Buying Groups and Product Variety

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Abstract

We study the impact of retailers' buying groups on product variety and profit sharing within the vertical chain with both multi-product suppliers and retailers. We consider a setting in which capacity constrained retailers operate in separated markets and must select their assortment in a set of differentiated products offered by large and small suppliers. Retailers may either have independent listing strategies, or build a buying group, thereby committing to a joint listing assortment. This alliance may cover the whole product line (full buying group) or only part of it (partial buying group, targeting only the products of large producers). We show that retailers may enhance their buyer power by jointly committing to a common listing strategy. As a result, buying groups reduce the overall product variety, consumer surplus, suppliers' profit and welfare. Authorizing only partial buying groups may limit welfare losses, but it is not sufficient to prevent exclusion of the small suppliers.

Keywords: Vertical relations, buying group, buyer power, vertical foreclosure.

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1 Introduction

Buying groups are purchasing alliances between retailers designed to enable them to negotiate together with their suppliers over the listing of products and/or tariffs. Such alliances are not supposed to affect downstream competition, as retailers keep operating their stores independently. Those agreements are widespread, and they often gather retailers that operate in different countries.[1] Although buying groups have long been well perceived by competition authorities, their welfare benefits are currently being reconsidered by several Competition Authorities, including the European Commission[2] and the French[3] and Belgian[4] national authorities.

The standard argument in favour of buying group is that they are likely to increase buyer-power and enable retailers to obtain discounts that translate into lower consumer prices. This "countervailing power" effect, first coined by Galbraith (1952), has been largely debated in the literature. Recent theoretical developments however point out that they rely on strong assumptions regarding the shape of tariffs, namely linear contracts (see von Ungern-Sternberg (1996) and Iozzi and Valletti (2014)) and the intensity of retail competition. Yet it has been widely documented that tariffs in the retail sector are scarcely linear (see Berto Villas-Boas (2007) and Bonnet and Dubois (2010)), and that the retail sector has achieved a high level of concentration both in Europe and in the United States (see Allain et al. (2017), Barros et al. (2006), and Hosken et al. (2018)). Besides, recent theoretical developments analyze the

[1]For instance, the buying group AMS, set up in 1988, is an alliance between Delhaize (Belgium), Essalunga (Italy) and Migros (Switzerland); European Marketing Distribution, created in 1989, grouped retailers from 20 countries including Germany, the Netherlands, Italy, Spain, Portugal, and Russia; Agecore, created in 2015, is an alliance between Colruyt (Belgium), Conad (Italy), Coop (Switzerland), Edeka (Germany), and Eroski (Spain); Eurelec has been created in 2016 by Leclerc (France) and Rewe (Germany); Horizon, set up in 2019, is an alliance between Casino and Auchan (France), Dia (Spain), Metro (Germany), Schiever Group (France and Poland).

[2]The European Commission is investigating supermarket commercial strategies and the conditions they impose when they build alliances: see Reuters `https://www.reuters.com/article/us-eu-retail-france-antitrust/eu-antitrust-inspectors-investigate-frances-casino-intermarche-idUSKCN1SS0TC`.

[3]The Loi Macron 2015-990 made mandatory for retailers to notify to the Competition Authority their decision to create a buying group at least two months in advance. Yet, no tools for controlling such alliances were granted to the Competition Authorities.

[4]The Belgian Competition Authority launched an inquiry in 2019 regarding the practices of Carrefour and Provera.

welfare effects of buyer power, pointing out its potential adverse effects on product variety, innovation, and the scope for collusion (see Inderst and Mazzarotto (2008)). Despite these potential adverse effects, purchasing alliances are not subject to approval by competition authorities, contrary to mergers.

Two waves of buying alliances in the grocery industry have recently attracted the attention of Competition Authorities. In 2014, three important purchasing agreements have been signed in France. In September, System U and Auchan formed an alliance, as well as Intermarché and Casino in November and Carrefour and Cora in December. This led the French Competition Authority to publish a report on the welfare effects of buying groups in 2015.[5] This analysis puts forward that those buying groups were likely to have limited anticompetitive effects, because their scope was restricted to national brand products, hence they could not affect products manufactured by small suppliers, in particular producers of fresh agricultural products that are more likely to be in a situation of dependence. In 2018, a second wave of international purchasing agreements involving French retailers started.[6] Three groups of retailers are involved. A first group called "Horizon" is composed of Auchan, Casino, Metro, Schiever and Dia, a second one is composed of Carrefour and System U and the third one involves Carrefour and Tesco. An important difference between this wave and the previous one is that the new buying groups gather retailers operating on separate markets. Furthermore, they cover a wider scope of brands. The French competition authority states that new agreements *"differ from the alliances made in 2015 due to their larger scope involving an international dimension, and because they include not only national brand goods but also store-brand products"*.[7] The retailers argue that this may give opportunities of international development to the suppliers of private labels.[8]

[5] See Autorité de la concurrence (2015).

[6] The French competition authority launched a new evaluation in July 2018 in order to investigate *"the competitive impact of these purchasing partnerships on the concerned markets, both upstream for the suppliers, and downstream for the consumers"*. Source: `http://www.autoritedelaconcurrence.fr/user/standard.php?id_rub=684&id_article=3226&lang=en`.

[7] See the July 2018 press release quoted above. For instance, Carrefour claimed that "the alliance will cover the strategic relationship with global suppliers, the joint purchasing of own brand products and goods not for resale." Source: `http://www.carrefour.com/current-news/tesco-and-carrefour-to-create-long-term-strategic-alliance`.

[8] Horizon communication thus claimed that "Auchan Retail, Casino Group and METRO

In this paper, we study the effect of buying groups on product variety, and we compare two types of alliances: partial buying groups, in which the retailers unite to negotiate jointly with the suppliers of leading brands, and full buying groups, in which they also negotiate jointly with SMEs producing locally sold products. To do so, we consider a setting in which two retailers act as monopolists on two independent markets.[9] They sell differentiated products manufactured by competing suppliers: a large supplier who can offer two products (typically a multinational company selling leading brands across markets), and, in each market, a small local supplier who offers only one product (typically, a SME producing a private label). We assume that the ranking of the products according to their profitability differs across markets (this heterogeneity may come from differences in consumer preferences or in production costs).[10] We consider that retailers may either adopt an independent listing strategy or build a buying group, thereby committing to listing the same product assortment. Buying groups may cover the whole product line (full buying group) or only part of it (partial buying group, targeting only the products of the large producer). We also assume that a full buying group enables a small producer to access both markets, by reducing the export cost of SMEs through the help of a well established retail network.[11]

In each of these situations, retailers and suppliers contract over three part tariffs as

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will assist SMEs in their international development, [...] and will be able to launch invitations to tender for their general expenses and their non-differentiating basic private-label brands" https://www.groupe-casino.fr/en/auchan-retail-casino-group-metro-and-schiever-group-announce-their-cooperation-in-purchasing-internationally-and-in-france-and-build-a-set-of-next-generation-purchasing-platforms-called-h/.

[9] It is the case for the above-mentioned alliance between Carrefour and Tesco. Tesco holds stores in five countries in Europe (Ireland, Poland, Hungary, Slovakia, Czech republic) and four in Asia (China, Japan, Malaysia and Thailand). Tesco's maon market is the United-Kingdom in which it represents 27.7% of total grocery market shares in 2019 (source: Kantar WorldPanel). Carrefour holds stores in seven countries in Europe (Belgium, France, Italy, Poland, Slovakia, Spain, Turkey), two in South-America (Argentina Brazil) and two in Asia (China, Taiwan). Carrefour and Tesco are simultaneously present in two countries in Europe and one in Asia. Similarly, the Horizon alliance gathers retailers active on separate markets. Auchan holds supermarkets in ten countries in Europe (France, Spain, Hungary, Italy, Poland, Portugal, Romania, Russia, Ukraine), three countries in Asia (China, Taiwan, Vietnam), four countries in Africa (Tunisia, Senegal, Mauritania, Algeria). Casino is active only in France in Europe, in four countries in South America (Argentina, Brazil, Colombia, Uruguay) and in Indian Ocean (Madagascar, Mayotte, Reunion...). Metro's retail brand is Real which is active in three countries in Europe (Germany, Turkey, Romania).

[10] These assumptions are close to those made by Inderst and Shaffer (2007).

[11] This argument is often put forward by new buying groups. See the above mentioned quotes by Carrefour and Horizon (footnotes 7 and 8).

follows. First, on each market, suppliers compete for being listed by the retailer by simultaneously offering lump-sum slotting fees conditional on the number of their products listed by the retailer. If the slotting fee of one supplier is accepted, the retailer is committed to enter into the second stage negotiation process with the supplier but is not tied to sell the product. After the listing decision, which is publicly observed, retailers engage in a "Nash-in-Nash" bargaining, over two-part tariff contracts, with the supplier(s) of the selected products. Finally, retailers sell their products on the downstream markets. This timing builds on Chambolle and Molina (2018), who show that it is equivalent to a one-stage Nash-in-Nash bargaining with outside option as well as to the Nash-in-Nash bargaining with threat of replacement equilibrium concept developed by Ho and Lee (2019).

As the preferred assortment differs across markets, committing to a similar assortment in the two markets always generates inefficiencies on one of the markets and in some cases in both markets. Despite this inefficiency retailers may find this strategy profitable because the alliance enhances their buyer power, as it increases the competition among the suppliers for being listed: in that case, the buying group enables the retailers to receive "łarger share of a smaller pie". As a result, it may be jointly profitable for the retailers to create a buying group only when their bargaining power is low, as the gain in bargaining power may then compensate for the loss in assortment efficiency. Our most striking results are that partial buying groups do not protect the small suppliers from being excluded or from bearing profit losses; they may even be more profitable for retailers than full buying groups.

This article contributes to the growing theoretical literature on buying groups. The most closely related paper is that of Inderst and Shaffer (2007), who analyze the impact of a cross-border merger between two single product retailers active in two separated markets with different local consumer preferences. They show that the merger can enhance the retailers buyer power when they commit to a single sourcing strategy. This implies a negative impact on consumer surplus in one market because of the reduction of the overall product variety. Building on the vertical contracting process developed by Chambolle and Molina (2018), we extend the framework of Inderst and Shaffer (2007) to multi-product suppliers and retailers. This multi-product setting allows us to consider different types of buying alliances that differ in their scope, and to analyze their effects on different types of suppliers (single- or multi-products). We also depart from their analysis by highlighting possible inefficiencies of the alliance on the two markets.

A large part of the existing literature on buying groups focuses on the rationality of purchasing cooperation between retailers who compete on the downstream market. In such a framework, Caprice and Rey (2015) show that a buying group increases each retailer's buyer power by enhancing his outside option in the negotiation with a supplier. Indeed, in case of a breakdown in the negotiation, the profit of the retailer decreases less when his competitors also delist the products of the supplier, which happens when the retailers adopt a joint listing strategy. Piccolo and Miklós-Thal (2012) and Doyle and Han (2014) show that buying groups agreements can improve retailers' ability to sustain collusive retail prices, by coordinating on high wholesale prices and using back margin payments.

This paper is also related to the literature on endogenous network formation in vertically related markets. Marx and Shaffer (2010) show that retailers can strategically use capacity constraints in order to increase their buyer power towards suppliers.[12] In the same vein, Ho and Lee (2019) develop a bargaining procedure called "Nash-in-Nash with threat of replacement" to explain American health insurers hospital network reduction, by profit extraction motives. Rey and Vergé (2017) and Nocke and Rey (2018)) also endogenize the retail network in more complex vertical structure with both upstream and downstream competition and show that, absent any capacity constraint, in equilibrium not all products are sold at all retailers which harms consumer surplus and welfare.

The article is organised as follows. Section 2 presents the baseline model and notations. Section 3 derives the equilibrium outcomes in the three cases : No buying group, partial buying group, and full buying group. Section 4 endogenizes the retailers decision to form a buying group and analyzes the effects of these buying groups on the sharing of profits in the industry, on product variety, and on welfare. Section 5 discusses the robustness of our results with different combinations of product positioning across markets. Section 6 concludes.

[12] Montez (2007) shows the same mechanism within a vertical structure in which a producer may strategically restrict its production capacity to increase its bargaining power towards retailers.

2 Model

We consider two separate markets $i \in \{1,2\}$ and in each of these markets three active firms s_i, l and r_i. In market i, the monopolist retailer r_i has a constrained stocking capacity: her shelf space consists of two indivisible slots, hence she can sell at most two products. There are three varieties of differentiated products available, produced by two upstream suppliers, s_i and l. Supplier l is a "large supplier" who carries two differentiated products A and C, which he can sell in the two markets through retailers r_1 and r_2. Supplier s_i is a "small supplier" who carries one product B that he can sell in his local market through retailer r_i. For the sake of simplicity, we assume that the small suppliers in the two markets supply perfectly substitute products (they occupy the same positioning on each market). This assumption can reflect for instance the fact that a small supplier's product is sold under the retailer's own brand. Each supplier has a constant per unit production cost for each product.[13]

Industry profits The ranking of products A, B and C according to their profitability may differ across markets. Such heterogeneity may come from differences in consumer preferences or in production costs.[14] To keep things simple, we adopt a reduced-form model of industry profits. We define the maximum industry profit for a given product assortment on market i, that is the profit made by an integrated monopolist on that market. On each market a product is positioned according to the maximum industry profit it generates: H for "High", M for "Medium" and L for "Low". Formally, Π^{P_i} denotes this maximum industry profit where $P_i \in \mathcal{A} \equiv \{H, M, L, HM, HL, ML\}$ denotes the assortment sold on market i. Products may be positioned differently on each market. For instance product A say, may generate Π^H on market 1 and Π^M on market 2.

We make the following assumptions on industry profits:

[13]We rule out any externality of production among products and markets such as economies of scope or economies of scale.

[14]In the same vein, Inderst and Shaffer (2007) assume that consumers may differ in tastes and preferences as markets 1 and may be located in different regions or even different countries. For instance Pepsi-Cola is the favourite cola brand in the US whereas Coca-Cola is the favourite one in Europe.

Assumption 1.

$$\Pi^H > \Pi^M > \Pi^L \geq 0$$
$$\Pi^{HM} > \Pi^{HL} > \Pi^{ML}$$

Note that under Assumption 1, HM is the efficient assortment.[15]

We consider that products can either be imperfect substitutes or independent, which implies that any assortment of two products does not yield more surplus than the sum of industry profits generated by each product, e.g, for $X \in \{M, L\}$:

Assumption 2.

$$\Pi^H + \Pi^X \geq \Pi^{HX} > \Pi^H$$
$$\Pi^M + \Pi^L \geq \Pi^{ML} > \Pi^M$$

We also assume that product M contributes more to total industry profit when associated to product L than when associated to product H.[16]

Assumption 3.

$$\Pi^{ML} - \Pi^L \geq \Pi^{HM} - \Pi^H$$

Timing and alliance strategies To analyse the effect of buying groups on the economic outcome, i.e. the assortment of products sold and the profits, we consider the outcome of a competition game under several alliance strategies. Before the competition game, the retailers choose among three alliance strategies: *no buying group*, *partial buying group*, and *full buying group*. This decision is common knowledge. We assume that the buying group is a common entity that collects slotting fees and redistributes them among its participants.

