda v^*(\overline{w_l}) + (1-\lambda)v_{-h}^*(\overline{w_l}) + (\overline{w_l}-c_l)q_l^*(\overline{w_l}) \\ &= \frac{\left\{\begin{array}{c} s_l(25+16\lambda s_r-17s_r-24\lambda-s_r^2+2s_r^3-\lambda s_r^3) \\ -s_l^2(1-s_r)(7+2\lambda s_r-3s_r-6\lambda)-9(s_r-\lambda)\end{array}\right\}}{64(1-s_r+(1-\lambda)(s_l-s_r))},\end{aligned} \tag{35}$$

whereas their joint profit when $q_r^* = 0$, is equal to

$$\lim_{s_r\to 0}\Pi_{r-l}(\overline{w_l}) = \frac{9\lambda+6(1-\lambda)(4-s_l)s_l+s_l(1-s_l)}{64(1+s_l-\lambda s_l)} \tag{36}$$

It can be shown that the function $\Pi_{r-l}(\overline{w_l})$ is concave over the interval $s_r \in [0, s_l]$. We therefore normalise $\lambda = 0$, without loss of generality. Taking the second derivative of $\Pi_{r-l}(\overline{w_l})$ w.r.t s_r, yields

$$g(s_r, s_l) = -\frac{\left\{\begin{array}{c} 18-8s_l s_r^3-(13-3s_l)s_l^3 \\ -6(1+s_l)(1+s_l-2s_r)s_r s_l-47(1-s_l)s_l\end{array}\right\}}{32(1+s_l-2s_r)^3} < 0 \tag{37}$$

which is negative as long as $s_r \leq s_l \leq 1$. Moreover, we have $\lim_{s_r\to 0}\Pi_{r-l}(\overline{w_l}) > \lim_{s_r\to s_l}\Pi_{r-l}(\overline{w_l})$. Hence, there exists a critical value $\underline{s}$, where $\underline{s} < s_l$, such that private label accommodation is stricly profitable if $s_r < \underline{s} < s_l$, and strictly unprofitable if $\underline{s} < s_r < s_l$. Consider the case $s_l = .7$ and $\lambda = .25$. Solving the inequality

$\Pi_{r-l}(\overline{w_l}) > \lim_{s_r \to 0} \Pi_{r-l}(\overline{w_l})$ for s_r in this case yields $s_r < 0.39751\,(=\underline{s})$.

II Suppose the retailer negotiates with manufacturer h first. The retailer's flow payoff at stage 3, using the fact that $w_l^* = c_l$, is

$$\begin{aligned}\upsilon(q_h, q_l, q_r) &= (1 - q_h - s_l q_l - s_r q_r - w_h)\, q_h + (s_l (1 - q_l - q_h) - s_r q_r - c_l)\, q_l \\ &\quad + (s_r (1 - q_r - q_l - q_h) - c_r)\, q_r \end{aligned} \tag{38}$$

if the negotiations with manufacturer l at stage 2 are successful ($q_l > 0$), and

$$\upsilon_{-l}(q_h, q_r, 0) = (1 - q_h - s_r q_r - w_h)\, q_h + (s_r (1 - q_r - q_h) - c_r)\, q_r \tag{39}$$

if the negotiations with l are not successful ($q_l = 0$). Maximising (38) w.r.t. q_h, q_l and q_r yields

$$q_h^* = \frac{4 + s_l^2 - 4s_l - 4w_h}{8(1 - s_l)}, q_l^* = \frac{s_l s_r + 4w_h - s_l - s_r}{8(1 - s_l)}, q_r^* = \frac{1}{8} s_l \tag{40}$$

q_r^* is positive and independent of w_h; private label introduction is therefore always optimal when negotiating with h first as long as $s_r \leq s_l$ (and given that $q_l^* > 0$, which always is the case). Maximising (39) w.r.t. q_h and q_r yields

$$q_h = q_{-l}^h = \frac{4 + s_r^2 - 4w_h - 4s_r}{8(1 - s_r)}, q_r = q_{-l}^r = \frac{4w_h - s_r}{8(1 - s_r)} \tag{41}$$

where again $q_{-l}^r > 0$ since $q_l^* > 0$. The condition for joint profit maximisation between the retailer and manufacturer h at stage 1 is

$$\frac{\partial q_h^*}{\partial w_h}(w_h - c_h) = (1 - \lambda)\left(q_{-l}^h - q_h^*\right) \tag{42}$$

which we can solve for w_h to obtain

$$w_h = \overline{w_h} = \frac{1}{4} - \frac{(1 - \lambda)(s_l - s_r)(1 - s_l)(1 - s_r)}{4(1 - s_r + (1 - \lambda)(s_l - s_r))} \tag{43}$$

where $\overline{w_h} < 1/4 = c_h$ as long as $s_r < s_l < 1$ and $\lambda < 1$, and $\overline{w_h} \to 1/4$ as $s_r \to s_l$. No private label introduction is equivalent to $s_r = 0$, in which case we have

$$w_h = \underline{w_h} = \frac{1}{4} - \frac{(1 - \lambda)(1 - s_l)\, s_l}{4(1 + s_l - \lambda s_l)} = \lim_{s_r \to 0} \overline{w_h} \tag{44}$$

III Suppose that $s_r > s_l$, and that the retailer negotiates with manufacturer l first. The retailer's flow payoff at stage 3 is then

$$\begin{aligned} \upsilon\left(q_h, q_l, q_r\right) = & \left(1 - q_h - s_l q_l - s_r q_r - c_h\right) q_h + \left(s_r\left(1 - q_r - q_h\right) - s_l q_l - c_r\right) q_r \\ & + \left(s_l\left(1 - q_l - q_h - q_r\right) - w_l\right) q_l \end{aligned} \tag{45}$$

if the negotiations with manufacturer h at stage 2 are successful ($q_h > 0$), and

$$\upsilon_{-h}\left(q_l, q_r, 0\right) = \left(s_r\left(1 - q_r\right) - s_l q_l - c_r\right) q_r + \left(s_l\left(1 - q_l - q_r\right) - w_l\right) q_l \tag{46}$$

if the negotiations with h are not successful ($q_h = 0$). Maximising (45) w.r.t. q_h, q_l and q_r yields

$$\begin{aligned} q_h^* &= \min\left\{\frac{1}{8}\left(3 - s_r\right), \frac{3 + 4w_l - 4s_l}{8\left(1 - s_l\right)}\right\} \\ q_l^* &= \min\left\{\frac{\left(s_l s_r - 4w_l\right) s_r}{8\left(s_r - s_l\right) s_l}, \frac{s_l - 4w_l}{8 s_l\left(1 - s_l\right)}\right\} \\ q_r^* &= \max\left\{\frac{4w_l + s_r - s_l - s_l s_r}{8\left(s_r - s_l\right)}, 0\right\} \end{aligned} \tag{47}$$

where $q_r^* > 0$ as long as $w_l > \left(s_l - s_r + s_l s_r\right)/4 = b < c_l$. Maximising (46) w.r.t. q_l and q_r yields

$$\begin{aligned} q_r &= q_{-h}^r = \max\left\{\frac{4w_l + 4s_r - 4s_l - s_r^2}{8\left(s_r - s_l\right)}, 0\right\} \\ q_l &= q_{-h}^l = \min\left\{\frac{\left(s_l s_r - 4w_l\right) s_r}{8\left(s_r - s_l\right) s_l}, \frac{s_l - w_l}{2 s_l}\right\} \end{aligned} \tag{48}$$

where $q_{-h}^r > 0$ as long as $w_l > \left(4s_l - 4s_r + s_r^2\right)/4 = a$, and $a < b$. The joint profit, $\Pi_{r-l}\left(w_l\right) = \lambda \upsilon^*\left(w_l\right) + \left(1 - \lambda\right) \upsilon_{-h}^*\left(w_l\right) + \left(w_l - c_l\right) q_l^*\left(w_l\right)$, is continuous everywhere on w_l. Moreover, Π_{r-l} is concave on w_l for either $w_l < a$ or $w_l > b$, with maxima at $w_l = \underline{w_l}$ and $w_l = c_l$ respectively. Π_{r-l} is either concave or convex over the interval $w_l \in (a, b)$, depending on the parameter values:

$$\frac{\partial^2 \Pi_{r-l}}{\partial w_l^2} = \frac{\left(1 - \lambda\right)\left(1 - s_r\right) s_l - \left(s_r - s_l\right)}{2\left(s_r - s_l\right)\left(1 - s_l\right) s_l} \gtrless 0 \text{ when } a < w_l < b, \tag{49}$$

Moreover, we have

$$\lim_{\varepsilon \to 0} \left.\frac{\partial \Pi_{r-l}}{\partial w_l}\right|_{w_l = b - \varepsilon} = \frac{1}{8 s_l}\left(s_r - s_l\right) > 0 \tag{50}$$

and

$$\lim_{\varepsilon\to 0}\left.\frac{\partial\Pi_{r-l}}{\partial w_l}\right|_{w_l=a-\varepsilon}=\lim_{\varepsilon\to 0}\left.\frac{\partial\Pi_{r-l}}{\partial w_l}\right|_{w_l=a+\varepsilon} \tag{51}$$

(49) is negative when the bargaining power of the retailer λ is sufficiently high, and when the degree of differentiation between the private label and the high-quality brand, $1-s_r$, is sufficiently low compared to the degree of differentiation between the private label and the low-quality brand, s_r-s_l. In this case, Π_{r-l} is concave everywhere on w_l, with $w_l=c_l$ as the unique maximum. (49) is positive when the bargaining power of the retailer is sufficiently low, and when the degree of differentiation between the private label and the high-quality brand is sufficiently high compared to the degree of differentiation between the private label and the low-quality brand. Π_{r-l} is then concave on w_l for $w_l<a$, convex on w_l over the interval $w_l\in(a,b)$, and concave on w_l for $w_l>b$. We then have two local maxima, at $w_l=\overline{w_l}=c_l$ and $w_l=\underline{w_l}$, respectively. To solve for the optimal strategy, it is then sufficient to compare the joint profit Π_{r-l} when $w_l=c_l$ and $q_r^*>0$, with the joint profit when $w_l=\underline{w_l}$ and $q_r^*=0$. In this case, the condition that private label accommodation be profitable, is

$$\begin{aligned}\Pi_{r-l}(c_l)|_{q_r^*>0} &= \frac{\lambda(1-s_r)(3-s_r)^2+s_r(4-s_r)^2+s_rs_l(s_r-s_l)}{64}\\ &> \frac{9\lambda+6(1-\lambda)(4-s_l)s_l+s_l(1-s_l)}{64(1+(1-\lambda)s_l)}=\Pi_{r-l}\left(\underline{w_l}\right)\big|_{q_r^*=0}\end{aligned} \tag{52}$$

The critical value $\overline{s}$ is the value for s_r that solves $\Pi_{r-l}(c_l)|_{q_r^*>0}=\Pi_{r-l}\left(\underline{w_l}\right)\big|_{q_r^*=0}$. Consider the case $s_l=.7$ and $\lambda=.25$. Solving (52) for s_r in this case yields $s_r>0.78616\,(=\overline{s})$

IV Suppose that $s_r>s_l$, and that the retailer negotiates with manufacturer h first. The retailer's flow payoff at stage 3 is then

$$\begin{aligned}\upsilon(q_h,q_l,q_r) &= (1-q_h-s_lq_l-s_rq_r-w_h)q_h+(s_r(1-q_r-q_h)-s_lq_l-c_r)q_r\\ &\quad+(s_l(1-q_l-q_h-q_r)-c_l)q_l\end{aligned} \tag{53}$$

if the negotiations with manufacturer l are successful ($q_l>0$), and

$$\upsilon_{-l}(q_h,q_r,0)=(1-q_h-s_rq_r-w_h)q_h+(s_r(1-q_r-q_h)-c_r)q_r \tag{54}$$

if the negotiations with l are not successful ($q_l = 0$). Maximising (53) yields

$$\begin{aligned} q_h^* &= \min\left\{\frac{4+s_r^2-4s_r-4w_h}{8(1-s_r)}, \frac{4+s_l^2-4s_l-4w_h}{8(1-s_l)}\right\} \\ q_l^* &= \min\left\{\frac{1}{8}s_r, \frac{4w_h-s_l}{8(1-s_l)}\right\} \\ q_r^* &= \max\left\{\frac{4w_h+s_ls_r-s_l-s_r}{8(1-s_r)}, 0\right\} \end{aligned} \tag{55}$$

where $q_r^* > 0$ iff $w_h > (s_r + s_l - s_l s_r)/4 = b$, and $b < c_h$. Maximising (54) yields

$$q_{-l}^h = \min\left\{\frac{4+s_r^2-4w_h-4s_r}{8(1-s_r)}, \frac{1-w_h}{2}\right\}, q_{-l}^r = \max\left\{\frac{4w_h-s_r}{8(1-s_r)}, 0\right\} \tag{56}$$

where $q_{-l}^r > 0$ iff $w_h > s_r/4 = a$, and $a < b$. The joint profit $\Pi_{r-h}(w_h) = \lambda v^*(w_h) + (1-\lambda) v_{-l}^*(w_h) + (w_h - c_h) q_h^*(w_h)$ is continuous everywhere on w_h, and may be either concave or convex over the interval $w_h \in (a, b)$ depending on the parameter values:

$$\frac{\partial^2}{\partial w_h^2}\Pi_{r-h} = \frac{(1-\lambda)(s_r-s_l)-(1-s_r)}{2(1-s_r)(1-s_l)} \lesseqgtr 0 \text{ for } a < w_h < b \tag{57}$$

Moreover, we have

$$\lim_{\varepsilon\to 0} \left.\frac{\partial \Pi_{h-l}}{\partial w_h}\right|_{w_h=b-\varepsilon} = \frac{1}{8}(1-s_r) > 0 \tag{58}$$

and

$$\lim_{\varepsilon\to 0} \left.\frac{\partial \Pi_{h-l}}{\partial w_h}\right|_{w_h=a-\varepsilon} = \lim_{\varepsilon\to 0} \left.\frac{\partial \Pi_{h-l}}{\partial w_h}\right|_{w_h=a+\varepsilon} \tag{59}$$

(57) is negative when the bargaining power of the retailer λ is sufficiently high, and when the degree of differentiation between the private label and the low-quality brand, $s_r - s_l$, is sufficiently low compared to the degree of differentiation between the private label and the high-quality brand, $1 - s_r$. In this case, Π_{r-h} is concave everywhere on w_h, and with $w_h = \overline{w_h} = c_l$ as the unique maximum. (57) is positive when the bargaining power of the retailer is sufficiently low, and when the degree of differentiation between the private label and the low-quality brand is sufficiently high compared to the degree of differentiation between the private label and the high-quality brand. In this case, Π_{r-h} is concave on w_h for $w_h < a$, convex on w_h over the interval $w_h \in (a, b)$, and concave on w_h for $w_h > b$. We then have two local maxima, at $w_h = c_l$ and $w_h = \underline{w_h}$, respectively. It is then sufficient to compare the joint profit Π_{r-h} when $w_h = c_l$ and $q_r^* > 0$, with the joint profit when $w_h = \underline{w_l}$ and $q_r^* = 0$. The condition that private label accommodation be profitable, is

then

$$\begin{aligned} \Pi_{r-h}\left(c_h\right)\big|_{q_r^*>0} &= \frac{9+s_r\left(1-s_r+s_l\lambda\left(s_r-s_l\right)\right)}{64} \\ &> \frac{9}{64}+\frac{s_l\left(1-s_l\right)\left(\lambda+s_l-\lambda s_l\right)}{64\left(1+s_l-\lambda s_l\right)}=\Pi_{r-h}\left(\underline{w_h}\right)\big|_{q_r^*=0} \end{aligned} \tag{60}$$

Consider the case $s_l = .7$ and $\lambda = .25$. Solving (60) for s_r in this case yields $s_r < 0.92357 (= \overline{\overline{s}})$. **Q.E.D.**

Proof of Lemma 4 To complete the proof, it is sufficient to show that $\Pi^h = \Pi\left(\overline{w_h}, c_l\right) > \Pi\left(c_h, \overline{w_l}\right) = \Pi^l$ when $s_r < s_l$. Taking the difference $\Pi^h - \Pi^l$ in this case yields

$$\Pi^h-\Pi^l=(1-\lambda)^2\,\frac{\left(s_l-s_r\right)\left(1-s_r\right)\left(1-s_l\right)\left(9+s_r-7s_l+s_ls_r+s_l^2-s_r^2\right)}{64\left(1-s_r+(1-\lambda)\left(s_l-s_r\right)\right)^2}>0,$$

which always is positive. It is not necessary to consider the case $\Pi^l = \Pi\left(c_h, \underline{w_l}\right)$, since it involves more distortion to the wholesale price w_l; all else equal, it therefore also yields a smaller overall industry profit. **Q.E.D.**

Proof of Proposition 3 For the case $s_r \leq s_l$, the consumers' surplus can be written

$$\begin{aligned} CS|_{s_r\leq s_l} &= s_r\int_{\frac{p_r^*}{s_r}}^{\frac{p_l^*-p_r^*}{s_l-s_r}}\theta\ \mathrm{d}\theta+s_l\int_{\frac{p_l^*-p_r^*}{s_l-s_r}}^{\frac{p_h^*-p_l^*}{1-s_l}}\theta\ \mathrm{d}\theta+\int_{\frac{p_h^*-p_l^*}{1-s_l}}^{1}\theta\ \mathrm{d}\theta \\ &\quad -q_r^*p_r^*-q_l^*p_l^*-q_h^*p_h^* \end{aligned} \tag{61}$$

where $p_r^* = s_r\left(s_r+4\right)/8$, $p_l^* = s_l\left(s_l+4\right)/8$ and $p_h^* = (1+\overline{w_h})/2$. Consumers' surplus under a ban on private labels, is simply $CS|_{s_r=0}$. Normalising $\lambda = 0$, yields

$$CS|_{s_r=0}=\frac{9+9s_l^2+25s_l-8s_l^3+s_l^4}{128\left(1+s_l\right)^2}, \tag{62}$$

and

$$\begin{aligned} \varphi\left(s_r,s_l\right)|_{\lambda=0} &= \left.\frac{CS|_{s_r\leq s_l}}{CS|_{s_r=0}}\right|_{\lambda=0} \\ &= \left(1+s_l\right)^2\frac{\left\{\begin{array}{c}\delta_r s_l^4-8\delta_r s_l^3+s_r\delta_r\left(25-6s_r\right)s_l^2+5\left(3+\delta_r\right)s_r^3s_l \\ +\left(3+s_r^2-7s_r\right)^2+s_l\left(25+9s_l-58s_r\right)\end{array}\right\}}{\left(9+25s_l+9s_l^2-8s_l^3+s_l^4\right)\left(\delta_r+s_l-s_r\right)^2}\lessgtr 1 \end{aligned} \tag{63}$$

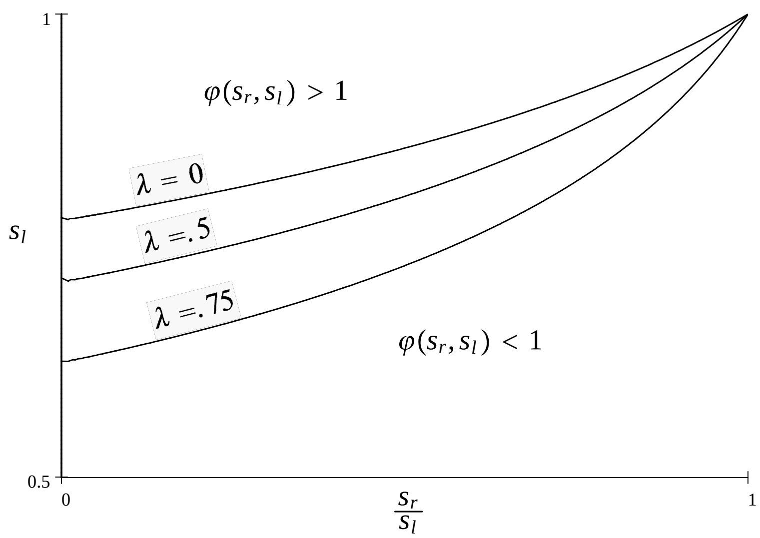

Figure 5: $\varphi(s_r, s_l) = 1$ plotted against s_r/s_l for different values for λ. Private label introduction causes an increase in consumers' surplus when $\varphi(s_r, s_l) > 1$, and a decrease when $\varphi(s_r, s_l) < 1$.

where $\delta_r = 1 - s_r$. Private label introduction causes an increase in consumers' surplus when $\varphi(s_r, s_l) > 1$, and a decrease when $\varphi(s_r, s_l) < 1$. In Figure 5 we have plotted the condition $\varphi(s_r, s_l) = 1$ for different values for λ. It shows that the private label causes an increase in consumers' surplus only as long as the private label and the low-quality brand are sufficiently differentiated, and as long as λ is sufficiently high. An increase in λ, makes for a smaller increase in the price of the high-quality brand when a private label is introduced, and therefore relaxes the condition $\varphi(s_r, s_l) \geq 1$. When $\lambda = 1$, the condition always holds.

For the case $s_r > s_l$, we have $p_h^* = 5/8$ if the private label is introduced ($q_r^* > 0$). In this case, the consumers' surplus is equal to

$$\begin{aligned} CS|_{s_r > s_l} &= s_l \int_{\frac{p_l^*}{s_l}}^{\frac{p_r^* - p_l^*}{s_r - s_l}} \theta \, \mathrm{d}\theta + s_r \int_{\frac{p_r^* - p_l^*}{s_r - s_l}}^{\frac{p_h^* - p_r^*}{1 - s_r}} \theta \, \mathrm{d}\theta + \int_{\frac{p_h^* - p_r^*}{1 - s_r}}^{1} \theta \, \mathrm{d}\theta \\ &\quad - q_l^* p_l^* - q_r^* p_r^* - q_h^* p_h^* \\ &= \frac{9 - s_r^2 + s_r + s_l s_r^2 - s_l^2 s_r}{128} \end{aligned} \tag{64}$$

$CS|_{s_r > s_l}$ is maximised for $s_r = (1 + s_l)/2 \equiv s_r^*$, i.e. when there is maximum differentiation between the private label and the two national brands (conditional on $s_r > s_l$). For the case $s_r > s_l$, the maximum consumers' surplus is therefore

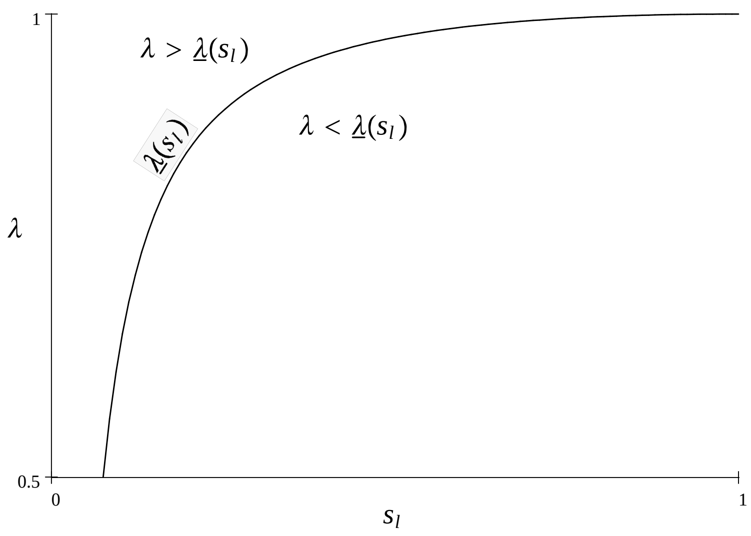

Figure 6: The case $s_r > s_l$, and with maximum differentiation between the private label and the two national brands, i.e. $s_r = s_r^*$. Private label introduction causes an increase in consumers' surplus when $\lambda > \underline{\lambda}\,(s_l)$, and a decrease when $\lambda < \underline{\lambda}\,(s_l)$.

$$CS|_{s_r=(1+s_l)/2} = \frac{36 + 1 + (1 - s_l)\,(1 + s_l)^2}{512} \tag{65}$$

Using (61), we can write the consumers' surplus without the private label, as

$$CS|_{s_r=0} = \frac{9 + (1-\lambda)^2\, s_l^4 - 8\,(1-\lambda)^2\, s_l^3 + (1-2\lambda)\,(9-8\lambda)\, s_l^2 + (25-24\lambda)\, s_l}{128\,(1 + s_l - \lambda s_l)^2} \tag{66}$$

Solving $CS|_{s_r=(1+s_l)/2} \geq CS|_{s_r=0}$ for λ, yields

$$\lambda \geq s_l \frac{11 + 25 s_l - 7 s_l^2 - s_l^3 - 2\sqrt{37 + 5 s_l^2 - 26 s_l}}{(3 - s_l)\,(9 + s_l)\, s_l^2} \equiv \underline{\lambda}\,(s_l) \tag{67}$$

$\underline{\lambda}\,(s_l)$ is plotted in Figure 6. We can see that for the case $s_r = s_r^* > s_l$, private label introduction causes an increase in consumers' surplus only when λ is sufficiently high, and/ or when there is a high degree of differentiation between the private label and both national brands (similar to the case $s_r < s_l$).

Finally, consider the overall social welfare function:

$$W|_{s_r<s_l} = s_r \int_{\frac{p_r^*}{s_r}}^{\frac{p_l^*-p_r^*}{s_l-s_r}} \theta \, \mathrm{d}\theta + s_l \int_{\frac{p_l^*-p_r^*}{s_l-s_r}}^{\frac{p_h^*-p_l^*}{1-s_l}} \theta \, \mathrm{d}\theta + \int_{\frac{p_h^*-p_l^*}{1-s_l}}^{1} \theta \, \mathrm{d}\theta \\ -q_r^* c_r - q_l^* c_l - q_h^* c_h \tag{68}$$

When $s_r = s_l$ (or equivalently, when $s_r = 1$), W is equal to

$$W|_{s_r=s_l} = \frac{3\left(9 + s_l - s_l^2\right)}{128} \tag{69}$$

Total welfare without the private label ($s_r = 0$) is equal to

$$W|_{s_r=0} = \frac{\left\{ \begin{array}{c} 27 - (1-\lambda)^2 s_l^4 - 4(1-\lambda)(2-\lambda) s_l^3 \\ + \left(32\lambda^2 - 62\lambda + 27\right) s_l^2 + (63 - 60\lambda) s_l \end{array} \right\}}{128\left(1 + s_l - \lambda s_l\right)^2} \tag{70}$$

Taking the difference $W|_{s_r=s_l} - W|_{s_r=0}$, yields

$$-\frac{s_l(1-s_l)(1-\lambda)(6 + 2s_l(1-2\lambda) + s_l(1-\lambda)(1-2s_l))}{128\left(1 + s_l - \lambda s_l\right)^2} < 0 \tag{71}$$

which is negative in the permitted range of parameters, $\lambda \in (0,1)$ and $s_l \in (0,1)$. **Q.E.D.**

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Chapter 3

Buyer Power and Exclusion in Vertically Related Markets

Buyer power and exclusion in vertically related markets*

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Abstract

We explore how the incentives for exclusion, both in upstream and downstream vertical markets, are related to the bargaining position of suppliers and retailers. We consider a model with a dominant upstream manufacturer and a competitive fringe of producers of imperfect substitutes offering their products to two differentiated downstream retailers. In this model we contrast the equilibrium outcome in two alternative situations. The first one is when the dominant supplier holds all the bargaining power, and this is compared with the outcome when the retailers have all the bargaining power. We show that exclusion occurs when interbrand and intrabrand competition is strong. Moreover, in contrast to the received literature, we find that when retailers have buyer power, this enhances welfare compared to when the manufacturer holds all the bargaining power.

JEL classifications: L40, L42

Keywords: exclusive dealing, exclusive purchasing, exclusive selling, buyer power, competition, vertical restraints.

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1 Introduction

Exclusion in vertical markets occurs when a seller or a buyer trades exclusively with one party. Exclusive purchasing is when a retailer trades exclusively with one manufacturer. On the other hand when a manufacturer decides to trade exclusively with one retailer, for instance in a given geographic region, this is denoted as exclusive territories or exclusive selling.

In vertically related markets exclusion has the potential to reduce social welfare and consumer surplus by increasing prices and reducing product variety. In this article we explore how the incentives for exclusion are related to the allocation of bargaining power between upstream manufacturers and downstream retailers. With differentiated manufacturers and retailers, exclusion can occur at both the upstream and downstream levels. Strong manufacturers may exclude both smaller upstream rivals and downstream retailers. Big retailers with strong bargaining power may also find it profitable to exclude smaller upstream producers and even rival retailers from distributing certain products.

The incentive to exclude rivals both in upstream and downstream markets, and its consequences for consumers and social welfare, are at the heart of a lively policy debate both in Europe and the US. This debate is partially concerned with the mere power of upstream and downstream firms, and partially concerned with specific contractual instruments that may facilitate the exclusion of rivals. One fear is that upstream firms with market power may enter into either explicit (or implicit) exclusive agreements with downstream retailers, or alternatively design wholesale contracts in such a way that retailers have the incentives to exclude upstream rivals. At the retail level the concern is that strong retailers may exploit their buyer power by auctioning exclusivity to competing manufacturers, or requiring high fixed payments from manufacturers with the exclusion of smaller upstream suppliers as a consequence. In addition, strong retailers may be able to exclude rival retailers from obtaining supplies.

The grocery market may serve as an example where both strong retailers and some strong upstream manufacturers are present. Over the last decades - and in most grocery markets around the world - the bargaining power has gradually shifted from the manufacturing sector to the retailers. The main reason for this shift is the consolidation of the retail sector that one has witnessed in grocery markets. In spite of this, there are still manufacturers that hold a strong position because they own strong brand names that can be regarded as so-called 'must-carry' for the retailers.

The grocery market also serves as an example of the application of advanced contractual instruments in wholesale contracts involving several vertical restraints, making contracts non-linear. In this market the use of fixed payments appears to be frequent. These payments are either charged to the suppliers by retailers - sometimes denoted as slotting allowances - or the other way around. There is some anecdotal evidence that the size and direction of fixed payments are related to the division of bargaining power between sellers and buyers. Policymakers largely regard these payments as instrumental in facilitating anticompetitive exclusion in both upstream and downstream markets. Consequently, policymakers in many countries seek to restrict the exploitation of buyer (or seller) power by regulating the possibility to use fixed fees as profit shifting devices. For example, the British regulation of the grocery market includes a ban on slotting fees. Another example is the Norwegian food chain commission, which recently suggested that a similar regulation should be considered for the grocery market in Norway.

This article explores how the incentives for exclusion, both in upstream and downstream markets, are related to the bargaining position of suppliers and retailers. We consider a model with a dominant upstream manufacturer and a competitive fringe of producers of imperfect substitutes offering their products to two differentiated downstream retailers. In this model we contrast the equilibrium outcome in two alternative situations. The first one is when the dominant supplier holds all the bargaining power, and this is compared with the outcome when the retailers have all the bargaining power. Bargaining power in our model is the ability to offer take-it-or-leave it contracts to the other party. By comparing the equilibrium outcomes in these two situations, we are able to gain some insight in how such a shift in bargaining power will affect the incentive to exclude and thereby social welfare and consumer surplus.

Our analysis is related to two strands of the literature on exclusion in vertical markets. First, our model is related to the literature on upstream exclusion; exclusive dealing. This literature investigates the Chicago doctrine (Bork, 1978; Posner, 1976), which basically states that exclusive dealing to dampen competition can never be profitable. Part of this literature investigates the potential for inefficient exclusion when buyers are final consumers (Aghion and Bolton, 1987; Bernheim and Whinston, 1998; O'Brien and Shaffer, 1997; Rasmusen et. al. (1991) and Segal and Whinston, 2000). The other part of this literature, and more related to our analysis, considers the case when buyers compete in a downstream market (Fumagalli and Motta, 2006, Abito and Wright, 2008 and Simpson and Wickelgren, 2007). Second, our analysis is related to recent literature on the potential for exclusion in downstream markets (Marx and Shaffer, 2007, Rey and Whinston, 2011; Miklos-Thal et al., 2011).