[15] It is efficient here from the industry perspective. Under common assumptions on demand it also ensures the efficiency from the consumers perspective (see section 4).

[16] We make this assumption fort the sake of simplicity. It is satisfied in a wide range of standard horizontal differentiation setups, for instance in a Shaked and Sutton (1983) model of vertical differentiation (see Chambolle and Molina (2018)), or in the quadratic utility setup we will develop in section 4.

We do not explicitly model the redistribution process, but we assume that the decision is efficient: the alliance strategy maximizing the joint profit is implemented in equilibrium.

For a given alliance strategy, we consider the following two stage game.

- **Stage 1**: The suppliers compete in slotting fees to ensure the listing of their products. The small supplier offers a unique slotting fee to have his product B listed. The large supplier offers a menu of slotting fee to have either A only, C only or A and C listed. Accepting a slotting fee commits the retailer to listing the corresponding products. The retailer can list at most two products and the listing decision is publicly observed.

- **Stage 2:** Each retailer r_i engages in a bilateral negotiation with the supplier(s) of the two products listed. Negotiations are simultaneous, contracts are secret and consist of fixed fee(s) $F_{k,i}^{P_i}$ where $k \in \{l, s_i\}$ denotes the supplier involved in the bargaining and $P_i \in \mathcal{A}$ the product assortment.

Note that if she accepts a slotting fee from one supplier in stage 1, the retailer is committed to enter into the second stage negotiation process with this supplier, but is not tied to sell the product. Note also that a retailer can list a product without accepting the slotting fee.

The alliance strategies have the following distinctive features:

- *No buying group*: The supplier l offers each retailer r_i a menu $S_{l,i} = (S_{l,i}^A, S_{l,i}^C, S_{l,i}^{AC})$ to have respectively A only, C only, or both A and C listed by r_i; supplier s_i offers a slotting fee $S_{s_i,i}^B$ to have his product B listed by r_i. Each retailer chooses independently which product to list, and receives the corresponding slotting fee(s).

- *Partial buying group*: The supplier l offers a menu $S_l = (S_l^A, S_l^C, S_l^{AC})$ to have his product(s) listed in the two markets by the partial buying group; each supplier s_i offers a slotting fee $S_{s_i,i}^B$ to have his product B listed by r_i. Retailers make a joint listing decision on the large supplier's product(s) and the buying group receives the corresponding slotting fees, but they continue to list independently small suppliers' products and they receive individually the corresponding slotting fee(s).

- *Full buying group*: The supplier l offers a menu $S_l = (S_l^A, S_l^C, S_l^{AC})$ to have his product(s) listed in the two markets by the full buying group; each supplier s_i offers a slotting fee S_s^B to have his product B listed in the two markets by the full buying group. Retailers make a joint listing decision over the whole product line (large and small suppliers' products), and the buying group receives the corresponding slotting fee(s). Under a full buying group, we assume that one of the small suppliers exports his products: To sell in the market $j \neq i$, supplier s_i incurs a fixed export cost E. As by assumption small suppliers are perfectly substitutes (they offer the same product B), at most one small supplier is listed on each market, hence a retailer cannot select the two of them.[17]

Equilibrium concept In Stage 2 of the game, we use a bargaining protocol à la Horn and Wolinsky (1988) commonly referred to as the "Nash-in-Nash" according to Collard-Wexler et al. (2019), which is an extension of the contract equilibrium concept developed in Crémer and Riordan (1987) (see also Allain and Chambolle (2011)). This bargaining protocol assumes that negotiations are simultaneous, that firms are schyzophrenic and that they form passive beliefs about others' negotiations. Schizophrenia here means that, when negotiating simultaneously with two partners, a firm delegates a different negotiator for each partner, each negotiator ignoring the outcome of other ongoing negotiations. Passive beliefs means that, when bargaining, a given pair of firms does not change its beliefs about the outcome of other pairs' negotiations when receiving an out-of-equilibrium offer (McAfee and Schwartz (1994)). The parameter α (resp. $(1-\alpha)$ denotes the exogenous bargaining weight of the retailer (resp. supplier).

This Nash-in-Nash bargaining in Stage 2 takes place within the selected network of suppliers previously determined in Stage 1 through the competition for slots. As in Stage 1 all suppliers available on the market compete for a restricted number of slots, our setting enables products that are not sold in equilibrium to affect the equilibrium profits. Yet, the

[17] Note that, absent buying group or under a partial buying group, small suppliers' export costs are prohibitive, which implies that each s_i is only active on market i. The full buying group reduces the exportation cost to E by providing a well established retail network to the small supplier in the new market (see. Emlinger and Poncet (2018)). See also footnote 8.

total profit obtained by a retailer comes from both the contracts negotiated in the bargaining and the slotting fees offered by suppliers. We follow the timing proposed by Chambolle and Molina (2018) who show that the outcome of this two-stage game coincides with that of a one-stage Nash-in-Nash bargaining with outside option. In our approach the outside option assortment of the retailer is to replace one of the products listed in equilibrium by the non-listed product that competes for slots in Stage 1; we may also refer for simplicity to this outside option assortment as the second best assortment of the retailer. The non-listed supplier is ready to offer all the surplus generated by the relationship when being listed, i.e. if the outside option assortment were selected, rather than non listed by the retailer. If equilibrium slotting fees are zero, the equilibrium profit sharing among the retailer and her selected suppliers is the outcome of the Nash-in-Nash bargaining. In contrast, when equilibrium slotting fees are positive, the outside option is binding and modifies the profit sharing. Manea (2018) and Ho and Lee (2019) provide non cooperative microfoundations for the Nash-in Nash bargaining with outside options equilibrium concept when these outside options are to deal with rival partners.

Bilateral efficiency Stage 2 involves bargaining over a fixed fee, and is itself a short version of a two-stage-game in which (i) firms would instead bargain over a two-part-tariff contract (w, F) and (ii) the retailer would choose quantities or prices maximizing her profit given this contract. Indeed, bilateral efficiency, i.e., cost-based wholesale contracts, always prevails in our vertical structure with a downstream monopoly on each separated market. Indeed, as shown by, *e.g.*, Bernheim and Whinston (1985) or O'Brien and Shaffer (2005), competing upstream suppliers internalize the competition among their products through their common monopolist retailer and therefore maximize the industry profit irrespective of the distribution of bargaining power in the vertical chain.[18] Such a result implies that, when selling an assortment P_i, r_i always chooses prices or quantities that maximize the integrated industry profit previously defined by Π^{P_i} and the fixed fee F simply shares the integrated profit among them. Based on this result, we consider a single stage (Stage 2) in which each

[18] This efficiency result would also hold under public contracts.

supplier-retailer pair k, i bargains over a fixed fee $F_{k,i}$ to share the integrated industry profit.

In our model the heterogeneity of product positioning among the two markets plays a key role. In the baseline case derived in sections 3, we solve the model under the following assumption:

Assumption 4.

- *$B \equiv M$ on both markets.*

- *$A \equiv H$ and $C \equiv L$ on market 1.*

- *$C \equiv H$ and $A \equiv L$ on market 2.*

In section 5 we will consider other possible product ranking to explore the robustness of results obtained under assumption 4.

3 The impact of the alliance strategy on equilibrium outcomes

In this section, we analyze the impact of each alliance strategy on the sharing of profits and on the variety of products sold in each market. We solve the game under each possible alliance strategy (no buying group, partial or full buying group) under the assumptions 1-4.

3.1 Bargaining

In this section we determine the stage-2 continuation equilibria on each market i, which depend only on the listing decisions of the retailer, regardless of the alliance strategies. In that stage, the retailer may have a status-quo in the bargaining, when she deals with l and s_i. In contrast the large supplier has no status-quo in the bargaining because the two markets are separate.[19] Note that status-quo differ from outside option. The outside option assortment play a role at the listing stage and is exerted by the product that will not be sold

[19]This derives from the absence of economies of scale and economy of scope that ensures the profit the large supplier obtains on the two markets are independent.

in equilibrium. In contrast status-quo play a role in the Nash-in-Nash bargaining stage and are the out-of equilibrium profit of firms that will be sold in equilibrium in the event of a breakdown. A detailed resolution is given in Appendix A.

Assortment HL There is only one negotiation between r_i and l for both products. The equilibrium outcome is derived from the bilateral Nash product (where the superscripts relate to the subgame equilibrium assortment on which we focus):

$$\max_{F_{l,i}^{HL}} (\Pi^{HL} - F_{l,i}^{HL})^{\alpha} (F_{l,i}^{HL})^{1-\alpha}$$

We obtain the following equilibrium fee $F_{l,i}^{HL} = (1-\alpha)\Pi^{HL}$. In equilibrium, the retailer thus receives a share α and the large supplier a share $1-\alpha$ of the joint profit. We denote by $\pi_{j,i}^{P_i}$ where $j \in \{l, s_i, r_i\}$ the gross profit (i.e gross of slotting fees) obtained by firm j on market i when selling the product assortment P_i. Equilibrium gross profits are:

$$\pi_{r_i,i}^{HL} = \alpha\Pi^{HL},\ \pi_{l,i}^{HL} = (1-\alpha)\Pi^{HL},\ \pi_{s_i,i}^{HL} = 0$$

Assortment XM We consider here the subgames where retailer r_i has listed products M and X with $X \in \{H, L\}$. Retailer r_i engages in two bilateral negotiations, one with s_i for product M and one with l for product X. We solve the following Nash-in-Nash program:

$$\max_{F_{l,i}^{XM}} (\Pi^{XM} - F_{s_i,i}^{XM} - F_{l,i}^{XM} - (\Pi^{M} - F_{s_i,i}^{XM}))^{\alpha} (F_{l,i}^{XM})^{1-\alpha}$$
$$\max_{F_{s_i,i}^{XM}} (\Pi^{XM} - F_{s_i,i}^{XM} - F_{l,i}^{XM} - (\Pi^{X} - F_{l,i}^{XM}))^{\alpha} (F_{s_i,i}^{XM})^{1-\alpha}$$

We obtain the following equilibrium fees:

$$F_{l,i}^{XM} = (1-\alpha)(\Pi^{XM} - \Pi^{M})\ ,\ F_{s_i,i}^{XM} = (1-\alpha)(\Pi^{XM} - \Pi^{X})$$

Equilibrium gross profits are :

$$\pi_{l,i}^{XM} = (1-\alpha)(\Pi^{XM} - \Pi^{M})$$
$$\pi_{s_i,i}^{XM} = (1-\alpha)(\Pi^{XM} - \Pi^{X})$$
$$\pi_{r_i,i}^{XM} = (1-\alpha)(\Pi^{X} + \Pi^{M}) + (-1+2\alpha)\Pi^{XM}$$

Assortment X We consider here the subgames where retailer r_i has listed product X only, with $X \in \{H, M, L\}$. Straightforward resolution of the bilateral negotiation yields the equilibrium fee $F_{k,i}^{X} = (1-\alpha)\Pi^{X}$, which is also the profit obtained by the supplier, and the retailer obtains $\alpha\Pi^{X}$.

Lemma 1. *Under Assumptions 1-4, firms' gross profits can be ranked as follows:*

$$\pi_{r_i,i}^{HM} \geq \max\{\pi_{r_i,i}^{HL}, \pi_{r_i,i}^{ML}\}, \text{ and } \min\{\pi_{r_i,i}^{HL}, \pi_{r_i,i}^{ML}\} \geq \pi_{r_i,i}^{H} \geq \pi_{r_i,i}^{M} \geq \pi_{r_i,i}^{L} \geq 0$$
$$\pi_{l,i}^{HL} \geq \pi_{l,i}^{H} \geq \max\{\pi_{l,i}^{HM}, \pi_{l,i}^{L}\} \geq \pi_{l,i}^{ML} \geq \pi_{l,i}^{M} = 0$$
$$\pi_{s_i,i}^{M} \geq \pi_{s_i,i}^{ML} > \pi_{s_i,i}^{HM} > \pi_{s_i,i}^{HL} = \pi_{s_i,i}^{H} = \pi_{s_i,i}^{L} = 0;$$

Proof. We provide a complete proof of lemma 1 in Appendix A.3. ∎

The gross profit of a retailer is thus the largest with the efficient assortment, and it is always larger with two products than with a single product. The large supplier is better off when he sells the two products, and he benefits more from the sale of product H than from that of product L; furthermore the presence of the rival product M reduces his gross profit. Finally, a small supplier earns a larger gross profit when listed with product L rather than with product H.

3.2 Listing decisions

In this section, we solve the stage 1 of the game (slotting fees offers, listing decisions and equilibrium profits) under all possible alliance strategies. In this stage, the capacity constrained retailer (resp. the buying group) makes the listing decision that maximizes her profit (resp. their joint profit), which is the sum of the slotting fees collected and the gross profit(s) obtained in the bargaining stage.[20] First we provide some general properties of the equilibrium listing strategy that hold irrespective of the alliance strategy (lemma 2). Then for each alliance strategy we characterize the listing decisions of the retailers in stage 1.

Lemma 2. *Under Assumptions 1-4, for any alliance strategy, (i) on each market, two products are listed – the listing assortment is either HM, HL or ML. (ii) Supplier l has no incentive to pay a positive slotting fee for selling only one product.*

Proof. We provide a complete proof of lemma 2 in Appendix B. ■

Lemma 2 (i) derives from two properties: first, each retailer's gross profit is always larger when she sells two products (see lemma 1), and second, for a given menu of slotting fees, it also (weakly) increase the sum of the slotting fees received by the retailer.[21] Lemma 2 (ii) can be proved using the fact that under our assumptions when listing B, retailers and large supplier's gross profits are maximized for the same assortments (see lemma 1). Then the large supplier has no incentive to offer slotting fee to change the listing decision.

3.2.1 No buying group

Absent buying group, retailers listing decisions are independent across markets. In our baseline case the large supplier and the small supplier are in a symmetric position on the two markets: on market 1 (resp. 2) the large supplier offers product A (resp. C) positioned as H and product C (resp. A) positioned as L, on each market the small supplier offers product B positioned as M. Therefore without loss of generality we focus on the resolution for a given market i.

First, note that the combination of lemma 1 and lemma 2 ensures that the inefficient assortment ML is not selected by retailer r_i.[22] Hence suppliers compete in slotting fees to

[20] Note that the bargaining outcomes of stage 2 depend only on the listing decisions, regardless of the alliance strategies.

[21] Recall that the slotting fees offered by a supplier cannot be conditional to which products of his rival are listed.

[22] See the proof of lemma 3.

enforce their favorite listing decision between HM (preferred by the small supplier) and HL (preferred by the large supplier).[23] The competition is won by the supplier which is willing to pay a slotting fee that ensures the highest total profit (sum of her gross profit and of the slotting fees) to the retailer.

In lemma 3 and lemma 4 we determine suppliers' willingness to pay to retailer r_i for being listed.

Lemma 3. *Under Assumptions 1-4, with no buying group, the large supplier's willingness to pay to have his two products listed on market i is:* $\overline{S}^{+}_{l,i} \equiv \pi^{HL}_{l,i} - \pi^{HM}_{l,i} = (1-\alpha)(\Pi^{HL} - \Pi^{HM} + \Pi^{M})$.

Proof. From lemma 2 (i), we know that retailer r_i is better off listing two products, hence at least one product of supplier l is listed in equilibrium. If supplier l sells products H and L and pays a slotting fee $S^{HL}_{l,i}$, he obtains a total profit $\pi^{HL}_{l,i} - S^{HL}_{l,i}$. Lemma 2 (ii) shows also that if supplier l sells one product only, he does not pay a slotting fee. As lemma 1 shows that, should the retailer sell only one product from l, her gross profit is larger with product H than with L, the retailer thus prefers to list product H rather than product L. Hence, if supplier l sells only one product, he sells product H and obtain $\pi^{HM}_{l,i}$. Hence, the maximum slotting fee supplier l is ready to pay to ensure his two products are listed is $\pi^{HL}_{l,i} - \pi^{HM}_{l,i}$. ■

Lemma 4. *Under Assumptions 1-4, with no buying group, supplier s_i's willingness to pay to have his product listed is: equal to* $\overline{S}^{+}_{s_i,i} \equiv \pi^{HM}_{s_i,i} = (1-\alpha)(\Pi^{HM}_{s_i,i} - \Pi^{M}_{s_i,i})$.

Proof. If B is not listed, s_i makes no profit and therefore he is willing to pay up to $\pi^{HM}_{s_i,i}$ to have product B listed on market i. ■

Under Assumptions 1-2, we have:

$$\pi^{HM}_{r_i,i} + \overline{S}^{+}_{s_i,i} \geq \pi^{HL}_{r_i,i} + \overline{S}^{+}_{l,i} \tag{1}$$
$$\Pi^{HM} \geq \Pi^{HL}$$

[23] The large supplier's gross profit is larger having two products listed (see lemma 1), and therefore is ready to offer a slotting fee for the two slots in Stage 1. In turn, the small supplier must compete for not being excluded.

Equation (1) shows that the supplier s_i wins the competition against the large supplier because the assortment HM leads to the highest industry profit. However the small supplier s_i may not need to pay a positive slotting fee, whenever product M generates much more gross profit for retailer r_i than product L. In equilibrium, when supplier s_i pays a positive slotting fee, he makes an offer such that the retailer r_i is indifferent between choosing HM and HL:

$$\begin{aligned}\overline{S}_{s_i,i} &= \max\{\pi_{r_i,i}^{HL} - \pi_{r_i,i}^{HM} + \overline{S}_{l,i}^{+}, 0\} \\ \Leftrightarrow \overline{S}_{s_i,i} &= \max\{(\Pi^{HL} - \Pi^{H}) - \alpha(\Pi^{HM} - \Pi^{H}), 0\}.\end{aligned}$$

The above reasoning leads us to the following proposition presenting the equilibrium without buying group:

Proposition 1. *Under Assumptions 1-4, with no buying group, in equilibrium the efficient assortment HM is sold on each market (i.e AB on market 1 and BC on market 2). Equilibrium profits are:*

$$\begin{aligned}&\overline{\Pi}_{r_i,i} \equiv \max\{\Pi^{HL} - (1-\alpha)(\Pi^{HM} - \Pi^{M}), (1-\alpha)(\Pi^{H} + \Pi^{M}) - (1-2\alpha)\Pi^{HM}\} \\ &\overline{\Pi}_{l,i} \equiv (1-\alpha)(\Pi^{HM} - \Pi^{M}) \\ &\overline{\Pi}_{s_i,i} \equiv \min\{\Pi^{HM} - \Pi^{HL}, (1-\alpha)(\Pi^{HM} - \Pi^{H})\}\end{aligned} \quad (2)$$

In equilibrium, the small supplier offers a slotting fee $\overline{S}_{s_i,i} = \max\{0, \Pi^{HL} - \alpha\Pi^{HM} - (1-\alpha)\Pi^{H}\}$*, and his offer is accepted; the large supplier offers a menu* $\overline{S}_{l,i} = (0, 0, (1-\alpha)(\Pi^{HL} - \Pi^{HM} + \Pi^{M})$ *and finally pays a zero slotting fee.*[24]

Proof. We provide a complete proof in Appendix C. ■

Note that the expression of the profits of the retailer and the small supplier depends on

[24] Note that in stage 1, there is a continuum of profiles of slotting fees that sustain an equilibrium where both suppliers offer higher fees and the retailer selects the assortment HM. This profile is selected by trembling-hand perfection. All equilibria display the same assortment HM.

whether the slotting fee is positive or not. The left term of both expressions represents their profits when the small supplier pays a positive slotting fee. This corresponds to the situation where product L exerts a threat of replacement on product M. In this case, the equilibrium has asymmetric Bertrand-like features. The retailer obtains the profit she would obtain by choosing the second best offer (i.e $\pi_{r_i,i}^{HL} + \overline{S}_{l,i}^{+}$). The small supplier obtains the profit he would get when the outside option assortment is chosen (i.e zero) plus the contribution of his product to the industry profit compared to the outside option assortment (i.e $\Pi^{HM} - \Pi^{HL}$).

The right term of retailer and small supplier's profits represent their profits when the small supplier does not pay a positive slotting fee (i.e product L does not represent a credible threat of replacement for product M). In this case, both firm obtain their standard Nash-in-Nash profit. Note that there is no threat of replacement for product H, hence the large supplier always obtains his Nash-in-Nash profit selling this product. These equilibrium properties have strong connections with the "Nash-in-Nash with threat of replacement developed by Ho and Lee (2019) (see also Chambolle and Molina (2018)).

3.2.2 Partial buying group

Assume now that retailers r_1 and r_2 have opted for a partial buying-group. This alliance strategy implies that the two retailers commit to adopting a common listing decision regarding the large supplier's product(s). This implies that they choose the same listing assortment, that is, either AB, BC, or AC. Whenever B is listed by r_i, the retailer sources from her own local supplier s_i. Among available assortments the buying group chooses the one maximizing retailers joint profit.

If the retailers list the two products A and C offered by the large supplier, it results in the same product positioning HL on the two markets. If the retailers list the assortment AB (resp. BC), the product positioning HM is offered on market 1 (resp. 2) whereas the product positioning ML is offered on market 2 (resp. 1). For the sake of simplicity, we focus here on competition for slots between the large and small suppliers on assortments AC and AB, the case of the assortment BC being symmetric to AB.

The following lemmas first determine the suppliers' willingness to pay to enforce their favorite listing decision.

Lemma 5. *Under Assumptions 1-4, with a partial buying group,*

(i) supplier l's willingness to pay to have his two products listed on the two markets is: $\widehat{S}_l^+ \equiv \pi_{l,1}^{HL} + \pi_{l,2}^{HL} - \pi_{l,1}^{HM} - \pi_{l,2}^{ML} = (1-\alpha)(2\Pi^{HL} + 2\Pi^M - \Pi^{HM} - \Pi^{ML})$.

(ii) Under Assumption 1 this total amount is always larger than the total amount he is ready to pay absent buying group (i.e $\widehat{S}_l^+ \geq \overline{S}_{l,1}^+ + \overline{S}_{l,2}^+$*).*

Proof. (i) With a partial buying group, if C is not listed, the large supplier anticipates a total profit $\pi_{l,1}^{HM} + \pi_{l,2}^{ML}$ in Stage 2 whereas he anticipates a total profit $\pi_{l,1}^{HL} + \pi_{l,2}^{HL}$ if he sells AC on the two markets. (ii) With no buying group, lemma 3 shows that the total amount the large supplier is ready to pay to impose his two products on both markets is equal to $\sum_i (\pi_{l,i}^{HL} - \pi_{l,i}^{HM})$. Under lemma 1 we know that $\pi_{l,i}^{HM} \geq \pi_{l,i}^{ML}$, and a straightforward comparison yields the result. ■

Lemma 5 highlights that the large supplier's willingness to pay to have his two products listed is larger under partial buying group than without buying group. This is because if he were to sell only one good on the two markets, say A, he would receive a smaller gross profit on market 2 under a partial buying group than in the absence of buying group. Therefore the large supplier has relatively more to gain in obtaining the two slots for his products, under partial buying group.

Lemma 6. *Under Assumptions 1-4, with a partial buying group,*

(i) Supplier s_1 and s_2's total willingness to pay to have their products listed is equal to $\widehat{S}_s^+ \equiv \pi_{s_1,1}^{HM} + \pi_{s_2,2}^{ML} = (1-\alpha)(\Pi^{HM} + \Pi^{ML} - \Pi^H - \Pi^L)$.

(ii) Under Assumption 3 this amount is larger than the total amount they are willing to pay absent buying group (i.e $\widehat{S}_l^+ \geq \overline{S}_{s_1,1}^+ + \overline{S}_{s_2,2}^+$*)*

Proof. (i) with a partial buying group, if B is not listed suppliers s_1 and s_2 are excluded and make a null profit. If B is listed, then assortment is, say, AB on the two markets (the case of assortment BC is symmetric). Suppliers' gross profits are $\pi^{HM}_{s_1,1}$ for s_1 and $\pi^{ML}_{s_2,2}$ for s_2. Hence the total amount suppliers s_1 and s_2 are willing to pay for being listed is equal to $\pi^{HM}_{s_1,1} + \pi^{ML}_{s_2,2}$. (ii) With no buying group, the total amount suppliers s_1 and s_2 are willing to pay to have their products listed is equal to $\sum_i \pi^{HM}_{s_i,i}$. Assumption 3 yields the result. ■

Lemma 6 highlights that the small suppliers' total willingness to pay for being listed is larger under a partial buying group than without buying group. This is because, as the product sold by the large supplier is the same on both markets, one of the small suppliers now faces the product L on his market, which, under lemma 1, increases his gross profit in the continuation equilibrium. The other small supplier's willingness to pay is unchanged. Lemmas 5 and 6 imply that competition for slots is strengthened under partial buying groups as compared to the benchmark with no buying group.

Consider now the buying group's listing decision.

A straightforward comparison of the retailers' maximum joint profits with the two assortments shows that small suppliers' product are listed whenever:

$$\begin{aligned} &\pi^{HM}_{r_1,1} + \pi^{ML}_{r_2,2} + \widehat{S}^{+}_{s} \geq \pi^{HL}_{r_1,1} + \pi^{HL}_{r_2,2} + \widehat{S}^{+}_{l} \\ \Leftrightarrow\ & \Pi^{HM} + \Pi^{ML} \geq 2\Pi^{HL} \end{aligned} \tag{3}$$

When Equation (3) holds, the industry profit is larger with assortment AB (or BC) on both markets rather than with AC on both markets. Among available assortments, the partial buying group always lists the assortment that generates the highest joint industry profit. Small suppliers then win the listing competition and offer a total amount $\widehat{S}^{ne}_{s}$ such that the partial buying group is indifferent between listing AB or AC. We denote this equilibrium as the "non exclusion" equilibrium, and label it with the superscript ne.[25]

When by contrast equation (3) does not hold, the large supplier wins the listing competition and offers a total amount $\widehat{S}^{e}_{l}$ such that retailers are indifferent between listing AB or AC. The superscript e henceforth refers to the "exclusion" equilibrium. This leads us to the

[25] As only the sum of the slotting fees is considered by the buying group, there is actually a continuum of equilibria such that $\widehat{S}^{ne}_{s_1,1} + \widehat{S}^{ne}_{s_2,2} = \widehat{S}^{ne}_{s}$, $\widehat{S}^{ne}_{s_1,1} \leq \pi^{HM}_{s_1,1}$ and $\widehat{S}^{ne}_{s_2,2} \leq \pi^{ML}_{s_2,2}$.

following proposition:

Proposition 2. *Under Assumptions 1-4, with a partial buying group complete efficiency never arises in equilibrium. Two types of equilibria may arise:*

Equilibrium with exclusion: *when* $2\Pi^{HL} > \Pi^{HM} + \Pi^{ML}$*, the retailers choose to list the two products of the large supplier (the assortment is* AC*) and thus exclude small suppliers in both markets.*

Slotting fees are:

- *The large supplier offers:* $\widehat{S}_l^e \equiv (0, 0, \max\{\alpha(\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}) + 2(1-\alpha)\Pi^M, 0\})$

- *The two small suppliers offer*[26] $\widehat{S}^e_{s_1,1} \equiv \pi^{HM}_{s_1,1}$ *and* $\widehat{S}^e_{s_2,2} = \pi^{ML}_{s_2,2}$

The resulting total profits on both markets are:

$$\widehat{\Pi}^e_r \equiv \max\{\alpha(\Pi^{HM} + \Pi^{ML}) + 2(1-\alpha)\Pi^M, 2\alpha\Pi^{HL}\}$$
$$\widehat{\Pi}^e_{s_1,1} \equiv \widehat{\Pi}^e_{s_2,2} = \widehat{\Pi}^e_s = 0$$
$$\widehat{\Pi}^e_l \equiv \min\{2\Pi^{HL} - \alpha(\Pi^{HM} + \Pi^{ML}) - 2(1-\alpha)\Pi^M, 2(1-\alpha)\Pi^{HL}\}$$

Equilibrium without exclusion: *when* $\Pi^{HM}+\Pi^{ML} \geq 2\Pi^{HL}$*, there are two mirror equilibria where the retailers list the product of the small supplier (the assortment is either* AB *or* BC*). The large supplier has a unique product, say* A*, listed on both markets.*

Slotting fees offers are:

- $\widehat{S}_l^{ne} \equiv (0, 0, (1-\alpha)(2\Pi^{HL} - \Pi^{HM} - \Pi^{ML} + 2\Pi^M))$ *for the large supplier;*

- *The small suppliers offer a total fee of* $\widehat{S}_s^{ne} \equiv \max\{2\Pi^{HL} - \alpha(\Pi^{HM} + \Pi^{ML}) - (1-\alpha)(\Pi^H + \Pi^L), 0\}$.

Resulting profits are:

$$\widehat{\Pi}^{ne}_r \equiv \max\{2\Pi^{HL} + (1-\alpha)(2\Pi^M - \Pi^{ML} - \Pi^{HM}), (1-\alpha)(\Pi^H + \Pi^L + 2\Pi^M) - (1-2\alpha)(\Pi^{HM} + \Pi^{ML})\}$$
$$\widehat{\Pi}^{ne}_s \equiv \max\{\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}, (1-\alpha)(\Pi^{HM} - \Pi^H + \Pi^{ML} - \Pi^L)\}$$
$$\widehat{\Pi}^{ne}_l \equiv (1-\alpha)(\Pi^{HM} - \Pi^M) + (1-\alpha)(\Pi^{ML} - \Pi^M)$$

[26] Again, we select this equilibrium among a continuum by the trembling-hand criterion.

Proof. See appendix D. ■

Proposition 2 highlights that, even though partial buying groups are not supposed to negotiate with small suppliers, they can lead to their exclusion. Furthermore, even when they are not excluded, small producers are worse off with a partial buying group than with no buying group.

Note that given the multiplicity of equilibria, the profits of the small suppliers and of the retailers are not uniquely defined. Proposition 2 shows however that the sum of the profits of the retailers and the small suppliers is uniquely defined.

When the equilibrium with exclusion arises, the inefficient assortment AC arises on both markets. Moreover when the equilibrium without exclusion arises, assortment AB is sold on both markets which is efficient on market 1 but inefficient on market 2. A partial buying group generates inefficiency either on one or two markets as compared to the benchmark situation with no buying group.