In our model the buyers compete in a downstream market and exclusion at either vertical level is driven by two basic factors; the degree of differentiation between upstream products (interbrand competition) on one side and differentiation between downstream retailers on the other (intrabrand competition), and the division of bargaining power between manufacturers and retailers. We find that both non-exclusionary and exclusionary equilibria exist under both seller and buyer power. Exclusion in our model occurs when either product and/or retailer differentiation is weak. However, we find that non-exclusionary equilibria can be sustained for a larger set of parameters for product and retail differentiation when the retailers have buyer power rather than when the bargaining power lies with the dominant manufacturer. This implies that retailer buyer power may enhance product variety. We also show that buyer power leads to lower prices compared with a situation where the manufacturer holds all the bargaining power.

With upstream bargaining power there is a trade-off for the dominant manufacturer between charging high wholesale prices and having more product variety. When differentiation is high, both upstream and downstream, no exclusion occurs in equilibrium. As the retailers, as well as the brands, become closer substitutes, the retailers are unable to sustain a high price on the competitive brand, and in turn this restricts the dominant manufacturer's ability to induce a high price for its product. At the same time, the value of variety is lower in this case. Hence, the manufacturer may want to use exclusive purchasing to reduce or eliminate competition from the competitive brand. This may result in partial foreclosure of the competitive brand. Moreover, we find that if intrabrand competition is strong enough, the dominant manufacturer may want to contract with only one retailer (exclusive selling); and if both interbrand and intrabrand competition are strong, the result may be complete foreclosure of either the competitive product, if interbrand competition is stronger, or one of the retailers, if intrabrand competition is stronger.

To some degree, our results resemble the Chicago school logic stating that one should expect that exclusion will occur only when it is efficient for the contracting parties. In our model the basic externalities arise from competition at both vertical levels, i.e. either competition between brands or between retailers. When competition at both levels becomes hard – in the sense that aggregate profit would be higher without competition at one level – then the agent causing the externality is excluded. However, the logic departs from the Chicago school when evaluating the consequences for social welfare. In our model social welfare is maximised under no exclusion, hence exclusion is always socially inefficient in our model.

When the manufacturer holds all the bargaining power our results also depart in a fundamental way from Fumagalli and Motta (2006)[1]. These authors – although in

[1]See also Rasmusen et al. (1991) and Segal and Whinston (2000).

a slightly different model – find that inefficient exclusion should not be expected when competition in the downstream market is hard. Instead, our results support the finding in Wright (2009) in a comment to Fumagalli and Motta's article; more intense downstream competition increases the likelihood of socially inefficient exclusion, a result that also has some intuitive appeal.

When retailers hold all the bargaining power, similar results apply; exclusionary equilibria arise when product and/or retail competition is hard enough. More important, with buyer power we find that non-exclusionary equilibria can be sustained for a larger set of parameter values than when the manufacturer holds all the bargaining power. This result is in some contrast to recent articles that investigate the effects of buyer power on downstream exclusion. Marx and Shaffer (2007) and Miklos-Thal et al. (2011) analyse the case where competing retailers make offers to a single manufacturer. Both papers explore the consequences of different contractual instruments under buyer power, specifically two-part and three-part tariffs and exclusive dealing provisions. When three-part tariffs or an exclusive dealing provision are feasible, Marx and Shaffer show that downstream exclusion (exclusive selling) always is an equilibrium outcome. In contrast, Miklos-Thal et al. find that if the retailers' offers instead can be made contingent on exclusivity or not, exclusion will occur only when retailers are very close substitutes.[2] This latter result resembles our result. However, the results in Marx and Shaffer and Miklos-Thal et al. indicate that, if anything, there will be more exclusion with buyer power than when the manufacturer has the bargaining power. We show that the key assumption leading to this conclusion is the upstream monopoly position of the manufacturer. When the dominant manufacturer is in competition with a fringe of smaller rivals, as in our model, the conclusion is reversed; buyer power leads to less exclusion.

The rest of the article is organised as follows. The next section presents the framework for our analysis. Section 3 analyses equilibrium outcomes when the seller has the bargaining power and the following section looks at the same under buyer power. Section 4 gives a conclusion.

2 The framework

We consider a market with two brands, A and B, that are distributed by two competing retailers, 1 and 2. Brand A is produced by a single manufacturer with market power (the

[2] If the retailers can use contingent offers and upfront payments (i.e., three-part tariffs), exclusion will never occur. See also Rey and Whinston (2011).

manufacturer). Whereas brand B, which we refer to as the competitive brand, is assumed to be supplied by a fringe of competitive firms, and offered to retailers at a price equal to marginal cost.[3] We assume that brands as well as retailers are imperfect substitutes in the eyes of the consumers.[4]

We will not put any ex-ante restrictions on the set of possible market configurations, and hence assume that, before contracts are entered into, each retailer has the ability to distribute both brands. If both retailers sell both brands (double common agency), then consumers are able to choose from a set Ω of four different "products", or product-service bundles, $\Omega = \{A1, B1, A2, B2\}$, where $\{A1, B1\}$ are distributed by retailer 1, and $\{A2, B2\}$ are distributed by retailer 2. To avoid confusion, we will refer to A and B as *brands*, and to $A1$, $B1$, $A2$ and $B2$ as *products* in the following.

We assume that the brands, as well as the retailers, are symmetrically differentiated. In order to make some comparisons and obtain some clear results, we are going to use the following linear model, where the inverse demand at retailer $j \neq k \in \{1, 2\}$ for brand $i \neq h \in \{A, B\}$, is equal to

$$p_{ij}(q_{ij}, q_{hj}, q_{ik}, q_{hk}) = 1 - q_{ij} - bq_{hj} - dq_{ik} - bdq_{hk} \tag{1}$$

The parameter $b \in (0, 1)$ represents the degree of interbrand competition; when $b \to 0$, A and B become independent brands, whereas when $b \to 1$, they become closer substitutes. Similarly, the parameter $d \in (0, 1)$ represents the degree of intrabrand competition (substitutability between retailer services). Finally, we assume that the degree of competition between different brands in different stores, e.g. between product A1 and B2, is the product of the degree of interbrand and intrabrand competition, $bd \in (0, 1)$.[5] If all the products are sold ($q_{ij} > 0$ for all $ij \in \Omega$), then the direct demand for product ij can be written

$$D_{ij}(p_{ij}, p_{hj}, p_{ik}, p_{hk}) = \beta - \lambda(p_{ij} - bp_{hj} - dp_{ik} + bdp_{hk}) \tag{2}$$

where $\beta = 1/(1 + b + d + bd)$ and $\lambda = 1/(1 - d^2 - b^2 + b^2d^2)$.[6] In the following we

[3] The competitive brand could for example represent the retailers' private labels.

[4] Differentiation between brands may be due to differences in taste, packaging, etc., whereas retailers may enjoy some market power due to due to differences in the type of services they offer, different geographic locations of the stores, etc.

[5] This demand system can be obtained from a representative consumer with a quadratic utility function. The same demand system is used in e.g. Dobson and Waterson (2007).

[6] The direct demand function is valid only as long as all four products are sold. E.g, when product ik is not sold ($q_{ik} = 0$), then demand for the rest of the products become:
$D_{ij} = (1 + d)(\beta - \lambda(1 - d)p_{ij} + \lambda b(1 - d)p_{hj})$

are going to use the notation $p_{ik} = \infty$, e.g. as in $D_{ij}(p_{ij}, p_{hj}, \infty, p_{hk})$, to indicate the situtation where a specific product, ik, is not sold.

2.1 Some preliminaries

We assume that unit production costs are constant and equal to $c \geq 0$ for each brand, A and B. Retailers have no costs other than the prices they pay when purchasing products in the intermediate market. Overall industry profit in the double common agency situation can then be written as $\Pi(p_{A1}, p_{B1}, p_{A2}, p_{B2}) = \sum_{ij \in \Omega}(p_{ij} - c) D_{ij}$, which has its maximum, Π^M, for symmetric prices $\mathbf{p}^M = \left(p^M, p^M, p^M, p^M\right)$, where $p^M = (1+c)/2$. Evaluated at the optimum, the first-order maximising condition for product A1 (symmetric for B1, A2 and B2) is

$$\left(p^M - c\right)\left[\sum_{ij \in \Omega} \partial_{p_{A1}} D_{ij}\right] + D_{A1}\left(\mathbf{p}^M\right) = 0, \tag{3}$$

where $\partial_{p_{A1}} D_{ij}$ is the partial derivative of the demand for product $ij \in \Omega$, with respect to the price of product A1. In the same fashion, we denote by Π^X the maximum profit with a "mixed" configuration, where only *three* products are sold, $\Omega \backslash hk = \{ij, hj, ik\}$:

$$\begin{aligned} \Pi^X &= \Pi\left(p^M, p^M, p^M, \infty\right) \\ &= \max_{p_{ij}, p_{hj}, p_{ik}} \left[(p_{ij} - c) D_{ij} + (p_{hj} - c) D_{hj} + (p_{ik} - c) D_{ik}\right]_{p_{hk} = \infty} \end{aligned} \tag{4}$$

The industry profit with three products is maximised for the same prices equal to p^M. Evaluated at the optimum, the first-order conditions for each product are:

$$\begin{aligned} \left(p^M - c\right)\left[\partial_{p_{ij}} D_{ij} + \partial_{p_{ij}} D_{hj} + \partial_{p_{ij}} D_{ik}\right]_{p_{hk}=\infty} & \\ + D_{ij}\left(p^M, p^M, p^M, \infty\right) &= 0 \end{aligned} \tag{5}$$

$$\begin{aligned} \left(p^M - c\right)\left[\partial_{p_{hj}} D_{hj} + \partial_{p_{hj}} D_{ij} + \partial_{p_{hj}} D_{ik}\right]_{p_{hk}=\infty} & \\ + D_{hj}\left(p^M, p^M, \infty, p^M\right) &= 0 \end{aligned} \tag{6}$$

$$\begin{aligned} \left(p^M - c\right)\left[\partial_{p_{ik}} D_{ik} + \partial_{p_{ik}} D_{ij} + \partial_{p_{ik}} D_{hj}\right]_{p_{hk}=\infty} & \\ + D_{ik}\left(p^M, \infty, p^M, p^M\right) &= 0 \end{aligned} \tag{7}$$

Finally, we denote by $\Pi^U = \Pi\left(p^M, \infty, p^M, \infty\right)$ and $\Pi^D = \Pi\left(p^M, p^M, \infty, \infty\right)$ the max-

$D_{hj} = (1 - bd)(\beta - \lambda(1 + bd) p_{hj}) + \lambda b\left(1 - d^2\right) p_{ij} + \lambda d\left(1 - b^2\right) p_{hk}$
$D_{hk} = (1 + b)(\beta - \lambda(1 - b) p_{hk} + \lambda d(1 - b) p_{hj})$

imum profits when only one brand is sold (upstream monopoly) and when only one retailer is active (downstream monopoly), respectively. With the marginal cost normalised to zero ($c = 0$), overall maximum profits with four and three products, respectively, are equal to

$$\Pi^M = \frac{1}{(1+d)(1+b)} \quad ; \quad \Pi^X = \frac{3+d+b-bd}{4(1+d)(1+b)},$$

whereas the maximum profits for an upstream or downstream monopoly, respectively, are

$$\Pi^U = \frac{1}{2(1+d)} \quad ; \quad \Pi^D = \frac{1}{2(1+b)}.$$

Since products are imperfect substitutes, the following inequalities always hold: $\Pi^U + \Pi^D > \Pi^M > \Pi^X$, and $\Pi^X > \Pi^U$ and $\Pi^X > \Pi^D$.[7]

In general, the incentives of manufacturers and retailers are not perfectly aligned. The question of which party has the initiative when contracts are offered, may therefore be important. The answer has distributional consequences (who obtains more profit), but it may also have consequences for equilibrium prices and the level of total surplus generated. In turn, this may influence the equilibrium incentives to sustain different market configurations, such as double common agency versus any configuration with exclusive distribution.

To capture the possible differences in the incentives of manufacturers and retailers, we compare two extremes in the following: In the first case, *seller power*, bargaining power resides with the dominant manufacturer, who makes take-it-or-leave-it offers to the retailers. In the second case, *retailer power* (or buyer power), the two retailers have all the bargaining power, and make offers to the manufacturer. In both cases, bilateral efficient (two-part) tariffs are used when trading with the manufacturer, and in both cases product B is offered to the retailers at a per-unit price equal to the marginal cost. Finally, we allow any manufacturer-retailer contract to include provisions for exclusive purchasing (upstream exclusion) and/ or exclusive selling (downstream exclusion).

[7] Whether $\Pi^U > \Pi^D$ or $\Pi^U < \Pi^D$ depends on the degree of interbrand (b) versus intrabrand differentiation (d).

3 Seller power

We start with the case where the dominant manufacturer offers contracts to the two retailers.[8] We consider the following four-stage game:

1. (The contracting stage.) The manufacturer offers (public) two-part tariffs to the retailers. The total price paid by retailer j for q_{Aj} units of product A, is $T_j(q_{Aj}) = F_j + w_j q_{Aj}$, where w_j is a wholesale price and F_j is a fixed fee. The fixed fee can either be positive (a franchise fee) or negative (a slotting allowance), and we assume that it is paid irrespective of the level of final sales, i.e. $T_j(0) = F_j$.[9] The manufacturer can offer a common contract to both retailers (double common agency) or to just one retailer (*exclusive selling*). In addition, one or both contract offers may include a provision for *exclusive purchasing*, in which case the retailer(s) will be forced to sell product A only.

2. (The accept-or-reject stage.) After having observed all the contract offers, each retailer simultaneously and independently either accept or reject the manufacturer's terms. If all the contracts are accepted, the game proceeds directly to stage 4.

3. (The recontracting stage.) If the manufacturer made offers to both retailers at stage 1, and only one retailer accepted, then the manufacturer is allowed to offer the accepting retailer a new contract.[10]

4. (The pricing stage.) The retailers compete on prices in the downstream market, according to the terms and provisions in their contracts with the manufacturer.

[8] This part of the analysis is related in particular to a recent paper by Inderst and Shaffer (2010). They study the situation where a dominant manufacturer make contract offers to competing retailers that also sell a substitute product. Inderst and Shaffer demonstrate how the manufacturer may use market-share contracts to restore the industry maximising outcome. These contracts makes the retailers' payments to the manufacturer dependent on how much they sell of the substitute good. We assume that the manufacturer makes use of exclusive contracts instead. Exclusive contracts may be easier to monitor, and hence more credible for both the manufacturer and the retailer, than for example a commitment from the retailers to give the manufacturer's brand a specific in-store market share (Rey and Tirole, 2007).

[9] This is unlike Marx and Shaffer (2007) and Miklós-Thal et al. (2011), who analyse the use of three-part tariffs that combine an upfront payment S_j to the retailer, with a *conditional* two-part tariff T_j where $T_j = 0$ if the retailer buys nothing from the manufacturer. Both papers analyse the situation where retailers make offers to a common manufacturer.

[10] We could also assume that, at this stage, if the manufacturer made an offer to only one retailer at stage 1, and the retailer rejected the offer at stage 2, the manufacturer receives a chance to make an offer to the rival retailer at the recontracting stage. This would not affect any of our results. We therefore assume that the manufacturer is not allowed to make another offer in this case.

We purposely restrict attention to two-part tariffs in the contracting game, since we are interested in cases where firms are unable to maximise overall profits when all four products are sold. If the manufacturer was able to use additional restraints, e.g. resale price maintenance or market-share contracts, then this could serve to restore the industry maximising outcome, which would make exclusive contracting superfluous. See e.g. Rey and Vergé (2010) and Inderst and Shaffer (2010), who demonstrate how such restraints can restore the industry maximising outcome.

We solve the game backwards in the usual way, looking for the subgame-perfect equilibria. Before we move on, it is useful to introduce some notation: Given that both retailers are offered contracts at stage 1, with terms $\{w_1, F_1\}$ and $\{w_2, F_2\}$ respectively, and provided that both retailers accept, we can write retailer j's profit at stage 4, $j \in \{1, 2\}$, as

$$\Pi_r^j = \max_{p_{Aj}, p_{Bj}} \{(p_{Aj} - w_j) D_{Aj} + (p_{Bj} - c) D_{Bj} - F_j\}$$

We denote by $\pi(w_1, c; w_2, c)$ and $\pi(w_2, c; w_1, c)$ the resulting equilibrium flow payoffs for retailer 1 and 2, respectively. Hence, we can write retailer j's equilibrium profits at stage 4 as $\pi(w_j, c; w_k, c) - F_j$. Similarly, we denote by $D_{Aj}(w_j, c, w_k, c)$ and $D_{Bj}(c, w_j, c, w_k)$ the resulting demand for products Aj and Bj respectively, $j, k \in \{1, 2\}$, $j \neq k$. When exclusivity provisions are used, we replace the respective term(s) in these functions with ∞, to indicate the situations where the corresponding products are not sold.[11]

3.1 Equilibrium analysis

Consider first the subgame where the manufacturer offers a contract to only one retailer (exclusive selling). Suppose that this retailer is retailer 1, and that the retailer accepts the contract. (The case is symmetric if retailer 2 were receiving the offer.) There are two options: Either the manufacturer offers a 'common agency' contract (a common contract), in which case retailer 1 is allowed to sell both brands A and B; alternatively, the contract could include an exclusive purchasing provision, in which case retailer 1 is not allowed to sell brand B.

[11] We denote by $\pi(w_1, c; \infty, c)$ and $\pi(\infty, c; w_2, c)$ be the flow payoffs for retailer 1 and 2 when retailer 2 is not selling brand A; and by $\pi(w_1, c; w_2, \infty)$ and $\pi(w_2, \infty; w_1, c)$ the flow payoffs when retailer 2 is not selling brand B. We write as $\pi(w_1, \infty; \infty, c)$ and $\pi(\infty, c; w_2, \infty)$ the flow payoffs of 1 and 2 when retailer 1 is selling brand A only, and retailer 2 is selling brand B only. (These cases are symmetric when switching retailer 1 with retailer 2.)

Similarly, we denote by $\pi(w_1, \infty; w_2, \infty)$ and $\pi(w_2, \infty; w_1, \infty)$ the flow payoff for retailer 1 and 2 when both retailers sell brand A only, and by $\pi(\infty, c; \infty, c)$ the flow payoff for each retailer when they both sell brand B only.

Exclusive selling without exclusive purchasing Suppose first that the manufacturer offers the retailer a common contract. If retailer 1 accepts, three products are sold in equilibrium, $\{A1, B1, B2\}$. The retailers' equilibrium profits at stage 4 are then $\pi(w_1, c; \infty, c) - F_1$ for retailer 1 and $\pi(\infty, c; w_1, c)$ for retailer 2. The manufacturer's maximisation problem at the contracting stage can then be written

$$\max_{w_1, F_1} [F_1 + (w_1 - c) D_{A1}(w_1, c, \infty, c)]$$
$$\text{s.t. } \pi(w_1, c; \infty, c) - F_1 \geq \overline{\pi}_r \ , \tag{8}$$

where $\overline{\pi}_r$ is retailer 1's reservation profit – i.e. the profit that the retailer earns when (at stage 2) it rejects the contract offer from the manufacturer. In case the retailer rejects the offer, the game proceeds directly to stage 4, where each retailer sells the competitive brand; in this case, the retailers earn the profit $\pi(\infty, c; \infty, c)$ each. Retailer 1's participation constraint can therefore be written $\pi(w_1, c; \infty, c) - F_1 \geq \pi(\infty, c; \infty, c)$; this constraint is clearly binding, since there is no incentive for the manufacturer to leave its retailer more surplus than it needs to accept the offer. We can therefore rewrite (8) as

$$\max_{w_1} \{\Pi(w_1, c, \infty, c) - \pi(\infty, c; w_1, c)\} - \pi(\infty, c; \infty, c) \tag{9}$$

where $\Pi(w_1, c, \infty, c)$ is the overall industry profit with three products $\{A1, B1, B2\}$, i.e. the manufacturer maximises its joint profit with retailer 1. It can be shown that, with our linear demand system, (9) is maximised for $w_1 = c$. Hence, in the subgame with exclusive selling (without exclusive purchasing), the retailers earn the profits $\Pi_r^1 = \pi(\infty, c; \infty, c)$ and $\Pi_r^2 = \pi(\infty, c; c, c)$, respectively, whereas the manufacturer earns the profit $\Pi_A = \pi(c, c; \infty, c) - \pi(\infty, c; \infty, c) > 0$,[12] i.e. the manufacturer earns its incremental contribution to the profit of the retailer that has 'exclusive selling rights' to brand A.

Exclusive selling and exclusive purchasing Suppose instead that the manufacturer offers retailer 1 an exclusive purchasing contract, and that the retailer accepts. In this case, the retailers sell different brands $\{A1, B2\}$. Maximisation by the retailers results in profits $\Pi_r^1 = \pi(w_1, \infty; \infty, c) - F_1$ to retailer 1 and $\Pi_r^2 = \pi(\infty, c; w_1, \infty)$ to retailer 2, where $\pi(w_1, \infty; \infty, c) < \pi(\infty, c; w_1, \infty)$ when $w_1 > c$, and $\pi(c, \infty; \infty, c) = \pi(\infty, c; c, \infty)$.

[12] With our linear demand system, the following always holds: $\pi(\infty, c; \infty, c) = \pi(\infty, c; c, c)$.

Again the manufacturer sets $\{w_1, F_1\}$ so as to maximise its joint profit with retailer 1,

$$\begin{aligned}&\max_{w_1,F_1}\left[F_1+(w_1-c)\,D_{A1}\,(w_1,\infty,\infty,c)\right]\\&\text{s.t. }\ \pi\,(w_1,\infty;\infty,c)-F_1\geq\pi\,(\infty,c;\infty,c)\ ,\end{aligned}\tag{10}$$

which we can rewrite

$$\max_{w_1}\left\{\Pi\,(w_1,\infty,\infty,c)-\pi\,(\infty,c;w_1,\infty)\right\}-\pi\,(\infty,c;\infty,c)\tag{11}$$

where $\Pi\,(w_1, c, \infty, c)$ is the overall industry profit when the retailers sell different brands, $\{A1, B2\}$. The joint profit of the manufacturer and its retailer in this case is maximised for a wholesale price $w_1 > c$. It should come as no surprise that the outcome of this maximisation problem is the wholesale price $w_1 = w_l^* > c$ which gives the Stackelberg leader price in a game where the retailer selling brand A is the price leader (and vertically integrated with the manufacturer), and the retailer selling brand B is the follower. Hence, maximising (11) is equivalent to

$$\max_{p_A}\,(p_A-c)\,D\left(p_A,\infty,\infty,p_B^b\,(p_A)\right),\tag{12}$$

where $p_B^b\,(p_A)$ is the rival retailer's best response to the price p_A. In this case, the joint profit of the manufacturer and its exclusive retailer is the Stackelberg leader profit, $\pi_l^* = (p_l^* - c)\,D\left(p_l^*, \infty, \infty, p_f^*\right)$, whereas the rival retailer earns the Stackelberg follower profit, $\pi_f^* = \left(p_f^* - c\right) D\left(p_f^*, \infty, \infty, p_l^*\right)$, where $p_l^* > p_f^*$ and $\pi_f^* > \pi_l^*$. Let π^E denote the maximum joint profit of the manufacturer and its retailer with exclusive selling, i.e., $\pi^E = \max\left\{\pi\,(c, c; \infty, c), \pi_l^*\right\}$. Let Π_r^O be the (equilibrium) profit of the retailer without a contract with the manufacturer. We then have the following result.

Lemma 1. *(Exclusive selling) The maximum profit that the manufacturer and a retailer make under an exclusive selling agreement is* $\pi^E \equiv \max\{\pi(c,c;\infty,c), \pi_l^*\}$*, where* π_l^* *is their joint (Stackelberg leader) profit when they also sign an exclusive purchasing agreement. With exclusive selling, the manufacturer earns the profit* $\Pi_A = \pi^E - \pi(\infty,c;\infty,c) > 0$*, whereas the profit of the retailer without a contract is*

$$\Pi_r^O = \begin{cases} \pi(\infty,c;c,c) & \text{if} \quad \pi(c,c;\infty,c) > \pi_l^* \\ \pi_f^* & \text{otherwise} \end{cases},$$

where π_f^* *is the Stackelberg follower profit. Moreover,* Π_r^O *is the reservation profit (outside option) for each retailer in the subgame where both receive an offer from the manufacturer at stage 1.*

Proof. Appendix A.

For the retailer who does not receive a contract offer at stage 1, say retailer 2, the subgame with exclusive selling is equivalent to the subgame where *i)* both retailers receive an offer, but where *ii)* retailer 2 (retailer 1) rejects (accepts) the manufacturer's offer at stage 2. In this case, the manufacturer will propose a new contract to retailer 1 at the recontracting stage. This new contract always maximises the joint profit of the pair $A-1$, which means that the manufacturer and the retailer earn the joint profit π^E. The profit of retailer 2 is therefore equal to Π_r^O, also in this case.

The equilibrium with exclusive selling is always somewhat competitive, in the sense that prices are below the integrated level, i.e. we have both $p_{B1}^*(c,c,c,\infty) = p_{B2}^*(c,\infty,c,c) \leq p_{A1}^*(c,c,\infty,c) < p^M$ when $\pi(c,c;\infty,c) > \pi_l^*$, and $p_{B2}^* = p_f^* < p_{A1}^* = p_l^* < p^M$ when $\pi(c,c;\infty,c) \leq \pi_l^*$.

Double common agency Suppose instead that the manufacturer offers (symmetric) contract terms $\{w, F\}$ to both retailers at stage 1, without any provisions for exclusivity.[13] If the retailers accept, we can write retailer 1's maximisation problem at stage 4 (symmetric for retailer 2) as

$$\max_{p_{A1},p_{B1}} \left\{ (p_{A1} - w) D_{A1} + (p_{B1} - c) D_{B1} - F \right\}, \tag{13}$$

[13] Since consumer demands at retailer 1 and 2 are perfectly symmetric, the manufacturer would never want to offer discriminatory contracts that has $w_1 \neq w_2$ and $F_1 \neq F_2$.

which yields the following first-order maximising conditions

$$(p_{A1} - w)\,\partial_{p_{A1}} D_{A1} + (p_{B1} - c)\,\partial_{p_{A1}} D_{B1} + D_{A1} = 0 \tag{14}$$

and

$$(p_{A1} - w)\,\partial_{p_{B1}} D_{A1} + (p_{B1} - c)\,\partial_{p_{B1}} D_{B1} + D_{B1} = 0. \tag{15}$$

Maximisation by the retailers results in profits equal to $\pi(w, c; w, c) - F$ for each retailer at stage 4. At stage 2, each retailer accepts the manufacturer's initial offer as long as they earn at least Π_r^O each from accepting (Lemma 1), i.e. both retailers accept as long as $\pi(w, c; w, c) - F \geq \Pi_r^O$. Accordingly, we can write the manufacturer's maximisation problem at stage 1 as

$$\begin{aligned} &\max_{w,F} 2\left[F + (w - c)\,D_A(w, c, w, c)\right] \\ &\text{s.t. } \pi(w, c; w, c) - F \geq \Pi_r^O \ , \end{aligned} \tag{16}$$

which we rewrite as (the participation constraints are binding)

$$\max_{w} \Pi(w, c, w, c) - 2\Pi_r^O, \tag{17}$$

where $\Pi(w, c, w, c)$ is industry profit as a function of wholesale prices. The first-order maximising condition for the manufacturer is then simply $\partial_w \Pi = 0$. I.e., the manufacturer sets the wholesale prices so as to maximise the overall industry profits. However, because the retailers are selling the competitive brand, the manufacturer is unable to achieve the integrated profit Π^M. To see this, compare the retailer's first-order conditions (14) and (15) with the maximising conditions of the fully integrated firm (3). In doing so, we find that the following conditions have to hold if the manufacturer is to induce retailer 1 (symmetric for retailer 2) to charge the industry maximising price p^M for each brand A and B:[14]

$$-\frac{\partial_{p_{A1}} D_{A2} + \partial_{p_{A1}} D_{B2}}{\partial_{p_{A1}} D_{A1}} = \frac{w - c}{p^M - c} \tag{18}$$

$$-\frac{\partial_{p_{B1}} D_{B2} + \partial_{p_{B1}} D_{A2}}{\partial_{p_{B1}} D_{A1}} = \frac{w - c}{p^M - c} \tag{19}$$

[14]Condition (18) and (19) are equivalent to condition (15) and (16) in Inderst and Shaffer (2010, p. 722) for the case of price competition.

Condition (18) is a familiar one: Since the own-price effect is negative, $\partial_{p_{A1}} D_{A1} < 0$, the condition says that to dampen competition for the manufacturer's brand, and induce a higher price p_{A1}, the manufacturer should *reduce* the retailers' markup by setting the wholesale price above marginal cost, $w > c$. On the other hand, since the cross-price effect is positive, $\partial_{p_{B1}} D_{A1} > 0$, condition (19) says that to induce a higher price p_{B1} for the competitive brand, the manufacturer should *increase* the retailers' markup on brand A, by setting the wholesale price below the marginal cost, $w < c$. Since the manufacturer cannot satisfy both conditions, equilibrium prices are therefore always below the integrated level p^M. We denote by $w = w^*$ the equilibrium (symmetric) wholesale price that solves the manufacturer's problem (13) and by p_A^{CS} and p_B^{CS} the equilibrium retail prices for each brand. Let $\Pi^{CS} = \Pi(w^*, c, w^*, c)$ be the resulting industry profit in the double common agency situation.

Lemma 2. *(Double common agency) In the double common agency situation, the manufacturer sets a uniform wholesale price equal to $w^* = d(1-b)/2$ $(c = 0)$. The resulting resale equilibrium has prices below the integrated level, $c < p_B^{CS} < p_A^{CS} < p^M$, and total industry profit equal to*

$$\Pi^{CS} = \frac{8(1-d) + (1-b)d^2}{2(1+b)(1+d)(2-d)^2} < \Pi^M$$

In the double common agency situation, the manufacturer earns the profit $\Pi_A = \Pi^{CS} - 2\Pi_r^O$, which is positive only as long as the degree of both interbrand and intrabrand competition is low enough.

Proof. Appendix A.

Intuitively, the manufacturer would like to set its wholesale price high to control downstream competition for its own product. However, since the manufacturer can not simultaneously raise the price for brand B, any increase in the price for brand A has the undesirable effect of diverting consumer demand to the competitive brand. This softens the manufacturer's incentives to increase its wholesale price. All retail prices are therefore slightly competitive in equilibrium in the double common agency situation.

Exclusive purchasing For the manufacturer, the worst case for double common agency, as well as for exclusive selling, is when products as well as retailers are perfect substitutes; the subgame equilibrium then has all the prices equal to marginal cost. Under double common agency, the problem for the manufacturer is that retailers compete too hard when setting their prices for the competitive product. In the absence of more complex (and costly) alternatives, the manufacturer may amend the situation by including a provision for exclusive purchasing in one or both contract offers.[15] If one retailer commits to selling brand A only, then this will reduce competition and increase the price on the competitive product, which in turn allows the manufacturer to profitably induce a higher own-price. To see this, suppose first that the manufacturer proposes a non-exclusive contract to one retailer (the common retailer), and an exclusive purchasing contract to the other retailer (the exclusive retailer). Suppose retailer 1 is the common retailer with contract terms $\{w_1, F_1\}$, and that retailer 2 is the exclusive retailer with contract terms $\{w_2, F_2\}$. If both retailers accept, only three products are sold in equilibrium, $\{A1, B1, A2\}$. The retailers' respective maximisation problems at stage 4, are then

$$\max_{p_{A1},p_{B1}} \Big\{ (p_{A1} - w_1) D_{A1} (p_{A1}, p_{B1}, p_{A2}, \infty) \\ + (p_{B1} - c) D_{B1} (p_{B1}, p_{A1}, \infty, p_{A2}) - F_1 \Big\} \tag{20}$$

for retailer 1, and

$$\max_{p_{A2}} (p_{A2} - w_2) D_{A2} (p_{A2}, \infty, p_{A1}, p_{B1}) - F_2 \tag{21}$$

for retailer 2. Notice that in this subgame, retailer 2 is active only as long as w_2 is low enough. As before, each retailer will accept the contract terms as long as each of them earns at least the outside option: The participation constraints in this case are $\pi (w_1, c; w_2, \infty) - F_1 \geq \Pi_r^O$ for retailer 1 and $\pi (w_2, \infty; w_1, c) - F_2 \geq \Pi_r^O$ for retailer 2. Again the manufacturer sets its fixed fees F_1 and F_2 so as to extract all of the retailers' surplus, net of their outside options, and then sets the wholesale prices w_1 and w_2 to maximise overall profits. The following first-order conditions characterise the Nash equilibrium at stage 4 as long as both retailers are active:

$$(p_{A1} - w_1) \partial_{p_{A1}} D_{A1} + (p_{B1} - c) \partial_{p_{A1}} D_{B1} + D_{A1} = 0 \big|_{p_{B2}=\infty} \tag{22}$$

$$(p_{A1} - w_1) \partial_{p_{B1}} D_{A1} + (p_{B1} - c) \partial_{p_{B1}} D_{B1} + D_{B1} = 0 \big|_{p_{B2}=\infty} \tag{23}$$

$$(p_{A2} - w_2) \partial_{p_{A2}} D_{A2} + D_{A2} = 0 \big|_{p_{B2}=\infty} \tag{24}$$

[15] As shown the by Inderst and Shaffer (2010), the dominant manufacturer may restore the integrated profit by offering each retailer a market-share contract, where the payment depends on how much the retailer sells of both product A and B. Exclusive contracts are just extreme versions of market-share contracts, and are generally not suitable to induce the integrated outcome (unless products are perfect substitutes) – since that would require all channels to be active. On the other hand, exclusive contracting may be cheaper to monitor and enforce than more complex contracts with horizontal elements, and may therefore provide a more credible (second-best) alternative.

In comparing the retailers' maximising conditions (22)-(24) with those of the integrated firm, (5)-(7), we find that, to induce the integrated price p^M on all three products, the manufacturer has to satisfy the following three conditions:

$$-\left.\frac{\partial_{p_{A1}} D_{A2}}{\partial_{p_{A1}} D_{A1}}\right|_{p_{B2}=\infty} = \frac{w_1 - c}{p^M - c} \tag{25}$$

$$-\left.\frac{\partial_{p_{B1}} D_{A2}}{\partial_{p_{B1}} D_{A1}}\right|_{p_{B2}=\infty} = \frac{w_1 - c}{p^M - c} \tag{26}$$

$$-\left.\frac{\partial_{p_{A2}} D_{A1} + \partial_{p_{A2}} D_{B1}}{\partial_{p_{A2}} D_{A2}}\right|_{p_{B2}=\infty} = \frac{w_2 - c}{p^M - c} \tag{27}$$

Similar to the case with double common agency, conditions (25) and (27) state that each retailer's wholesale price has to be above the marginal cost to achieve the integrated price for brand A. On the other hand, because $\partial_{p_{B1}} D_{A1} > 0$, condition (26) says that the wholesale price to the common retailer, w_1, should be *below* the marginal cost in order to induce a higher price on brand B. Hence, again the manufacturer is unable to get the retailers to charge the integrated price p^M for all products. We denote by $w_2 = w^E$ and $w_1 = w^N$ the manufacturer's optimal wholesale price to the exclusive and the common retailer respectively, where $c < w^N < w^E$ as long as both retailers are active, i.e. as long as $D_{A2} > 0$. We denote by p_A^E, p_A^N and p_B^N the corresponding retail prices.

Lemma 3. *(Mixed configurations) The manufacturer is able to dampen retail intrabrand competition for the competitive brand by offering one retailer an exclusive contract* $\left\{w^E, F^E\right\}$ *and the other retailer a non-exclusive contract* $\left\{w^N, F^N\right\}$*, where* $c < w^N < w^E$*. Provided that both retailers are active, the resale equilibrium has prices below the integrated level, but higher than in the double common agency situation,* $p_A^{CS} < p_B^N < p_A^N = p_A^E < p^M$*. The industry profit is then equal to*

$$\Pi^{XS} = \frac{(1-bd)\left[6+2b+2d+db\left(2b+2d-bd+4\right)\right]}{2\left(1+d\right)\left(1+b\right)\left(4-3b^2d^2\right)} < \Pi^X$$

With a mixed configuration, the manufacturer earns the profit $\Pi_A = \Pi^{XS} - 2\Pi_r^O > 0$.

Proof. Appendix A.

As long as there is some competition at the downstream level, the manufacturer is unable to induce the integrated price for both brands. By offering one retailer an exclusive contract, however, the manufacturer is able to reduce intrabrand competition for the competitive brand, which allows for a price increase for both brands compared to the double common agency situation.

To achieve prices equal to p^M, the manufacturer would have to induce a monopoly at either the upstream or the downstream level: First, notice that it follows from the retailers' participation constraints above that the exclusive retailer is willing to accept any wholesale price $w_2 \in [c, \infty)$, as long as $F_2 \leq -\Pi_r^O$. Hence, the manufacturer could offer the common retailer a wholesale price $w_1 = c$, and set the wholesale price w_2 of the exclusive retailer equal to infinity. This effectively precludes the exclusive retailer from competing in the downstream market, and allows for the common retailer to set the integrated price p^M forboth brands. Gross of the fixed fee, the common retailer then earns the downstream monopoly profit $\pi(c, c; \infty, \infty) = \Pi^D$. To extract as much surplus as possible, and at the same time induce both retailers to accept these contract terms, the manufacturer should in this case offer the exclusive retailer a slotting allowance, $F_2 = -\Pi_r^O < 0$, and charge the common (active) retailer a franchise fee, $F_2 = \Pi^D - \Pi_r^O > 0$.

Lemma 4. *(Downstream monopoly) The manufacturer is able to achieve the downstream monopoly outcome, by offering one retailer an exclusive purchasing contract $\{\infty, F^E\}$, where $F^E = -\Pi_r^O$, and by offering the rival retailer a non-exclusive contract $\{w^N, F^N\}$, where $w^N = c$ and $F^N = \Pi^D - \Pi_r^O$. The resale price equilibrium then has prices $p_A = p_B = p^M$ and industry profit equal to Π^D. When inducing a downstream monopoly, the manufacturer earns the profit $\Pi_A = \Pi^D - 2\Pi_r^O$, which is positive as long as the degree of both interbrand and intrabrand competition is high enough.*

Proof. Appendix A.

Offering one retailer an exclusive selling contract is not sufficient to induce the downstream monopoly outcome in our model, since the rival retailer would still be able to sell the competitive product (Lemma 1). The only way for the manufacturer to achieve the downstream monopoly outcome, is therefore to have both a common and an exclusive retailer, and then charge the exclusive retailer a sufficiently high wholesale price to prevent it from undercutting the common retailer's monopoly price p^M.

Alternatively, the manufacturer could induce the upstream monopoly outcome by offering each retailer a contract $\{w, F\}$ that includes an exclusive purchasing provision, and hence exclude the competitive brand altogether. If both retailers accept the contract offer, then each retailer sells only the manufacturer's brand (single-sourcing). Retailer j's maximisation problem at stage 4 is then

$$\max_{p_{Aj}} (p_{Aj} - w) D_{Aj}(p_{Aj}, \infty, p_{Ak}, \infty) - F \tag{28}$$

which gives the first order condition

$$\left(p^M - w\right) \partial_{p_{Aj}} D_{Aj}\big|_{p_{B1}=p_{B2}=\infty} + D_A\left(p^M, \infty, p^M, \infty\right) = 0 \tag{29}$$

evaluated at the price p^M for $j \in \{1, 2\}$. It is then a simple task for the manufacturer to adjust the wholesale price w such that (29) holds for both retailers. We denote by $w = w^U$ the (optimal) wholesale price for the manufacturer in this case. As before, each retailer will accept the contract as long as $\pi\left(w^U, \infty; w^U, \infty\right) - F \geq \Pi_r^O$. This proves the following result.

Lemma 5. *The manufacturer is able to achieve the upstream monopoly outcome, by offering each retailer an exclusive purchasing contract with terms* $\left\{w^U, F^U\right\}$*, where* $w^U = d/2$ $(c = 0)$*. The resale price equilibrium then has prices* $p_{A1} = p_{A2} = p^M$ *and industry profit equal to* Π^U*. When inducing an upstream monopoly, the manufacturer earns the profit* $\Pi_A = \Pi^D - 2\Pi_r^O$*, which is positive as long as the degree of both interbrand and intrabrand competition is high enough.*

This is a well known result in vertical models where an upstream monopolist makes (public) offers to competing retailers. When both retailers are bound by provisions for exclusive purchasing, the manufacturer can charge wholesale prices that are high enough to induce each retailer to set the integrated price p^M, without having to worry about losing demand to rival brands. The manufacturer can then use its fixed fees to induce each retailer to accept the exclusive contracts.

The following two propositions summarise our subgame perfect equilibria respectively when $\pi(c, c; c, \infty) > \pi_l^*$ and $\pi(c, c; c, \infty) \leq \pi_l^*$.

Proposition 1. *The following cases depict the equilibrium market configurations when* $\pi(c, c; c, \infty) > \pi_l^*$.

- *Double common agency. An equilibrium exists where each retailer carries both brands, as long as* $\Pi^{CS} \geq \Pi^{XS}$.
- *Mixed configurations. An equilibrium exists where one retailer carries both brands and the rival carries the manufacturer's brand, as long as* $\Pi^{XS} \geq \max\left\{\Pi^{CS}, \Pi^U\right\}$.
- *Upstream monopoly (single sourcing). An equilibrium exists where each retailer carries only the manufacturer's brand, as long as* $\Pi^U \geq \Pi^{XS}$.

Proof. Appendix A.

For the manufacturer, there is a trade-off between charging higher wholesale prices, and having more product variety. When the two brands, as well as the retailers, are poor substitutes ($b, d \to 0$), the value of variety is high; at the same time the retail prices are close to the integrated level, even when all four products are sold. Hence, no exclusion occurs in this case. As the retailers, as well as the brands, become closer substitutes, the retailers are unable to sustain a high price on the competitive brand, and in turn this restricts the manufacturer's ability to induce a high price for brand A. At the same time, the value of variety is lower in this case. Hence, the manufacturer may want to use exclusive purchasing to reduce intrabrand competition for the competitive brand. This may result in either partial foreclosure of the competitive brand (mixed configurations), or complete foreclosure (upstream monopoly) when interbrand competition is fierce enough.

Proposition 2. *The following cases depict the equilibrium market configurations when* $\pi(c, c; c, \infty) \leq \pi_l^*$.

- *Mixed single sourcing. An equilibrium exists where one retailer carries the manufacturer's brand and the other retailer carries the competitive brand, as long as* $\pi_l^* - \pi(\infty, c, \infty, c) \geq \max\left\{\Pi^U, \Pi^D\right\} - 2\pi_f^*$.
- *Downstream monopoly. An equilibrium exists where one retailer is active and carries both brands, as long as* $\Pi^D - 2\pi_f^* \geq \max\{\Pi^U - 2\pi_f^*, \pi_l^* - \pi(\infty, c, \infty, c)\}$
- *Upstream monopoly (single sourcing). An equilibrium exists where each retailer carries only the manufacturer's brand as long as* $\Pi^U \geq \max\{\Pi^D - 2\pi_f^*, \pi_l^* - \pi(\infty, c, \infty, c)\}$.

Proof. Appendix A.

A comparison of the retailer's profits when intrabrand (and interbrand) competition is relatively strong, i.e. when $\pi(c, c; c, \infty) \leq \pi_l^*$, suggests that there is both a gain and a cost for the manufacturer of contracting with both retailers. The gain for the manufacturer is $\max\left\{\Pi^U, \Pi^D\right\} - \pi_f^* - \pi_l^* > 0$, which is the increase in the overall industry profits when inducing either the upstream or downstream monopoly profits; the equilibrium with exclusive selling yields Stackelberg leader-follower profits, which involve more competition and lower profits as long as both interbrand and intrabrand competition is strong. On the other hand, there is also a cost for the manufacturer, equal to $\pi_f^* - \pi(\infty, c, \infty, c) > 0$, which is the increase in retailer compensation when inducing either an upstream monopoly or a downstream monopoly. When the cost outweighs the gain, the manufacturer prefers

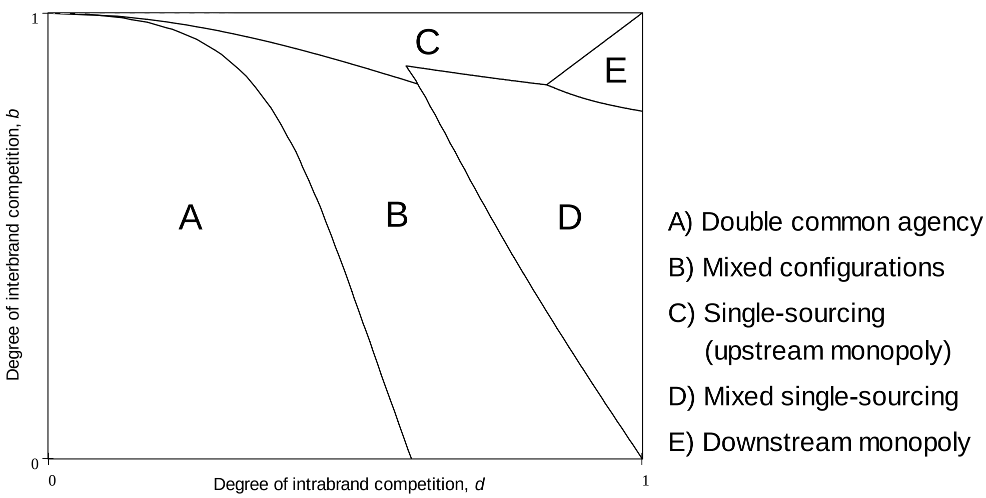

Figure 1: Equilibrium market configurations when the manufacturer makes the offers.

exclusive selling (mixed single sourcing).[16] However, as both interbrand and intrabrand competition becomes stronger $(b, d \to 1)$, we have both $\pi_f^* - \pi(\infty, c, \infty, c) \to 0$ and $\pi_f^* + \pi_l^* \to 0$, i.e. the Stackelberg leader-follower profits approach the profits under Bertrand competition, and the gains then outweighs the costs for the manufacturer; the result is then complete foreclosure of either the competitive brand, if interbrand competition is stronger, or one of the retailers, if intrabrand competition is stronger. Fig. 1 illustrates the results in Propositions 1 and 2.

Restricting the use of exclusive purchasing contracts may enhance welfare when it is the manufacturer that makes the offers. Moreover, this is the case even if not simultaneously restricting the use of exclusive selling. The key to this understanding is that, without exclusive purchasing provisions, retailers are in a prisoners' dilemma where neither of them is able to commit to not selling the competitive brand.[17] Furthermore, as long as both retailers are selling the competitive brand, it is straightforward to show that the manufacturer always benefits from also distributing its brand through both stores.[18]

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[16]The reason that the retailer compensation increases, is that, when competition is relatively fierce $(\pi_l^* \geq \pi(c, c; \infty, c))$, and the manufacturer contracts with both retailers, each retailer considers a unilateral deviation where it earns the Stackelberg follower profit π_f^*, where $\pi_f^* > \pi_l^* \geq \pi(c, c; \infty, c) > \pi(\infty, c; \infty, c)$ when (interbrand and intrabrand) differentiation is low. Hence, each retailer has to earn at least π_f^* when accepting the manufacturer's offer.

[17]This is the case irrespective of whether a retailer has an exclusive selling contract with the manufacturer

[18]When there is a ban on exclusive purchasing, each retailer's reservation profit is equal to $\overline{\pi}_r \equiv \pi(\infty, c; c, c)$ irrespective of whether the manufacturer contracts both retailers. The manufacturer's profit

Hence, with a ban on exclusive purchasing, consumers may gain from both higher product variety *and* lower prices.

4 Retailer power

In situations where a monopolist manufacturer makes offers to competing retailers, or when competing manufacturers make offers to a monopolist retailer (O'Brien and Shaffer, 1997; Bernheim and Whinston, 1998), two-part tariffs are sufficient to induce the industry maximising outcome, and no exclusion occurs in equilibrium. In contrast, when there is competition at both levels – as for example when retailers also sell private labels that are substitutes for the manufacturer's brand – then two-part tariffs do not suffice to achieve the industry maximising outcome, and exclusion therefore occurs for a large range of parameter values – even if it is the manufacturer who makes the contract offers (Propositions 1 and 2). This is a relevant backdrop when examining whether there is more exclusivity when instead it is the retailers that dictate the contract terms.

In this section we assume that the retailers make the offers to the manufacturer. As in the case with seller power, we assume that the contracts are two-part tariffs, and that they may include exclusive purchasing and/or exclusive selling requirements.

It is a known result that when each retailer makes a single (non-contingent) contract offer to the manufacturer, and each offer consists of a fixed fee and a wholesale price, then there is no pure strategy equilibrium where both retailers sell the manufacturer's brand: Based on intuition, in every equilibrium with common agency the manufacturer should be indifferent between accepting both retailers' offers or only one retailer's offer. If not, then either retailer could increase its profit by offering a smaller fixed fee and still have the manufacturer accept both offers. Each retailer, on the other hand, is clearly better off if the manufacturer accepts only its offer, since the retailer would then be a monopolist. Hence, each retailer has an incentive to deviate to an exclusive selling contract (if allowed), or to slightly adjust its offer so as to induce the manufacturer to reject the rival's offer. If exclusive selling contracts are allowed, the only pure strategy equilibrium therefore has the manufacturer dealing with only one retailer.[19] This result is counter-intuitive,

is therefore $\pi(c, c; \infty, c) - \overline{\pi}_r$ under exclusive selling, and $\Pi^{CS} - 2\overline{\pi}_r$ under double common agency. It can be shown that the inequality $\Pi^{CS} \geq \pi(\infty, c; c, c) + \pi(c, c; \infty, c)$ always holds; this implies that the manufacturer always prefers a double common agency in this case.

[19] If explicit exclusive agreements are banned, then the retailer could slightly change its contract terms so as to make the manufacturer accept only its offer. There is then no pure strategy equilibrium in the game.

since it suggests that retailers are unable to coexist, even under the smallest degree of competition.

In contrast, if each retailer's offer can be contingent on whether it obtains the manufacturer's brand exclusively, as in Bernheim and Whinston's (1998) seminal paper, then a (double) common agency equilibrium can be restored for some range of parameter values.[20] In the following we therefore assume that the retailers' make use of such contingent contracts. The game then unfolds as follows:[21]

1. (The contracting stage.) Retailers simultaneously make (public) take-it-or-leave-it offers to the manufacturer. Each retailer's contract offer may be contingent on whether the retailer obtains product A exclusively: In this case, retailer $j \in \{1, 2\}$ offers a pair of two-part tariffs $\left(T_j^C, T_j^E\right)$ where T_j^C applies if A is sold by both retailers (common agency) and T_j^E applies if retailer j obtains brand A exclusively (exclusive selling). In addition, we allow each retailer's offer to include a provision for exclusive purchasing, in which case the retailer makes a commitment not to sell the competitive brand. A retailer is also allowed not to make an offer to the manufacturer.

2. (The accept or reject stage.) After having observed both retailers' offers, the manufacturer decides whether to accept both offers $\left\{T_1^C, T_2^C\right\}$, only one of the offers, T_1^E or T_2^E, or none of the offers.

3. (The pricing stage) Retailers compete on prices in the downstream market in accordance with their contract terms.

Notice that in this game, there is no recontracting stage. When the manufacturer makes the offers, renegotiation occurs when the manufacturer's offer is rejected by one of the retailers. On the other hand, when the retailers make the offers, for the retailer there is no contract to renegotiate should the manufacturer reject its offer (the retailer then sells the competitive brand). Moreover, since each retailer's contract offer is contingent on whether or not the manufacturer deals with the rival, there is no reason to renegotiate the contract should the manufacturer reject the rival's offer – provided that each retailer's

[20] Bernheim and Whinston (1998) study the case where two competing manufacturers make (contingent) offers to a common retailer. However, to sustain a common agency equilibrium, offers do not need to be contingent on exclusivity in their model.

[21] This is similar to the game assumed in Miklos-Thal et al. (2011), with the exception that the retailers in our model use two-part tariffs (not three-part tariffs). In addition, the retailers in our model may sell a substitute brand, hence there is competition at both levels in our model. The contracts offers to the the manufacturer may therefore include exclusive purchasing as well as exclusive selling provisions.

offer is optimally designed for either situation, common agency or exclusivity. We therefore make the following assumption:

Assumption 1. *The retailers' exclusive offers, T_1^E and T_2^E, are renegotiation proof: If retailer $k \in \{1, 2\}$ withdraws its offers $\left\{T_k^C, T_k^E\right\}$, or if the manufacturer rejects retailer k's offers, then the pair $A - j$ cannot increase their joint profit by renegotiating the contract T_j^E. This assumption implies that the contract T_j^E yields a joint profit equal to π^E (Lemma 1) for the manufacturer and retailer j.*

Since common agency equilibria are sustained by the retailers' "out-of-equilibrium" offers, T_1^E and T_2^E, Assumption 1 is potentially important. It simply requires that these offers are optimally designed (i.e. credible).

4.1 Equilibrium analysis

Unlike the case when the manufacturer makes the offers, the equilibria need not be unique. For example, if a retailer insists on getting exclusive selling rights to brand A, then the rival retailer will have to compete for the same exclusive selling rights. For that reason, there always exists an equilibrium with exclusivity – even if the retailers, as well as the two brands, are virtually independent. Our strategy for solving the game is therefore to find for what range of parameter values the retailers can sustain a double common agency equilibrium, and then compare it with the situation when the manufacturer makes the offers. As in Bernheim and Whinston (1998), we restrict attention to equilibria that are Pareto-undominated for the retailers.

Double common agency Suppose the retailers at stage 1 offer the manufacturer (double) common agency contracts with terms $\{w_1, F_1\}$ and $\{w_2, F_2\}$, respectively. If the manufacturer accepts the contracts, competition at the last stage gives equilibrium flow payoffs equal to $\pi(w_1, c; w_2, c)$ and $\pi(w_2, c; w_1, c)$ for retailers 1 and 2 respectively. Let u_1^E (respectively u_2^E) be the profit that the manufacturer receives by accepting retailer 1's (respectively 2's) exclusive selling contract T_1^E (respectively T_2^E).

At the contracting stage, retailer 1 will maximise its own profit, subject to the condition that the manufacturer accepts each retailers' common agency contract and none of the exclusive offers. We can then write retailer 1's maximisation problem (symmetric for retailer 2) as

$$\max_{w_1,F_1} \left\{ \pi_1 \left(w_1, c; w_2, c\right) - F_1 \right\}$$
$$\text{s.t.} \sum_{j\in\{1,2\}} \left\{ \left(w_j - c\right) D_{Aj} \left(w_j, c, w_k, c\right) + F_j \right\} \geq \max\left\{u_1^E, u_2^E\right\} \tag{30}$$

Similar to the case when the manufacturer made the offers, each retailer should set its fixed fee such that the manufacturer's incentive constraint holds with equality – i.e. the manufacturer should (weakly) prefer to accept the common contracts instead of one of the exclusive offers. Hence, we can rewrite the retailer's maximisation problem as

$$\max_{w_1} \left\{ \Pi\left(w_1, c, w_2, c\right) - \pi_2\left(w_2, c; w_1, c\right) \right\} + F_2 - \max\left\{u_1^E, u_2^E\right\}, \tag{31}$$

Retailer $j \in \{1,2\}$ therefore offers a contract that maximises its joint profit with the manufacturer. (Note that the latter also trivially implies that both retailers always are active in equilibrium.[22]) Due to symmetry, we then have the first order condition $\partial_{w_j}\Pi - \partial_{w_j}\pi_k = 0$ for each retailer, $j \in \{1,2\}$, $j \neq k$, at stage 1. Note that as long as both retailers have positive sales and markups on brand A, we have $\partial_{w_j}\pi_k > 0$. Furthermore, if each retailer's wholesale price is equal to the industry maximising wholesale price, $w_1 = w_2 = w^*$, then we have $\partial_{w_j}\Pi = 0$ (Lemma 2). However, since $\partial_{w_j}\pi_k > 0$, it follows that the wholesale price cannot be equal to w^* in equilibrium when the retailers make the offers; the equilibrium wholesale prices are therefore below the industry maximising level. We denote by $w_1 = w_2 = \widetilde{w}$ the wholesale prices that solve the retailers' problems at stage 1, and let p_A^{CR} and p_B^{CR} denote the corresponding retail prices at each store. Furthermore, let $\pi^{CR} = \pi\left(\widetilde{w}, c; \widetilde{w}, c\right)$ be each retailer's profit gross of the fixed fee, and $\Pi^{CR} = \Pi\left(\widetilde{w}, c, \widetilde{w}, c\right)$ the resulting industry profit.

[22] This is unlike the case when the manufacturer makes the offers. It is easy to show that any offer that maximises the joint profit of the pair $A - j$, yields $D_{Aj} > 0$ in equilibrium. Moreover, if a retailer's offer is not accepted by the manufacturer, then the retailer always sells the competitive brand. Hence, the retailer is always active.

Lemma 6. *In the double common agency situation, each retailer sets its wholesale price equal to* $\widetilde{w} = d^2 (1 - b)/4 < w^*$ $(c = 0)$*. The resulting resale equilibrium has prices that are lower than when the manufacturer makes the offers,* $c < p_B^{CR} = p_B^{CS} < p_A^{CR} < p_A^{CS}$*. The total industry profit is equal to*

$$\Pi^{CR} = \frac{32 (1 - d) + d^3 (1 - b) (4 - d)}{8 (1 + b) (1 + d) (2 - d)^2} < \Pi^{CS} < \Pi^M$$

Proof. Appendix B.

The intuition for this result is straightforward: In equilibrium, each retailer makes an offer that maximises its joint profit with the manufacturer. The retailer then fails to take into account the effect of its own wholesale price on the rival's equilibrium flow payoff. The equilibrium wholesale prices are therefore lower than the industry maximising wholesale price.

To sustain a double common agency equilibrium with contingent contracts, each pair $A - j$ have to jointly earn at least as much as they could by deviating to an exclusive selling contract, i.e. each pair have to earn more than π^E, where π^E is the maximum joint profit of the manufacturer and a retailer when they have an exclusive selling agreement, as specified by Lemma 1.

To determine when a double common agency equilibrium exists, we start with the case $\pi^E = \pi (c, c; \infty, c) > \pi_l^*$: Without loss of generality, let $F_1^E = F_2^E = F^E$ denote the profit that the manufacturer could obtain by accepting one of the exclusive offers. To prevent either retailer from profitably inducing exclusivity, the following condition then has to hold

$$\pi^{CR} - F^C \geq \pi (c, c; \infty, c) - F^E, \tag{32}$$

where F^C is the (symmetric) fixed fee offered by each retailer to the manufacturer under double common agency. Since the manufacturer should be indifferent between accepting both retailers' offers and only one offer, we have $F^E = \Delta^C + 2F^C \geq 0$ in equilibrium, where $\Delta^C = 2 (\widetilde{w} - c) D (\widetilde{w}, c, \widetilde{w}, c)$ is the manufacturer's equilibrium flow payoff if it accepts the common agency contracts. Hence, to obtain brand A exclusively, retailer $j \in \{1, 2\}$ would have to marginally increase its exclusive bid, $F_j^E > F^E$, and/ or marginally reduce its common offer, $F_j^C < F^C$, which clearly is not profitable as long as (32) holds. By substituting $F^E = \Delta^C + 2F^C$ into (32) and rearranging, we obtain

$$\pi^{CR} + \Delta^C + F^C \geq \pi (c, c; \infty, c), \tag{33}$$

which states that a retailer's joint profit with the manufacturer (the left-hand side) has to be higher than their joint profit if they sign an exclusive deal. This condition implies that the fixed fee paid by the rival retailer (F^C) has to be high enough for a deviation to be unprofitable. By solving the inequality for the fixed fee, we get

$$F^C \geq \pi(c, c; \infty, c) - \pi^{CR} - \Delta^C \equiv \underline{F}, \tag{34}$$

where $\underline{F}$ is the minimum fixed fee needed to sustain a double common agency equilibrium. However, since a retailer could always withdraw its offer and earn the profit $\Pi_r^O = \pi(\infty, c; c, c)$, the following condition also has to hold

$$F^C \leq \pi^{CR} - \pi(\infty, c; c, c) \equiv \overline{F}, \tag{35}$$

where $\overline{F}$ is the maximum fixed fee that a retailer is willing to pay to obtain a (common) contract. Hence, as long as $\overline{F} \geq \underline{F}$ there exist (symmetric) fixed fees that can sustain a double common agency equilibrium. By rearranging the condition, we obtain

$$\Pi^{CR} \geq \pi(c, c; \infty, c) + \pi(\infty, c; c, c) \equiv \Pi^{XR}, \tag{36}$$

which says that the total profit Π^{CR} when the manufacturer deals with both retailers, has to be higher than the overall profit Π^{XR} in the mixed configuration where the manufacturer deals with only one retailer, where $\Pi^{XR} < \Pi^{XS} < \Pi^X$.

Suppose instead that $\pi(c, c; \infty, c) \leq \pi_l^*$. By the same logic as before, the joint profit of the manufacturer and a retailer have to be higher under double common agency than their profit if they sign an exclusive contract, $\pi^{CR} + \Delta^C + F^C \geq \pi_l^*$ – which we can solve in turn for the minimum fixed fee $\underline{F}$. However, as long as $u_1^E, u_2^E \geq 0$, either retailer can now withdraw its contract offer and earn the Stackelberg follower profit, $\Pi_r^O = \pi_f^*$.[23] Since each retailer has to earn at least π_f^* to prevent it from deviating, and since $\pi_f^* > \pi_l^*$, the relevant condition for a double common agency equilibrium to exist is therefore $\Pi^{CR} - 2\pi_f^* \geq 0$. However, since $\Pi^{CR} - 2\pi(c, c; \infty, c) \leq 0$, the latter condition clearly cannot hold if also $\pi_f^* > \pi_l^* \geq \pi(c, c; \infty, c)$. Therefore there exists no double common agency equilibrium in this case.

For the sake of completeness, we should also check the joint incentives (under double common agency) for the manufacturer and a retailer to deviate to an exclusive purchasing

[23] Assumption 1 requires that $u_1^E, u_2^E \geq 0$. If $u_j^E < 0$, and and retailer k withdraws its offers, then $u_j^E < 0$ cannot be optimal, since the retailer could set $u_j^E = 0$ to make the manufacturer accept its exclusive contract, which yields a joint profit $\pi_l^* > \pi(\infty, c; \infty, c)$.

agreement. This is never profitable as long as the following inequality holds.

$$\Pi^{CR} - \pi^{CR} \geq \max_{w} \left\{ \Pi\left(w, \infty, \widetilde{w}, c\right) - \pi\left(\widetilde{w}, c; w, \infty\right) \right\} \tag{37}$$

Removing the competitive brand from the store reduces the retailers' sales and markup, whereas it increases the sales and markup for the manufacturer. It can therefore only be profitable if the upstream margins are high and downstream margins are small – i.e., when downstream competition is fierce enough. Furthermore, it can be shown that condition (37) always holds as long as both $\Pi^{CR} \geq \Pi^{XR}$ and $\pi\left(c, c; \infty, c\right) > \pi_l^*$. The following proposition summarises the discussion so far.