As in the no buying group situation, the expression of firms' profits depends on the positivity of the slotting fee. The left term of each expression represents the firms' profits when a positive slotting fee is paid. In this case, the retailer obtains the profit she would obtain by choosing the outside option (i.e $\pi^{HL}_{r_1,1} + \pi^{HL}_{r_2,2} + \widehat{S}^+_l$ for the exclusion equilibrium and $\pi^{HM}_{r_1,1} + \pi^{ML}_{r_2,2} + \widehat{S}^+_s$ for the non exclusion equilibrium). The supplier(s) who wins competition for the slots obtains the profit he (they) would get when the outside option assortment is chosen plus the increase of industry profit he generates as compared to this outside option assortment (i.e $\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}$ for the small suppliers without exclusion, and $\pi^{HM}_{l,1} + \pi^{ML}_{l,2} + 2\Pi^{HL} - \Pi^{HM} - \Pi^{ML}$ for the large supplier with exclusion). The right term represents the firms profit whenever no positive slotting fee is paid, and in that case it amounts to the standard Nash-in-Nash profit.

3.2.3 Full buying group

Assume now that retailers r_1 and r_2 have opted for a full buying-group. This alliance strategy implies that the two retailers commit to listing the same two products on both markets. More precisely, if the retailers choose to list product B they select one of the two small suppliers to supply both markets, which generates a fixed export cost E for the selected small supplier. Again, three types of listing decisions may arise in equilibrium, AB, BC or AC on both markets.

As under partial buying group, we focus here on competition for slots between the large and small suppliers on assortments AC and AB, the case of the assortment BC being symmetric to AB. Note however that instead of competing "together" to gain one slot on each market, as under partial buying group, the small suppliers now compete against each other *à la Bertrand* to win both markets.

Again, the outcome of such competition depends on the two suppliers' willingness to pay to ensure the listing of their products. Consider first the large supplier. We obtain the following lemma:

Lemma 7. *Under Assumptions 1-4, with a full buying group, the large supplier's willingness to pay to have his two products listed is the same than with a partial buying group, that is* $\widetilde{S}_l^+ \equiv \pi_{l,1}^{HL} + \pi_{l,2}^{HL} - \pi_{l,1}^{HM} - \pi_{l,2}^{ML} = (1-\alpha)(2\Pi^{HL} + 2\Pi^{M} - \Pi^{HM} - \Pi^{ML})$.

Proof. See the proof of lemma 5. ■

Consider now the small suppliers. We obtain the following lemma:

Lemma 8. *Under Assumptions 1-4, with a full buying group, each small supplier offers a slotting fee equal to his willingness to pay, which is* $\widetilde{S}_s^+ \equiv \pi_{s_i,i}^{HM} + \pi_{s_i,i}^{ML} - E$*, and makes a null profit.*

Proof. With a full buying group, when product B is listed a unique small supplier is selected to supply for the two markets and bears a fixed export cost E. The small supplier who loses the competition makes a null profit. Hence each small supplier s_i offers $\pi_{s_i,i}^{HM} + \pi_{s_i,i}^{ML} - E$ for being listed. ■

Consider now the listing decision by the buying group. Competition between the suppliers to be listed is such that the assortment AB is chosen if and only if :[27]

$$\pi^{HM}_{r_1,1} + \pi^{ML}_{r_2,2} + \widetilde{S}^{+}_{s} \geq \pi^{HL}_{r_1,1} + \pi^{HL}_{r_2,2} + \widetilde{S}^{+}_{l}$$
$$\Pi^{HM} + \Pi^{ML} - E \geq 2\Pi^{HL}$$

This leads to the following proposition:

Proposition 3. *Under Assumptions 1-4, with a full buying group complete efficiency never arises in equilibrium. Two types of equilibria may arise:*

Equilibrium with exclusion: *If $2\Pi^{HL} > \Pi^{HM} + \Pi^{ML} - E$, the buying group chooses to list the two products of the large supplier (the assortment is AC) and thus excludes small suppliers on both markets.*

Slotting fees are:

- *The large supplier offers: $\widetilde{S}^{e}_{l} = (0, 0, \max\{(1-\alpha)(2\Pi^{M}) + \alpha(\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}) - E, 0\})$*
- *Each small supplier s_i offers $\widetilde{S}^{e}_{s} = \max\{(1-\alpha)(\Pi^{HM} + \Pi^{ML} - \Pi^{M} - \Pi^{L}) - E, 0\}$*

Resulting profits are :

$$\widetilde{\Pi}^{e}_{r} = \max\{2(1-\alpha)(\Pi^{M}) + \alpha(\Pi^{ML} + \Pi^{HM}) - E, 2\alpha\Pi^{HL}\}$$
$$\widetilde{\Pi}^{e}_{s_1,1} = \widetilde{\Pi}^{e}_{s_2,2} = \widetilde{\Pi}^{e}_{s} = 0$$
$$\widetilde{\Pi}^{e}_{l} = \min\{2\Pi^{HL} - 2(1-\alpha)\Pi^{M} - \alpha(\Pi^{HM} + \Pi^{ML}) + E, 2(1-\alpha)\Pi^{HL}\}$$

Equilibrium with a partial exclusion*: When $\Pi^{HM} + \Pi^{ML} - E \geq 2\Pi^{HL}$, there are two mirror equilibria where the retailers list the product of a unique small supplier for the two markets (the assortment is either AB or BC). The large supplier has a unique product, say A listed on both markets. Slotting fees are:*

- *The large supplier offers: $\widetilde{S}^{pe}_{l} = (0, 0, \max\{(1-\alpha)(2\Pi^{HL} - \Pi^{HM} - \Pi^{ML} + 2\Pi^{M}) - E), 0\})$*

[27] Again, the asymmetric Bertrand-like structure of the game leads to multiplicity of equilibria issues, but selection by the trembling-hand criterion gives the result.

- *Each small supplier s_i offers* $\widetilde{S}_s^{pe} = \max\{(1-\alpha)((\Pi^{HM} - \Pi^{H}) + (\Pi^{ML} - \Pi^{L})) - E, 0\}$

Resulting profits are :

$$\widetilde{\Pi}_r^{pe} = \max\{2(1-\alpha)\Pi^M + \alpha(\Pi^{HM} + \Pi^{ML}) - E, (1-\alpha)(2\Pi^M + \Pi^L + \Pi^H) + (2\alpha - 1)(\Pi^{HM} + \Pi^{ML})\}$$
$$\widetilde{\Pi}_{s_1,1}^{pe} = \widetilde{\Pi}_{s_2,2}^{pe} = \widetilde{\Pi}_s^{pe} = 0$$
$$\widetilde{\Pi}_l^{pe} = (1-\alpha)((\Pi^{HM} - \Pi^M) + (\Pi^{ML} - \Pi^M))$$

Proof. See Appendix E ■

With a full buying group, at least one firm is excluded in equilibrium. The full exclusion equilibrium is similar to the exclusion equilibrium with a partial buying group. The difference is that the export cost introduces a new source of inefficiencies compared to the partial buying group case. As a consequence, the full buying group paradoxically relaxes competition for slots among suppliers: as under partial buying group, small suppliers are ready to give all their profits, however, they are less efficient because of the export cost, hence the large supplier is better off. When the large supplier pays a positive slotting fee, the retailer obtains her outside option profit (i.e $\pi_{r_1,1}^{HM} + \pi_{r_2,2}^{ML} + \widetilde{S}_S^{+}$), the large supplier obtains the profit he would get if the retailer were selecting the outside option assortment plus the increase of industry profit he generates(i.e $\pi_{l,1}^{HM} + \pi_{l,2}^{ML} + 2\Pi^{HL} + \Pi^{HM} + \Pi^{ML}$). The partial exclusion equilibrium is different from the partial buying group case, because Bertrand competition between the two small suppliers dissipates their profits. Hence the retailer does not obtain her outside option profit, instead she obtains the same profit than with a full exclusion (i.e $\pi_{r_1,1}^{HM} + \pi_{r_2,2}^{ML} + \widetilde{S}_s^{+}$).

4 Profitability and welfare effects of buying groups

In this section, we analyze when retailers are likely to form buying groups, and we compare the profitability of the different types of buying groups. We then analyze the effects of these buying groups on the sharing of profits in the industry and on product variety, and offer some insights on their welfare effects.

4.1 Choice of alliance strategy by the retailers

We compare here the retailers' joint profit in the three different situations, that is: without buying group, with a partial buying group and with a full buying group. We assume that the buying group is a common entity that collects slotting fees and redistributes it among its participants in an efficient way, such that a buying group will be created whenever it is jointly profitable for the retailers.[28] Comparing the sum of retailers profits in the three cases (see Propositions 1, 2 and 3) we obtain the following proposition.

Proposition 4. *Under Assumptions 1-4, retailers' decision to form a buying group depends on their buyer power, the relative profitability of assortments and small suppliers' export cost:*

- *When the export fixed cost is relatively high compared to the contribution of product M to the industry profit, that is when* $\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq E$*, retailers trade-off between partial buying group and no buying group.*
  - *Retailers form a partial buying group*
    - *with a full exclusion when* $\alpha \leq \min\{\alpha_1, \alpha_2\}$ *and* $\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq 0$*,*
    - *without exclusion when* $\alpha \leq \alpha_3$ *and* $\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \geq 0$*,*
  - *Retailers form no buying group otherwise.*

  With $\alpha_1 \equiv \frac{2(\Pi_{HM}-\Pi_{HL})}{\Pi_{HM}-\Pi_{ML}}$, $\alpha_2 \equiv \frac{2(\Pi_{HM}-\Pi_{H})}{3\Pi_{HM}-\Pi_{ML}-2\Pi_{H}}$ *and* $\alpha_3 \equiv \frac{\Pi_{HM}+2\Pi_{HL}-2\Pi_{H}-\Pi_{ML}}{3\Pi_{HM}-\Pi_{ML}-2\Pi_{H}}$.

- *When the export fixed cost is relatively low compared to the contribution of product M to the industry profit, that is when* $\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} > E$*, retailers trade-off between full buying group and no buying group.*
  - *Retailers form a full buying group with a partial exclusion when buyer power is low, that is when* $\alpha \leq \min\{\alpha_4, \alpha_5\}$*,*
  - *Retailers form no buying group otherwise.*

  With $\alpha_4 \equiv \frac{2(\Pi_{HM}-\Pi_{HL})-E}{\Pi_{HM}-\Pi_{ML}}$ *and* $\alpha_5 \equiv \frac{2(\Pi_{HM}-\Pi_{H})-E}{3\Pi_{HM}-\Pi_{ML}-2\Pi_{H}}$.

[28] We do not fully model the redistribution process but assume it is efficient.

Proof. See Appendix F ∎

Proposition 4 shows that the three types of alliance strategy can arise in equilibrium.

We observe that it is profitable for retailers to form a buying group whenever their bargaining power α is low. When they create a buying group, retailers commit themselves to a joint listing strategy. When α is large enough for slotting fees to be null, buying groups cannot be profitable as retailers' joint gross profit is maximized selling the efficient assortment on each market. When slotting fees are positive retailers face the following trade-off : on the one hand, their joint gross profit is reduced because their commitment prevents them from listing the efficient assortment, and thus to maximize their gross profit on each market; on the other hand, they obtain higher slotting fees, as competition for the slots is intensified.[29] When α is large, retailers capture a large share of the joint profit in stage 2, hence suppliers offer low slotting fees in stage 1. The buying groups intensifies competition for slots in stage 1, and leads to an increase in slotting fees, that is however not sufficient to compensate for the loss of gross profit in stage 2. When α is low, by contrast, the implementation of a buying group is profitable.[30]

Consider now the type of buying group that is chosen by the retailers. First, assume that $\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq 0$, which means that the overall industry profit (on both markets) is larger when product B is excluded (assortment AC on both markets) than when B is listed (assortment AB or BC on both markets). In that case, the retailers choose the assortment AC, regardless of the type of buying group: their gross profit is thus the same in the two cases. Furthermore, the small suppliers are ready to give all their profit through the slotting fee in both cases ($\pi^{HM}_{s_i,i} + \pi^{ML}_{s_i,i}$), but in the case of the full buying group they incur the export cost E. As a result, the large supplier pay a larger slotting fee with a partial buying group and retailers are better of with this alliance strategy.

Assume now that $0 < \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq E$. In that case, with a partial buying

[29] With a partial or full buying group, the large supplier may sell a same unique product on the two markets, thereby providing an inefficient product on one of the two markets. With a full buying group, competition between the two small suppliers for the unique slot dissipates their profits.

[30] This result is in line with Inderst and Shaffer (2007) who show that cross-borders mergers between retailers leading to a single-sourcing strategy are profitable when retailers have a low bargaining power.

group, the retailers select the symmetric assortment that maximizes the industry profit, that is, either AB or BC is sold on both markets. By contrast, with a full buying group, because of the export cost E, the assortment is AC on both markets, although absent the export cost, the industry profit would be lower with this assortment than with the assortment AB or BC ($2\Pi^{HL} < \Pi^{HM} + \Pi^{ML}$). Hence the retailers choose the partial rather than the full buying group. Indeed, choosing the full buying group, leading to the assortment AC on both markets, would give them the same profit than with a partial buying group under the assortment AC, less the export cost E; furthermore, with a partial buying group the equilibrium assortment is AB or BC on both markets, which leads to a larger joint profit for the retailers than the assortment AC: again, the retailers prefer a partial buying group.

Finally, suppose that $E < \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}$. Even with a full buying group, the assortment is now AB or BC on both markets, because selling product B generates an additional surplus in the industry that compensates for the export cost. With a partial buying group, the retailers obtain their outside option profit (that is, the maximum profit the large supplier would leave them, should they list the assortment AC) and the small suppliers receive a positive profit; with a full buying group however, competition for the slots induces the small suppliers to leave the retailers all of their profits: the retailers are then better off with a full buying group.

4.2 Effect of the buying groups on the industry profit and on profit sharing

In this section, we analyze the effects of buying groups on the efficiency of the whole industry profit, and we analyze the profit sharing in the industry.

4.2.1 Industry profit

The above analysis reveals that a first consequence of the creation of a buying group (whether full or partial) is the standardization of the assortment decision over the two countries, which, in our baseline case, is always inefficient from the industry perspective, as it dissipates part of the joint profit. More precisely, three cases may occur, depending on the type of buying group that emerges in equilibrium.

(i) When the retailers form a partial buying group with full exclusion, the second-preferred variety is excluded from both markets, hence in each market the joint profit decreases from Π^{HM} to Π^{HL}.

(ii) When the retailers form a partial buying group with no exclusion, the assortment remains efficient in one market, but in the other the preferred variety is replaced by the least-preferred one. In the former the joint profit is not affected, but in the latter it drops from Π^{HM} to Π^{ML}.

(iii) When the retailers form a full buying group it leads to the partial exclusion equilibrium, where the same product of the large supplier is sold on both markets, and the product of one of the small suppliers is sold on both markets. This configuration involves two sources of inefficiency: in one market the joint profit drops from Π^{HM} to Π^{ML}, and the fixed export cost E is wasted.

An interesting question is to compare the effects of the different types of buying groups on industry profit.

- If $\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq 0$, then both types of buying groups lead to the same equilibrium assortment (HL on both markets), and they both have the same impact on joint profit. However, a full buying group is less profitable than a partial buying group, and is thus less likely to be created by the retailers.