Proposition 3. *When retailers make the offers, there exist double common agency equilibria that are Pareto-undominated (for the retailers), as long as both $\pi\left(c, c; \infty, c\right) > \pi_l^*$ and*

$$\Pi^{CR} \geq \pi\left(c, c; \infty, c\right) + \pi\left(\infty, c; c, c\right) \equiv \Pi^{XR}$$

If either condition fails, then there is no (Pareto-undominated) equilibrium where all products are sold.

Proof. Appendix B.

The following corollary then follows directly from Proposition 1 and 3.

Corollary 1. *Double common agency equilibria exist for a wider range of parameter values when the retailers make the offers.*

There exist an infinite number of (symmetric) double common agency equilibria as long as both conditions in Proposition 3 hold. The most preferred equilibrium for the retailers, however, is the one where each of them pays the minimum fixed fee $\underline{F}$, in which case each retailer earns the profit

$$\Pi_r = \pi^{CR} - \underline{F} \Longleftrightarrow \Pi_r = \Pi^{CR} - \Pi^{XR} + \Pi_r^O. \tag{38}$$

Hence, in this case each retailer earns its incremental contribution to the total profit also from selling brand A (relative to the retailer only selling the competitive brand), $\Pi^{CR} - \Pi^{XR}$, plus its outside option, $\Pi_r^O = \pi\left(\infty, c; c, c\right)$. Hence, if the retailer's incremental contribution from also selling brand A is negative, $\Pi^{CR} - \Pi^{XR} < 0$, then this would imply that each retailer earns less than its outside option, even if paying the minimum fee $\underline{F}$.

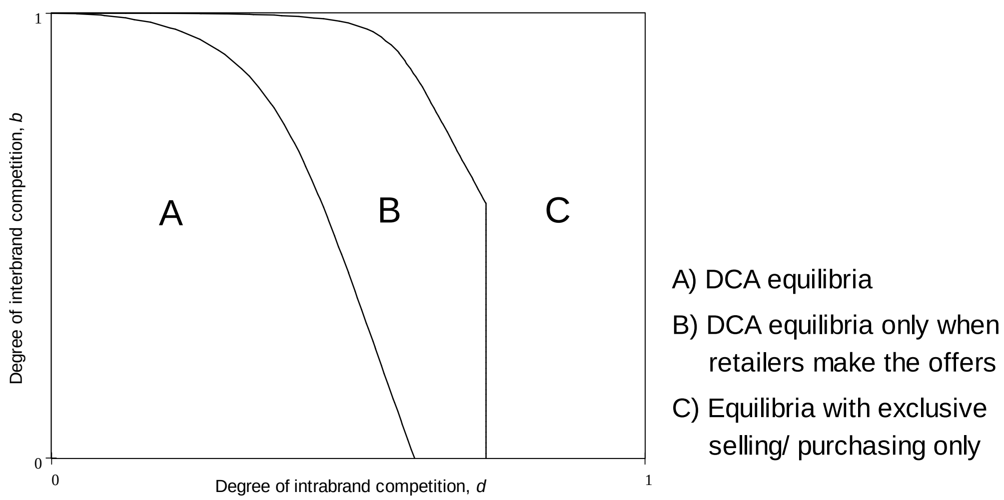

Figure 2: Double common agency equilibria exist for a wider range of parameter values when the retailers make the offers.

This clearly cannot be the case, and hence there is no equilibrium with double common agency in this case.

Corollary 1 is illustrated in Figure 2. Even though the overall profit is smaller in the double common agency situation when retailers make the offers, there is still less exclusivity compared to the situation when the manufacturer makes the offers. The key to this result is that when the retailers make the offers, each of them fails to consider the positive effect of signing an exclusive purchasing agreement on the rival's equilibrium flow payoff; in the same way that each retailer fails to take into account the positive effect of committing to a higher wholesale price on the rival's profit. Hence, it is less likely that exclusive purchasing agreements will be used when retailers make the offers; conversely, there is a higher chance that an exclusive selling provision will be used, since each retailer may have an incentive to try to prevent its rival from selling the manufacturer's brand.

When either condition in Proposition 3 fails, then there are only exclusionary equilibria. In the following we identify three Pareto-undominated equilibria with exclusivity, depending on the relative degree of downstream versus upstream competition.

Mixed configurations When the degree of intrabrand (interbrand) competition is sufficiently high (low), then we have both $\pi(c, c; \infty, c) > \pi_l^*$ and $\Pi^{CR} < \Pi^{XR}$, in which case there only exist equilibria in mixed configurations, where one retailer sells both brands and the other retailer sells the competitive brand. In this case, each retailer bids

$$F^E = \pi\left(c, c; \infty, c\right) - \pi\left(\infty, c; c, c\right) \tag{39}$$

to obtain an exclusive selling agreement. The manufacturer accepts one of the offers, and earns the profit $\Pi_A = F^E$, while each retailer earns its outside option, $\Pi_r = \pi\left(\infty, c; c, c\right)$. Since $\pi\left(c, c; \infty, c\right) > \pi_l^*$, the manufacturer and the retailer who's contract is accepted, cannot do better by also signing an exclusive purchasing agreement. Moreover, the retailer that is without a contract, cannot do better by increasing its bid F^E – since the retailer would then earn less than its outside option. Similarly, the retailer whose offer is accepted, cannot do better by reducing its bid F^E, since it would still only earn its outside option.

Equilibria with single sourcing When $\pi\left(c, c; \infty, c\right) \leq \pi_l^*$, the only undominated equilibria imply that each retailer single-sources; i.e. either the retailers carry different brands, in which case we have either $\{A1, B2\}$ or $\{B1, A2\}$, or each retailer carries the manufacturer's brand, in which case we have $\{A1, A2\}$:

First, it can be shown that there always exists an equilibrium where the retailers carry different brands. In this case, one retailer (say retailer 1) offers a contract to the manufacturer that includes both an exclusive purchasing provision and a provision for exclusive selling, while the other retailer (say retailer 2) refrains from offering a contract to the manufacturer. The retailers then earn the profits $\Pi_r^1 = \pi_l^*$ and $\Pi_r^2 = \pi_f^*$, respectively, while the manufacturer earns nothing. Since $\pi\left(\infty, c; \infty, c\right) < \pi\left(c, c; \infty, c\right) \leq \pi_l^*$, the manufacturer and retailer 1 cannot increase their joint profit by waiving the exclusive purchasing agreement, and retailer 1 cannot increase its profit by withdrawing its contract offer. Moreover, since $\pi_f^* > \pi_l^* \geq \pi\left(c, c; \infty, c\right)$, retailer 2 cannot increase its profit by bidding to obtain an exclusive contract with the manufacturer.

If the degree of interbrand competition is sufficiently strong, then an equilibrium also exists in which the competitive brand is foreclosed and each retailer only carries the manufacturer's brand. In this case, retailer $j \in \{1, 2\}$ offers a (common) contract, T_j^C, that includes a provision for exclusive purchasing, and where T_j^C maximises the joint profit of $A - j$ with respect to the wholesale price w_j:

$$\max_{w_j} \left\{ \Pi\left(w_j, \infty, w_k, \infty\right) - \pi_k\left(w_k, \infty; w_j, \infty\right) \right\} + F_k - \max\left\{u_1^E, u_2^E\right\} \tag{40}$$

Since $\partial_{w_j}\pi_k > 0$, the resulting equilibrium yields symmetric wholesale prices, $w_1 = w_2 = \widetilde{w}^U = d^2/4$ (when $c = 0$), where $c < \widetilde{w} < \widetilde{w}^U < w^U$. We let $\Pi^{UR} = \Pi\left(\widetilde{w}^U, \infty, \widetilde{w}^U, \infty\right)$

be the total industry profit in this case, where $\Pi^{UR} < \Pi^{U}$. Furthermore, we let $\pi^{UR} = \pi\left(\widetilde{w}^{U}, \infty; \widetilde{w}^{U}, \infty\right)$ be each retailer's equilibrium profit gross of the fixed fee. For this to constitute an equilibrium, it is both a necessary and sufficient condition that neither pair, $A-1$ or $A-2$, can increase their joint profit by waiving the exclusive purchasing agreement and deviate to a mixed configuration where the retailer is allowed to sell the competitive brand B:

$$\Pi^{UR} - \pi^{UR} \geq \max_{w}\left\{\Pi\left(w, c, \widetilde{w}^{U}, \infty\right) - \pi_k\left(\widetilde{w}^{U}, \infty; w, \infty\right)\right\} \equiv \overline{X}_{A-j} \tag{41}$$

This condition always holds as long as the degree of interbrand competition is sufficiently strong. For example, it is clearly not profitable to drop the exclusive purchasing agreement if the brands are perfect substitutes; there is then no value in being able to sell the competitive brand (since the brands are identical), while there is clearly a value in committing to a wholesale price above cost, $w > c$. In this case, there exists a symmetric equilibrium where each retailer earns the profit $\Pi_r = \Pi^{UR}/2$, while the manufacturer earns nothing.

The following proposition summarises our equilibria with exclusivity when the retailers make the offers:

Proposition 4. *The following cases depict the Pareto-undominated (for the retailers) equilibrium market configurations when either $\pi_l^* \geq \pi(c, c; \infty, c)$ (and) or $\Pi^{CR} < \Pi^{XR}$.*

- *Mixed configurations. One retailer carries both brands and the other retailer carries the competitive brand as long as both $\Pi^{CR} < \Pi^{XR}$ and $\pi_l^* < \pi(c, c; \infty, c)$.*
- *Mixed single sourcing. One retailer carries the manufacturer's brand and the other retailer carries the competitive brand as long as both $\pi_l^* \geq \pi(c, c; \infty, c)$ and $\Pi^{UR} - \pi^{UR} < \overline{X}_{A-1} = \overline{X}_{A-2}$.*
- *Upstream monopoly (single sourcing). Each retailer carries only the manufacturer's brand as long as $\Pi^{UR} - \pi^{UR} \geq \overline{X}_{A-1} = \overline{X}_{A-2}$.*

Proof. Appendix B.

Proposition 3 and 4 are illustrated in Figure 3. When the retailers are allowed to offer tariffs that are contingent on exclusivity, then, for a certain parameter range, there exist offers that gives each pair $A-1$ and $A-2$ a higher joint profit under double common agency than either pair could achieve under exclusive selling. Hence, it may also be

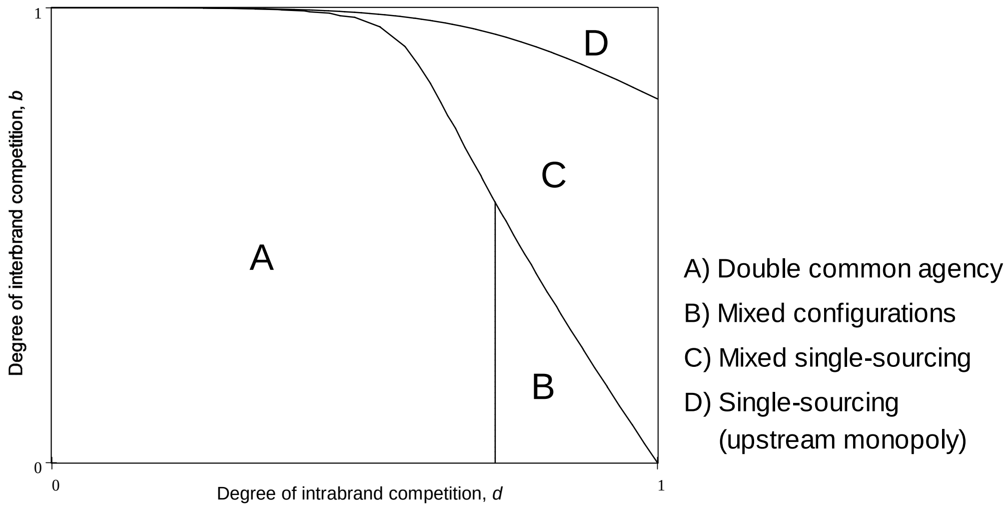

Figure 3: Equilibrium market configurations when the retailers make the offers.

possible to sustain a full distribution equilibrium.[24] However, as the degree of interbrand and/or intrabrand competition increases, the overall profit in a double common agency situation may no longer be high enough to prevent deviations to exclusivity. In this case, a retailer may want to use either an exclusive purchasing contract, to commit to a higher price on brand A, or an exclusive selling provision, to prevent the rival retailer from selling the manufacturer's brand.

Our results suggests that a ban on exclusive purchasing may enhance welfare, even if the retailers have all the bargaining power. Again the reason is that the retailers are unable to commit to not selling the competitive brand if they are not allowed to use such provisions. A ban on exclusive purchasing will not necessarily lead to full distribution of both brands, however, since there may still be an incentive for retailers to compete for an exclusive selling contract with the manufacturer whenever the degree of intrabrand competition is strong enough (i.e. whenever $\Pi^{CR} < \Pi^{XR}$). Moreover, since double common agency equilibria are sustained by each retailer's explicit "threat" of deviation to an exclusive selling agreement, the welfare consequence of restricting the use of such provisions is now unclear at best; a ban on exclusive selling may have the unintentional effect of causing more exclusivity.[25]

[24] Unlike the case with non-contingent offers; the manufacturer's joint profit with a retailer is then always higher with exclusive selling.

[25] See also Miklos-Thal et al. (2011).

5 Conclusions

In this article we have analysed how the incentives for exclusion, both in upstream and downstream markets, are related to the bargaining position of suppliers and retailers. Whereas most of the earlier literature has focused either on exclusion in upstream markets or in downstream markets, our model encapsulates both possibilities. In a model with a dominant upstream manufacturer and a competitive fringe of producers of imperfect substitutes. we have contrasted the equilibrium outcome in two alternative situations. The first one is when the manufacturer holds all the bargaining power, and this is compared with the outcome when the retailers have all the bargaining power.

We find that exclusionary equilibria exist when competition - either upstream or downstream - is hard enough. With upstream bargaining power these results depart from parts of the received literature (e.g. Fumagalli and Motta, 2006), who predict that exclusion should not occur when competition is hard. Our second main finding is that buyer power leads to less exclusion than when the bargaining power resides with the upstream manufacturer. This result is in contrast to some recent contributions (Marx and Shaffer (2007) and Miklos-Thal et al. (2011)), whose results suggest that there will be more exclusivity when retailers make the offers, rather than when manufacturers make the offers. This calls into question the welfare effects of buyer power, since the above papers indicate that more bargaining power to the retailers may lead to both higher prices and less choice for the consumer. Our results show that the key feature leading to this conclusion, is that, in the framework of both papers above, the manufacturer is assumed to be a monopolist. We find that their conclusion is reversed when the manufacturer faces competition from a fringe of competitive rivals. Then the manufacturer may want to use exclusivity provisions to limit the distribution of the competitive brand, and sometimes even to foreclose one of its retailers (to induce a downstream monopoly). In addition, we find that the manufacturer sometimes finds it optimal to contract with only one of the retailers (exclusive selling). As a consequence, equilibria with full distribution of both brands (double common agency) exists for a larger parameter range in our model when the retailers have buyer power, rather than when the manufacturer has the upper hand. We therefore come to the opposite conclusion, that buyer power may in fact often improve social welfare, since it may lead to both lower prices *and* higher product variety.

The key to our results is the fact that we distinguish between different types of exclusivity provisions – i.e. exclusive purchasing versus exclusive selling.[26] In our model, both

[26] This distinction is not possible in the framework of Marx and Shaffer (2007) and Miklos-Thal et al. (2011), since the manufacturer in their model is a monopolist.

the manufacturer, as well as the retailers, may want to use exclusive purchasing contracts in order to dampen downstream competition. However, unlike exclusive selling provisions, options to explicitly engage in exclusive purchasing are not necessary to sustain double common agency equilibria in our model. Hence, a restriction on the use of exclusive purchasing may improve social welfare, whether it is the retailers or the manufacturer that make the contract offers, while a restriction on the use of exclusive selling provisions may reduce social welfare, a result in seemingly stark opposition to current antitrust policy in for instance the European Union. It is also worth noting that, if we only consider exclusive selling contracts, then the result in Miklos-Thal et al. (2011) is reproduced in our model; there will then be exclusion of a retailer (although not complete) whenever the retailers make the offers, provided there is sufficient intrabrand competition, while exclusion never occurs if it is the manufacturer that makes the offers instead.

Although we feel that it may often be more appropriate to assume an asymmetric upstream industry, as in our model, with a dominant manufacturer competing against a fringe of competitive rivals, it could be interesting to also investigate the case of an asymmetric downstream industry. The mirror image of our framework would be two manufacturers, A and B, that both have some market power, an who distribute their brands at two retail locations, 1 and 2, assuming there is a retail bottleneck (a dominant retailer) at only one of the locations. In this case, we should get the (reverse) result that it may be socially beneficial to restrict the use of exclusive selling provisions – while a ban on exclusive purchasing may be harmful (since manufacturers would need exclusive purchasing options to sustain a common agency equilibrium). Furthermore, we believe that our result of there being less exclusivity under buyer power may also be reversed in this case.

Appendix A: Seller power

Proof of Lemma 1 (exclusive selling) We normalise $c = 0$. At stage 1 the manufacturer offers a contract $\{w_1, F_1\}$ only to retailer 1 (the case is symmetric if it is retailer 2). Suppose first that the contract is not an exclusive purchasing contract, in which case retailer 1 is allowed to sell brand B. We then have $q_{A1}, q_{B1}, q_{B2} > 0$, and $q_{A2} = 0$. This gives the following demand at stage 4

$$\begin{aligned}
D_{A1} &= (1+d)\left(\beta-\lambda(1-d)\,p_{A1}+\lambda b(1-d)\,p_{B1}\right) \\
D_{B1} &= (1-bd)\left(\beta-\lambda(1+bd)\,p_{B1}\right) \\
&\quad +\lambda b\left(1-d^2\right)p_{A1}+\lambda d\left(1-b^2\right)p_{B2} \\
D_{B2} &= (1+b)\left(\beta-\lambda(1-b)\,p_{B2}+\lambda d(1-b)\,p_{B1}\right)
\end{aligned} \tag{42}$$

where $\beta = 1/(1+b+d+bd)$ and $\lambda = 1/(1-d^2-b^2+b^2d^2)$. The retailers' profits at stage 4 are $\Pi_r^1 = (p_{A1}-w_1)\,D_{A1}+p_{B1}D_{B1}-F_1$ and $\Pi_r^2 = p_{B2}D_{B2}$. Maximisation by the retailers yields prices $p_{A1} = [(2-d)(1+w_1)-bd]/[2(2-d)]$ and $p_{B1} = p_{B2} = (1-d)/(2-d)$. Substituting into the demand functions and the retailers' profit functions gives the flow payoffs $\pi(w_1, c; \infty, c)$ (for retailer 1), $\pi(\infty, c; w_1, c)$ (for retailer 2), and $w_1 D_{A1}(w_1, c, \infty, c)$ for the manufacturer. The joint profit of the manufacturer and retailer 1 is then

$$\begin{aligned}
\pi(w_1, c; \infty, c)+w_1 D_{A1}(w_1, c, \infty, c) &= \frac{(8+d^3-4bd-3d^2-4d+3bd^2-bd^3)}{4(1+b)(1+d)(2-d)^2} \\
&\quad -\frac{w_1^2}{4(1+b)(1-b)}
\end{aligned} \tag{43}$$

which is decreasing in w_1 for $w_1 > 0$ (and increasing in w_1 for $w_1 < 0$). Maximising (43) (which is equivalent to (8) or (9)) w.r.t. w_1 therefore yields $w_1 = 0\,(= c)$. Accordingly, the equilibrium joint profit of the manufacturer and retailer 1, and the profit of retailer 2, are equal to

$$\Pi_r^1 = \pi(c, c; \infty, c) = \frac{(8+d^3-4bd-3d^2-4d+3bd^2-bd^3)}{4(1+b)(1+d)(2-d)^2} \tag{44}$$

$$\Pi_r^2 = \pi(\infty, c; c, c) = \frac{1-d}{(1+d)(2-d)^2} \quad (= \pi(\infty, c; \infty, c)) \tag{45}$$

Suppose instead that the contract is an exclusive purchasing contract, and that the retailer accepts (in which case we have $q_{A1}, q_{B2} > 0$ and $q_{B1} = q_{A2} = 0$). Consumer demands at stage 4 are then

$$D_{A1} = \frac{1-\sigma-p_{A1}+\sigma p_{B2}}{1-\sigma^2} \text{ and } D_{B2} = \frac{1-\sigma-p_{B2}+\sigma p_{A1}}{1-\sigma^2}, \tag{46}$$

where $\sigma = bd$, and the retailers' profits are $\Pi_r^1 = (p_{A1}-w_1)\,D_{A1}-F_1$ and $\Pi_r^2 = p_{B2}D_{B2}$. Maximisation by the retailers yields prices $p_{A1} = (2-\sigma-\sigma^2+2w_1)/(4-\sigma^2)$

and $p_{B2} = \left(2-\sigma-\sigma^2+\sigma w_1\right)/\left(4-\sigma^2\right)$. Substituting these into the demand functions and the retailers' profit functions gives the flow payoffs $\pi\left(w_1,\infty;\infty,c\right)$ (for retailer 1) and $\pi\left(\infty,c;w_1,\infty\right)$ (for retailer 2), and $w_1 D_{A1}\left(w_1,\infty,\infty,c\right)$ for the manufacturer. The joint profit of the manufacturer and retailer 1 is then

$$\begin{aligned}\pi\left(w_1,\infty;\infty,c\right)+w_1 D_{A1}\left(w_1,\infty,\infty,c\right) &= -\frac{w_1\left(4w_1-2\sigma^2 w_1-2\sigma^2+\sigma^3+\sigma^4\right)}{\left(1-\sigma\right)\left(1+\sigma\right)\left(2-\sigma\right)^2\left(2+\sigma\right)^2} \\ &\quad +\frac{1-\sigma}{\left(1+\sigma\right)\left(2-\sigma\right)^2} \qquad (47)\end{aligned}$$

Maximising (47) (which is equivalent to (11)) w.r.t. w_1 yields $w_1 = w_l^* = \left(1-\sigma\right)\left(2+\sigma\right)\sigma^2 / \left[4\left(2-\sigma^2\right)\right] > 0$. Substituting this into the retail prices gives the Stackelberg leader and follower prices; $p_{A1} = p_l^* = \left(1-\sigma\right)\left(2+\sigma\right)/\left[2\left(2-\sigma^2\right)\right]$ and $p_{B2} = p_f^* = \left(1-\sigma\right)\left(4+2\sigma-\sigma^2\right)/\left[4\left(2-\sigma^2\right)\right]$. The joint profit of the manufacturer and retailer 1 therefore amounts to the Stackelberg leader profits π_l^* in a game where $A-1$ are vertically integrated and act as a price leader, and $B-2$ is the follower. Retailer 2 therefore earns the Stackelberg follower profits π_f^*:

$$\pi_l^* = \pi\left(w_l^*,\infty;\infty,c\right)+w_l^* D_{A1}\left(w_l^*,\infty,\infty,c\right) = \frac{\left(1-\sigma\right)\left(2+\sigma\right)^2}{8\left(1+\sigma\right)\left(2-\sigma^2\right)} \qquad (48)$$

$$\pi_f^* = \pi\left(\infty,c;w_l^*,\infty\right) = \frac{\left(1-\sigma\right)\left(4+2\sigma-\sigma^2\right)^2}{16\left(1+\sigma\right)\left(2-\sigma^2\right)^2} \qquad (49)$$

Retailer 1 will accept any exclusive selling contract that yields $\Pi_r^1 \geq \pi\left(\infty,c;\infty,c\right)$. The manufacturer therefore sets F_1 such that $\Pi_r^1 = \pi\left(\infty,c;\infty,c\right)$ in both situations (with or without exclusive purchasing). It follows that the manufacturer earns the profit $\pi\left(c,c;\infty,c\right)-\pi\left(\infty,c;\infty,c\right) > 0$ without exclusive purchasing, and the profit $\pi_l^*-\pi\left(\infty,c;\infty,c\right) > 0$ with exclusive purchasing; the manufacturer therefore strictly prefers to offer an exclusive purchasing contract if $\pi_l^* > \pi\left(c,c;\infty,c\right)$. The equilibrium joint profit of the manufacturer and its retailer under exclusive selling is therefore $\pi^E = \max\left\{\pi\left(c,c;\infty,c\right),\pi_l^*\right\}$. It follows that the profit of the retailer without a contract, is

$$\Pi_r^O = \begin{cases} \pi\left(\infty,c;c,c\right) & \text{if } \pi\left(c,c;\infty,c\right) \geq \pi_l^* \\ \pi_f^* & \text{otherwise} \end{cases} \qquad (50)$$

For use later in the appendix, we define

$$\Pi^{XR} \equiv \pi\left(c,c;\infty,c\right)+\pi\left(\infty,c;c,c\right), \qquad (51)$$

which is the total industry profit under exclusive selling for the case $\pi_l^* \leq \pi(c, c; \infty, c)$.

If both retailers are offered contracts at stage 1, but retailer 2 rejects the contract at stage 2 (retailer 1 accepts), then the manufacturer and retailer 1 will agree on a new contract at stage 3. This contract maximises the joint profit of the manufacturer and retailer 1.[27] This means that the pair $A-1$ always earn a joint profit of π^E in this subgame as well. Which means that retailer 2 earns Π_r^O. For retailer 2, these two subgames are therefore equivalent. **Q.E.D.**

Proof of Lemma 2 (double common agency) We normalise $c = 0$. The manufacturer's problem ((16) and (17)) is to set wholesale prices $\{w_1, w_2\}$ so as to maximise total industry profits, and adjust the fixed fees $\{F_1, F_2\}$ so that each retailer earns no more than its outside option, Π_r^O (Lemma 1). By symmetry, we can set $w_1 = w_2 = w$ and $F_1 = F_2 = F$. Under double common agency ($q_{ij} > 0$ for all $ij \in \Omega$), consumer demand for product $ij \in \Omega$ is equal to

$$D_{ij} = \frac{1 - d - b + bd - p_{ij} + bp_{hj} + dp_{ik} - bdp_{hk}}{1 - d^2 - b^2 + b^2 d^2}, \tag{52}$$

Retailer j's profit at stage 4 is $\Pi_r^j = (p_{Aj} - w) D_{Aj} + p_{Bj} D_{Bj} - F$, $j \in \{1, 2\}$. Maximisation by the retailers yields prices $p_A^* = (1 - d + w) / (2 - d)$ and $p_B^* = (1 - d) / (2 - d)$ at each store. By substituting these into the demand functions, we obtain the following overall industry profit.

$$\Pi(w, c, w, c) = \sum_{ij \in \Omega} p_{ij} D_{ij} \Bigg|_{p_{ij} = p_i^*} = \frac{2(2 + 2bd - 2d - 2b + dw - bdw - w^2)}{(1 + b)(1 + d)(1 - b)(2 - d)^2} \tag{53}$$

Maximising $\Pi(w, c, w, c) - 2\Pi_r^O$ w.r.t. w yields $w^* = d(1 - b)/2$. By substituting w^* into (53), we obtain

$$\Pi(w^*, c, w^*, c) = \Pi^{CS} = \frac{8(1 - d) + (1 - b) d^2}{2(1 + b)(1 + d)(2 - d)^2} \leq \Pi^M. \tag{54}$$

The equilibrium retail prices $\left(p_A^{CS}, p_B^{CS}\right)$ then satisfy $0 < p_B^{CS} = (1 - d) / (2 - d) < p_A^{CS} = [2 - (1 + b) d] / [2(2 - d)] < 1/2 = p^M$. The manufacturer's profit in the double common agency situation is $\Pi_A = \Pi^{CS} - 2\Pi_r^O$ (follows from Lemma 1). Hence, as long as both inter-

[27] It does not matter whether we assume that the original contract no longer applies in this case, or if we assume that the original contract still binds but may be renegotiated. Either way, negotiations between the manufacturer and retailer 1 at stage 3 will result in joint profit maximisation.

brand and intrabrand competition is low enough ($\pi_l \leq \pi(c, c; \infty, c)$), the manufacturer's profit is equal to

$$\Pi_A = \Pi^{CS} - 2\pi(\infty, c; c, c) = \frac{1-b}{2(1+d)(1+b)} > 0 \tag{55}$$

When interbrand and intrabrand competition is strong, we have $\Pi_A = \Pi^{CS} - 2\pi_f^*$, which is negative when $\pi_l^* > \pi(c, c; \infty, c)$. E.g., when $b = .5$ and $d = 1$, we have $\pi_l^* > \pi(c, c; \infty, c)$ and $\Pi_A = -0.22364$. **Q.E.D.**

Proof of Lemma 3. (Mixed configuration) We normalise $c = 0$. The manufacturer offers two contracts $\{w_1, F_1\}$ and $\{w_2, F_2\}$. The contract to retailer 1 is a common contract, whereas retailer 2 is bound by an exclusive purchasing provision. We assume that the terms $\{w_1, w_2\}$ are such that both retailers have positive demand. (We then have $q_{A1}, q_{B1}, q_{A2} > 0$ and $q_{B2} = 0$.) This gives the following demand at stage 4

$$\begin{aligned} D_{A1} &= (1-bd)(\beta - \lambda(1+bd)p_{A1}) \\ &\quad + \lambda b\left(1-d^2\right)p_{B1} + \lambda d\left(1-b^2\right)p_{A2} \\ D_{B1} &= \frac{1-b-p_{B1}+bp_{A1}}{1-b^2} \\ D_{A2} &= \frac{1-d-p_{A2}+dp_{A1}}{1-d^2} \end{aligned} \tag{56}$$

The retailers' profits at stage 4 are $\Pi_r^1 = (p_{A1} - w_1) D_{A1} + p_{B1} D_{B1} - F_1$ and $\Pi_r^2 = (p_{A2} - w_2) D_{A2} - F_2$. Maximisation by the retailers yields the prices

$$\begin{aligned} p_{A1} &= \frac{1-d}{2-d} + \frac{2w_1 + dw_2}{(2+d)(2-d)} \\ p_{B1} &= \frac{1-d}{2-d} + \frac{d((2+d)(1-b) + 2bw_2 + dbw_1)}{2(2-d)(2+d)} \\ p_{A2} &= \frac{1-d}{2-d} + \frac{2w_2 + dw_1}{(2+d)(2-d)} \end{aligned} \tag{57}$$

Substituting these into the demand functions, yields an overall industry profit equal to

$$\begin{aligned} \Pi(w_1, c, w_2, \infty) &= \frac{(2-d-d^2+2w_1+dw_2)x_1}{2(1+b)(1+d)(1-b)(1-d)(2+d)^2(2-d)^2} \\ &+ \frac{(1-b+bw_1)x_2}{4(1-b)(1+b)(2+d)(2-d)} + \frac{(2-d-d^2+2w_2+dw_1)x_3}{(1-d)(1+d)(2+d)^2(2-d)^2} \end{aligned} \tag{58}$$

where $x_2 = 4 - d^2 - bd^2 + 2bdw_2 - 2bd + bd^2 w_1$, $x_3 = 2 - d - d^2 + dw_1 - 2w_2 + d^2 w_2$ and

$$x_1 = (2+d)\left(2 + bd^2 - bd\right)\beta\lambda^{-1} - w_1\left(4 + b^2 d^4 - 3b^2 d^2 - 2d^2\right) + 2w_2 d(1+b)(1-b) \quad (59)$$

Maximising (58) w.r.t. w_1 and w_2 yields

$$w_1 = w^N = \frac{2(1+b)(1-b)d}{4 - 3b^2 d^2} \text{ and } w_2 = w^E = \frac{d}{2}\left(1 - \frac{d^3 b^2}{4 - 3b^2 d^2}\right) \quad (60)$$

where

$$w^E - w^N = \frac{b^2 d(1-d)(2+d)^2}{2(4 - 3b^2 d^2)} \geq 0. \quad (61)$$

By substituting w^E and w^N into the retail prices, we get

$$\begin{aligned} p_{A1} &= p_A^N = \frac{1}{2}\left(1 - \frac{b^2 d(2 - d^2)}{4 - 3b^2 d^2}\right) \\ p_{B1} &= p_B^N = \frac{1}{2}\left(1 - \frac{bd(2 - b^2 d^2)}{4 - 3b^2 d^2}\right) \\ p_{A2} &= p_A^E = \frac{1}{2}\left(1 - \frac{d^2 b^2}{4 - 3b^2 d^2}\right) \end{aligned} \quad (62)$$

where $p_A^{CS} < p_B^N < p_A^N < p_A^E < p^M$ as long as $b, d \in (0,1)$. By substituting $w_1 = w^N$ and $w_2 = w^E$ into (58), we get the equilibrium industry profit:

$$\begin{aligned} \Pi\left(w^N, c, w^E, \infty\right) &= \Pi^{XS} = \frac{(1-bd)(6 + 2b + 2d + db(2b + 2d - bd + 4))}{2(1+d)(1+b)(4 - 3b^2 d^2)} \\ &\leq \frac{3 + d + b - bd}{4(1+d)(1+b)} = \Pi^X \end{aligned} \quad (63)$$

The manufacturer's profit in the mixed configuration (when partially foreclosing brand B) is $\Pi_A = \Pi^{XS} - 2\Pi_r^O$ (follows from Lemma 1). An implicit plot of $\Pi^{XS} - 2\pi_f^* = 0$ reveals that this profit always is positive. **Q.E.D.**

Proof of Lemma 4. (Downstream monopoly) We normalise $c = 0$. It follows from Lemma 1 that a retailer who is bound by an exclusive purchasing provision, say retailer 2, will accept any contract terms that yield a profit at least equal to Π_r^O. The contract $\{w_2, F_2\} = \left\{\infty, -\Pi_r^O\right\}$ is such a contract. I.e., the manufacturer can use an exclusive purchasing agreement with retailer 2 and then set $w_2 \to \infty$ and $w_1 = c$ to induce $D_{A2} = 0\,(= D_{B2})$ at stage 4 irrespective of the level of p_{A1} and p_{B1}. Retailer 1 is then free to set the integrated prices for both brands: In this situation, consumer demands for the two products $\{A1, B1\}$ are equal to

$$D_{A1} = \frac{1 - b - p_{A1} + bp_{B1}}{1 - b^2} \tag{64}$$
$$D_{B1} = \frac{1 - b - p_{B1} + bp_{A1}}{1 - b^2} \tag{65}$$

and retailer 1's profit is $\Pi_r^1 = p_{A1}D_{A1} + p_{B1}D_{B1} - F_1$, which is maximised for prices $p_{A1} = p_{B1} = p^M = 1/2$. By substituting these into the demand functions, we obtain the industry profit

$$\Pi^D = \pi\left(c, c; \infty, \infty\right) = \frac{1}{2\left(1 + b\right)}. \tag{66}$$

If retailer 2 accepts the (exclusive purchasing) contract $\{\infty, F_2\}$, then retailer 1 will also accept the (common) contract $\{c, F_1\}$ as long as $\pi\left(c, c; \infty, \infty\right) - F_1 \geq \Pi_r^O$, i.e. as long as $\Pi^D - \Pi_r^O \geq F_1$. The manufacturer can therefore set $F_1 = \Pi^D - \Pi_r^O$ and $F_2 = -\Pi_r^O$ to induce both retailers to accept. The manufacturer then earns the profit $\Pi_A = \Pi^D - 2\Pi_r^O$, which is positive as long as intrabrand (and interbrand) competition is strong enough. For example, with $b = .9$ and $d = 1$, we have $\Pi_A = 0.14748$. **Q.E.D.**

Proof of Lemma 5. (Upstream monopoly) Straightforward.

Proof of Proposition 1. From Lemma 1-5 we know that the retailers earn the profit $\pi\left(\infty, c; c, c\right) = \pi\left(\infty, c; \infty, c\right)$ in all subgames, whereas the manufacturer earns the remainder. Since $\Pi^{XS} > \Pi^{XR}$, the optimal choice for the manufacturer reduces to $\max\{\Pi^{CS}, \Pi^{XS}, \Pi^U, \Pi^D\}$. A pairwise comparison of the industry profits under the different strategies, reveals that $\max\{\Pi^{CS}, \Pi^{XS}, \Pi^U\} > \Pi^D$ when $\pi_l^* < \pi\left(c, c; \infty, c\right)$ A pariwise comparison of Π^{CS}, Π^{XS} and Π^U, yields Figure 4, which shows that the manufacturer prefers i) a double common agency (no exclusion) when $\Pi^{CS} > \Pi^{XS}$, ii) a mixed configuration (partial foreclosure of the competitive brand) when both $\Pi^{XS} > \Pi^{CS}$ and $\Pi^{XS} > \Pi^U$ (indifferent between double common agency and partial foreclosure when $\Pi^{CS} = \Pi^{XS}$), and iii) an upstream monopoly (complete foreclosure of the competitive brand) when $\Pi^U > \Pi^{XS}$ (indifferent between partial and full foreclosure when $\Pi^{XS} = \Pi^U$). **Q.E.D.**

Proof of Proposition 2. From Lemma 1-5 we know that the retailers earn the joint profit $\pi\left(\infty, c; \infty, c\right) + \pi_f^*$ in the subgame with exclusive selling, whereas they earn the joint profit $2\pi_f^*$ if the manufacturer contracts with both of them. The manufacturer earns the remainder. A pairwise comparison of the industry profits under the different strategies, reveals that $\Pi^{CS} < \max\left\{\Pi^{XS}, \Pi^U, \Pi^D\right\}$ when $\pi_l^* \geq \pi\left(c, c; \infty, c\right)$. The manufacturer's

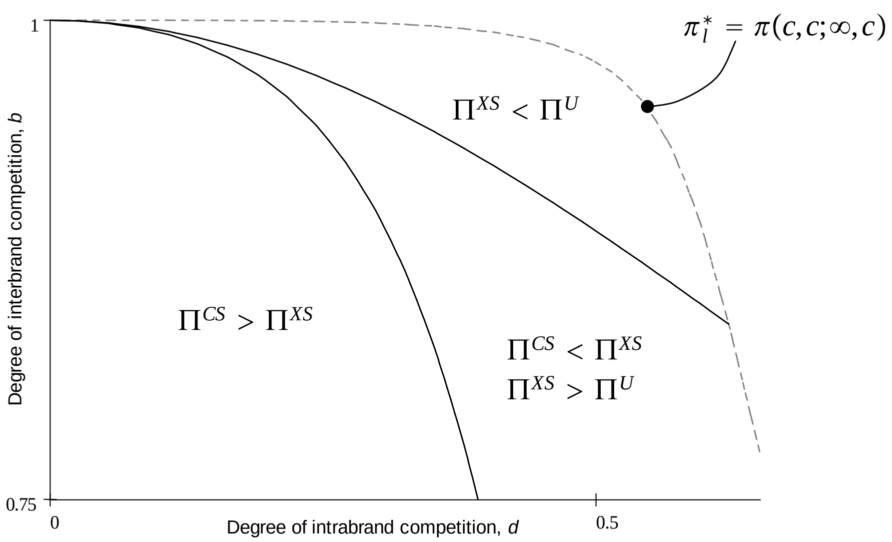

Figure 4: Seller power. Comparison of profits when $\pi_l^* < \pi\,(c, c; \infty, c)$.

profit can therefore be written $\max\left\{\Pi^{XS}, \Pi^U, \Pi^D\right\} - 2\pi_f^*$ when contracting with both manufacturers, and $\pi_l^* - \pi\,(\infty, c; \infty, c)$ with exclusive selling. Pairwise comparison reveals that $\pi_l^* - \pi\,(\infty, c; \infty, c) > \Pi^{XS} - 2\pi_f^*$ when $\Pi^{XS} > \max\left\{\Pi^U, \Pi^D\right\}$. We can therfore conclude that the manufacturer strictly prefers i) exclusive selling (mixed single sourcing) when

$$\pi_l^* - \pi\,(\infty, c; \infty, c) > \max\left\{\Pi^U, \Pi^D\right\} - 2\pi_f^*, \tag{67}$$

ii) a downstream monopoly when both $\Pi^D > \Pi^U$ and

$$\Pi^D - 2\pi_f^* > \pi_l^* - \pi\,(\infty, c; \infty, c) \tag{68}$$

and iii) an upstream monopoly (single sourcing) when both $\Pi^U > \Pi^D$ and

$$\Pi^U - 2\pi_f^* > \pi_l^* - \pi\,(\infty, c; \infty, c) \tag{69}$$

This yields Figure 5. Combining Figure 4 and 5, gives us Figure 1. **Q.E.D.**

6 Appendix B: Retailer power

Proof of Lemma 6 We normalise $c = 0$. Demand for product $ij \in \Omega$ is given by (52). The profit of retailer $j \in \{1, 2\}$ at stage 4 is $\Pi_r^j = (p_{Aj} - w_j)\,D_{Aj} + p_{Bj}D_{Bj} - F_j$.

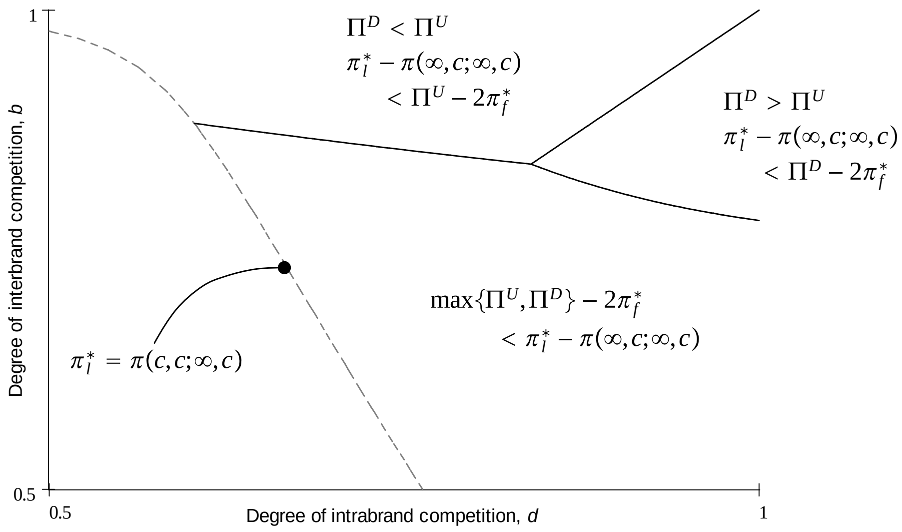

Figure 5: Seller power. Comparison of profits when $\pi_l^* > \pi(c, c; \infty, c)$.

Maximisation by the retailers yields a price for brand B equal to $p_B^* = (1-d)/(2-d)$ at each store, and a price for brand A at retailer $j \in \{1, 2\}$ equal to

$$p_{Aj}^*(w_j, w_k) = \frac{1-d}{2-d} + \frac{2w_j + dw_k}{(2-d)(2+d)} \tag{70}$$

Inserting these into the retailers demand functions, yields the following flow payoff for retailer $j \in \{1, 2\}$

$$\begin{aligned} \pi(w_j, c; w_k, c) \quad &= \quad \left(\frac{1}{\rho} - \frac{(2-d^2)\, w_j - dw_k}{\theta\rho}\right)\left(\frac{1-d}{2-d} - \frac{(2-d^2)\, w_j - dw_k}{(2-d)(2+d)}\right) \\ &\quad + \left(\frac{1}{\rho} + b\frac{(2-d^2)\, w_j - dw_k}{\theta\rho}\right)\frac{1-d}{2-d} \end{aligned} \tag{71}$$

where $\theta = (1-d)(1-b)(2+d)$ and $\rho = (1+b)(1+d)(2-d)$, and the following flow payoff for the manufacturer.

$$\Delta(w_1, c, w_2, c) = \left(\frac{1}{\rho} - \frac{(2-d^2)\, w_1 - dw_2}{\theta\rho}\right) w_1 + \left(\frac{1}{\rho} - \frac{(2-d^2)\, w_2 - dw_1}{\theta\rho}\right) w_2 \tag{72}$$

At stage 1, retailer $j \in \{1, 2\}$ sets w_j so as to maximise its joint profit with the manufacturer, subject to the condition that the manufacturer accepts the non-exclusive contract offers (see (30) and (31))

$$\max_{w_j} \left\{ \pi \left(w_j, c; w_k, c \right) + \Delta \left(w_j, c, w_k, c \right) \right\} + F_k - \max \left\{ u_1^E, u_2^E \right\} \tag{73}$$

Maximisation by the retailers yields a symmetric wholesale price $w_1 = w_2 = \widetilde{w} = d^2 (1 - b) / 4$, where $\widetilde{w} < w^*$. Inserting this into the retailers' flow payoffs in (71), yields the following equlibrium flow payoff for each retailer

$$\pi^{CR} = \pi \left(\widetilde{w}, c; \widetilde{w}, c \right) = \frac{(1-d)\left(32 - (1-b)\left(8 - d^2\right) d^2\right)}{16 (1+b)(1+d)(2-d)^2} \tag{74}$$

and the following equilibrium flow payoff for the manufacturer

$$\Delta^C = \Delta \left(\widetilde{w}, c, \widetilde{w}, c \right) = \frac{(1-b)(2+d) d^2}{8 (1+b)(1+d)} \tag{75}$$

The overall industry profit is then equal to

$$\Pi^{CR} = \Pi \left(\widetilde{w}, c, \widetilde{w}, c \right) = 2\pi^{CR} + \Delta^C = \frac{32(1-d) + d^3 (1-b)(4-d)}{8(1+b)(1+d)(2-d)^2} < \Pi^{CS} \tag{76}$$

Q.E.D.

Proof of Proposition 3 We normalise $c = 0$. To complete the proof, it is sufficient to show that as long as $\pi_l^* < \pi (c, c; \infty, c)$ and $\Pi^{CR} \geq \Pi^{XR}$, then

i) a retailer and a manufacturer cannot increase their joint profit by deviating to an exclusive purchasing agreement, and

ii) there are no equilibria with exclusive selling or exclusive purchasing, which Pareto dominate (for the retailers) the double common agency equilibria.

The joint profit of the manufacturer and a retailer (say retailer 2) in the double common agency situation, is

$$\Delta^C + \pi^{CR} + F^C = \Pi^{CR} - \pi^{CR} + F^C \tag{77}$$

The maximum joint profit for the manufacturer and retailer 2 when deviating instead to an exclusive purchasing agreement, is

$$\begin{aligned} &\max_{w_2} \left\{ \Delta \left(\widetilde{w}, c, w_2, \infty \right) + \pi \left(w_2, \infty; \widetilde{w}, c \right) \right\} + F^C \\ &\quad = \max_{w_2} \left\{ \Pi \left(\widetilde{w}, c, w_2, \infty \right) - \pi \left(\widetilde{w}, c; w_2, \infty \right) \right\} + F^C \end{aligned} \tag{78}$$

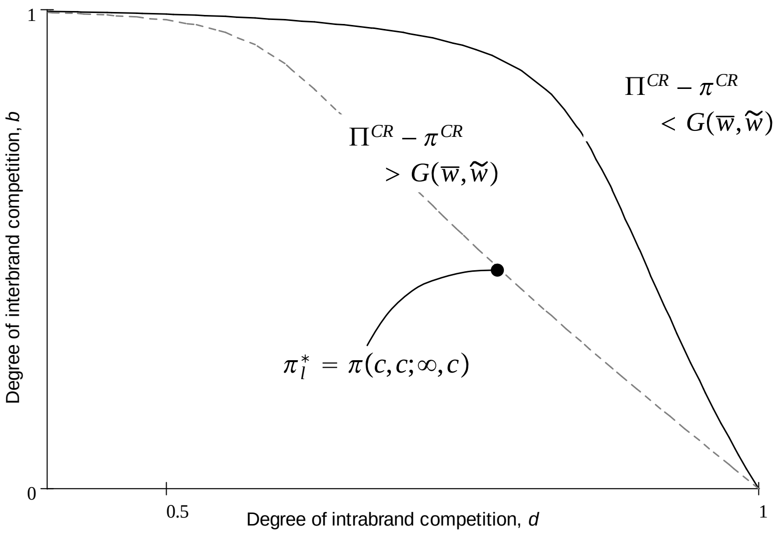

Figure 6: Retailer power. Double common agency. To the left of the solid line, a unilateral deviation (by a retailer) to exclusive purchasing is not profitable.

Let $\Pi(\widetilde{w}, c, w_2, \infty) - \pi(\widetilde{w}, c; w_2, \infty) \equiv G(w_2, \widetilde{w})$. We use the demand functions, prices and total industry profit function obtained in the proof of Lemma 3. Maximising $G(w_2, \widetilde{w})$ w.r.t. w_2 then yields the wholesale price $w_2 = \overline{w} = (2 - bd - d^2)\, d^2 / (8 - 4d^2)$, where $\overline{w} > \widetilde{w}$. After substituting $\overline{w}$ for w_2 in $G(w_2, \widetilde{w})$, the inequality $G(\overline{w}, \widetilde{w}) > \Pi^{CR} - \pi^{CR}$ determines when a deviation to exclusive purchasing is profitable. We have plotted $G(\overline{w}, \widetilde{w}) = \Pi^{CR} - \pi^{CR}$ in Figure 6, which shows that the deviation is never profitable as long as $\pi_l^* < \pi(c, c; \infty, c)$. This completes the proof that there exist double common agency equilibria as long as both $\pi_l^* < \pi(c, c; \infty, c)$ and $\Pi^{CR} \geq \Pi^{XR}$.

Moreover, we have to show that there exist double common agency equilibria which Pareto dominate (for the retailers) all equilibria with exclusive purchasing or exclusive selling. First, it can be shown that, as long as $\pi_l^* < \pi(c, c; \infty, c)$, there exist no equilibria where one retailer (say retailer 2) sells only the manufacturer's brand, and the other retailer (retailer 1) sells both brands, i.e., where e.g. the products $\{A1, B1, A2\}$ are sold. In this situation, the equilibrium wholesale prices are given by

$$\max_{w_1} \{\Pi(w_1, c, w_2, \infty) - \pi(w_2, \infty; w_1, c)\} + F_2 - \max\left(u_1^E, u_2^E\right) \tag{79}$$

and

$$\max_{w_2}\left\{\Pi\left(w_1,c,w_2,\infty\right)-\pi\left(w_1,c;w_2,\infty\right)\right\}+F_1-\max\left(u_1^E,u_2^E\right)$$
$$=\max_{w_2}G\left(w_2,w_1\right)+F_1-\max\left(u_1^E,u_2^E\right) \tag{80}$$

Solving (79) and (80) w.r.t w_1 and w_2, yields:

$$w_1 = v^* = \frac{2\left(1+b\right)\left(1-b\right)d^2}{8-b^2d^2\left(6-d^2\right)} \tag{81}$$
$$w_2 = v^{**} = \frac{\left(8-4b^2d-d^2b^2\left(d+3\right)\left(2-d\right)\right)d^2}{4\left(8-b^2d^2\left(6-d^2\right)\right)} \tag{82}$$

Substituting v^* and v^{**} for w_1 and w_2 in $G\left(w_2,w_1\right)$, yields the joint profit of the manufacturer and retailer 2, $G\left(v^{**},v^*\right)+F_1$. For this to consitute an equilibrium, it must be jointly unprofitable for the manufacturer and retailer 2 to deviate to a contract which allows retailer 2 to sell brand B. The following condition therefore has to hold:

$$G\left(v^{**},v^*\right)\geq\max_{w_2}\left\{\Pi\left(v^*,c,w_2,c\right)-\pi\left(v^*,c;w_2,c\right)\right\} \tag{83}$$

The solution to $\max_{w_2}\left\{\Pi\left(v^*,c,w_2,c\right)-\pi\left(v^*,c;w_2,c\right)\right\}$ is the wholesale price

$$w_2=v'=\frac{\left(1-b\right)\left(16-8d^2+db\left(8-\left(1-d\right)\left(2+d\right)\left(6-d^2\right)db\right)\right)d^2}{4\left(8-\left(6-d^2\right)d^2b^2\right)\left(2-d^2\right)} \tag{84}$$

The condition for a deviation to be unprofitable is therefore $G\left(v^{**},v^*\right)>\Pi\left(v^*,c,v',c\right)-\pi\left(v^*,c;v',c\right)$. We have plotted $G\left(v^{**},v^*\right)=\Pi\left(v^*,c,v',c\right)-\pi\left(v^*,c;v',c\right)$ in Figure 7, which shows that, as long as $\pi_l^*<\pi\left(c,c;\infty,c\right)$, the deviation is always profitable.

We can conclude that, when $\pi_l^*<\pi\left(c,c;\infty,c\right)$, there exists no equilibrium where both retailers sell brand A, and only one retailer sells the competitive brand B. In the same fashion, it can be shown that there exists no equilibrium where both retailers sign an exclusive purchasing contract: In this situation, the equilibrium wholesale prices are given by

$$\max_{w_j}\left\{\Pi\left(w_j,\infty,w_k,\infty\right)-\pi\left(w_k,\infty;w_j,\infty\right)\right\}+F_k-\max\left(u_1^E,u_2^E\right) \tag{85}$$

for $j,k\in\{1,2\}$, $k\neq j$, which yields $w_1=w_2=\widetilde{w}^U=d^2/4$. For this to constitute an equilibrium, it must be jointly unprofitable for the manufacturer and a retailer (say retailer 1) to deviate to a (common) contract, which would allow retailer 1 to sell brand

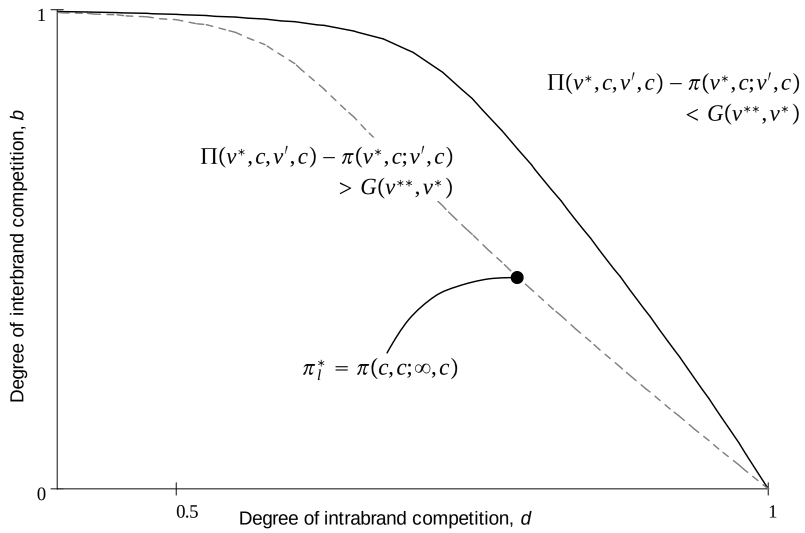

Figure 7: Retailer power. Mixed configuration, where one retailer sells both brands, and the rival retailer sells brand A only. To the left of the solid line, a deviation to double common agency is profitable for the retailer who is selling brand A only.

B. Their joint profit with an exclusive purchasing contract is

$$\begin{aligned}
&\Pi\left(\widetilde{w}^U, \infty, \widetilde{w}^U, \infty\right) - \pi\left(\widetilde{w}^U, \infty; \widetilde{w}^U, \infty\right) + F_2 \\
&= \Pi^{UR} - \pi^{UR} + F_2 \ , \\
&= \frac{(2+d)(2-d)}{8(1+d)} - \frac{(1-d)(2+d)^2}{16(1+d)} + F_2 \ ,
\end{aligned} \tag{86}$$

whereas their joint profit when waiving the exclusive purchasing agreement is

$$\begin{aligned}
&\Pi\left(w_1, c, \widetilde{w}^U, \infty\right) - \pi\left(\widetilde{w}^U, \infty; w_1, c\right) + F_2 \\
&= X_{A-1}\left(w_1, \widetilde{w}^U\right) + F_2
\end{aligned} \tag{87}$$

Maximising $X_{A-1}\left(w_1, \widetilde{w}^U\right)$ w.r.t. w_1, yields

$$w_1 = \widetilde{v} = \frac{2(1+b)(1-b)(2-d^2)d^2}{16 - 8d^2 - d^2b^2(16 + d^4 - 9d^2)} \tag{88}$$

Substituting w_1 for $\widetilde{v}$ in $X_{A-1}\left(w_1, \widetilde{w}^U\right) + F_2$ yields the maximum profit for the manufacturer and retailer 1 when deviating to a common contract: $X_{A-1}\left(\widetilde{v}, \widetilde{w}^U\right) + F_2 = \overline{X}_{A-1} + F_2$.

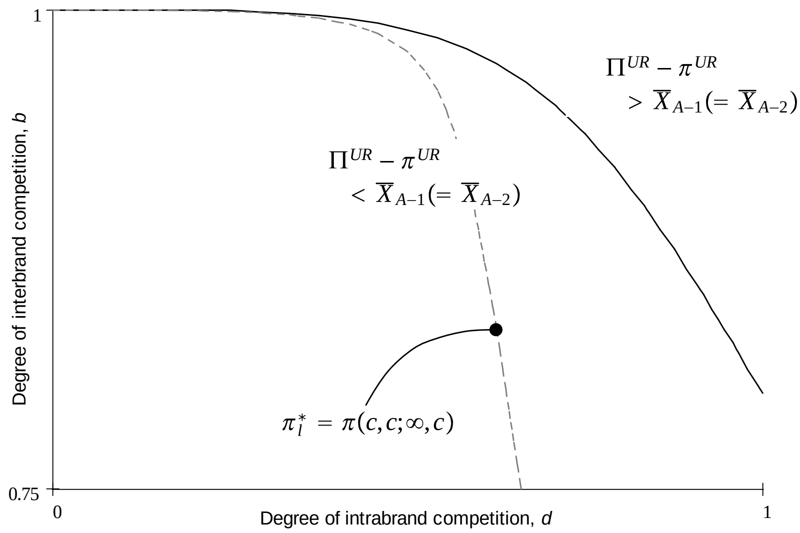

Figure 8: Retailer power. Single sourcing (upstream monopoly). Below the solid line, it is profitable for a retailer to waive the exclusive purchasing provision – to be able to sell both brands.

The condition for this deviation to be unprofitable, is therefore

$$\Pi^{UR} - \pi^{UR} > \overline{X}_{A-1}(= \overline{X}_{A-2} \text{ by symmetry}) \tag{89}$$

We have plotted $\Pi^{UR} - \pi^{UR} = \overline{X}_{A-1}$ in Figure 8, which shows that the deviation is always profitable as long as $\pi_l^* < \pi(c, c; \infty, c)$.

We can conclude that, when both $\pi_l^* < \pi(c, c; \infty, c)$ and $\Pi^{CR} \geq \Pi^{XR}$, there exist only i) double common agency equilibria and ii) equilibria with exclusive selling. To see that the double common agency equilibria are Pareto undominated in this case, note that, in any equilibrium with exclusive selling, both the retailer that is without a contract, and the retailer that wins the exclusive selling contract, earns the profit $\pi(\infty, c; c, c)$. On the other hand, of all the double common agency equilibria, the one which is least preferred by the retailers, is the one where each retailer pays the maximum fixed fee, $\overline{F} = \pi^{CR} - \pi(\infty, c; c, c)$, and earns the profit $\Pi_r = \pi^{CR} - \overline{F} = \pi(\infty, c; c, c)$. In all the other double common agency equilibria, the retailers earn a strictly higher profits, $\Pi_r > \pi(\infty, c; c, c)$, given that $\underline{F} < \overline{F}$, which holds iff $\Pi^{CR} > \Pi^{XR}$. **Q.E.D.**

Proof of Proposition 4 As long as both $\pi_l^* < \pi(c, c; \infty, c)$ and $\Pi^{CR} < \Pi^{XR}$, there only exist equilibria where one retailer sells both brands and the other retailer sells the

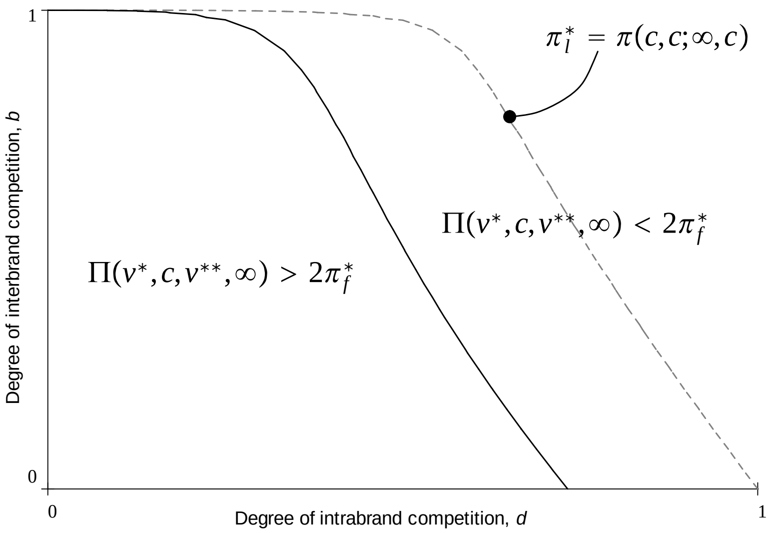

Figure 9: Retailer power. Mixed configuration, where one retailer sells both brands, and the rival retailer sells brand A only. To the right of the solid line, it is profitable for one of the retailers to deviate to mixed single-sourcing.

competitive brand. In this case, each retailer bids $F^E = 2\pi(c, c; \infty, c) - \Pi^{CR}$ to obtain brand A exclusively, and each retailer earns $\pi(\infty, c; c, c)$. Since $\pi_l^* < \pi(c, c; \infty, c)$, mixed single sourcing cannot be an equilibrium; and by the same logic, a deviation to exclusive purchasing for the retailer that has exclusive selling rights to brand A, cannot be profitable. Moreover, since each retailer earns the profit $\pi(\infty, c; c, c)$, neither retailer can increase its profit by withdrawing or increasing its exclusive offer. (It follows from the proof of Proposition 3 that there are no equilibria in this case where both retailers sell brand A and only one retailer sells brand B, nor any equilibria with single-sourcing (upstream monopoly).)

Suppose instead that $\pi_l^* \geq \pi(c, c; \infty, c)$. First we show that there is no equilibrium where both retailers sell brand A and only one retailer sells brand B. For this to constitute an equilibrium, we showed in the proof of Proposition 3 that the following condition has to hold.

$$G(v^{**}, v^*) \geq \Pi(v^*, c, v', c) - \pi(v^*, c; v', c) \tag{90}$$

Suppose the condition in (90) holds (see Fig. 7). In addition, the condition $\Pi(v^*, c, v^{**}, \infty) \geq 2\pi_f^*$ has to hold. Otherwise, at least one of the retailers has an incentive to withdraw its offer to obtain the Stackelberg follower profit π_f^*. We have plotted $\Pi(v^*, c, v^{**}, \infty) = 2\pi_f^*$ in Figure 9, which shows that the condition never holds as long as $\pi_l^* \geq \pi(c, c; \infty, c)$.

We can conclude that when $\pi_l^* \geq \pi(c, c; \infty, c)$, there exist no equilibria where only one retailer sells brand B and both retailers sell brand A. Our candidate equillibria are therefore i) equilibria with single-sourcing, where both retailers sell brand A only (upstream monopoly), and ii) equilibria with mixed single-sourcing, where the retailers sell different brands $\{A1, B2\}$ or $\{B1, A2\}$.