- If $0 < \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} < E$, then in equilibrium the assortment is HL on both markets with a full buying group, while with a partial buying groups it is HM on one market and ML on the other. In that case, a partial buying group inflicts less losses to the industry profit than a full buying group: the loss created by the assortment distortion is lower. However, again, the condition for profitability may be easier to satisfy for a partial buying group than for a full buying group.

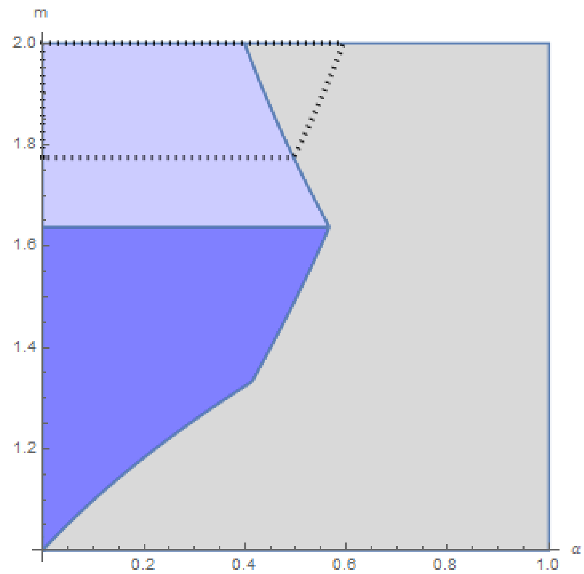
- If $E \leq \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}$, then in equilibrium the assortment is HM on one market and ML on the other with both types of buying groups. In that case, a partial buying group is less harmful for industry profit; moreover, a full buying group is more likely to be profitable.

Finally, both types of buying groups harm the industry profit. Comparing the relative losses in industry profit reveals first that, provided that they are created, a partial buying group always leads to less inefficiencies than a full buying group. However, in some cases, a partial buying group is profitable while a full is not, and the reverse may also occur.

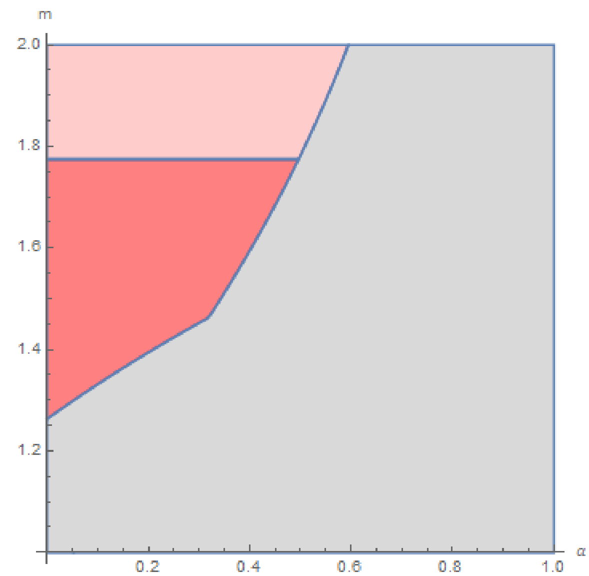
To illustrate these results, we provide here a numerical application based on the linear demand model derived from the standard representative consumer utility of Singh and Vives (1984) (see Appendix for the details). In this framework, we solve the model to derive the profitability conditions for each type of buying group. We derive the equilibrium assortment for a partial buying group and for a full buying group, and we display the alliance strategy and the assortment when the retailers may choose either type of buying group. Figure 1 displays the results in the three cases, with the retailers' bargaining power α on the horizontal axis, and m, the consumers' relative preference for the variety M, on the vertical axis.

These figures provide several insights. First, creating a buying group is never profitable for retailers when their bargaining power is high (α large). Second, figure (c) challenges the common view that partial buying groups are less harmful than full ones. Indeed, in the area where the retailers implement a full buying group with partial exclusion, prohibiting full buying groups and allowing only partial would improve industry profit by saving the export cost E and by reducing the profitability of the buying group, thereby making its creation less likely. In the area where the retailers create a partial buying group without exclusion, full buying groups would lead to heavier distortions, except in the area where α is relatively large, where a full buying group would not be profitable. Finally, in the area where the retailers create a partial buying group without exclusion, the partial buying group does not lead to less distortion than a full buying group, and furthermore it is more likely to be implemented.

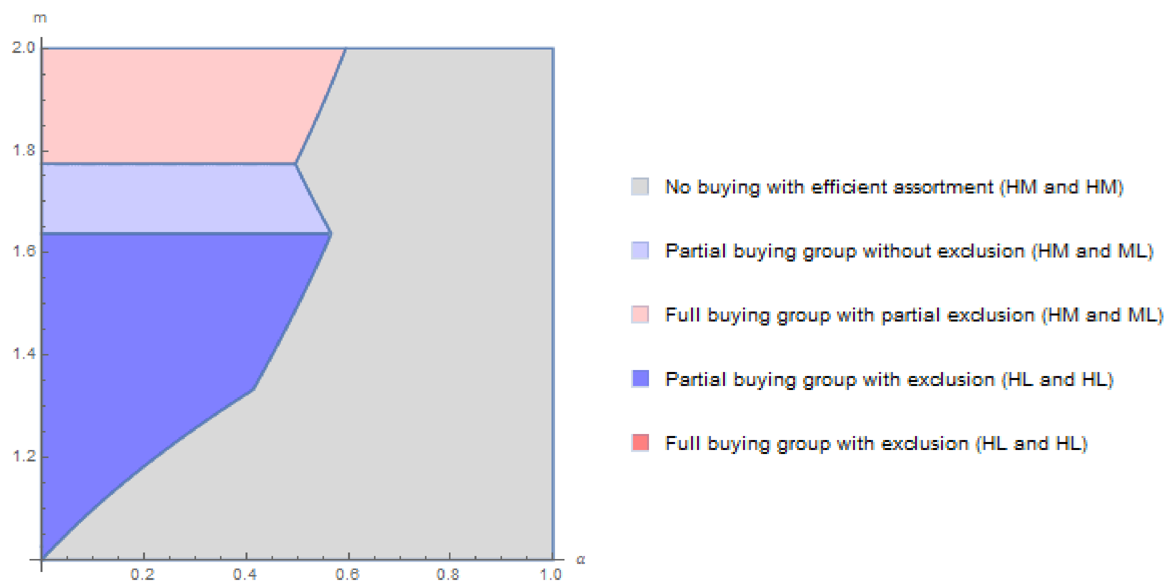
Figure 1: Alliance strategies and listing decisions



(a) Only partial buying group



(b) Only full buying group



(c) All buying groups authorized

Numerical application with linear demand, $a = 0.2$ and $E = 0.2$

4.3 The effect of buying groups on suppliers and consumers

We have seen that buying groups affect the equilibrium assortment. The above analysis reveals that small suppliers are hurt not only when they are excluded from the market (which occurs with both types of buying groups). A full buying group always enable the retailers to capture the small suppliers' profits). Partial buying groups are less harmful whenever they do not lead to the exclusion of the small suppliers (for instance in the light blue area in figure 1) but they often lead to their exclusion in equilibrium (for instance in the dark blue area in figure 1). The large suppliers are also worse off with a buying group than without, and they prefer a partial rather than a full buying group.[31]

As retailers and suppliers negotiate cost based tariffs, the buying group implementation has no effect on downstream prices for a given listing decision. Hence, consumer surplus is affected only by the product assortment. To extend the above reduced form model analysis to consumer surplus we need additional assumptions on the ranking of consumer surplus. Denoting C^{XY} the consumer surplus in the reduced form equilibrium with assortment XY on a market

Assumption 5. *Consumer surplus are ranked in the same way than industry profits:* $C^H > C^M > C^L$ *and* $C^{HM} > C^{HL} > C^{ML}$.

Assumption 5 is verified with usual demand systems such as our linear demand specification or with a model with vertical differentiation à Shaked and Sutton (1983).

Under Assumption 5, the same ranking holds for welfare (where W^{XY} is the welfare with the assortment XY):

$$\begin{aligned} &W^H > W^M > W^L \\ &W^{HM} > W^{HL} > W^{ML} \end{aligned} \tag{4}$$

Proposition 5. *Under Assumption 5, buying groups implementation always affect negatively consumer surplus and total welfare. Authorizing only partial buying group may increase consumer surplus and welfare but does not protect small suppliers from exclusion or profit losses.*

Proof. Straightforward given the ranking of industry profit previously found. ■

[31] Note that the full buying group leading to assortment AC is less profitable than a partial buying group, hence large suppliers do not benefit from the inefficiency due to the export cost of small suppliers.

The effect of authorizing only partial buying group can be analysed by comparing Figure 1-(a) and 1-(c). The two main changes, which arise only when product B is highly profitable, are delimited with dotted lines in Figure 1-(a). When the retailer's bargaining power is relatively high, a full buying group is profitable whereas a partial buying group is not. In this case, when authorizing only a partial buying group, retailers may now prefer to buy their product independently which increases consumers surplus and welfare. In contrast, when the retailers bargaining power is lower, a partial buying is created instead of the full buying group which does not affect consumer surplus but increases welfare (by saving the export cost). Finally, when product B is less profitable, the equilibrium is unaffected and the partial buying group with full exclusion still arises.

5 Discussion: product positioning across markets

In our baseline case we assume a particular product positioning on the two markets (see Assumption 4). Here we taste the robustness of our results for all possible combinations of product positioning. Among the thirty-six existing combinations of product positioning, many of which are symmetric, we can focus on the twelve different cases presented in Table 1. Note that case (12) corresponds to our baseline case.

Table 1: Twelve possible product positioning

Market 1\Market 2	ABC	ACB	BAC
ABC	(1)		
ACB	(2)	(3)	
BAC	(4)	(5)*	(6)
BCA	(7)	(8)	(9)
CAB	(10)	(11)	
CBA	(12)		

* $B \equiv H$, $A \equiv M$, $C \equiv L$ on market 1 and $A \equiv H$, $C \equiv M$ and $B \equiv L$ on market 2.

For the sake of simplicity we introduce Assumption 6, which generalizes Assumption 3. This assumption sets that the marginal contribution of a product to industry profit is higher when associated with a less profitable product.

Assumption 6.

$$\Pi^{ML} - \Pi^{L} \geq \Pi^{HM} - \Pi^{H}$$
$$\Pi^{HL} - \Pi^{L} \geq \Pi^{HM} - \Pi^{M}$$
$$\Pi^{ML} - \Pi^{M} \geq \Pi^{HL} - \Pi^{H}$$

Without buying group in all twelve cases the efficient assortment is always sold in equilibrium. With a partial or full buying group, the buying alliances limit the set of assortments available to the retailers since the assortments must be the same on the two markets. However, within this constrained set of assortments, the efficiency rule still prevails and the assortment that maximizes the sum of industry profits on the two markets is always chosen. For each of the twelve cases, we provide firms gross profit for each of the listing decisions in Appendix H, the full resolution of the twelve cases is available upon demand. In what follows we give the main insights on the profitability of buying groups for simple cases and provide a sketch of the proof for the more complex in Appendix J.

For each of the different existing product positioning we first study the profitability of a partial buying group for the retailers. For simplicity we consider that α is small enough (close to zero) which are cases in which a buying group is most likely to be profitable. In such cases, with or without buying group, retailers perceive strictly positive slotting fees. Therefore, the retailers joint profit is equal to the joint profit they would make in choosing the outside option assortment (i.e their second preferred listing decision). This outside option profit is the sum of the gross profit and the slotting fees obtained in outside option. Hence the profitability of a partial buying group depends on both the variation of the retailers' outside option gross profit and the variation of the outside option slotting fee.

In our baseline case Lemmas 5 and 6 show that suppliers' willingness to pay to have their product(s) listed is higher with a partial buying group. The following lemma 9 provides a necessary and sufficient condition on product positioning for these properties to hold.

Lemma 9. *Under Assumptions 1-2 and Assumption 6 the large supplier and small suppliers total willingness to pay to have their product(s) listed on both markets is higher with a partial buying group than without buying group whenever the ranking between A and C is inverted on the two markets. This condition is satisfied for cases in* 6 *out of* 12 *cases, namely in cases (7) to (12). In contrast, a partial buying group does not affect the suppliers' willingness to pay for being listed in cases (1) to (6).*

Proof. See appendix I. ■

Studying the variation of outside option gross profits, we obtain the following lemma:

Lemma 10. *The retailers' outside option gross profit is constant in 6 out of the twelve cases namely in cases (1), (3), (4), (6), (7), (9).*

Proof. For cases (1), (3) and (6) the ranking of products is the same on the two markets. It is straightforward that partial buying group neither affect the listing decision nor the outside option assortment and therefore has no impact. In cases (4), (7) and (9) the outside option assortment is AC on each market without buying group. with a partial buying group, whether or not the equilibrium listing decision changes (which happens in cases (7) and (9)), the outside option assortment remains AC. Therefore, the gross outside option profit of the retailer is $\pi^{AC}_{r_i,i}$ on each market with and without buying group. ■

Given lemmas 9 and 10, a partial buying group can be profitable for the retailer in cases (7) and (9) because the outside option gross profit of the retailers is unchanged whereas the suppliers' willingness to pay to be listed by the buying group weakly increases. These two lemmas 9 and 10 also enable us to show that a partial buying group cannot be profitable in cases (1), (3), (4), (6).

Interestingly the buying group can be profitable when the willingness to pay of suppliers to be listed is unaffected by the partial buying group. For example, in cases (2) and (5), according to lemma 9, the suppliers' willingness to pay to be listed is unchanged. In these cases, a partial buying group only affects one of the two markets, both in terms of equilibrium assortment and outside option. Moreover, the efficient assortment becomes the outside option on the affected market which benefits to the retailers. Here, the creation of partial buying group only triggers an increase in the outside option gross profit on the affected market. Remaining cases are more complex because both variations in outside option slotting fees and in outside option gross profits are opposed (A detailed proof is available in Appendix J). We obtain the following proposition:

Proposition 6. *Under Assumption 1-2 and Assumption 6, a partial buying group can be profitable for retailers if and only if the least profitable product is not the same on the two markets that is for cases: (2), (5), (7), (8), (9), (10), (12). A partial buying group does not affect retailers joint profit in cases (1), (3), (4) and (6) and is always unprofitable in the case (11).*

Proof. See Appendix J. ∎

Resolution of the model in the twelve cases allow us to asses the generality of the results obtained in the baseline case. Forming a partial buying group can be profitable for retailers only if the least profitable product is not the same on the two market. This implies that a partial buying group is profitable only when it harms the industry profit. We find that in both cases (8) and (12) the partial buying group may create inefficiencies on the two markets. In all the remaining cases in which a partial buying group can be profitable an inefficient assortment arises in equilibrium on one of the two markets. Both large and small suppliers bears the reduction of the industry profit, this generalizes an interesting competition policy result of the Proposition 2 which argues that restricting the scope of buying groups to their negotiations with large supplier does not prevent any harm to small suppliers. Small suppliers can be fully excluded in cases (2), (8), (10) and (12).