First, note that equilibria with mixed single-sourcing exist: A retailer, say retailer 2, can always refrain from making an offer to the manufacturer. Retailer 1's best response is then to offer a contract, $\{w_l^*, F_l^*\}$, which includes both an exclusive selling and exclusive purchasing provision, and where $F_l^* = -w_l^* D_{A1}(w_l^*, \infty, \infty, c)$. This contract induces a profit $\Pi_r^1 = \pi_l^*$ for retailer 1, whereas the manufacturer earns zero. Retailer 2 then earns the Stackelberg follower profit π_f^*. Since $\pi_l^* \geq \pi(c, c; \infty, c)$, retailer 1 and the manufacturer cannot increase their joint profit by waiving the exclusive purchasing agreement, and since $\pi_f^* > \pi_l^*$, retailer 2 cannot increase its profit by competing to obtain a contract with the manufacturer.

There is also an equilibrium with single sourcing, where each retailer only sells the manufacturer's brand. (89) gives a necessary condition for single sourcing to constitute an equilibrium. This condition is illustrated in Figure 8. In addition, we have as a condition that each retailer has to earn at least the Stackelberg follower profit π_f^*; otherwise, one of the retailers could increase its profit by refraining from making an offer to the manufacturer. The second condition is therefore

$$\Pi^{UR} - 2\pi_f^* \geq 0 \tag{91}$$

Since $\pi_f^* > \pi_l^*$, the retailers have no incentive to compete for an exclusive selling contract in this case, and the profit of the manufacturer is therefore zero. Figure 10 illustrates conditions (89) and (91). It shows that condition (89) is the relevant condition.

Since $\Pi^{UR} - 2\pi_f^* > 0$ when (89) holds, it follows that, whenever both equilibria exist, the equilibrium with mixed-single sourcing is dominated by the equilibrium with single-sourcing (upstream monopoly). **Q.E.D.**

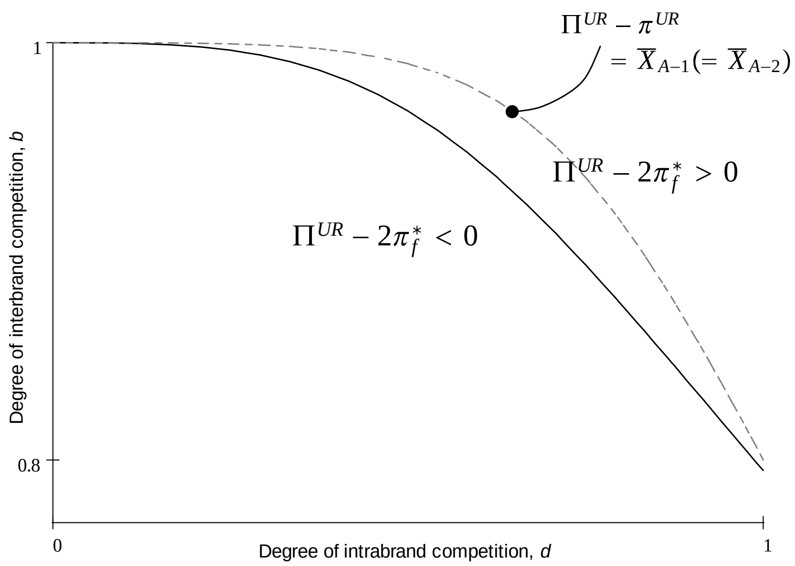

Figure 10: Retailer power. Single sourcing (upstream monopoly). Above the solid line, it is not profitable for a retailer to deviate, by refraining from offering a contract to the manufacturer, in order to obtain the Stackelberg follower profit π_f^*.

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Chapter 4

The Buyer Power of Multiproduct Retailers: Competition with One-Stop Shopping

The buyer power of multiproduct retailers: Competition with one-stop shopping*

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October 31, 2011

Abstract

This paper illustrates how, in local retail markets, a multiproduct retailer may gain buyer power when some consumers are one-stop shoppers (multi-product shoppers). We consider a model where independent suppliers negotiate terms of trade with a large multiproduct retailer and a group of smaller single product retailers, respectively. We find that an increase in the share of one-stop shoppers intensifies the degree of competition between the retailers, and hence reduces the overall industry profit – while at the same time enabling the multiproduct retailer to obtain discounts from its suppliers, in the form of lower fixed fees. We also show that the presence of a large retailer may positively affect the suppliers' incentives to invest in product quality or cost reductions.

JEL classifications: L11, L22, L25, L41, L42

Keywords: one-stop shopping, buyer power, dynamic efficiency, public policy

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1 Introduction

The increased supply and demand for one-stop shopping opportunities is one of the important changes in retailing over the recent decades. In the presence of shopping costs, and with growing opportunity costs of time, consumers increasingly prefer to fix all their purchases to a single weekday – to reduce both the number of shopping trips and the amount of time spent shopping (OECD, 1999; UK Competition Commission, 2000). Alongside this development in consumer behaviour, or as a consequence of it, many retailers have drastically increased their size and assortment of products.[1] We have seen the success of large, "big-box" retailers, such as Wal-Mart, Carrefour, and Tesco, who stock tens of thousands of products lines under one roof.

In light of these trends, there has been a growing concern among policy makers and competition authorities that manufacturers may have become adversely affected. A sometimes expressed view is that the growing size of retail outlets, together with the trend towards one-stop shopping behaviour, where consumers purchase a whole basket of goods at each shopping trip, has contributed to the buyer power of retailers' against their manufacturers (Inderst and Mazorotto, 2006).[2] The fear is that, as retailers capture a bigger share of the total profit, manufacturers will respond by cutting back on innovation and product development, and that consumers will suffer as a result.

Despite the great public interest, to our knowledge there is no formal theory that relates the one-stop shopping phenomenon to the bargaining power of multiproduct retailers. Moreover, the existing literature says little or nothing about how, in one-stop shopping markets, the "polarization in store size", in Chen's (2003) words, affects buyer power. This paper aims to fill this gap, by analysing the balance of power among manufacturers and multiproduct retailers that operate in the presence of one-stop shopping, and the welfare and public policy implications of increasing retailer size and the one-stop shopping phenomenon.

Large retailers have in part replaced and in part come in addition to smaller conve-

[1]The UK Competition Commission (2000) found that the average supermarket store size in 1997-98 was around 2.325 square metres compared with an average of less than 1.860 square metres five years earlier.

[2]This concern is clearly expressed e.g. the OECD (1999) report on the buying power of multiproduct retailers: "Because of significant economies of scope in shopping, many consumers prefer infrequent, one-stop shopping [...] If consumers preferring fewer, one-stop shopping trips find that their primary store is no longer carrying a specific good, they may be more willing to substitute a similar good than eventually to change stores to find the missing product. Where a sufficient number of consumers display that behaviour, the result will be significant buyer power..." (p. 8) Similar concerns are expressed in European Comission (1999).

nience stores and specialised corner shops, who offer a more limited variety. However, in many countries, public policy puts restrictions on both the number and size of large outlets. This is due to both local planning restrictions and/ or policies that more intentionally seek to protect smaller retailers. The mode of competition has therefore become one where a few very large retail outlets (out-of-town or edge-of-town superstores) compete against groups of smaller retailers (e.g. a shopping street), each carrying a narrower range of products. In line with this, we consider a downstream market where a multiproduct retailer competes against a group of single-product retailers in the presence of one-stop shopping. The upstream market consists of a number of (monopolist) suppliers that manufacture independent products. Each manufacturer negotiate a bilateral efficient (two-part) contract with both a single-product retailer and the multiproduct retailer, before competition takes place in the downstream market. To model the increase in one-stop shopping behaviour, we consider two types of consumers; one-stop shoppers, who buy all products, and top-up (single product) shoppers, each buying one specific product only.

We find that as the share of one-stop shoppers increases, holding total demand for each product constant, a multiproduct retailer chooses to reduce its prices to internalise the demand externalities created by the consumers that bundle their purchases. As a result, single-product retailers have to reduce their prices as well. Hence, as more and more consumers bundle their purchases, downstream competition becomes tougher, and total industry profit falls. In turn this affects the negotiations between the large retailer and its manufacturers. We find that when the share of one-stop shoppers grows, at first the incremental gains from trade between a manufacturer and a large retailer, are reduced. When the number of one-stop shoppers is not too high, the multiproduct retailer is therefore able to extract more rent from each of its manufacturers, and, as a result, earns a larger share of a smaller overall profit. The manufacturers, on the other hand, in addition to being squeezed by the multiproduct retailer, earn less profit from their small retailers, who have difficulty competing against the large retailer in the presence of one-stop shopping. The latter result provides some support for the claim that "the combined trend towards larger outlets and all-in-oneshopping trips", in the words of Inderst and Mazarotto (2006 p. 14), has contributed to a shift in power towards large retailers – to the detriment of both manufacturers and smaller shops.

However, we also find that when the share of one-stop shoppers becomes sufficiently high, and competition for these consumers becomes fierce, it becomes more and more costly for a large retailer to delist a product. The reason is that when competition is though, by delisting one product the retailer risks losing demand also for the rest of its products; if prices are low enough, some one-stop shoppers will shift their attention to the smaller retailers to obtain the full assortment of goods – and in doing so they take all their demand with them. When there is a significant number of one-stop shoppers, the retailers' assortment is therefore of greater importance when it comes to bringing consumers to the store. The incremental gain to the multiproduct retailer from stocking a manufacturer's product may be higher in this case, which implies that the manufacturer can extract more profit in negotiations with the large retailer. A manufacturer's profit may therefore be a non-monotonic function of the number of one-stop shoppers; decreasing for low numbers of one-stop shoppers, and then increasing, for higher numbers of one-stop shoppers.

We also analyse the effect that the large retailer may have on the manufacturers incentives to innovate. Specifically, we consider the incentives of manufacturers to further increase the quality of their products (increasing consumers' willingness to pay) or to further reduce their marginal production costs. We find that, even if manufacturers earn lower profits, they can counteract the power of the large retailer by making an effort to become more efficient or to improve the quality of their products. By offering their products at lower costs (or higher quality), the manufacturers are able to "tempt" more one-stop shoppers to switch shopping location should the large retailer delists one of their products. In turn, this undermines the value of the large retailer's disagreement payoff, and increases the fixed fee that the manufacturer can charge in the negotiations with the retailer.

We also briefly explore possible effects on product entry. The results here are less clear; the conclusion largely depends on assumptions about the distribution of fixed entry costs between different types of manufacturers. However, with a uniform entry cost, under certain conditions it can be shown that the number of manufacturers that enter the upstream market is always weakly smaller when facing a multiproduct retailer, compared to the case with only single-product retailers.

Hence, according to our model, the presence of a larger retailer contributes to more competition and lower prices for consumers in the short run, and may stimulate manufacturers to produce their products at lower costs (or higher qualities) in the long run. The effect on product variety is less clear. It may be that, by squeezing the profits of its manufacturers, a multiproduct retailer reduces the incentives for new manufacturers to enter the industry. The long-run implications are therefore unclear.

Related Literature This paper relates to the growing literature that analyse the effects of buyer power on both short-term and long-term welfare.[3] Much of the early work

[3]See Inderst and Mazorotto (2006, 2008) and Inderst and Shaffer (2008). They discuss the welfare implications of buyer power, and give a thorough review of the literature.

focus on short term effects, i.e. the incentives of strong retailers to pass on discounts from their manufacturers to their consumers. See e.g. von Ungern-Sternberg (1996), Dobson and Waterson (1997) and Chen (2003). Since we assume that manufacturers and retailers use secret and non-linear (two-part) tariffs, we largely ignore these effects in our paper. However, there is a competition effect in our model, in that the presence of multiproduct retailers creates tougher competition in the downstream market, which in turn yields lower prices for the consumer.

There are also a number of papers that analyse how buyers may obtain discounts due to their size. This branch of the literature mainly focuses on cross-border mergers between retailers (i.e., the creation of retail chains). See e.g. the seminal work by Katz (1987), Inderst and Wey (2003, 2007, 2011), Vieira-Montez (2007) and Inderst and Shaffer (2007). In contrast, we formalise the buyer power that may arise from the size of local retail outlets, measured as the number of independent products (or product lines) that the retailer stocks under one roof.

Of the papers that focus on buyer power and dynamic efficiency, it is interesting to note the very different results obtained by e.g. Battigalli et al. (2007) and Inderst and Wey (2011) respectively, although in two very different models. Battigalli et al. find that an increase in buyer power, measured as an increase in the degree of differentiation between the retailers (less downstream rivalry), aggravates the hold-up problem and thus reduces the manufacturers investments in quality improvements. Inderst and Wey, on the other hand, building on the work by Katz (1987), show that large buyers have more credible outside options, which means that they can extract more of the total surplus in the negotations with the manufacturer. However, even though the buyer extracts more of the total surplus, Inderst and Wey are able to show that large buyers may provide the manufacturer with stronger incentives to innovate, since investing in e.g. lower marginal costs contributes to reducing the value of the buyer's outside option. Our result resembles that of Inderst and Wey. When a manufacturer reduces his marginal cost, he is able to sell to retailers at a lower wholesale price – which in turn is passed on to consumers in the form of lower prices. In this situation (with sufficiently low retail prices), a one-stop shopper is more inclined to switch shopping location to obtain the manufacturer's product, in the event that the product can not be obtained from the multiproduct retailer. Because one-stop shoppers are extra valuable, a reduction in the manufacturer's marginal cost thus undermines the value of the the large retailer's disagreement payoff, and increases the surplus that the manufacturer can extract in the negotiations with the multiproduct retailer – provided there are sufficiently many one-stop shoppers. The combination of one-stop shopping behaviour and large retail outlets may therefore increase the manufacturer's incentives to invest in our model.

Our paper also relates to the literature that investigate consumers' one-stop shopping behaviour. See e.g. the seminal paper by Bliss (1988), Lal and Matutes (1989, 1994), Beggs (1994), Smith and Hay (2005) and Chen and Rey (2011). This literature focuses, among other things, on retailers incentives for loss-leading, on the retailers ability to discriminate between different types of consumers (i.e., one-stop shoppers vs. multi-stop shoppers), and on how the specific form of organisation at the retail level affects both the product assortment, the internalisation of pricing decisions, etc.[4] This literature mostly ignore the vertical relations aspect, however.

There is some new theory that tries to link one-stop shopping to the problem of buyer power, but the literature is yet scarce. See Schlippenbach and Wey (2011), who, in a similar model to ours (but with a monopolist retailer), analyse the incentives of two manufacturers to merge, depending on the share of one-stop shoppers. They find that an increase in the retailer's (exogenous) bargaining power may prevent welfare improving mergers between manufacturers.

The rest of the paper is organised as follows. Section 2 presents the basic framework and provides a benchmark. Section 3 analyses equilibrium outcomes when the manufacturers face both a multiproduct retailer as well as a group of single-product retailer. Section 4 analyse respectively the manufacturers incentives to invest and the incentives for product entry. Section 5 concludes.

2 The model

2.1 The economy

The market consists of $n \geq 2$ monopolist manufacturers, denoted by subscript $i \in \{1, ..., n\}$, each producing its own product, which is then sold through competing retailers to final consumers. We first consider the number of manufacturerers as fixed. In Section 3, where we analyse implications for dynamic efficiency, we will endogenise the number of upstream firms (or products).

There are two types of retailers; single-product retailers (small retailers), who stock different products but only one product each, and a multiproduct retailer (large retailer), who is assumed to stock all of the n products. The two types of retailers are located at opposite ends of a Hotelling line of unit length, the large retailer at address 0 and all the

[4] The effects of one-stop shopping on the retailers' promotion and pricing strategies have been widely explored in the marketing literature. See e.g. Messinger and Narasimhan (1997).

single-product retailers at address 1. We denote the large retailer by subscript L, and the group of small retailers by subscript S. Similarly, we denote the small retailer selling product i by subscript $iS \in \{1S, ..., nS\}$. Each manufacturer i is assumed to produce its product at constant marginal costs c_i. The retailers have no costs other than those charged by manufacturers.

The consumers that buy product i are uniformly distributed with density one along the Hotelling line. Each consumer has inelastic demand for one unit of the product, with a reservation price υ_i. The consumers' reservation price may among other things reflect the quality of the manufacturer's product. We later endogenise both c_i and υ_i by allowing the manufacturer to make an effort to become more efficient/ produce at higher quality before competition takes place in the downstream market. For each product i, there are two types of consumers buying the product; one-stop shoppers and top-up shoppers (single shoppers). A one stop-shopper buys all n products, whereas a top-up shopper buys product i only. Both types are assumed to be fully informed about the prices and the product assortment at each location.[5] We let $\sigma \in [0, 1]$ be the share of one-stop shoppers, and $1 - \sigma$ the share of top-up shoppers for each product $i \in \{1, ..., n\}$.[6]

We denote by $x \in [0, 1]$ the consumer's address on the Hotelling line. The consumer incurs a transportation cost $\tau > 0$ per unit travelled to visit a retail location. Hence, the consumer's total cost (shopping cost) of visiting a small retailer is $\tau (1 - x)$, and the cost of visiting the large retailer is τx. We can then write the utility of a one-stop shopper at address x as

$$U_O(x) = \begin{cases} u_0 + \sum_{i=1}^{n} (\upsilon_i - P_{iL}) - \tau x & \text{if buying from } L \\ u_0 + \sum_{i=1}^{n} (\upsilon_i - P_{iS}) - \tau (1 - x) & \text{if buying from } S \end{cases}, \tag{1}$$

where P_{iL} and P_{iS} are the prices of product i charged by the large retailer and the small

[5] Realistically, consumers do not have perfect information about the availability and prices of all goods. To what extent there should be any systematic differences one way or the other between different types of consumers , such as one-stop shoppers and top-up shoppers, is to us not obvious. To keep the analysis tractable, we therefore assume that all consumers have the same information.

[6] The total mass of consumers that buy at least one product is therefore $\sigma + (1 - \sigma) n$. This secures that the total demand for each product is independent of the share of one-stop shoppers. We think of an increase in one-stop shopping as consumers taking fewer shopping trips (which reduces the mass of consumers at any given point in time) but buying more products on each trip (which keeps total demand for each product constant).

retailer respectively. Similarly, we can write the utility of a top-up shopper as

$$U_T^i(x) = \begin{cases} u_0 + \upsilon_i - P_{iL} - \tau x & \text{if buying from } L \\ u_0 + \upsilon_i - P_{iS} - \tau(1-x) & \text{if buying from } iS \end{cases}, \tag{2}$$

for $i \in \{1, ..., n\}$. In both (1) and (2), we include $u_0 > \tau$, which represents the consumer's utility from visiting one of the locations (without buying). This can be viewed as the consumer's utility from enjoying other services at the retail location, which are assumed to be exogenous to the retailers in our model.[7] We assume that the consumer incurs u_0 only once, and that she receives no additional utility on the second visit, or by visiting multiple locations. Importantly, this ensures that in our subgame-perfect equilibrium, the market is covered as long as P_{iL} and P_{iS} are equal or below the monopoly price, $P_i^M = \upsilon_i$. This assumption is not critical, but helps to keep the model tractable. We also make the following two assumptions about consumer behaviour "out-of-equilibrium":

Assumption 1. *If a product is not stocked at both locations, a one-stop shopper does not visit both locations to obtain all products.*[8]

Assumption 2. *If a top-up shopper finds that her product is not stocked at both locations, she always visits the location where the product is stocked – given that the price for the product is not higher than her reservation price.*[9]

Using this we find that, in equilibrium, when all products are stocked at both locations, the one-stop shopper that is indifferent between buying from the large retailer and the small retailers, is located at

$$x_O^* = \frac{1}{2} - \frac{1}{2\tau}\sum_{i=1}^{n}(P_{iL} - P_{iS}), \tag{3}$$

[7] This could be, e.g., a gas station at the location, or the utility that accrues from browsing the product assortment without buying anything.

[8] This assumption does not have any effect on equlibrium prices in our subgame-perfect equilibrium, i.e. when all products are sold at both locations. Due to consumers' shopping costs, it is then always optimal for a one-stop shopper to visit only one location. However, it may affect pricing out-of-equilibrium, when the large retailer delists one of its products. If prices are low enough, some one-stop shoppers may find it optimal to visit the large retailer to obtain most products at low prices, and then visit a small retailer to obtain the missing product. Allowing for this kind of behaviour complicates the analysis without affecting our qualitative results.

[9] This assumption is admittedly ad hoc, but it does not affect our qualitative results. It affects some of the critical values in our propositions and lemmas, however. We briefly discuss the implications of this assumption later in the analysis.

whereas the indifferent top-up shopper is located at

$$x_{Ti}^{*}=\frac{1}{2}-\frac{1}{2\tau}\left(P_{iL}-P_{iS}\right). \tag{4}$$

Consumers' utility maximisation therefore yields the following demand for product $i \in \{1, ..., n\}$ at the large retailer,

$$Q_{iL}=\sigma x_{O}^{*}+(1-\sigma)\, x_{iT}^{*}, \tag{5}$$

and the following demand at the single-product retailer,

$$Q_{iS}=\sigma\left(1-x_{O}^{*}\right)+(1-\sigma)\left(1-x_{Ti}^{*}\right). \tag{6}$$

The game consists of two stages. At stage 1, each manufacturer $i \in \{1, ..., n\}$ engage in simultaneous bilateral negotiations with each of its two buyers, L and iS. We assume that the manufacturer has two agents, each negotiating with a retailer on the manufacturer's behalf. Similarly, we assume that the large retailer has n agents, each negotiating with a manufacturer on the retailer's behalf.[10] We assume that each agent forms rational expectations about the outcome in all other bilateral negotiations.[11] The contracts between the manufacturer and the retailers are assumed to be in two-part tariffs, (w_{iL}, F_{iL}) and (w_{iS}, F_{iS}), where w_{iL} and w_{iS} are (linear) wholesale prices, and F_{iL} and F_{iS} are fixed fees, paid by the large retailer and the single-product retailer respectively.

At stage 2, the retailers simultaneously set prices to compete in the downstream market. We assume that the retailers learn which negotiations have been (un)successful before competing, and therefore know whether their rival is carrying a specific product. The supply terms, on the other hand, are assumed to be secret (i.e., retailers do not learn their rivals' wholesale prices before competing in the downstream market).

In each manufacturer-retailer negotiation, we assume that the agents maximise the manufacturer's and the retailer's joint profit, taking as given their expectations about the outcome of the other negotiations. They then divide the surplus so that each receives its diagreement profit plus a fixed (exogenous) share of the incremental gains from trade, with

[10] An implicit assumption is here that the manufacturer is unable to commit to distributing its product through one retailer exclusively. Exclusive selling could be deemed unlawful by competition authorities. In this case, the manufacturer is unable to credibly commit to exclusivity, since it is without an enforcable contract; if each retailer believes that the manufacturer is simultaneously negotiating a contract with the rival, then the manufacturer is effectively precluded from obtaining higher compensation from the retailer in exchange for a promise of exclusivity. The same restriction occurs in e.g. Hart and Tirole (1990) and O'Brien and Shaffer (1994).

[11] See also Inderst and Wey (2011), who use the same assumption.

a portion $\lambda \in (0, 1)$ going to the manufacturer and a portion $1 - \lambda$ going to the retailer.[12] We assume that both the large and small retailers have the same exogenous bargaining power $1 - \lambda$ against their manufacturers, and conversely that all manufactureres hold the same bargaining power λ against both of their retailers.[13]

2.2 A benchmark: All retailers are single-product retailers

Before we look at the case with a multiproduct retailer, we consider as our benchmark case a situation where there are only single-product retailers at both locations. Hence, there is one single-product retailer that sells product $i \in \{1, ..., n\}$ at each location, and $2n \geq 4$ retailers total. We denote retailers with subscript il, where $i \in \{1, ..., n\}$ is the retailer's product, and $l \in \{0, 1\}$ is the retailer's location. As specified above, if all products are sold at both locations, the indifferent one-stop shopper is located at

$$x_O^* = \frac{1}{2} - \frac{1}{2\tau} \sum_{i=1}^{n} (P_{i0} - P_{i1}) \tag{7}$$

(where we have replaced the subscripts on the prices) and the indifferent top-up shopper at

$$x_{iT}^* = \frac{1}{2} - \frac{1}{2\tau} (P_{i0} - P_{i1}). \tag{8}$$

Accordingly, the demand function (as specified above) is equal to $Q_{i0} = \sigma x_O^* + (1 - \sigma) x_{iT}^*$ for the single-product retailer selling product i at location 0, and $Q_{i1} = 1 - Q_{i0}$ for the single-product retailer at location 1.

Consider the maximisation problem for a retailer at stage 2, assuming all negotiations at stage 1 have been successful.

$$\pi_{il}^r = \max_{P_{il}} (P_{il} - w_{il}) Q_{il} - F_{il}. \tag{9}$$

This gives $2n$ first-order maximising conditions, one for each retailer, of the type

$$\frac{\partial \pi_{il}^r}{\partial P_{il}} = (P_{il} - w_{il}) \frac{\partial Q_{il}}{\partial P_{il}} + Q_{il} = 0 \tag{10}$$

[12] These assumption are consisten with for example the generalised Nash bargaining solution.

[13] It is perfectly conceivable that different manufacturers have different bargaining powers towards their respective retailers, and, conversely, that different types of retailers have different bargaing powers towards their respective manufacturers. However, given that we are interested in how consumer behaviour and retailer size affects the bargaining outcome, we let the (exogenous) bargaining power be symmetric across different retailers and different manufacturers. The same approach is used in e.g. Inderst and Shaffer (2007) and Inderst and Wey (2011).

Maximisation by the retailers results in prices $P_{i0}^*\left(w_{i0},\mathbf{w}_{-i0}^*\right)$ and $P_{i1}^*\left(w_{i1},\mathbf{w}_{-i0}^*\right)$ for product i at each location, 0 and 1. In $P_{il}^*\left(w_{il},\mathbf{w}_{-il}^*\right)$, w_{il} is the wholesale price of retailer $il\in\{i0,i1\}$, whereas $\mathbf{w}_{-il}^*$ represents the retailer's rational expectations about the wholesale prices of the $2n-1$ other retailers. Turning to the negotiations at stage 1, we can write the joint profit between retailer $i0$ and manufacturer i (symmetric for $i1$ and i) as

$$\Pi_{i-i0}=\pi_{i0}^r\left(\mathbf{P}^*\right)+\left(w_{i0}-c_i\right)Q_{i0}\left(\mathbf{P}^*\right)+\left(w_{i1}^*-c_i\right)Q_{i1}\left(\mathbf{P}^*\right)+F_{i0}+F_{i1},\tag{11}$$

where $\mathbf{P}^*=\left(P_{10}^*\left(w_{10},\mathbf{w}_{-10}^*\right),...,P_{n0}^*\left(w_{n0},\mathbf{w}_{-n0}^*\right),P_{11}^*\left(w_{11},\mathbf{w}_{-11}^*\right),...,P_{n1}^*\left(w_{n1},\mathbf{w}_{-n1}^*\right)\right)$. Using the envelope theorem, we obtain the following first-order condition for joint profit maximisation between manufacturer i and retailer $i0$[14]

$$\frac{\partial\Pi_{i-i0}}{\partial w_{i0}}=\left[\left(w_{i0}-c_i\right)\frac{\partial Q_{i0}}{\partial P_{i0}}+\left(w_{i1}^*-c_i\right)\frac{\partial Q_{i1}}{\partial P_{i0}}\right]\frac{\partial P_{i0}^*}{\partial w_{i0}}=0,\tag{12}$$

and symmetric for i and $i1$. Notice that we have $\partial P_{i0}^*/\partial w_{i0}>0$ and $\partial P_{i1}^*/\partial w_{i1}>0$, but $\partial P_{i1}^*/\partial w_{i0}=\partial P_{i0}^*/\partial w_{i1}=0$, since contracts are unobservable. From condition (12) it is easy to see that wholesale prices have to be uniform, $w_{i0}^*=w_{i1}^*$, in equilibrium. Moreover, we have proved the following result.

Lemma 1. *Under the assumption that a manufacturer and a retailer maximises their joint profit in pairwise, secret negotiations, there exists an infinite number of equilibria of the type* $w_{i0}^*=w_{i1}^*=w_i^*\geq 0$.

Hotelling competition is a special case, in the sense that own-price and cross-price effects cancel out ($\partial Q_{i0}/\partial P_{i0}=-\partial Q_{i1}/\partial P_{i0}$). Hence, as long as the wholesale price for product i is equal for the retailers at location 0 and 1, $w_{i0}^*=w_{i1}^*=w_i^*$, and $w_i^*\geq 0$, there is no incentive for any pair, $i-i0$ or $i-i1$, to deviate to a lower (higher) wholesale price – even if $w_i^*>c_i$.[15] This holds because for any small reduction in the wholesale price w_{i0} (repectively w_{i1}), the corresponding increase in downstream profit π_{i0}^r (respectively π_{i1}^r) is offset by an equal reduction in manufacturer i's upstream profit. Because this is a special case, in the following we will use the convention that wholesale prices equal marginal costs:

Assumption 3. *We restrict attention to equilibria where the wholesale prices are set*

[14] The envelope theorem implies that $\frac{\partial\pi_{i0}^r(\mathbf{P}^*)}{\partial w_{i0}}=-Q_{i0}$.

[15] If own-price and cross-price effects do not cancel out, i.e., $\partial Q_{i0}/\partial P_{i0}<-\partial Q_{i1}/\partial P_{i0}$, then there is a unique equilibrium where wholesale prices equal marginal costs. This is a standard result in models with unobservable two-part tariffs.

equal to marginal cost.[16]

With wholesale prices $w_{i0}^* = w_{i1}^* = c_i$ for all $i \in \{1, ..., n\}$, the equilibrium in the retail market has a very simple solution where $P_{i0}^* = P_{i1} = \tau + c_i$, for $i \in \{1, ..., n\}$. Hence, we obtain the standard Hotelling prices. We now make the following assumption.

Assumption 4. *The inequality $\tau \leq \upsilon_i - c_i \equiv \Delta_i$ holds for all $i \in \{1, ..., n\}$.*

Assumption 4 requires that there is sufficient competition at the retail level, in the sense that retail prices are always below the monopoly level in equilibrium. Assumptions 3 and 4 ensures that our model has a very simple solution: In our benchmark, since each retailer only sells one product, and since the manufacturers earns their profit through fixed fees only ($w_i^* = c_i$), we do not need to specify what happens out of equilibrium, when negotiations break down between a retailer and a manufacturer. If all negotiations are successful, which they are in equilibrium, each retailer then earns the profit $\pi_{il}^r = \tau/2 - F_{il}$, whereas each manufacturer earns the profit $\pi_i^m = F_{i0} + F_{i1}$. The retailer and the manufacturer therefore negotiate over the (incremental) profit $\tau/2$. We therefore get fixed fees equal to $F_{i0} = F_{i1} = F^B = \lambda\tau/2$ in equilibrium. We have the following result.

Proposition 1. *When all retailers are single-product retailers, equilibrium retailer prices at both locations are equal to $P_i^* = \tau + c_i$ for $i \in \{1, ..., n\}$. Moreover, in equilibrium, each retailer and manufacturer earns the profits $\pi_B^r = (1 - \lambda)\,\tau/2$ and $\pi_B^m = \lambda\tau$ respectively.*

When all retailers are single-product retailers, each of them ignores the positive externality on nearby retailers (at the same location) of setting a lower retail price. We therefore get the standard Hotelling prices and profits in equilibrium, irrespective of the share σ of one-stop shoppers.