Now we focus on the profitability of a full buying group. First, note that if the export cost is null ($E = 0$), whenever a partial buying group is profitable it is also the case for a full buying group. However, a partial buying group is always preferred to a full buying group when the export cost is positive ($E > 0$) and the total industry profit (sum of market 1 and

2 industry profit) is higher excluding B than excluding A or C. Solving the model for each of the cases gives us the following proposition:

Proposition 7. *Under Assumption 4-2 and Assumption 6, whenever $E > 0$, a full buying group can be profitable for retailers if and only if the listing of product B is efficient. That is for cases: (1), (4), (5), (6), (7), (8), (9), (12). By contrast, a full buying group is always unprofitable in the cases (2), (3), (10), (11).*

Proof. For a given alliance strategy, the listing decision is such that the most efficient assortment of product available is listed. When AC is listed, the slotting fee is paid by the large supplier to avoid the threat of replacement exerted by product B. With a full buying group, small suppliers willingness to pay for being listed on the two markets is lower than with partial buying group because of the export cost. Hence retailers' profit is higher with a partial buying group than with a full buying group.

When B is listed, the slotting fee is paid by the small supplier. With a full buying group, small suppliers offer their total gross profit minus the export cost. When E is sufficiently small this is larger than what they offer with a partial buying group. Hence when industry profit is greater with AB or BC on the two markets than with AC on the two markets, a full buying group can be profitable. ■

6 Conclusion

This article analyzes the impact of retailers' buying groups on product variety and profit sharing within a vertical chain with both multi-product suppliers and retailers. We extend the results previously highlighted by Inderst and Shaffer (2007) to a more complex setting and find that creating a buying group reduces the overall variety of products, thereby harming consumer surplus and welfare. By committing themselves to a joint listing strategy, retailers may increase the competition among suppliers for being listed and capture a larger share of a smaller industry profit. Creating a buying group is thus profitable for retailers when their buyer power is limited.

By considering a multi-product setting with asymmetric suppliers, we are able to analyze the effects of buying groups on the selection of products and on the sharing of profits in the vertical chain, and especially to differentiate their effects on "large" versus "small" suppliers, for instance, the producers of national brands vs. those of private labels. We show that when buying groups are created, all suppliers are worse off, and small suppliers can be excluded. We point out that even if retailers argue that (full) buying groups may create an opportunity for SMEs to access new markets, there is little benefit to expect for small suppliers.

We also address the competition policy issue of the scope of buying groups, by comparing the effects of partial and full buying groups on product variety, industry profit and welfare. Our results confirm that restricting the scope of the buying group to the negotiation with large suppliers can reduce the harm for welfare. But we contradict the widespread argument in favour of partial buying groups stating that because small suppliers are outside of the scope of the buying group they are not harmed: on the contrary, we show that partial buying group always lead to a decrease in profits for the small suppliers, and in some cases to their exclusion from the market. These results suggest that competition authorities should have a careful look at the constitution of new buying groups even when retailers commit to leaving small suppliers out of the scope of their alliance. These conclusions also hold for cross-border mergers. We show that our main results apply for different types of market heterogeneity as long as without buying groups the listing decision differ across markets.

By construction, we emphasize here the "dark side" of buying groups; in practice, their "bright side", highlighted in the literature, may also translate into lower final prices. The present analysis is designed to contribute to the evaluation of the overall impact of buying groups on welfare, so as to provide guidance for antitrust policy.

Appendix

A Stage 2 negotiation

In our paper, we assume that slotting fees are non-negative hence in stage 2, retailers always negotiate for two products.

A.1 Product M is sold

Consider first the subgames where retailer r_i sells product M, that is, assortment is XM, with $X \in \{H, L\}$.

Consider the negotiation between r_i and l. The retailer's profit when she succeeds in both negotiations is $\Pi^{XM} - F_{l,i}^{XM} - F_{s_i,i}^{XM}$, while her status quo profit in case of a breakdown is $\Pi^M - F_{s_i,i}^{XM}$. The supplier's profit if the negotiation succeeds is $F_{l,i}^{XM} + F_{lj}$, while his status quo profit in case of a breakdown is F_{lj}. Consider now the negotiation between r_i and s_i. The retailer's profit when she succeeds in both negotiations is $\Pi^{XM} - F_{l,i}^{XM} - F_{s_i,i}^{XM}$, while her status quo profit in case of a breakdown is $\Pi^M - F_{l,i}^{XM}$. The supplier's profit if the negotiation succeeds is $F_{s_i,i}^{XM}$, while his status quo profit in case of a breakdown is 0.

Standard resolution of the Nash bargaining thus yields the following profit sharing:

$$(1-\alpha)(\Pi^{XM} - F_{l,i}^{XM} - F_{s_i,i}^{XM} - (\Pi^M - F_{s_i,i}^{XM}) = \alpha(F_{l,i}^{XM} + F_{lj} - F_{lj})$$
$$(1-\alpha)(\Pi^{XM} - F_{l,i}^{XM} - F_{s_i,i}^{XM} - (\Pi^M - F_{l,i}^{XM}) = \alpha F_{s_i,i}^{XM}$$

Hence the following equilibrium values:

$$F_{l,i}^{XM} = (1-\alpha)(\Pi^{XM} - \Pi^M)$$
$$\pi_{r_i,i}^{XM} = \Pi^{XM} - F_{l,i}^{XM} - F_{s_i,i}^{XM} = (1-\alpha)(\Pi^X + \Pi^M) + (-1+2\alpha)\Pi^{XM}$$
$$\pi_{l,i}^{XM} = F_{l,i}^{XM} = (1-\alpha)(\Pi^{XM} - \Pi^M)$$
$$\pi_{s_i,i}^{XM} = F_{s_i,i}^{XM} = (1-\alpha)(\Pi^{XM} - \Pi^X)$$

A.2 Assortment HL is chosen

Consider the negotiation between r_i and l. The retailer's profit when she succeeds in both negotiations is $\Pi^{HL} - F^{HL}_{l,i}$, while her status quo profit in case of a breakdown is 0. The supplier's profit if the negotiation succeeds is $F^{HL}_{l,i} + F^{HL}_{lj}$, while his status quo profit in case of a breakdown is F^{HL}_{lj}. In this case, there is only one negotiation, the retailer negotiates for both products simultaneously, and the Nash condition can be written as follows:

$$(1-\alpha)(\Pi^{HL} - F^{HL}_{l,i}) = \alpha F^{HL}_{l,i}$$

Hence the following equilibrium values:

$$\begin{aligned}
F^{HL}_{l,i} &= (1-\alpha)\Pi^{HL} \\
\pi^{HL}_{r_i,i} &= \Pi^{HL} - F^{HL}_{l,1} = \alpha\Pi^{HL} \\
\pi^{HL}_{l,i} &= F^{HL}_{l,i} = (1-\alpha)\Pi^{HL} \\
\pi^{HL}_{s_i,i} &= 0
\end{aligned}$$

A.3 Proof lemma 1

Lemma 1 states that under Assumptions 1-3 firms' profits gross of slotting fees can be ranked as follows:

$$\begin{aligned}
&\pi^{HM}_{r_i,i} \geq \max\{\pi^{HL}_{r_i,i}, \pi^{ML}_{r_i,i}\} \;\&\; \min\{\pi^{HL}_{r_i,i}, \pi^{ML}_{r_i,i}\} \geq \pi^{H}_{r_i,i} \geq \pi^{M}_{r_i,i} \geq \pi^{L}_{r,i} \geq 0 \\
&\pi^{HL}_{l,i} \geq \pi^{H}_{l,i} \geq \max\{\pi^{HM}_{l,i}, \pi^{L}_{l,i}\} \geq \pi^{ML}_{l,i} \geq \pi^{M}_{l,i} = 0 \\
&\pi^{M}_{s_i,i} \geq \pi^{ML}_{s_i,i} > \pi^{HM}_{s_i,i} > \pi^{HL}_{s_i,i} = \pi^{H}_{l,i} = \pi^{L}_{l,i} = 0;
\end{aligned}$$

Under Assumption 3, on each market, supplier l sells product H and L and supplier s_i sells product M. For such a market structure we compare continuation profits obtains in stage 2 for each continuation game.

- First, $\pi^{HM}_{r_i,i} \geq \max\{\pi^{HL}_{r_i,i}, \pi^{ML}_{r_i,i}\} \;\&\; \min\{\pi^{HL}_{r_i,i}, \pi^{ML}_{r_i,i}\} \geq \pi^{H}_{r_i,i} \geq \pi^{M}_{r_i,i} \geq \pi^{L}_{r,i} \geq 0$

- $\pi^{HM}_{r_i,i} - \pi^{HL}_{r_i,i} = \alpha(\Pi^{HM} - \Pi^{HL}) + (1-\alpha)(\Pi^{H} + \Pi^{M} - \Pi^{HM}) \geq 0$. Under Assumption 1, $\Pi^{HM} - \Pi^{HL} > 0$ and under Assumption 2, $\Pi^{H} + \Pi^{M} - \Pi^{HM} > 0$.
- $\pi^{HM}_{r_i,i} - \pi^{ML}_{r_i,i} = \alpha(\Pi^{HM} - \Pi^{ML}) + (1-\alpha)(\Pi^{ML} - \Pi^{L} - (\Pi^{HM} - \Pi^{H})) \geq 0$. Under Assumption 1, $\Pi^{HM} - \Pi^{ML} > 0$ and under Assumption 4, $(\Pi^{ML} - \Pi^{L} - (\Pi^{HM} - \Pi^{H})$.
- Under assumption 1 it is straightforward that $\pi^{HL}_{r_i,i} \geq \pi^{H}_{r_i,i} \geq \pi^{M}_{r_i,i} \geq \pi^{L}_{r,i} \geq 0$. Moreover $\pi^{ML}_{r_i,i} - \pi^{H}_{r_i,i} = \alpha(\Pi_{ML} - \Pi_{H}) + (1-\alpha)(\Pi^{M} + \Pi^{L} - \Pi^{ML}) \geq 0$. Under Assumption 1 $\Pi_{ML} - \Pi_{H} > 0$ and under Assumption 2 $\Pi^{M} + \Pi^{L} - \Pi^{ML} > 0$.

- Second, $\pi^{HL}_{l,i} \geq \pi^{H}_{l,i} \geq \max\{\pi^{HM}_{l,i}, \pi^{L}_{l,i}\} \geq \pi^{ML}_{l,i} \geq \pi^{M}_{l,i} = 0$
  - $\pi^{HL}_{l,i} - \pi^{H}_{l,i} = (1-\alpha)(\Pi^{HL} - \Pi^{H}) \geq 0$ under Assumption 1.
  - $\pi^{H}_{l,i} - \pi^{HM}_{l,i} = (1-\alpha)(\Pi^{H} - (\Pi^{HM} - \Pi^{H})) \geq 0$. Under Assumption 2 $\Pi^{HM} - \Pi^{H} < \Pi^{M}$, under Assumption 1 $\Pi^{H} > \Pi^{M}$. $\pi^{H}_{l,i} - \pi^{L}_{l,i} = (1-\alpha)(\Pi^{H} - \Pi^{L}) \geq 0$ under Assumption 1.
  - $\pi^{HM}_{l,i} - \pi^{ML}_{l,i} = (1-\alpha)(\Pi^{HM} - \Pi^{ML} > 0)$ under Assumption 1. $\pi^{L}_{l,i} - \pi^{ML}_{l,i} = (1-\alpha)(\Pi^{L} - (\Pi^{ML} - \Pi^{M}) > 0)$. $\Pi^{ML} - \Pi^{M} < \Pi^{L}$ under Assumption 2.

- Third, $\pi^{M}_{s_i,i} \geq \pi^{ML}_{s_i,i} \geq \pi^{HM}_{s_i,i} \geq \pi^{HL}_{s_i,i} = \pi^{H}_{l,i} = \pi^{L}_{l,i} = 0$.
  - $\pi^{M}_{s_i,i} - \pi^{ML}_{s_i,i} = (1-\alpha)(\Pi^{M} - (\Pi^{ML} - \Pi^{L}) \geq 0$. Under Assumption, 2 $\Pi^{ML} - \Pi^{L} < \Pi^{M}$.
  - $\pi^{ML}_{s_i,i} - \pi^{HM}_{s_i,i} = (1-\alpha)((\Pi^{ML} - \Pi^{L}) - (\Pi^{HM} - \Pi^{H}))) \geq 0$ under Assumption 4.

B Proof of lemma 2

(i) Under Assumptions 1 to 4, retailers always prefer to list two products. Indeed, lemma 1 shows that listing any combination of two products (weakly) increases retailers' profit gross of slotting fees as compared to listing only one product. Moreover, for any menu of slotting fees, listing two products (weakly) increase slotting-fees paid by suppliers as slotting fees are not conditional on the other supplier's product listed.

(ii) Under Assumptions 1 to 4, for any alliance strategy, suppliers are never ready to pay a positive slotting fee for selling only one product.

- With no buying group, whenever r_i decides to list product M she chooses between listing HM or ML. Under Assumptions 2 and 3, in the continuation equilibria r_i obtains the highest gross profit with the assortment HM. Hence, l does not need to pay a positive slotting fee for his product H to be listed. Furthermore, l has a larger gross profit when selling HM than ML and he will thus not offer a positive slotting fee for product L only.

- With a partial / full buying group, whenever r_i decides to list product M she chooses to list assortment HM on one market and ML on the other (because she lists either AB or BC on the two markets). Under assumption 1, l makes a higher gross profit selling products H and L on both markets rather than selling only one product on the two markets (leading to assortment HM on one market and ML on the other). Hence, it is never profitable for l to pay a positive slotting fee for selling only one product.

C Proof of Proposition 1

We subsequently analyze deviations from suppliers' slotting fees offers. Then, we consider r_i's deviations from the product assortment HM.

- Consider the slotting fees offered by l. We have shown in lemma 2 that supplier l is not ready to offer a positive slotting fee to have only product H or L listed. In equilibrium, as he expects product H to be listed, he thus offers $\overline{S}^H_{s_i,i} = 0$: paying more would decrease his profit. Besides, offering a positive fee to push product L only would not be profitable. Finally, if l increased his offer by ε for the third fee, r_i would accept it and list his two products; however, this would not be profitable for l as shown in lemma 3.

- Consider now the slotting fees offered by s_i, $\overline{S}_{s_i,i} = max\{0, \Pi^{HL} - \alpha\Pi^{HM} - (1-\alpha)\Pi^H\}$. When $\overline{S}_{s_i,i} = 0$, s_i has no incentive to increase it because it would decrease his profit.

When $\overline{S}_{s_i,i} = \Pi^{HL} - \alpha\Pi^{HM} - (1-\alpha)\Pi^{H}$: Offering less would not be profitable as r_i would switch to the assortment HL and that would reduce l's profit to zero offering more would decrease his profit.

Finally, given the profile of slotting fees, r_i is indifferent between the assortments HM and HL, and any other assortment is a dominated choice.

Due to the asymmetric Bertrand competition structure of the game, the above pure-strategy Nash equilibrium is not unique, but the other equilibria rely on weakly dominated strategies and the equilibrium described in Proposition 1 can be selected by the trembling-hand selection criterion. All equilibria display the same assortment HM.

D Proof of Proposition 2

We first show that with a partial buying group, the assortment that arises in equilibrium is either AC on both markets (that is, the two small suppliers are excluded from the market) or one of the two symmetric assortment AB or BC on both markets (that is, the small supplier is not excluded). The equilibrium assortment is the one that maximizes the sum of the two retailers profits.