3 Equilibrium analysis and main results

We now turn to the case when there is a multiproduct retailer at location 0. This retailer is assumed to have the capacity distribute all $n \geq 2$ products. If all the negotiations at stage 1 are successful, then the multiproduct retailer's flow payoff (profit gross of fixed

[16] Note that Assumption 3 can be obtained as a unique equilibrium if we assume that the manufacturer and the retailer maximise their total channel profit only, instead of maximising their total joint profit. In this case, the manufacturer and the retailer ignore the manufacturer's contract with the rival retailer. See e.g. Chen (2003, 2004) who use this assumption.

fees) at stage 2 is equal to

$$r_L = \sum_{i=1}^{n} (P_{iL} - w_{iL}) \, Q_{iL} \tag{13}$$

whereas the flow payoff of a small retailer is equal to

$$r_{iS} = (P_{iS} - w_{iS}) \, Q_{iS} \tag{14}$$

subject to $w_{iL} \leq P_{iL} \leq v_i$, $w_{iS} \leq P_{iS} \leq v_i$ for all $i \in \{1, ..., n\}$. Differentiating the profit functions with respect to the prices P_{iL} and P_{iS}, respectively, gives us the following first-order conditions for profit maximisation for the large retailer with respect to the price for product i,

$$\frac{\partial r_L}{\partial P_{iL}} = 0 \Longleftrightarrow \frac{\partial Q_{iL}}{\partial P_{iL}} (P_{iL} - w_{iL}) + Q_{iL} = -\sigma \frac{\partial x_O^*}{\partial P_{iL}} \sum_{j \neq i} (P_{jL} - w_{jL}) \tag{15}$$

and for the small retailer iS with respect to its price P_{iS},

$$\frac{\partial r_{iS}}{\partial P_{iS}} = 0 \Longleftrightarrow \frac{\partial Q_{iS}}{\partial P_{iS}} (P_{iS} - w_{iS}) + Q_{iS} = 0 \tag{16}$$

Because the large retailer sells more than one product, it takes into account the revenue from the rest of its assortment when setting the price P_{iL}. This is reflected in the right-hand side of eq. (15), which is positive as long as $\sigma > 0$ and $P_{jL} > w_{jL}$ for $j \neq i \in \{1, ..., n\}$. It follows that, when some consumers bundle their purchases, i.e. $\sigma > 0$, the profit maximising price for the large retailer is below the equilibrium price when all consumers are top-up shoppers, and hence below the equilibrium price in our benchmark. On the other hand, a small retailer only takes into account the effect on its own sales when setting the price P_{iS}. It follows that, as long as $\sigma > 0$, the price of each small retailer is above the level that is jointly optimal for the group of small retailers as a whole (as in our benchmark).

In solving the retailer's first-order conditions, and defining $k \equiv n - 1$, we obtain the following best response function for the large retailer for product i,

$$P_{iL}^b (P_{iS}) = \frac{P_{iS} + w_{iL}}{2} + \frac{\tau}{2(1 + \sigma k)} \tag{17}$$

and the best response function

$$P_{iS}^b (P_{iL}) = \frac{(1 - \sigma) P_{iL} + w_{iS}}{2 - \sigma} + \frac{\tau}{2 + \sigma k} + \sigma \delta_S, \tag{18}$$

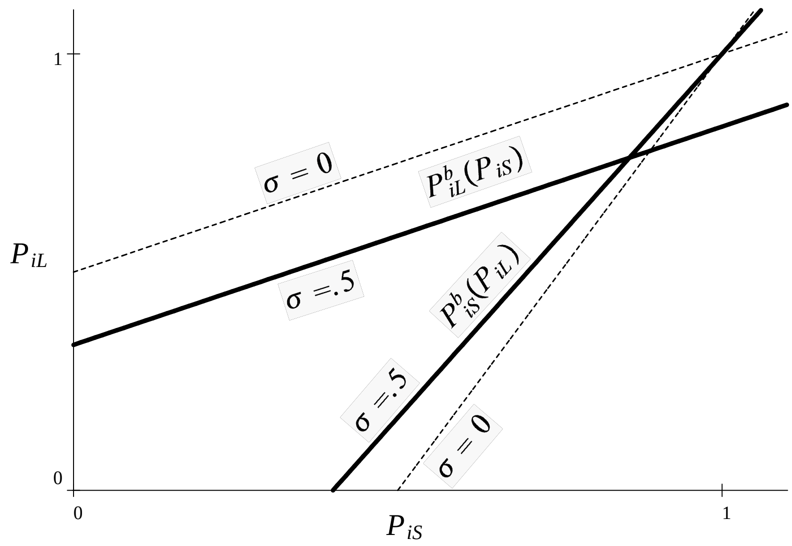

Figure 1: Best-response functions.

for each of the small retailers, $iS \in \{1S, ..., nS\}$, where[17]

$$\delta_S = \frac{\sum_{i=1}^{n} (P_{iL} - w_{iS})}{(2-\sigma)(2+\sigma k)} \tag{19}$$

Notice that as $\sigma \to 0$, the two functions converge to $P^b_{iL} = \frac{1}{2}(P_{iS} + w_{iL} + \tau)$ and $P^b_{iS} = \frac{1}{2}(P_{iL} + w_{iS} + \tau)$, in which case we obtain standard Hotelling prices $P^*_{iL} = \tau + \frac{2}{3}w_{iL} + \frac{1}{3}w^*_{iS}$ and $P^*_{iS} = \tau + \frac{2}{3}w_{iS} + \frac{1}{3}w^*_{iL}$. However, as the the share of one-stop shoppers σ increases, the best response function of the large retailer shifts down – which in turn forces the small retailers to reduce their prices. This effect is illustrated in Fig. 1, for the case $n = 2$ and $\tau = 1$ (and assuming $w_{iS} = w_{iL} = c_i = 0$ for $i \in \{1, 2\}$).

At stage 1, the manufacturers and the retailers engage in pairwise negotiations over two-part tariffs. We can write the joint profit between manufacturer $i \in \{1, ..., n\}$ and the multiproduct retailer as

$$\Pi_{L-i} = r^*_L(\mathbf{P}^*) + (w_{iL} - c_i) Q_{iL}(\mathbf{P}^*) + (w^*_{iS} - c_i) Q_{iS}(\mathbf{P}^*) + F_{iS} - \sum_{j \neq i} F_{jL}, \tag{20}$$

where $\mathbf{P}^* = \left(P^*_{1L}(\mathbf{w}_L, \mathbf{w}^*_S), ..., P^*_{nL}(\mathbf{w}_L, \mathbf{w}^*_S), P^*_{1S}\left(w_{1S}, \mathbf{w}^*_{-1S}\right), ..., P^*_{nS}\left(w_{nS}, \mathbf{w}^*_{-nS}\right)\right)$ is the vector of prices that solves the retailers' maximisation problems (15) and (16) at stage 2.

[17] We have solved for retailer iS's best-response assuming that all the other small retailers play their best reponse – i.e., assuming that $P_{jS} = P^b_{jS}$ for all $j \in \{1, ..., n\}$, $i \neq j$.

In $P_{iL}^*\left(\mathbf{w}_L, \mathbf{w}_S^*\right)$, $\mathbf{w}_L$ represents the vector of the wholesale prices for the large retailer, whereas $\mathbf{w}_S^*$ is the large retailer's rational expectation about the wholesale prices of the small retailers. Similarly, in $P_{iS}^*\left(w_{iS}, \mathbf{w}_{-iS}^*\right)$, w_{iS} is the wholesale price of retailer iS, whereas $\mathbf{w}_{-iS}^*$ represents retailer iS' rational expectations about the wholesale prices of both the large retailer and the other small retailers.

In the same way we can write the joint profit between the manufacturer and the small retailer as

$$\Pi_{S-i} = r_{iS}\left(\mathbf{P}^*\right) + \left(w_{iL}^* - c_i\right) Q_{iL}\left(\mathbf{P}^*\right) + \left(w_{iS} - c_i\right) Q_{iS}\left(\mathbf{P}^*\right) + F_{iL}. \tag{21}$$

Using the envelope theorem, we obtain the following first-order conditions for joint profit maximisation between the large retailer and manufacturer i, and between the small retailer and manufacturer i

$$\frac{\partial \Pi_{L-i}}{\partial w_{iS}} = \sum_{j=1}^{n} \left\{ \frac{\partial P_{jL}^*}{\partial w_{iL}} \left[\left(w_{iL} - c\right) \frac{\partial Q_{iL}}{\partial P_{jL}} + \left(w_{iS}^* - c\right) \frac{\partial Q_{iS}}{\partial P_{jL}} \right] \right\} = 0, \tag{22}$$

$$\frac{\partial \Pi_{S-i}}{\partial w_{iS}} = \left[\left(w_{iL}^* - c_i\right) \frac{\partial Q_{iL}}{\partial P_{iS}} + \left(w_{iS} - c_i\right) \frac{\partial Q_{iS}}{\partial P_{iS}} \right] \frac{\partial P_{iS}^*}{\partial w_{iS}} = 0. \tag{23}$$

Notice that these are equivalent to the first-order conditions in our benchmark, (12).[18] Hence, we can rely on Assumption 3, which says that $w_{iL}^* = w_{iS}^* = c_i$ in equilibrium. The solution to our model then has a relatively simple characterisation, in which the unique equilibrium prices are equal to

$$P_{iL}^* = \tau + c_i - \sigma \frac{\tau k \left(2 + k\sigma\right)}{\left(1 + k\sigma\right)\left(3 + k\sigma\right)} \quad \text{and} \quad P_{iS}^* = \tau + c_i - \sigma \frac{\tau k}{3 + k\sigma}, \tag{24}$$

for $i \in \{1, ..., n\}$. Using this, we can write the retailers' equilibrium flow profits as

$$r_L^* = \frac{\tau \left(k + 1\right)\left(3 + 2k\sigma\right)^2}{2\left(3 + k\sigma\right)^2 \left(1 + k\sigma\right)} \tag{25}$$

for the large retailer, and

$$r_S^* = \frac{9\tau}{2\left(3 + k\sigma\right)^2} \tag{26}$$

for each small retailer. Notice that both $\partial r_L^*/\partial\sigma < 0$ and $\partial r_S^*/\partial\sigma < 0$. Hence, as the share of one-stop shoppers increases, downstream competition gets tougher, and both types of

[18] In (22) and (23), the price effects cancel out: We have $\partial Q_{iL}/\partial P_{jL} = -\partial Q_{iS}/\partial P_{jL}$ and $-\partial Q_{iL}/\partial P_{iS} = \partial Q_{iS}/\partial P_{iS}$.

retailers (large and small) earn lower flow payoffs. The overall industry profit therefore falls as the share of one-stop shoppers increases.

As in our benchmark, the disagreement profit of a small retailer is always zero. We therefore have $F_{iS}^* = F_S^* = \lambda r_S^*$ for all $i \in \{1, ..., n\}$ in equilibrium. The disagreement profit of the multiproduct retailer, on the other hand, is non-zero. To determine the distribution of profits between manufacturer i and the large retailer we therefore have to specify the large retailer's flow payoff r_L^{-i} in the subgame where negotiations break down between L and i:

When the large retailer is not stocking product i, the marginal one-stop shopper is located at

$$x_O^{**} = \frac{1}{2} - \frac{1}{2\tau}\left[\sum_{j \neq i}(P_{jL} - P_{jS}) + v_i - P_{iS}\right], \tag{27}$$

where $P_{iS} \leq v_i$. In this case there is a trade-off for the one-stop shopper between visiting the small retailers, to obtain all products (at possibly higher prices), and visiting the large retailer, to obtain all products but product i (at possibly lower prices). As before, product $j \in \{1, ..., n\}$, $i \neq j$, can still be obtained at both locations. The marginal top-up up shopper who is buying product j is therefore located at

$$x_{jT}^* = \frac{1}{2} - \frac{1}{2\tau}(P_{jL} - P_{jS}) \tag{28}$$

Hence, we write the demand for product j at the multiproduct retailer as

$$\widehat{Q}_{jL} = \sigma x_O^{**} + (1 - \sigma) x_{jT}^*, \tag{29}$$

and as $\widehat{Q}_{jS} = 1 - \widehat{Q}_{jL}$ the demand for product j at the small retailer jS. Given that $P_{iS} \leq v_i$, under Assumption 2 all the top-up shoppers that are after product i now shop from the small retailer iS. The demand at retailer iS, who in this case has monopoly on the sales of product i, is therefore

$$\overline{Q}_{iS} = \sigma(1 - x_O^{**}) + 1 - \sigma, \tag{30}$$

for $P_{iS} \leq v_i$, and zero otherwise. We write the equilibrium (gross) profit of retailer iS in this case as $\overline{r}_{iS} = \left(\overline{P}_{iS} - c_i\right)\overline{Q}_{iS}$, where $\overline{P}_{iS}$ is the equilibrium price. It can be shown that the price $\overline{P}_{iS}$ satisfies $\overline{P}_{iS} < v_i$ only as long as

$$\Delta_i > \tau \frac{6 + (8k - 11)\sigma + (k-1)(k-6)\sigma^2 - (k-1)^2\sigma^3}{(3 + k\sigma - \sigma)(1 + k\sigma - \sigma)\sigma} \equiv \Delta(\sigma, n, \tau) \tag{31}$$

We denote by P_{jL}^{**} and P_{jS}^{**} the subgame-equilibrium prices for product $j \in \{1, ..., n\}$, $i \neq j$. (The derivation of the equilibrium values, and the condition in (31), are detailed in the appendix.) We have the following result.

Lemma 2. *Suppose there is disagreement in the negotiations between the multiproduct retailer and manufacturer i. In this subgame there exist a function $\widehat{\sigma}_i(\Delta_i, n, \tau) > 0$, such that the price for product i at the small retailer iS is equal to*

$$\overline{P}_{iS} = \begin{cases} \upsilon_i & \text{if} \quad \sigma \leq \widehat{\sigma}_i \\ \rho_i(\Delta_i, \sigma, n) < \upsilon_i & \text{otherwise} \end{cases}$$

where $\partial \rho_i / \partial \sigma < 0$. Moreover, we have $\partial \widehat{\sigma}_i / \partial \Delta_i < 0$ and $\partial \widehat{\sigma}_i / \partial n < 0$.

Proof. See Appendix A.

The function $\widehat{\sigma}_i(\Delta_i, n, \tau)$ in Lemma 2, is the unique value of σ for which the condition in (31) holds with equality. Lemma 2 states that as long as the share of one-stop shoppers is not too high, $\sigma < \widehat{\sigma}_i$, the small retailer sets the price for product i equal to the (monopoly) reservation price, $\overline{P}_{iS} = \upsilon_i$, and then free-rides on the demand from the one-stop shoppers created by the other single-product retailers. With a sufficiently high number of one-stop shoppers, however, retailer iS will find it optimal to set a lower price, $\overline{P}_{iS} < \upsilon_i$ – despite having a monopoly on the sales of product i – to attract more one-stop shoppers to its location.[19] Hence, in one sense, there may be competition "for the manufacturer's product" also out-of-equilibrium (when the large retailer delists product i), which is created by consumers' one-stop shopping behaviour.

Lemma 2 also states that for a higher "quality/cost gap" for product i, $\Delta_i \equiv \upsilon_i - c_i$, it is more likely that $\sigma > \widehat{\sigma}_i$ holds, and that $\overline{P}_{iS} < \upsilon_i$. The result is illustrated in Figure 2 for the case $n = 2$.

The implications of Assumption 2 are perhaps already obvious to the reader: If not all top-up shoppers were to visit the small retailer iS to obtain product i, which in this case is not stocked by L, then this would imply lower demand for the small retailer; ceteris paribus, this could give a lower price $\overline{P}_{iS}$. Hence, under Assumption 2, the model is biased in favour of weaker retail competition in the subgame where iS has monopoly on the sales of product i. The critical number of one-stop shoppers $\widehat{\sigma}_i$ is therefore biased upwards under Assumption 2.

[19] If the share of one-stop shoppers is very low, e.g. $\sigma = 0$, then $P_{iS} < \upsilon_i$ is clearly not optimal, in which case the price will be equal to the monopoly price.

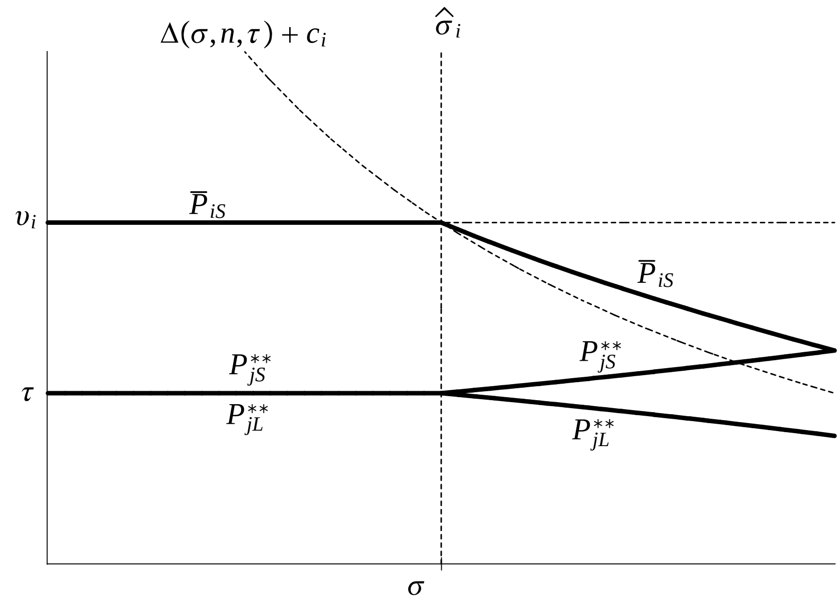

Figure 2: Equilibrium prices for products $i, j \in \{1, 2\}$ when the large retailer is not selling product i. ($n = 2$).

If $\sigma \leq \widehat{\sigma}_i$, then the equilibrium in this subgame is very simple. The large retailer's (out-of-equilibrium) flow payoff, when in disagreement with manufacturer i, is then equivalent to its equilibrium flow payoff r_L^* from above, but with $n-1$ instead of n products. I.e., the large retailer and the group of $n-1$ small retailers (excluding iS) compete as though product i does not exist, since its price P_{iS} is set equal to the consumers' reservation price υ_i. When $\sigma > \widehat{\sigma}_i$, on the other hand, the price for product i is below υ_i, which (ceteris paribus) will cause more one-stop shoppers to buy from the single-product retailers. The large retailer may therefore have to reduce its prices to compensate. In this case, the large retailer's flow payoff when in disagreement with i, is partially determined by the quality/cost gap Δ_i on manufacturer i's product. By solving for the optimal prices in both cases, $\sigma \leq \widehat{\sigma}_i$ and $\sigma > \widehat{\sigma}_i$, we find that the large retailer's flow payoff when not selling product i, is equal to

$$r_L^{-i} = \begin{cases} \dfrac{\tau k \left(3 + 2\left(k-1\right)\sigma\right)^2}{2\left(3 + \left(k-1\right)\sigma\right)^2 \left(1 + \left(k-1\right)\sigma\right)} & \text{if} \quad \sigma \leq \widehat{\sigma}_i \\ \dfrac{k\left(1 + \left(k-1\right)\sigma\right)\left(8\tau + 2k\sigma\tau - 5\sigma\tau - \sigma\Delta_i\right)^2}{2\tau\left(6 + 6k\sigma - 8\sigma + 2\sigma^2 - 3k\sigma^2 + k^2\sigma^2\right)^2} & \text{otherwise} \end{cases} \tag{32}$$

In equilibrium, the incremental gains from trade between manufacturer i and the multi-product retailer are equal to $r_L^* - r_L^{-i} \geq 0$. The fixed fee agreed between manufacturer

i and the large retailer is therefore equal to $F_{iL}^* = \lambda \left(r_L^* - r_L^{-i} \right)$. Accordingly, we can write manufacturer i's equilibrium profit as $\pi_i^* = \lambda \left(r_L^* - r_L^{-i} \right) + \lambda r_S^*$, and the profit of the multiproduct retailer as[20]

$$\pi_L^* = r_L^* - \lambda \sum_{i=1}^{n} \left(r_L^* - r_L^{-i} \right) \tag{33}$$

Notice that, as $\sigma \to 0$, $\pi_L^* \to n\pi_B^r$ and $\pi_i^* \to \pi_B^m$. I.e., as the share of one-stop shoppers approaches zero, the *per-product* profit of the large retailer becomes equal to the benchmark profit of a small retailer, π_r^B. In the same way, the profit of each manufacturer approaches the benchmark profit π_B^m.

We now make the following assumption.

Assumption 5. *We restrict attention to parameter values such that F_{iL}^* is increasing in σ over the interval $\sigma \in (\widehat{\sigma}_i, 1)$.*

Assumption 5 holds for a range of parameter values and makes it easier to prove our remaining results. Specifically, the assumption requires that Δ_i is not too high relative to the number of upstream firms n and the transportation cost τ. Note that the assumption that Δ_i (and/or λ) is not too high, is necessary also to ensure that the large retailer's profit in (33) is non-negative. We can derive the following results.

Lemma 3. *If $\sigma < \widehat{\sigma}_i$, then $F_{iL}^* \leq F^B$. Moreover, we have $F_{iL}^* < F^B$ everywhere on $\sigma \in (0, 1)$ as long as $\Delta_i < \tau \left(3 + 2k - \sqrt{(2 + k)\, 3k} \right) \equiv \Delta^*$.*

Proof. See Appendix B.

Proposition 2. *Assume $\sigma > 0$. A manufacturer is then strictly worse off when facing a multiproduct retailer as long as the manufacturer's quality/cost gap Δ_i is not too high; a sufficient condition is that $\Delta_i < \Delta^*$. The multiproduct retailer is strictly better off following an increase in the share of one-stop shoppers, as long as σ is not too high, and λ is not too low; a necessary condition is that $\lambda > 1/2$. More specifically, we have*

- $\lim_{\sigma \to 0} \partial \pi_i^* / \partial \sigma < 0$ *for all* $i = 1, ..., n$, *and*

- $\lim_{\sigma \to 0} \partial \pi_L^* / \partial \sigma > 0$ *as long as* $\lambda > 1/2$.

Proof. See Appendix B.

[20] It is assumed that the multiproduct retailer's profit in (33) is non-negative.

With a positive share of one-stop shoppers ($\sigma > 0$), the equilibrium flow payoff r_L^* of the large retailer becomes concave in the number of firms n. Loosely speaking: Starting at $\sigma = 0$, in the eyes of the large retailer, the manufacturers' products become "more substitutable" when increasing σ, in the sense that, when delisting a product, the multiproduct retailer will increase prices and earn more revenue on its other products. As each manufacturer negotiates on the retailer's margin – i.e., a manufacturer negotiates over its incremental contribution $r_L^* - r_L^{-i}$ to the retailer's profit taking as given the retailer's contracts with other manufacturers – each of them captures a smaller share of the profits as σ increases and r_L^* becomes concave. By the same token, there are two opposing forces affecting the large retailer's profit as the share of one-stop shoppers increases. On one hand, the retailer may be paying a smaller fixed fee to at least some of its manufacturers, i.e. $F_{iL}^* = \lambda \left(r_L^* - r_L^{-i} \right) < F^B$ for some $i \in 1, ..., n$, which affects the retailer's profit positively, ceteris paribus. On the other hand, as σ increases, the multiproduct retailer is unable to commit not to reduce its prices, and downstream profits is reduced as a result. Hence, the multiproduct retailer may benefit from an increase in the degree of one-stop shopping, but only as long as the decrease in the manufacturers' fixed fees is large enough – which implies that λ has to be sufficiently high.

Notice that Proposition 2 does not rule out $F_{iL}^* > F^B$ for some $i \in \{1, ..., n\}$. For a multiproduct retailer, it may be particularly important to get access to so-called must-carry brands, i.e. products with strong brand names. We may interpret this as products with a high quality/cost gap Δ_i in our model. When the multiproduct retailer lose access to such products (with high Δ_i), its total demand falls "over-proportionally", in the sense that a high portion of one-stop shoppers will switch shopping location to get hold of the delisted product, and in doing so they take all of their demand (for the rest of the products) with them. If Δ_i is high enough, this effect may even dominate the reduction in surplus that the manufacturer extracts from its small retailer (the competition effect). In this case, the manufacturer earns a strictly higher profit when facing a multiproduct retailer, compared to in our benchmark. We have the following result.

Proposition 3. *Assume $\sigma > 0$. Manufacturer $i = 1, ..., n$ may earn strictly higher profit when facing a multiproduct retailer. A necessary condition is that $\Delta_i > \tau \left(3 + 2k - k\sqrt{2} \right) \equiv \underline{\Delta} > \Delta^*$.* (Under Assumption 5, $\Delta_i > \underline{\Delta}$ is a sufficient condition only when $\sigma = 1$.)

Proof. See Appendix B.

Our model is similar in spirit, but the mirror image when it comes to market structure, to the model of Inderst and Wey (2007), who assume that a monopolist manufacturer is supplying a number of downstream firms that operate in separate markets. Inderst and Wey assume that the total surplus function is concave in the quantity supplied, and hence also concave in the number of buyers (or markets) served. This could for example be due to the supplier's cost function being convex (i.e., increasing marginal costs). Since small buyers negotiate more "on the seller's margin", where incremental contributions are small, a small buyer also captures a smaller portion of the total surplus relative to a large buyer, who negotiate over a large number of units (where incremental contributions are high). Horizontal cross-border mergers (i.e., forming a retail chain/ buyer cooperative) may therefore be profitable for the buyers in these models.[21] In our model, on the other hand, consumers' one-stop shopping behaviour makes the multiproduct retailer's flow profit concave in the number of upstream firms, n. Consequentially, each individual manufacturer may capture a smaller portion of the large retailer's total surplus, even though the manufacturers are not in direct competition with each other. This observation brings us to our next result.

Proposition 4. ($\sigma > 0$) *When facing a multiproduct retailer, it may sometimes be jointly profitable for a subset $M_S \subset \{1, .., n\}$ of manufacturers to form a cooperative (e.g., merging) before they enter into negotiations with the retailers.*

Proof. See Appendix B.

Proposition 4 states that one way for (otherwise independent) manufacturers to counter the buyer power of multiproduct retailers, is to form a sellers' cooperative before negotiations with the retailers take place. For example through a merger. (This follows directly from the concavity of the large retailer's equilibrium flow payoff.) This result is fully independent of the initial distribution of bargaining power, with the only condition that $\lambda > 0$. I.e., we only require that manufacturers always earn some positive profits. However, often the manufacturers will never be able to fully restore their benchmark profits. The reason for this is that, in a market with one-stop shopping, the overall industry profit is smaller when there is a multiproduct retailer, compared to in our benchmark situation with only single-product retailers. Hence, a merger for example between all n manufacturers, would only give the new sellers' cooperative a joint profit of λ times the overall industry profit, which is strictly smaller compared to in our benchmark.[22]

[21] See also Chipty and Snyder (1999) and Raskovich (2003). Horn and Wolinsky (1988) and Stole and Zwiebel (1996) make the same point, but in models of wage negotiations between firms and their employees. Similar effects emerge in DeGraba (2003) and Chae and Heidhues (2004), where the surplus function is concave due to either seller's or buyers' risk aversion.

[22] See also Schlippenbach and Wey (2011). In a model where two independent manufacturers negoti-

4 Dynamic efficiency

4.1 Investments in technology or product improvements

We have seen that in the short run, as long as some consumers are one-stop shoppers, the presence of a large retailer leads to lower retail prices for all products at all retail outlets. Which (trivially) gives a higher consumers' surplus. We have also seen that the retailer may benefit from being large, in the sense that the multiproduct retailer may be paying a lower fixed fee for at least some the products, and hence extracts a higher share of an otherwise smaller total profit. Manufacturers, on the other hand, may be adversely affected, in the sense that each of them receives a smaller share of a strictly smaller industry profit.

In the short run, however, the distribution of profits between manufacturers and retailers does not have any welfare consequences. It may, however, affect efficiency in the long run. Suppose we add a stage 0 to our model, where manufacturers are allowed to make some effort to become more efficient (reduce their unit cost c_i) or produce a higher quality (inrease υ_i). I.e., we consider the incentives of a manufacturer to further increase its initial quality/cost gap Δ_i. We define as $\varphi_i \equiv \Delta_i + s_i$ the new quality/cost gap after the manufacturer has made an effort to increase it by s_i, where $0 \leq s_i \leq c_i$.[23] Let $C_I(s_i)$ be the manufacturer's total cost of increasing the quality/ cost gap by s_i, where $C_I(0) = C_I'(0) = 0$, $C_I'(s_i) > 0$ for all $s_i > 0$, and $C'(s_i) \to \infty$ for $s_i \to c_i$.

Consider first the manufacturers' incentives when facing only single-product retailers. In this case we have $\pi_B^m = \lambda\tau - C_I(s_i)$. The manufacturer's incentives at the margin are then equal to $\partial\pi_B^m/\partial s_i = -C_I'$. We therefore get a corner solution where each manufacturer invests nothing in neither cost reductions nor quality improvements:

ate with a monopolist multiproduct retailer, they find that, with one-stop shopping, more (exogenous) bargaining power to the retailer (a smaller λ in our model), or a smaller number of one-stop shoppers (σ in our model), may cause manufacturers to prefer separation to merger. In their model, separation between the manufacturers is inefficient due to the assumption that retailers and manufacturers use linear wholesale contracts; a merger will then induce manufacturers to internalise the demand externalities (due to consumers' one-stop shopping behaviour) by reducing their wholesale prices, which ultimately causes lower retail prices for consumers. In our model, on the other hand, there is no (short-run) efficiency gain from an upstream merger; it only affects the overall distribution of surplus. This is due to the assumption that manufacturers and retailers use bilateral efficient (two-part) tariffs, and that wholesale prices always equal marginal costs. Hence, there is no double marginalisation problem to rectify.

[23]We put an upper bound on s_i to secure an interior solution. Our assumption implies that if c_i is "high", there is more scope for both cost reductions and quality improvements. We feel this is a realistic assumption; if the manufacturers costs are already high, there may be ways for the manufacturer to utilise its resources more efficiently, for example to produce more quality without increasing costs – or to reduce its costs without affecting the quality level.

Lemma 4. *In our benchmark with only single-product retailers, the manufacturers have no incentives to further increase their quality/cost gaps. I.e., in equilibrium we have* $s_i^B = 0$ *for all* $i \in \{1, ..., n\}$*.*

Hotelling competition is again a special case. With sufficient downstream competition, i.e., $\tau \leq v_i - c_i$ for all $i = 1, ..., n$, we have zero investments at the upstream level. First, consumers' unit demand implies that retailers pass on all of their costs to consumers. Also, a *reduction* in prices has no effect on total demand. This means that there are no gains from further cost reductions. With the addition of retail competition, any rents that accrue from increasing consumers' willingness-to-pay, is competed away by the retailers. Hence, there is no gain from quality improvements either. Manufacturers therefore invest too little in our benchmark.

Now, consider instead a manufacturer's incentives when facing a multiproduct retailer. At stage 0, each manufacturer chooses s_i so as to maximise

$$\pi_i^* (\varphi_i) = \lambda \left(r_L^* - r_L^{-i} (\varphi_i)\right) + \lambda r_S^* - C_I (s_i), \tag{34}$$

where we substitute Δ_i with $\varphi_i = \Delta_i + s_i$ in the manfuacturer's profit function. The manufacturer's incentives at the margin are then equal to

$$\mu_i (s_i) \equiv \begin{cases} -C' & \text{if} \quad \sigma < \widehat{\sigma}_i \\ \lambda \dfrac{\sigma k (1 + k\sigma - \sigma)(8\tau - 5\sigma\tau + 2k\sigma\tau - \sigma\varphi_i)}{\tau (6 + 6k\sigma - 8\sigma + 2\sigma^2 - 3k\sigma^2 + k^2\sigma^2)^2} - C' & \text{otherwise} \end{cases}, \tag{35}$$

where $\mu_i (0) = 0$ if $\sigma < \widehat{\sigma}_i$ and $\mu_i (0) > 0$ if $\sigma \geq \widehat{\sigma}_i$. We thus have the following result.

Proposition 5. *When facing a multiproduct retailer, manufacturer i's marginal costs may be strictly lower in equilibrium, compared to the benchmark situation with only single-product retailers. Similarly, manufacturer i's choice of product quality may be strictly higher. A sufficient condition is that* $\sigma \geq \widehat{\sigma}_i$*.*

A manufacturer may be able to counteract the power of the large retailer by making an effort to become more efficient (or to improve its product quality): By supplying its small retailer at a lower per-unit cost (or by improving quality), the manufacturer may be able to tempt more one-stop shoppers to switch shopping location should the large retailer delist its product. Because one-stop shoppers are extra valuable to the large retailer, both cost reductions and quality improvements thus undermine the value of the large retailer's flow payoff when in disagreement with the manufacturer, which in turn increases the profit that the manufacturer is able to extract in negotiations with the retailer – provided, of course, the share of one-stop shoppers is high enough. A manufacturer's incentives may therefore be strictly higher compared to in our benchmark, even if the manufacturer earns a strictly lower profit in equilibrium.[24]

Our result is similar to that of Inderst and Wey (2011). They consider a model where a single manufacturer supplies a number of markets, where, in each maret, two local retilers compete a-la Cournot. Inderst and Wey show that an increase in retailer size, measured as the number of markets the retailer, or retail chain (buyer group), operates in, may give rise to buyer power by creating a situation where the retailer can credibly threaten to integrate backwards into supply.[25] As in our model, this creates competition for the manufacturer's product both in and out of equilibrium; the ability to integrate backwards implies that a large retailer is active even if negotiations break down with the manufacturer. The disagreement profit (or outside option) of a large retailer is therefore partially determined by how efficiently the manufacturer can supply the retailer's (local) rival; by supplying its product at a lower marginal cost, the manufacturer intensifies out-of-equilibrium competition for the retailers. This reduces the value of the large retailer's outside option, and in turn enables the manufacturer to capture a higher share of the total surplus in the negotiations. This bargaining effect comes in addition to the standard effects that lower unit costs may have on the total surplus; hence, the presence of fewer but larger buyers increases the manufacturer's incentives to become more efficient in their model. Our result identifies another way in which this bargaining effect may materialise; namely through the combination of retailer size, measured here as the number of products the retailer stocks, and consumers' one-stop shopping habbits.

4.2 Product entry

Manufacturers' incentives for investments in respectively product improvements (e.g., brand building and quality improvements) and in new product introduction (entry), are generally not the same. Hence, it may very well be that more buyer power gives the

[24] Notice also that, due to Assumption 2, Proposition 5 is biased in favour of weaker incentives for the manufacturers – since competition ("out-of-equilibrium") would be even tougher without Assumption 2. I.e., the condition $\sigma > \widehat{\sigma}_i$ would then be more likely to hold.

[25] Inderst and Wey (2011) follow the approach developed by Katz (1987), where, in case of disagreement with its manufacturer, a buyer is able to pay a fixed cost to integrate backwards into supply. When the buyer operates in several markets, the buyer is able to spread this fixed cost over a higher number of units produced. Hence, as the buyer grows, the threat to integrate backwards becomes more credible.

manufacturer incentives to exert more effort to improve its product, given that it has entered the upstream market, but at the same time provides the manfuacturer with weaker incentives to enter the market in the first place.

In the following we ignore investments to increase the quality and reduce costs, and assume instead that, at stage 0, each manufacturer i has to pay a fixed cost, which we denote $\theta > 0$, in order to enter the upstream market. Suppose that there is consumer demand for a predetermined number of products, $N \geq 2$, and that there is an equal number of manufacturers, $i \in \{1, ..., N\}$, each of them producing one product, and who are ready to enter the market. How many, and which manufacturers will enter?

In our benchmark, the condition for all N manufacturers to enter is simply $\lambda\tau > \theta$. Suppose this condition holds. When the manufacturers face a multiproduct retailer instead, the equilibrium number n^* that enters the market is in this case always $n^* \leq N$. This follows directly from Proposition 2. If, for some manufacturers, $\sigma < \widehat{\sigma}_i$, the following is a sufficient condition for $n^* < N$

$$\begin{aligned} \lambda\tau &> \theta > \lambda \left[\frac{9\tau}{2(3+K\sigma)^2} \right. \\ &\left. + \frac{\tau(K+1)(3+2K\sigma)^2}{2(3+K\sigma)^2(1+K\sigma)} - \frac{\tau K(3+2(K-1)\sigma)^2}{2(3+(K-1)\sigma)^2(1+(K-1)\sigma)} \right] \end{aligned} \tag{36}$$

where $K \equiv N-1$. Hence, since some manufacturers may earn strictly lower profits when facing a multiproduct retailer, some of these manufacturers may choose not to enter the market at stage 0, provided that θ is sufficiently high. For $\tau = 1$, $K = 3$, and $\lambda = .65$, condition (36) reduces to

$$.65 > \theta > \frac{.65\left(18 + 114\sigma + 257\sigma^2 + 227\sigma^3 + 48\sigma^4 - 16\sigma^5\right)}{2(1+\sigma)^2(3+2\sigma)^2(1+3\sigma)(1+2\sigma)}. \tag{37}$$

We therefore have the following straightforward result.

Proposition 6. *Assume i) a uniform entry cost θ, and that ii) θ is such that all manufacturers enter the market in our benchmark, i.e. $\lambda\tau > \theta$. When facing a multiproduct retailer, the equilibrium number of manufacturers that enter the market satisfies $n^* \leq N$, where $n^* < N$ if θ is sufficiently close to $\lambda\tau$ and $\sigma < \widehat{\sigma}_i$ for some $i \in \{1, ..., N\}$.*

It is perhaps more realistic to assume that the manufacturers have different entry costs, and, moreover, that a manufacturer's entry cost depend on the type of product it sells. For example, it may be natural to assume that the entry cost of manufacturer i,

θ_i, is higher when the manufacturer produces a high-value product. I.e., if Δ_i is high, then θ_i is also high. Suppose that $\theta_i > \lambda\tau$ for some manufacturers with high Δ_i. Then things are less clear; some manufacturers who would not have entered in our benchmark, may enter instead when facing a multiproduct retailer – provided that Δ_i is high enough. This follows directly from Proposition 6. Suppose $\sigma = 1$ and $\theta_i = \theta + \varepsilon > \lambda\tau = \theta$, where ε is an infinitesimal value. Manufacturer i then does not enter in our benchmark. A sufficient condition that manufacturer i will enter when facing a multiproduct retailer instead, is then $\Delta_i > 3\tau + 2k\tau - k\tau\sqrt{2} \equiv \underline{\Delta}$. Hence, it is possible to construct scenarios where different manufacturers choose to enter in our benchmark compared to when facing a multiproduct retailer, and even scenarios where more manufacturers enter when facing a multiproduct retailer.

5 Conclusions

In this article we have analysed how buyer power relates to retailer size in markets with one-stop shopping behaviour. An often expressed view is that, in these markets, the trend where consumers reduce the number of weekly shopping trips, and hence bundle more of their purchases, has contributed to a shift in power towards large, multiproduct retailers. The fear is that, as the manufacturers earn a smaller share of the profits, they may respond by cutting back on innovation and product development.

We have contrasted two extreme cases: i) The case when all retailers are single-product retailers, and ii) the case where one retailer is a multiproduct retailer that competes against a group of single-product retailers. Our results confirm that large retailers may be able to obtain discounts, and therefore may be earning a higher profit (per product) than their smaller rivals. However, in contrast to some often expressed views, we do not find that large retailers harm supplier's incentives to innovate. On the contrary, we find that, if anything, large retailers tend to stimulate both product and process innovation at the upstream level, and that consumers, as a result, may benefit from both lower retail prices and higher quality on products.

By lowering its marginal cost, the manufacturer is able to offer its small retailer a lower wholesale price, which in turn translates into a lower final price for the consumers. By doing this, the manufacturer may be able to tempt more one-stop shoppers to switch shopping location should the multiproduct retailer delist its product. This undermines the value of the large retailer's disagreement payoff in the negotiations with the manufacturer – since one-stop shoppes, who buy many products, are more valuable to the large retailer than top-up shoppers, who only buy one product. Cost reductions (or quality improvements) may therefore contribute to increasing the profit that the manufacturer can extract in negotiations with the multiproduct retailer.

We also briefly discussed the effect of multiproduct retailers on product entry. Our results are then unclear. Given that manufacturers often earn lower profits when facing a multiproduct retailer, it may be that some manufacturers will choose not to enter the market. However, depending on our assumptions about manufacturers entry costs, it is possible to contstruct scenarios where different manufacturers enter the market when facing a multiproduct retailer, compared to in our bencmark case with only single-product retailers. This is an issue that needs further investigation. In particular, we have only investigated the case with manufacturers that produce independent products (i.e., entry of all new product categories). The same dynamics may not apply when considering for example the incentives for manufacturers of introducing new products variants (substitutes) in their respective product categories.

Few papers in the economic literature analyse the effects of consumers' tendency to bundle their purchases. In particular, more work needs to be done to understand how this affects vertical relations. There are different ways to extend our model to gain additional insight. An interesting extension would be to allow both the retailers and the manufacturers to merge. The results could be interesting for competition policy, since the conclusion could have implications for how we should think of mergers between producers of seemingly independent products. Our model also contains some shortcomings that deserve future investigation. For example, even though we believe our qualitative results should still apply, it may be worth investigating the case when consumers' demand is elastic.[26] A possible extension could also be to investigate what happens when some of the manufacturers' products are substitutes. Or the situation where the retailers have access to an alternative source of supply for at least some of the products, for example a private label of inferior quality. We leave these questions for future research.

Appendix A: Retail market equilibria

Here we detail the retail market equilibrium when the large retailer sells all products, and every small retailer is active. According to (22) and (23), we have an equilibrium at stage 1 where each manufacturer $i \in \{1, ..., n\}$ and the retailers, L and iS, agree on

[26] This may prove technically difficult, however.

$w_{iL}^{*}=w_{iS}^{*}=c_i$. The large retailer's profit at stage 2 is then

$$\begin{aligned}\pi_L &= \sum_{i=1}^{n}\left\{(P_{iL}-c_i)\,Q_{iL}-F_{iL}\right\} \\ &= \sum_{i=1}^{n}\left\{\left[\sigma\left(\frac{1}{2}-\frac{\sum_{i=1}^{n}(P_{iL}-P_{iS})}{2\tau}\right)\right.\right. \\ &\qquad \left.\left.+(1-\sigma)\left(\frac{1}{2}-\frac{P_{iL}-P_{iS}}{2\tau}\right)\right](P_{iL}-c_i)-F_{iL}\right\}, \qquad (38)\end{aligned}$$

and the profit of the small retailer selling product i, is

$$\begin{aligned}\pi_{iS} &= (P_{iS}-c_i)\,Q_{iS}-F_{iS} \\ &= \left[\sigma\left(\frac{1}{2}+\frac{\sum_{i=1}^{n}(P_{iL}-P_{iS})}{2\tau}\right)\right. \\ &\qquad \left.+(1-\sigma)\left(\frac{1}{2}-\frac{P_{iL}-P_{iS}}{2\tau}\right)\right](P_{iS}-c_i)-F_{iS} \qquad (39)\end{aligned}$$

Taking the derivative of (38) w.r.t. the prices $P_{1L},...,P_{nL}$ yields n first-order conditions for the multiproduct retailer:

$$\begin{aligned}-\frac{P_{1L}-c_1}{2\tau}+\sigma\left(\frac{1}{2}-\frac{\sum_{i=1}^{n}(P_{iL}-P_{iS})}{2\tau}\right)+(1-\sigma)\left(\frac{1}{2}-\frac{P_{1L}-P_{1S}}{2\tau}\right) \\ =\frac{\sigma}{2\tau}\textstyle\sum_{j\neq 1}(P_{jL}-c_j) \qquad (40) \\ \vdots \\ -\frac{P_{nL}-c_n}{2\tau}+\sigma\left(\frac{1}{2}-\frac{\sum_{i=1}^{n}(P_{iL}-P_{iS})}{2\tau}\right)+(1-\sigma)\left(\frac{1}{2}-\frac{P_{nL}-P_{nS}}{2\tau}\right) \\ =\frac{\sigma}{2\tau}\textstyle\sum_{j\neq n}(P_{jL}-c_j)\end{aligned}$$

Taking the derivative of the profit for each small retailer, $iS\in\{1S,...,nS\}$, w.r.t its price P_{iS}, yields n first-order conditions (one for each retailer)

$$\begin{aligned}-\frac{P_{1S}-c_1}{2\tau}+\sigma\left(\frac{1}{2}+\frac{\sum_{i=1}^{n}(P_{iL}-P_{iS})}{2\tau}\right)+(1-\sigma)\left(\frac{1}{2}+\frac{P_{1L}-P_{1S}}{2\tau}\right)=0 \\ \vdots \qquad (41) \\ -\frac{P_{nS}-c_1}{2\tau}+\sigma\left(\frac{1}{2}+\frac{\sum_{i=1}^{n}(P_{iL}-P_{iS})}{2\tau}\right)+(1-\sigma)\left(\frac{1}{2}+\frac{P_{nL}-P_{nS}}{2\tau}\right)=0\end{aligned}$$

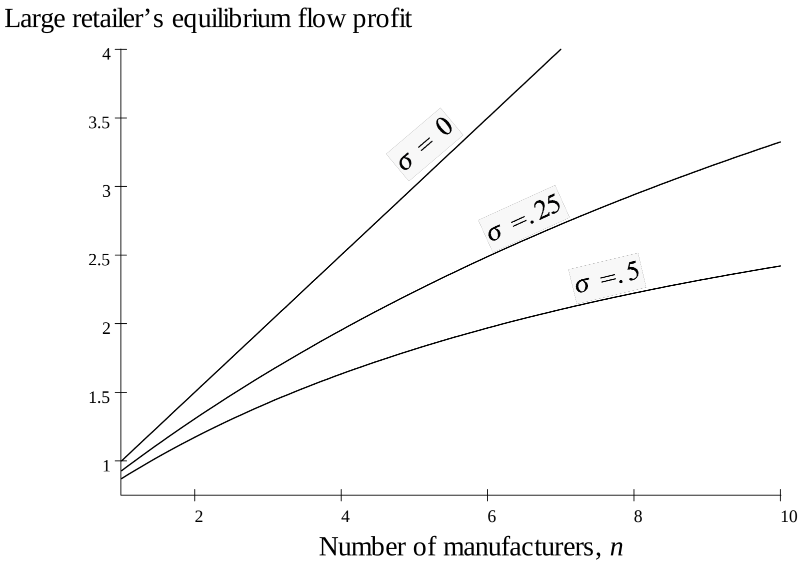

Figure 3: The multiproduct retailer's flow profit as a function of the number of products/ upstream firms.

Notice the symmetry. By imposing $P_{iL} = p_{iL} + c_i$ and $P_{iS} = p_{iS} + c_i$ for all $i \in \{1, ..., n\}$, setting $p_{1S} = ... = p_S$ and $p_{1L} = ... = p_L$, and defining $k \equiv n-1$, we can write the first-order condtitions for the large retailer and each small retailer, respectively, as

$$-\frac{1}{2\tau}p_L + \sigma\left(\frac{1}{2} - \frac{(k+1)(p_L - p_S)}{2\tau}\right) + (1-\sigma)\left(\frac{1}{2} - \frac{p_L - p_S}{2\tau}\right) = \sigma\frac{1}{2\tau}kp_L \tag{42}$$

and

$$-\frac{1}{2\tau}p_S + \sigma\left(\frac{1}{2} + \frac{(k+1)(p_L - p_S)}{2\tau}\right) + (1-\sigma)\left(\frac{1}{2} + \frac{p_L - p_S}{2\tau}\right) = 0. \tag{43}$$

Solving these for $p_L = p_L^*$ and $p_S = p_S^*$, respectively, and setting $P_{iL}^* = p_L^* + c_i$ and $P_{iS}^* = p_S^* + c_i$ for all $i \in \{1, ..., n\}$, yields the prices in (24). Inserting these into the retailers' flow payoffs $r_L = \sum_{i=1}^{n} (P_{iL} - c_i) Q_{iL}$ and $r_{iS} = (P_{iS} - c_i) Q_{iS}$, yields the expressions in (25) and (26). r_L^* is plotted in Figure 3 for $\tau = 1$, and for different values on σ. Notice how, when increasing σ, r_L^* becomes concave in the number of firms $n = k+1$.

Proof of Lemma 2. When not stocking product i, the large retailer has $n-1$ symmetric first-order conditions. By the same logic, the first-order conditions are symmetric also for the $n-1$ small retailers who are not selling product i. Using these symmetry properties, and setting $P_{jL} = p_L + c_j$ and $P_{jS} = p_S + c_j$ for all $j \in \{1, ..., n\}$, $j \neq i$, and $P_{iS} = p_{iS} + c_i$, we can write the first-order conditions for the large retailer and the k small retailers who not selling product i, respectively, as

$$-\frac{p_L}{2\tau}+\sigma\left(\frac{1}{2}-\frac{k\left(p_L-p_S\right)+\Delta_i-p_{iS}}{2\tau}\right)+\left(1-\sigma\right)\left(\frac{1}{2}-\frac{p_L-p_S}{2\tau}\right) = \frac{\sigma}{2\tau}\left(k-1\right)p_L \quad (44)$$

$$-\frac{p_S}{2\tau}+\sigma\left(\frac{1}{2}+\frac{k\left(p_L-p_S\right)+\Delta_i-p_{iS}}{2\tau}\right)+\left(1-\sigma\right)\left(\frac{1}{2}+\frac{p_L-p_S}{2\tau}\right) = 0 \quad (45)$$

where $\Delta_i \equiv \upsilon_i - c_i$. Notice that if the price for product i is equal to the monopoly price, $p_{iS}+c_i=\upsilon_i$, then (44) and (45) are equivalent to (42) and (43), but with k instead of $n=k+1$ products. The first-order condition for retailer iS, who has monopoly on the sales of product i, is

$$-\frac{\sigma}{2\tau}p_{iS}+\sigma\left(\frac{1}{2}+\frac{k\left(p_L-p_S\right)+\Delta_i-p_{iS}}{2\tau}\right)+\left(1-\sigma\right)\geq 0. \quad (46)$$

Assuming we have an interior solution (i.e., that $P_{iS}<\upsilon_i$, in which case (45) should hold with equality), the solutions to (44), (45) and (46), setting $p_L=p_L^{**}$, $p_S=p_S^{**}$ and $p_{iS}=\rho_i-c_i$, yields

$$P_{jL}^{**} = c_j+\frac{8\tau-\sigma\left(5\tau-2k\tau+\Delta_i\right)}{6+\sigma^2\left(k-1\right)\left(k-2\right)+2\left(3k-4\right)\sigma} \quad (47)$$

$$P_{jS}^{**} = c_j+\frac{4\tau+\sigma\left(2k\tau-3\tau+\Delta_i\right)+\sigma^2\left(k-1\right)\left(\tau+\Delta_i\right)}{6+\sigma^2\left(k-1\right)\left(k-2\right)+2\left(3k-4\right)\sigma} \quad (48)$$

$$\rho_i = p_S^{**}+c_i+\frac{\left(1-\sigma\right)\left[6\tau+\sigma^2\left(k-1\right)\left(k\tau+2\Delta_i\right)+\sigma\left(8k\tau-9\tau+3\Delta_i\right)\right]}{\sigma\left(6+\sigma^2\left(k-1\right)\left(k-2\right)+2\left(3k-4\right)\sigma\right)} \quad (49)$$

In solving $\rho_i=\upsilon_i$ for Δ_i, we find that ρ_i is below or equal to the reservation price υ_i only as long as

$$\Delta_i \geq \tau\frac{6+\sigma^2\left(k-1\right)\left(k-6\right)+\sigma\left(8k-11\right)-\sigma^3\left(k-1\right)^2}{\left(3+k\sigma-\sigma\right)\left(1+k\sigma-\sigma\right)\sigma} \equiv \Delta\left(\sigma,n,\tau\right). \quad (50)$$

in which case we have an interior solution to (46). We can rewrite this constraint as $\upsilon_i \geq \Delta\left(\sigma,n,\tau\right)+c_i$. Taking the derivative of $\Delta\left(\sigma,n,\tau\right)$ w.r.t. σ, yields

$$\frac{\partial\Delta\left(\sigma,n,\tau\right)}{\partial\sigma}=-\tau\frac{\left\{\begin{array}{c}18+\left(k-2\right)\left(k-1\right)^3\sigma^4+16\left(k-1\right)^3\sigma^3\\+\left(47k-44\right)\left(k-1\right)\sigma^2+48\left(k-1\right)\sigma\end{array}\right\}}{\sigma^2\left(3+k\sigma-\sigma\right)^2\left(1+k\sigma-\sigma\right)^2}<0 \quad (51)$$

which is negative. Hence, as σ increases, the constraint, $\upsilon_i \geq \Delta(\sigma, n, \tau) + c_i$, becomes more relaxed. Hence, there exist a critical value $\widehat{\sigma}_i$, such that when $\sigma \leq \widehat{\sigma}_i$, the constraint binds and the equilibrium price for product i is $\overline{P}_{iS} = \upsilon_i$; if $\sigma > \widehat{\sigma}_i$, the constraint does not bind, and the equilibrium price is $\overline{P}_{iS} = \rho_i < \upsilon_i$. Taking the derivative of $\Delta(\sigma, n, \tau)$ w.r.t the number of firms, $n = k + 1$, yields

$$\frac{\partial \Delta(\sigma, n, \tau)}{\partial k} = -\tau \frac{\left(\sigma(4-\sigma) k^2 + (1-\sigma)(3-\sigma)(2k-1)\right)\sigma}{(3 + k\sigma - \sigma)^2 (1 + k\sigma - \sigma)^2} < 0, \tag{52}$$

which is negative. Hence, as the number of firms, $n = k + 1$, increases, the constraint, $\upsilon_i \geq \Delta(\sigma, n, \tau) + c_i$, becomes more relaxed, which means that the critical value $\widehat{\sigma}_i$ is a decreasing function of the number of upstream firms. Finally, it is straightforward to see that as either υ_i increases and/ or c_i decreases, the constraint becomes more relaxed, which means that $\widehat{\sigma}_i$ is also a decreasing function of the quality/ cost gap, Δ_i.

If $\sigma \leq \widehat{\sigma}_i$ and $\overline{P}_{iS} = \upsilon_i$, we can solve the first-order conditions (44) and (45) for $p_L = p_L^{**}$ and $p_S = p_S^{**}$ respectively, and set $P_{jL}^{**} = p_L^{**} + c_j$ and $P_{jS}^{**} = p_S^{**} + c_j$. We then obtain the prices

$$P_{jL}^{**} = \tau + c_j + \sigma \frac{\tau(2 + \sigma(k-1))(k-1)}{(3 + \sigma(k-1))(1 + \sigma(k-1))} \; ; \; P_{jS}^{**} = \tau + c_j - \sigma \frac{(k-1)\tau}{(3 + \sigma(k-1))}, \tag{53}$$

which are equivalent to the prices in (24), but with k instead of $n = k + 1$ products. It is easily checked that the prices in (53), and the prices in (47) and (48), are equal when $\upsilon_i = \Delta(\sigma, n, \tau) + c_i$. Inserting the equilibrium prices into the large retailer's flow payoff, $r_L = \sum_{j \neq i} (P_{jL} - c_j) Q_{jL}$, yields the expressions in (31). **Q.E.D.**

Appendix B

An example for Assumption 5 The fixed fee paid by the large retailer to manufacturer i, is $F_{iL}^* = \lambda\left(r_L^* - r_L^{-i}\right)$. By setting $n = 3$, $\tau = 1$, $\upsilon_i = 2$, $\lambda = 1$ and $c_i = 0$, we obtain $\widehat{\sigma}_i \approx 0.62269$. The fixed fee is then equal to

$$F_{iL}^* = \begin{cases} \dfrac{81 + 297\sigma + 405\sigma^2 + 195\sigma^3 - 8\sigma^4 - 16\sigma^5}{2(1+2\sigma)(1+\sigma)(3+\sigma)^2(3+2\sigma)^2} & \text{if} \quad \sigma \leq 0.62269 \\ \dfrac{(69\sigma - 18\sigma^2 + 103)\sigma^2 - 10}{4(2\sigma+3)^2(2\sigma+1)} & \text{otherwise} \end{cases} \tag{54}$$

(53) is plotted in Figure 4. It is easy to see that F_{iL}^* is increasing in σ over the interval $(0.62269, 1)$.

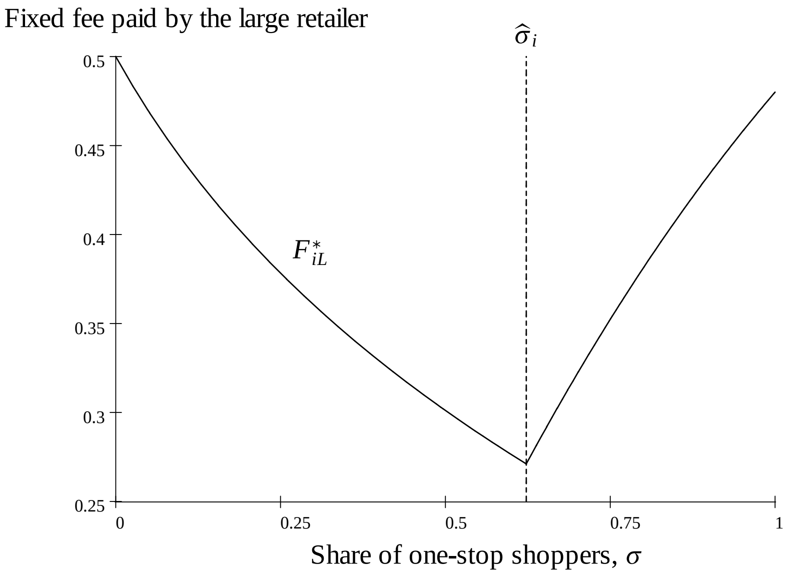

Figure 4: The fixed fee paid by the large retailer to manufacturer i.

Proof of Lemma 3. When $\sigma > 0$, it follows from the concavity of $r^*_L(n)$, that $F^*_{iL} = \lambda\left(r^*_L - r^{-i}_L\right) < F^B$ when $\sigma \in (0, \widehat{\sigma}_i)$ Let $g_r(k, \sigma)$ be the second order partial derivative of r^*_L w.r.t $k = n - 1$:

$$g_r = -\sigma\tau \frac{\left\{\begin{array}{c} 9(3-2\sigma) + k^4 4\sigma^4 (4-\sigma) + k^3 3\sigma^3 (19-4\sigma) \\ +k^2 9\sigma^2 (9-2\sigma) + k 3\sigma (21-8\sigma) \end{array}\right\}}{(k\sigma+3)^4 (k\sigma+1)^3} < 0 \tag{55}$$

This is strictly negative as long as $\sigma > 0$. r^*_L is therefore concave in the number of upstream firms n. Under Assumption 5, $\lambda\left(r^*_L - r^{-i}_L\right)$ is strictly increasing in σ over the interval $\sigma \in (\widehat{\sigma}_i, 1)$. When $\sigma = 1$, we have

$$F^*_{iS} = \frac{\lambda(6\tau + 4k\tau - \Delta_i)\Delta_i}{2(k+3)^2\tau}, \tag{56}$$

provided that $\widehat{\sigma}_i < 1$. In solving the following inequality

$$\frac{\lambda(6\tau + 4k\tau - \Delta_i)\Delta_i}{2(k+3)^2\tau} - \frac{\lambda\tau}{2} \leq 0 \tag{57}$$

for Δ_i, we obtain $\Delta_i \leq \tau\left(3 + 2k - \sqrt{3}\sqrt{k(2+k)}\right) \equiv \Delta^*$. **Q.E.D.**

Proof of Proposition 2. Suppose $\sigma \in (0, \widehat{\sigma}_i)$ for all $i \in \{1, ..., n\}$. From the concavity of $r_L^*(n)$, it follows that manufacturer i earns strictly lower profits compared to in our benchmark. We can write the profit of the large retailer in this case as

$$\pi_L^* = r_L^*(n) - n\lambda \left[r_L^*(n) - r_L^*(k) \right], \tag{58}$$

where $k = n - 1$. Suppose $\lambda = 1$, then we have $\pi_L^* = 0$ when $\sigma = 0$. If $\sigma > 0$, then $\pi_L^* > 0$ iff

$$\frac{r_L^*(k)}{n-1} > r_L^*(n) - r_L^*(k), \tag{59}$$

which holds iff $r_L^*(n)$ is strictly concave. If $\lambda < 1$, then $\pi_L^* = n(1-\lambda)\tau/2$ when $\sigma = 0$. The multiproduct retailer then earns strictly higher profit when $\sigma > 0$ iff

$$\frac{r_L^*(k)}{n\lambda - 1} - \frac{n\tau(1-\lambda)}{2(n\lambda - 1)} > r_L^*(n) - r_L^*(k) \tag{60}$$

which holds iff $r_L^*(n)$ is strictly concave and λ is not too low. Taking the derivative of π_L^* as $\sigma \to 0$, yields

$$\lim_{\sigma \to 0} \frac{\partial \pi_L^*}{\partial \sigma} = \frac{1}{6}\tau k(k+1)(2\lambda - 1), \tag{61}$$

which is positive as long as $\lambda > 1/2$. Taking the derivative of $\pi_i^* = \lambda\left(r_L^* - r_L^{-i}\right) + \lambda r_S^* = \lambda\left[r_L^*(n) - r_L^*(k)\right] + \lambda r_S^*$, as $\sigma \to 0$, yields

$$\lim_{\sigma \to 0} \frac{\partial \pi_i^*}{\partial \sigma} = -\frac{2}{3}\tau\lambda k, \tag{62}$$

which is negative. **Q.E.D.**

Proof of Proposition 3. The manufacturer earns strictly lower profit when $\sigma \in (0, \widehat{\sigma}_i)$, as shown above. Under Assumption 5, F_{iL}^* is increasing in σ over the interval $\sigma \in (\widehat{\sigma}_i, 1)$. Hence, we have to evaluate manufacturer i's profit π_i^* as $\sigma \to 1$. This yields

$$\lim_{\sigma \to 1} \pi_i^* = \lambda \frac{9\tau^2 + \Delta_i(6\tau + 4k\tau - \Delta_i)}{2\tau(k+3)^2} \tag{63}$$

assuming $\widehat{\sigma}_i < 1$, which is strictly higher than $\pi_B^m = \lambda\tau$ iff $\Delta_i > \tau\left(3 + 2k - \sqrt{2}k\right) = \underline{\Delta}$. **Q.E.D.**

Proof of Proposition 4. To demonstrate that a merger between manufacturers (before negotiations with the retailers take place) may be profitable, it is sufficient to give an example. Take the simplest case: Suppose $\sigma < \widehat{\sigma}_i$ for all $i \in \{1, ..., n\}$, and that all n manufacturers decide to merge. Since the large retailer's disagreement payoff is zero in the negotiations with the merged manufacturer, the manufacturers' joint (post-merger) profit is simply $\Pi_M = \lambda \left(r_L^* \left(n\right) + n r_S^*\right)$. Their (joint) pre-merger profit is $n\pi_i^* = \lambda n \left(r_L^* \left(n\right) - r_L^* \left(k\right) + r_S^*\right)$. We then have

$$\Pi_M - n\pi_i^* = \left(k+1\right) k\sigma\tau\lambda \frac{\left\{ \begin{array}{c} 27 + 27\left(2k-1\right)\sigma + 3\left(17k^2 - 17k + 3\right)\sigma^2 \\ +12k\left(2k-1\right)\left(k-1\right)\sigma^3 + 4\left(k-1\right)^2 k^2 \sigma^4 \end{array} \right\}}{2\left(1+k\sigma\right)\left(1+k\sigma-\sigma\right)\left(3+k\sigma\right)^2\left(3+k\sigma-\sigma\right)^2} > 0 \qquad (64)$$

which is strictly positive as long as $\sigma, \lambda > 0$. **Q.E.D.**

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