The maximum fee l is ready to pay to ensure his two products are listed (see lemma 5) yields a total joint profit for the retailers of

$$\pi^{HL}_{r_1,1} + \pi^{HL}_{r_2,2} + \pi^{HL}_{l,1} + \pi^{HL}_{l,2} - \pi^{HM}_{l,1} - \pi^{ML}_{l,2}, \tag{5}$$

whereas the maximum fee the small suppliers are ready to pay to have their products listed (see lemma 6) yield a total joint profit for the retailers of

$$\pi^{HM}_{r_1,1} + \pi^{ML}_{r_2,2} + \pi^{HM}_{s_1,1} + \pi^{ML}_{s_2,2}. \tag{6}$$

Comparing these two expressions yields the following result: Whenever

$$2\Pi^{HL} \geq \Pi^{HM} + \Pi^{ML}. \tag{7}$$

then the buying group will choose the assortment AC in equilibrium; in that case l offers them in stage 1 the following profile of slotting fees:

$$\widehat{S}_l^e = (0, 0, \max\{\alpha(\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}) + 2(1-\alpha)\Pi^M, 0\})$$

Note that the third fee is positive if the joint profit of the retailers with the competing assortment (AB or BC) is larger that the gross profit expected by the retailers with the assortment AC (in that case, it makes the buying group indifferent between the two possible assortments), otherwise it is zero.

By contrast if condition 7 does not hold, the buying group prefers to list the small supplier's product, and choose a common assortment that is either AB or BC. In that case the small suppliers offer $\widehat{S}_s^{ne} = \max\{2\Pi^{HL} - \alpha(\Pi^{HM} + \Pi^{ML}) - (1-\alpha)(\Pi^H + \Pi^L), 0\}$ such that $\widehat{S}_{s_1,1}^{ne} \leq \pi_{s_1,1}^{HM}$ and $\widehat{S}_{s_2,2}^{ne} \leq \pi_{s_2,2}^{ML}$. Again, the fee is positive if the joint profit of the retailers with the competing assortment (AC) is larger that the gross profit expected by the retailers with the assortment AB (in that case, it makes the buying group indifferent between the two possible assortments), otherwise it is zero.

We check now that this is indeed an equilibrium. First, if the suppliers make the above offers, we have shown that the buying group chooses the assortment that maximizes the joint profit of the retailers. Consider now possible deviations by the suppliers.

Assume first that $2\Pi^{HL} \geq \Pi^{HM} + \Pi^{ML}$. We have shown in lemma 2 that l is not ready to offer a positive slotting fee to have only product H or L listed. In equilibrium, as he expects product assortment HL to be listed, he thus offers $\widehat{S}_{l,i}^A = \widehat{S}_{l,i}^C = 0$, offering more would increase profitability of this assortment for the retailers, then he would have to offer a larger $\widehat{S}_{l,i}^{AC}$ to have his two products listed. Furthermore, when $\max\{\alpha(\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}) + 2(1-\alpha)\Pi^M, 0\} = 0$, l has not incentive to increase it offer because it would decrease his profit.When $\max\{\alpha(\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}) + 2(1-\alpha)\Pi^M, 0\} > 0$: offering less would not be profitable as the buying group would switch to assortment AB (see lemma 5), offering more would clearly reduce his profit. Finally, the small suppliers cannot afford to make any offer that would lead the buying group to list their products (see lemma 6). [32]

Assume now that $2\Pi^{HL} < \Pi^{HM} + \Pi^{ML}$. We have shown in lemma 2 that l is not ready to offer a positive slotting fee to have only product H or L listed. In equilibrium, as he expects product assortment AB to be listed, he thus offers $\widehat{S}^{A}_{l,i} = 0$: paying more to push product A only would not be profitable. Furthermore, lemma 5 shows that if l increased his slotting fee offer by ϵ for assortment AC, the retailer would accept it which would not be profitable for the supplier.

Consider now slotting fees offered by s_1 and s_2. Their joint offer is $\widehat{S}^{ne}_{s} = \max\{2\Pi^{HL} - \alpha(\Pi^{HM}+\Pi^{ML}) - (1-\alpha)(\Pi^{H}+\Pi^{L}), 0\}$ such that $\widehat{S}^{ne}_{s_1,1} \leq \pi^{HM}_{s_1,1}$ and $\widehat{S}^{ne}_{s_2,2} \leq \pi^{ML}_{s_2,2}$. If $\max\{2\Pi^{HL} - \alpha(\Pi^{HM}+\Pi^{ML}) - (1-\alpha)(\Pi^{H}+\Pi^{L}), 0\} = 0$, each small supplier has not interest to increase it offer because it would decrease his profit. When $\max\{2\Pi^{HL} - \alpha(\Pi^{HM}+\Pi^{ML}) - (1-\alpha)(\Pi^{H}+\Pi^{L}), 0\} > 0$, if one of the small suppliers decreased it offer, then the buying group would choose assortment AC and both small suppliers would make zero profit. It is clear that none of the two small suppliers is willing to pay a larger slotting fee.

E Proof of Proposition 3

We first show that with a partial buying group, the assortment that arises in equilibrium is either AC on both markets (that is, the two small suppliers are excluded from the market) or one of the two symmetric assortment AB or BC on both markets (that is, one small supplier is listed for the two markets). The equilibrium assortment is the one that maximizes the sum of the two retailers profits.

First, we have shown in lemma 8 that, being listed or not each small suppliers always offers a slotting fee equal to his willingess to pay to be listed on the two markets. Then, it is

[32] As in Proposition 1, there exist a continuum of equilibria where all suppliers offer larger fees and the buying group selects the two products of the large supplier; we select by the trembling-hand criterion.

straightforward that the joint profit of retailers for a listing decision AB or BC is:

$$(1-\alpha)(2\Pi^{M})+\alpha(\Pi^{HM}+\Pi^{ML})-E \tag{8}$$

Now we show that there are no profitable deviation for the buying group and l.

Consider first the buying group incentives to deviate. Assume $\Pi^{HM}+\Pi^{ML}-E\geq 2\Pi^{HL}$, then retailers' joint profit listing AB or BC is higher that what it would be listing products AC (which is equal to $2\pi^{HL}_{r_i,i}+\widetilde{S}^{pe}_{l}$). Hence, retailers have no incentive to deviate form the listing assortment AB or BC. Assume now that $\Pi^{HM}+\Pi^{ML}-E<2\Pi^{HL}$, then retailers' joint profit is the same listing AC that what they would obtain listing AB or BC (which is equal to $\pi^{HM}_{r_i,i}+\pi^{ML}_{r_i,i}+\widetilde{S}^{e}_{s}$). Then retailers have no incentive to deviate from the listing assortment AC.

Consider now the large supplier incentive to deviate. Assume $\Pi^{HM}+\Pi^{ML}-E\geq 2\Pi^{HL}$, the equilibrium listing decision is either AB or BC. The large supplier equilibrium menu of slotting fees is: $\widetilde{S}^{pe}_{l}=(0,0,\max\{(1-\alpha)(2\Pi^{HL}-\Pi^{HM}-\Pi^{ML}+2\Pi^{M})-E),0\})$. He has no incentive to increase his offer for products A or B because it would decrease his profit. Moreover, it is not profitable for l to increase his slotting fee offer for having his two products listed because it would not be profitable (see 7). Assume now that $\Pi^{HM}+\Pi^{ML}-E<2\Pi^{HL}$, the equilibrium listing decision is AC. The large supplier equilibrium menu of slotting fees is : $\widetilde{S}^{e}_{l}=(0,0,\max\{(1-\alpha)(2\Pi^{M})+\alpha(\Pi^{HM}+\Pi^{ML}-2\Pi^{HL})-E,0\})$. l has no incentive to have only one product listed, say A, as if the listing assortment AB was selected, it would only decrease his profit. l has no incentive to decrease his offer for having his two products listed, otherwise the listing decision would be changed. He has no incentive to raise his offer neither, because it would decrease his profit.

F Proof of Proposition 4

Retailers choose their alliances strategy in order to maximize their joint profit.

First assume that $\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq 0 < E$. Proposition 2 and Proposition 3 show that whenever retailers have opted for partial or full buying groups they choose a listing decision AC. From these two Propositions we also know that $\widehat{\Pi}_r^e \geq \widetilde{\Pi}_r^e$ because in the case with a full buying group retailers compete against an inefficient small suppliers instead of two efficient suppliers with a partial buying group. Hence, when $\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq 0 < E$ full buying group is (weakly) dominated by partial buying group. Now lets compare $\overline{\Pi}_r^e$ to $\widehat{\Pi}_r^e$. When $\overline{S}_{l,i} > 0$ and $\widehat{S}_l^e > 0$, $\widehat{\Pi}_r^e \geq \overline{\Pi}_r^e$ as long as $\alpha \leq \frac{2(\Pi^{HM} - \Pi^{HL})}{\Pi^{HM} - \Pi^{ML}} = \alpha_1$. When $\overline{S}_{l,i} = 0$ and $\widehat{S}_l^e > 0$, $\widehat{\Pi}_r^e \geq \overline{\Pi}_r^e$ as long as $\alpha \leq \frac{2(\Pi^{HM} - \Pi^{H})}{3\Pi^{HM} - \Pi^{ML} - 2\Pi^{H}} = \alpha_2$. When $\widehat{S}_l^e = 0$, $\widehat{\Pi}_r^e \leq \overline{\Pi}_r^e$.

Assume now that $0 \leq \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq E$. Proposition 2 that whenever retailers have opted for partial buying group the listing decision is AB or BC and Proposition 3 show that whenever retailers have opted for partial or full buying groups they choose a listing decision AC. It is clear that $\widehat{\Pi}_r^e \geq \widetilde{\Pi}_r^e$, in fact assume that $E = 0$, $\widetilde{\Pi}_r^{ne} \leq \widetilde{\Pi}_r^e = \widehat{\Pi}_r^e$. Now lets compare $\widehat{\Pi}_r^{ne}$ to $\overline{\Pi}_r^e$. When $\overline{S}_{s_i,i} > 0$ and $\widehat{S}_s^{ne} > 0$, $\widehat{\Pi}_r^e \geq \overline{\Pi}_r^e$. When $\overline{S}_{s_i,i} > 0$ and $\widehat{S}_s^{ne} = 0$, $\widehat{\Pi}_r^e \geq \overline{\Pi}_r^e$ as long as $\alpha \leq \frac{\Pi_{HM} + 2\Pi_{HL} - 2\Pi_H - \Pi_{ML}}{3\Pi_{HM} - \Pi_{ML} - 2\Pi_H} = \alpha_3$. When $\overline{S}_{s_i,i} = 0$ and $\widehat{S}_s^{ne} = 0$, $\widehat{\Pi}_r^e \leq \overline{\Pi}_r^e$. Finally $\overline{S}_{s_i,i} > 0$ and $\widehat{S}_s^{ne} = 0$ does not exist as $\overline{S}_{s_i,i} \geq \widehat{S}_l^{ne}$

Assume now that $\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \geq E$. Proposition 2 and Proposition 3 show that whenever retailers have opted for partial or full buying groups they choose a listing decision AB or BC. In this case, $\widehat{\Pi}_r^e \leq \widetilde{\Pi}_r^e$ because in the two cases the slotting fee is paid by small supplier(s), this amount is larger with a full buying group. Lets compare $\overline{\Pi}_r^e$ to $\widetilde{\Pi}_r^e$. It is clear that when $\widetilde{S}_l^e = 0$ that $\overline{\Pi}_r^e \geq \widetilde{\Pi}_r^e$. Whenever $\widetilde{S}_l^e = 0$ we know from Proposition 3 and Proposition 2 that $\widetilde{\Pi}_r^e = \widehat{\Pi}_r^e - E$, then simple computation gives that $\overline{\Pi}_r^e < \widetilde{\Pi}_r^e$ if and only if $\alpha \leq \min\{\alpha_4, \alpha_5\}$.

G Numerical application

We consider that in each market, there are three differentiated goods H, M, L, and as the retailers have limited capacity, only two goods are available on each market. When the two goods X, Z are available, the representative consumer's utility is defined as follows for $x, z \in \{h, m, l\}$ & $x \neq z$, where h, m, l represents intrinsic preference for goods H, M, L:

$$\nu + U_{x,z} = \nu + xq_x + zq_z - \frac{1}{2}(q_x^2 + q_z^2) - aq_x \times q_z.$$

The parameter ν is a numeraire ($p_\nu = 1$), and a represents the degree of substitutability between goods x and z. Maximizing the utility of the representative consumer under the budget constraint leads to the following linear demand functions:

$$q_x = \frac{x - az - p_x + ap_z}{1 - a^2}$$
$$q_z = \frac{z - ax - p_z + ap_x}{1 - a^2}$$

We set $h = 2$, $l = 1$ $m \in [1, 2]$ and $a \in [0; 0.5]$; this calibration satisfies the assumptions 1-4 of the model.

H Gross profits for alternative profit positioning

Assume $\boldsymbol{A \equiv H}$, $\boldsymbol{B \equiv L}$, $\boldsymbol{C \equiv M}$, firms gross profits are :

$$
\begin{array}{l|l|l}
\text{For assortment } AB: & \text{For assortment } BC: & \text{For assortment } AC: \\
\pi^{HL}_{s_i,i} = (1-\alpha)(\Pi^{HL} - \Pi^{H}) & \pi^{ML}_{s_i,i} = (1-\alpha)(\Pi^{ML} - \Pi^{H}) & \pi^{HM}_{s_i,i} = 0 \\
\pi^{HL}_{l,i} = (1-\alpha)(\Pi^{HL} - \Pi^{L}) & \pi^{ML}_{l,i} = (1-\alpha)(\Pi^{ML} - \Pi^{L}) & \pi^{HM}_{l,i} = (1-\alpha)(\Pi^{HM}) \\
\pi^{HL}_{r_i,i} = (1-\alpha)(\Pi^{H} + \Pi^{L}) & \pi^{ML}_{r_i,i} = (1-\alpha)(\Pi^{M} + \Pi^{L}) & \pi^{HM}_{r_i,i} = \alpha\Pi^{HM} \\
\quad + (-1+2\alpha)\Pi^{HL} & \quad + (-1+2\alpha)\Pi^{ML} &
\end{array}
$$

Assume $\boldsymbol{A \equiv M}$, $\boldsymbol{B \equiv H}$, $\boldsymbol{C \equiv L}$, firms gross profits are :

$$
\begin{array}{l|l|l}
\text{For assortment } AB: & \text{For assortment } BC: & \text{For assortment } AC: \\
\pi^{HM}_{s_i,i} = (1-\alpha)(\Pi^{HM} - \Pi^{M}) & \pi^{HL}_{s_i,i} = (1-\alpha)(\Pi^{HL} - \Pi^{L}) & \pi^{ML}_{s_i,i} = 0 \\
\pi^{HM}_{l,i} = (1-\alpha)(\Pi^{HM} - \Pi^{H}) & \pi^{HL}_{l,i} = (1-\alpha)(\Pi^{HL} - \Pi^{H}) & \pi^{ML}_{l,i} = (1-\alpha)(\Pi^{ML}) \\
\pi^{HM}_{r_i,i} = (1-\alpha)(\Pi^{H} + \Pi^{M}) & \pi^{HL}_{r_i,i} = (1-\alpha)(\Pi^{H} + \Pi^{L}) & \pi^{ML}_{r_i,i} = \alpha\Pi^{ML} \\
\quad + (-1+2\alpha)\Pi^{HM} & \quad + (-1+2\alpha)\Pi^{HL} &
\end{array}
$$

Assume $\boldsymbol{A \equiv L}$, $\boldsymbol{B \equiv H}$, $\boldsymbol{C \equiv M}$, firms gross profits are :

$$
\begin{array}{l|l|l}
\text{For assortment } AB: & \text{For assortment } BC: & \text{For assortment } AC: \\
\pi^{HL}_{s_i,i} = (1-\alpha)(\Pi^{HL} - \Pi^{L}) & \pi^{HM}_{s_i,i} = (1-\alpha)(\Pi^{HM} - \Pi^{M}) & \pi^{ML}_{s_i,i} = 0 \\
\pi^{HL}_{l,i} = (1-\alpha)(\Pi^{HL} - \Pi^{H}) & \pi^{HM}_{l,i} = (1-\alpha)(\Pi^{HM} - \Pi^{H}) & \pi^{ML}_{l,i} = (1-\alpha)(\Pi^{ML}) \\
\pi^{HL}_{r_i,i} = (1-\alpha)(\Pi^{H} + \Pi^{L}) & \pi^{HM}_{r_i,i} = (1-\alpha)(\Pi^{H} + \Pi^{M}) & \pi^{ML}_{r_i,i} = \alpha\Pi^{ML} \\
\quad + (-1+2\alpha)\Pi^{HL} & \quad + (-1+2\alpha)\Pi^{HM} &
\end{array}
$$

Assume $\boldsymbol{A \equiv M}$, $\boldsymbol{B \equiv L}$, $\boldsymbol{C \equiv H}$, firms gross profits are :

$$
\begin{array}{l|l|l}
\text{For assortment } AB: & \text{For assortment } BC: & \text{For assortment } AC: \\
\pi^{ML}_{s_i,i} = (1-\alpha)(\Pi^{ML} - \Pi^{M}) & \pi^{HL}_{s_i,i} = (1-\alpha)(\Pi^{HL} - \Pi^{H}) & \pi^{HM}_{s_i,i} = 0 \\
\pi^{ML}_{l,i} = (1-\alpha)(\Pi^{ML} - \Pi^{L}) & \pi^{HL}_{l,i} = (1-\alpha)(\Pi^{HL} - \Pi^{L}) & \pi^{HM}_{l,i} = (1-\alpha)(\Pi^{HM}) \\
\pi^{ML}_{r_i,i} = (1-\alpha)(\Pi^{M} + \Pi^{L}) & \pi^{HL}_{r_i,i} = (1-\alpha)(\Pi^{H} + \Pi^{L}) & \pi^{HM}_{r_i,i} = \alpha\Pi^{HM} \\
\quad + (-1+2\alpha)\Pi^{ML} & \quad + (-1+2\alpha)\Pi^{HL} &
\end{array}
$$

I Proof of lemma 9

Assume that the ranking between A and C is inverted among the two markets: $\Pi^A > \Pi^C$ on market 1 and $\Pi^A < \Pi^C$ on market 2, say. Consider also that with buying group, whenever B is listed the listing decision is AB (BC would be equivalent).

First consider l's willingness to pay. Without buying group, l's willingness to pay to have his two products listed is equal to $\overline{S}^+_{l,1} = \pi^{AC}_{l,1} - \pi^{AB}_{l,1}$ on market 1 and $\overline{S}^+_{l,2} = \pi^{AC}_{l,2} - \pi^{BC}_{l,2}$ on market 2, hence l's willingness to pay to have his two products listed on both market is equal to $\overline{S}^+_{l,1} + \overline{S}^+_{l,2}$. With a buying group, the l's willingness to pay to have his two products listed on both markets is equal to $\widehat{S}^+_l = (\pi^{AC}_{l,1} - \pi^{AB}_{l,1}) + (\pi^{AC}_{l,2} - \pi^{AB}_{l,2}) \geq \overline{S}^+_{l,1} + \overline{S}^+_{l,2}$ because in the case we focus on, $\Pi^A < \Pi^C$ on market 2, under Assumption 1 we have $\pi^{BC}_{l,2} \geq \pi^{AB}_{l,2}$.

Consider now small suppliers' total willingness to pay. Without buying group, the s_1's (resp. s_2) willingness to pay to have his product listed is $\overline{S}^+_{s_1,1} = \pi^{AB}_{s_1,1}$ (resp. $\overline{S}^+_{s_2,2} = \pi^{BC}_{s_2,2}$) on market 1 (resp. on market 2). Hence the small supplier's total willingness to pay to be listed on both markets is equal to $\widehat{S}^+_s = \pi^{AB}_{s_1,1} + \pi^{BC}_{s_2,2}$. With a buying group, the small suppliers' total willingness to pay to have their listed on each market is equal to $\widehat{S}^+_s \geq \overline{S}^+_{s_1,1} + \overline{S}^+_{s_2,2}$ because in the case we focus on $\Pi^A < \Pi^C$ on market 2, under Assumption 6 $\pi^{AB}_{s_2,2} \geq \pi^{BC}_{s_2,2}$.

Assuming now that product A and C are ranked in the same way on the two markets, a similar reasoning shows that supplier's total willingness to pay is not affected by buying group implementation.

J Proof of Proposition 6

Using lemmas 9 and 10 we have shown that a partial buying group can be profitable (compared to no buying group) for cases: (7), (9). We have also shown that a partial buying group does not affect retailers joint profit for cases (1), (3), (4) and (6). Now we show that a partial buying group can be profitable for cases: (2), (5), (8) and (10); and that it is always unprofitable in case (11). We consider α small enough such that slotting fees are positive for the two types of alliance strategy.

First we show that a partial buying group can be profitable in cases (2) and (5). In these two cases, there is no inversion of the ranking of the l's product but the identity of the outside option supplier changes. We focus on case (2), reasoning being similar for case (5). Without buying group, on market 1 the listing decision is AC and the outside option is AB because $\pi^{AC}_{r_1,1} + \overline{S}^+_{l,1} \geq \pi^{AB}_{r_1,1} + \overline{S}^+_{s_1,1}$. On market 2 the listing decision is AB and the outside option is AC because $\pi^{AB}_{r_2,2} + \overline{S}^+_{s_1,1} \geq \pi^{AC}_{r_1,1} + \overline{S}^+_{l,1}$. Retailers joint profit is equal to the sum of their outside option profit which is equal to $\pi^{AB}_{r_1,1} + \overline{S}^+_{s_1,1} + \pi^{AC}_{r_2,2} + \overline{S}^+_{l,2}$. With partial buying group two listing decisions may arise which are either AB or AC on both markets. If AB is chosen the retailers obtain the following profit: $\pi^{AC}_{r_1,1} + \pi^{AC}_{r_2,2} + \widehat{S}^+_l$ with $\widehat{S}^+_l = \overline{S}^+_{l,1} + \overline{S}^+_{l,2}$. Because $\pi^{AC}_{r_1,1} + \overline{S}^+_{l,1} \geq \pi^{AB}_{r_1,1} + \overline{S}^+_{s_1,1}$ it is strictly profitable. If AC is chosen the retailers obtain the following profit: $\pi^{AB}_{r_1,1} + \pi^{AB}_{r_2,2} + \widehat{S}^+_s$ with $\widehat{S}^+_s = \overline{S}^+_{s_1,1} + \overline{S}^+_{s_2,2}$. Because $\pi^{AB}_{r_2,2} + \overline{S}^+_{s_1,1} \geq \pi^{AC}_{r_1,1} + \overline{S}^+_{l,1}$ it is strictly profitable.

Now we show that a partial buying group can be profitable in case (8). Without buying group, on market 1, the listing decision is BC and the outside option is AC because $\pi^{BC}_{r_1,1} + \overline{S}^+_{s_1,1} \geq \pi^{AC}_{r_1,1} + \overline{S}^+_{l,1}$, with $\overline{S}^+_{s_1,1} = \pi^{BC}_{s_1,1}$ and $\overline{S}^+_{l,1} = \pi^{AC}_{l,1} - \pi^{BC}_{l,1}$. on market 2 the listing decision is AC because $\pi^{AC}_{r_2,2} + \overline{S}^+_{l,2} \geq \pi^{AB}_{r_2,2} + \overline{S}^+_{s_2,2}$, with $\overline{S}^+_{l,2} = \pi^{AC}_{l,2} - \pi^{AB}_{l,2}$ and $\overline{S}^+_{s_2} = \pi^{AB}_{s_2,2}$. Retailers joint profit is equal to $\pi^{AC}_{r_1,1} + \pi^{AC}_{l,1} - \pi^{BC}_{l,1} + \pi^{AB}_{r_2,2} + \pi^{AB}_{s_2,2} = (1-\alpha)(\Pi^H + \Pi^L - \Pi^{HM}) + \Pi^{ML} + \alpha\Pi^{HL}$. Note that the whole industry profit is the same with assortment AC or BC it is equal to $\Pi^{HM} + \Pi^{ML}$, whereas industry profit with assortment AB is $2\Pi^{HL}$. We have $\pi^{AC}_{r_1,1} + \pi^{AC}_{r_2,2} + \widehat{S}^+_l = \pi^{BC}_{r_1,1} + \pi^{BC}_{r_2,2} + \widehat{S}^+_s$, with $\widehat{S}^+_l = \pi^{AC}_{l,1} + \pi^{AC}_{l,2} - \pi^{AB}_{l,1} - \pi^{AB}_{l,2}$ and $\widehat{S}^+_s = \pi^{BC}_{s_1,1} + \pi^{BC}_{s_2,2}$ and $\pi^{AB}_{r_1,1} + \pi^{AB}_{r_2,2} + \widehat{S}^+_s$ with $\widehat{S}^+_s = \pi^{AB}_{s_1,1} + \pi^{AB}_{s_2,2}$. Whenever $2\Pi^{HL} > \Pi^{HM} + \Pi^{ML}$ the listing decision is AB and retailers' joint profit is $\pi^{AC}_{r_1,1} + \pi^{AC}_{r_2,2} + \pi^{AC}_{l,1} + \pi^{AC}_{l,2} - \pi^{AB}_{l,1} - \pi^{AB}_{l,2} = (1-\alpha)(\Pi^H + \Pi^L - 2\Pi^{HL} - \Pi^{ML}) + \Pi^{ML} + \Pi^{HM}$ which is larger than the retailers joint profit without buying group. Whenever $2\Pi^{HL} \leq \Pi^{HM} + \Pi^{ML}$ retailers are indifferent between AC or BC, their joint profit is $\pi^{BC}_{r_1,1} + \pi^{BC}_{r_2,2} + \pi^{BC}_{s_1,1} + \pi^{BC}_{s_2,2} = (1-\alpha)(\Pi^H + \Pi^L) + \alpha(\Pi^{HM} + \Pi^{ML})$ which is always lower than the retailers joint profit without buying group. Hence, creation of a partial buying group is always profitable for retailers when $2\Pi^{HL} > \Pi^{HM} + \Pi^{ML}$.

We show now that a partial buying group can be profitable in case (10). Without buying group, on market 1, the listing decision is AC because $\pi^{AC}_{r_1,1} + \overline{S}^+_{l,1} \geq \pi^{BC}_{r_1,1} + \overline{S}^+_{s_1,1}$, with $\overline{S}^+_{l,1} = \pi^{AC}_{l,1} - \pi^{BC}_{l,1}$ and $\overline{S}^+_{s_1,1} = \pi^{BC}_{s_1,1}$. On market 2, the listing decision is AB because $\pi^{AB}_{r_2,2} + \overline{S}^+_{s_2,2} \geq \pi^{AC}_{r_2,2} + \overline{S}^+_{l,2}$, with $\overline{S}^+_{l,2} = \pi^{AC}_{l,2} - \pi^{AB}_{l,2}$ and $\overline{S}^+_{s_2,2} = \pi^{AB}_{s_1,1}$. Hence, retailers joint profit without buying group is equal to $\pi^{BC}_{r_1,1} + \pi^{BC}_{s_1,1} + \pi^{AC}_{r_2,2} + \pi^{AC}_{l,2} - \pi^{AB}_{l,2} = (1-\alpha)(\Pi^M + \Pi^L + \Pi^{HL} - \Pi^{HM})$. With a partial partial buying group the equilibrium listing decision is AC in the two markets and the outside option is AB because $\pi^{AC}_{r_1,1} + \pi^{AC}_{r_2,2} + \widehat{S}^+_l \geq \pi^{AB}_{r_1,1} + \pi^{AB}_{r_2,2} + \widehat{S}^+_s$ with $\widehat{S}^+_l = \pi^{AC}_{l,1} + \pi^{AC}_{l,2} - \pi^{AB}_{l,1} - \pi^{AB}_{l,2}$ and $\widehat{S}^+_s = \pi^{AB}_{s_1,1} + \pi^{AB}_{s_2,2}$. Retailers' joint profit is $\pi^{AB}_{r_1,1} + \pi^{AB}_{r_2,2} + \pi^{AB}_{s_1,1} + \pi^{AB}_{s_2,2} = (1-\alpha)(\Pi^M + \Pi^L) + \alpha(\Pi^{HM} + \Pi^{ML})$ which is always larger than the retailers' joint profit without buying group.

Finally we show that a partial buying group is never profitable in case (11). Without buying group, on market 1, the listing decision is AC because $\pi^{AC}_{r_1,1} + \overline{S}^+_{l,1} \geq \pi^{BC}_{r_1,1} + \overline{S}^+_{s_1,1}$, with $\overline{S}^+_{l,1} = \pi^{AC}_{l,1} - \pi^{BC}_{l,1}$ and $\overline{S}^+_{s_1,1} = \pi^{BC}_{s_1,1}$. On market 2 the listing decision is AC because $\pi^{AC}_{r_2,2} + \overline{S}^+_{l,2} \geq \pi^{AB}_{r_2,2} + \overline{S}^+_{s_2,2}$, with $\overline{S}^+_{l,2} = \pi^{AC}_{l,2} - \pi^{AB}_{l,2}$ and $\overline{S}^+_{s_2} = \pi^{AB}_{s_2,2}$. Without buying group, retailers joint profit is $\pi^{BC}_{r_1,1} + \pi^{BC}_{s_1,1} + \pi^{AB}_{r_2,2} + \pi^{AB}_{s_2,2} = 2\alpha\Pi^{HL} + 2(1-\alpha)\Pi^L$. With a partial buying group the equilibrium listing decision is AB and the outside option is say AB (considering BC would be equivalent) because $\pi^{AC}_{r_1,1} + \pi^{AC}_{r_2,2} + \widehat{S}^+_l \geq \pi^{AB}_{r_1,1} + \pi^{AB}_{r_2,2} + \widehat{S}^+_s$ with $\widehat{S}^+_l = \pi^{AC}_{l,1} + \pi^{AC}_{l,2} - \pi^{AB}_{l,1} - \pi^{AB}_{l,2}$ and $\widehat{S}^+_s = \pi^{AB}_{s_1,1} + \pi^{AB}_{s_2,2}$. Hence retailers joint profit is $\pi^{AB}_{r_1,1} + \pi^{AB}_{r_2,2} + \pi^{AB}_{s_1,1} + \pi^{AB}_{s_2,2} = 2(1-\alpha)\Pi^L + \alpha(\Pi^{ML} + \Pi^{HL})$ which is lower than retailers' joint profit with no buying group.

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