Série des Documents de Travail

n° 2020-13

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Purchasing Alliances and Product Variety*

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June 2020

Abstract

We analyze the impact of purchasing alliances on product variety and profit sharing in a setting, in which capacity constrained retailers operate in separated markets and select their assortment in a set of differentiated products offered by heterogeneous suppliers (multinationals vs. local SMEs). Retailers may either have independent listing strategies or build a buying group, thereby committing to a joint listing strategy. This alliance may cover the whole product line (full buying group) or only the products of large suppliers (partial buying group). We show that a buying group may enhance the retailers' buyer power and reduce the overall product variety to the detriment of consumers. Our most striking result is 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.

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

JEL Classification: L13, L42, L81.

*We thank the editor Juan-Pablo Montero and two anonymous referees, Laurent Linnemer, Hugo Molina, Thibaud Vergé, Håvard Sandvik, as well as participants to the CRESSE Conference 2019, Jornadas de Economia Industrial 2019 and to INRA-ALISS and CREST seminars for helpful comments. We also thank the organizers and participants of the European Commission DG-Agri JRC Workshop 2019 on "The role of national and international retail alliances in the agricultural and food supply chain" for fruitful exchanges. We gratefully acknowledge support from Labex Ecodec Investissements d'Avenir (ANR-11-IDEX-0003/Labex Ecodec/ANR-11-LABX-0047).

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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. Those agreements are widespread, and they often gather retailers that operate in different countries.[1] Such alliances are not supposed to affect downstream competition, as retailers keep operating their stores independently, but they are a mean to enhance buyer power, which is usually well perceived by competition authorities.

The pro-competitive effects of buyer power have been first coined by Galbraith (1952), who explains how this "countervailing power" enables retailers to obtain discounts that translate into lower consumer prices. Since then, the economic literature has reconsidered these conclusions. First, discounts obtained by retailers may not translate into lower consumer prices: the countervailing power effect relies on strong assumptions regarding the shape of tariffs, namely linear contracts (see von Ungern-Sternberg (1996) and Iozzi and Valletti (2014)) and intense retail competition (see Gaudin (2018)). 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)). Furthermore, recent empirical and theoretical developments point out potential adverse effects of buyer power on product variety and innovation (see European Economic Community (2014) and Inderst and Mazzarotto (2008) for a survey, Inderst and Shaffer (2007), Caprice and Rey (2015) and Chambolle and Villas-Boas (2015).)

Despite the potential adverse effects highlighted in the above literature, purchasing alliances are usually not subject to *ex ante* approval by competition authorities, contrary to mergers. In the European Union, buying groups are subject to scrutiny under Article 101

[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 together 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).

of the Treaty on the Functioning of the European Union, as any horizontal co-operation agreements: they are lawful if and only if their restrictive effects are more than outweighed by pro-competitive effects, provided that consumers receive a "fair share" of the resulting benefits. There is no *ex ante* control by the European Competition Authority, but firms entering into a purchasing agreement must carry out a self-assessment of the legality of such agreement, based on the *Guidelines on the applicability of Article 101 of the Treaty on the Functioning of the European Union to Horizontal Co-operation Agreements* (henceforth the Guidelines) and on the rules on the vertical agreements displayed in the *Guidelines on Vertical Restraints*. Section 5 of the Guidelines acknowledges that "joint purchasing arrangements [...] may force suppliers to reduce the range or quality of products they produce, which may bring about restrictive effects on competition such as quality reductions, lessening of innovation efforts, or ultimately sub-optimal supply" (§ 194 and 202). However, the Guidelines consider that if "competing purchasers co-operate who are not active on the same relevant selling market (for example, retailers which are active in different geographic markets and cannot be regarded as potential competitors), the joint purchasing arrangement is unlikely to have restrictive effects on competition [...] " (§ 212 and 223). In this paper, we therefore focus on the case where retailers cannot be regarded as potential competitors.

Recent waves of buying alliances in the grocery industry have attracted the attention of several Competition Authorities, including the European Commission[2] and the French[3] and Belgian[4] national authorities. Between September and December 2014, three large purchasing agreements have been signed in France: between System U and Auchan, between Intermarché and Casino, and between Carrefour and Cora. In its 2015 Opinion (15-A-06),

[2]The DG AGRI organized a Workshop on "The role of national and international retail alliances in the agricultural and food supply chain" in 2019 which led to the following report: https://publications.jrc.ec.europa.eu/repository/handle/JRC120271. In 2019 the European Commission launched an investigation on 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.

the French Competition Authority claims that these buying groups are likely to have limited anticompetitive effects because their scope is restricted to national brand products: they cannot affect products manufactured by small suppliers or fresh agricultural products, that are more likely to be in a situation of dependence. A second wave of international purchasing agreements involving French retailers started in 2018: besides Horizon (see footnote 1), two new agreements involve Carrefour and System U on the one hand, and Carrefour and Tesco on the other. An important difference with the previous wave is that the new buying groups gather retailers operating on separate markets. Furthermore, they cover a wider scope of brands.[5] 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 products but also store-brand products".[6] The retailers argue that this may give opportunities of international development to the suppliers of private labels.[7]

In this paper, we study the effect of alliance strategies on product variety, and we compare two types of alliances: partial buying groups, in which the retailers negotiate jointly with the suppliers of leading brands, and full buying groups, in which they also negotiate jointly with local SMEs. We deliberately abstract from the effects of such alliances on downstream competition, and thus consider two retailers acting as monopolists on two independent markets, (*e.g.* two countries).[8] We model two types of suppliers: a large supplier who offers two products in both markets (typically a multinational company selling leading brands across

[5]Carrefour claimed for instance that "the alliance will cover the strategic relationship with global suppliers [and] the joint purchasing of own brand products" Source: http://www.carrefour.com/current-news/tesco-and-carrefour-to-create-long-term-strategic-alliance.

[6]The French competition authority launched a new evaluation in July 2018 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]Horizon communication thus claimed that "Auchan Retail, Casino Group and METRO 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/.

[8]Many buying groups involve retailers active in different countries: for instance, Carrefour and Tesco, are both active in many countries, but simultaneously in only two countries in Europe (Poland and Slovakia) and one in Asia (China). Similarly, the Horizon alliance gathers retailers active on separate markets.

markets), and, in each market, a small local supplier who offers only one product (typically, a SME producing a private label). Each small supplier must incur export costs to enter in the other market. We assume that there is heterogeneity of the products profitability across markets.[9] 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).

In each of these situations, retailers and suppliers contract over three part tariffs following the timing of Chambolle and Molina (2019). First, on each market, suppliers compete for being listed by the retailer by simultaneously offering lump-sum slotting fees. After the listing decision, which is publicly observed, retailers engage in a "Nash-in-Nash" bargaining over efficient two-part tariff contracts, with the supplier(s) of the selected products. Finally, retailers sell their products on the downstream markets.

Absent buying group, we first highlight that each retailer chooses the efficient assortment of products in its market, excluding the least efficient product - this efficient assortment differs however across market. Hence, with a buying group, committing to a similar assortment in the two markets always generates inefficiencies in one of the markets and in some cases in both. Despite this inefficiency, retailers may find this strategy profitable because the alliance enhances their buyer power, as it increases competition among the suppliers for being listed. Indeed, in one market the excluded product is no longer the least efficient: its supplier is therefore ready to pay a higher slotting fee to be listed, and this, in turn, leads to an increase in the slotting fees paid by the selected supplier. In that case, the buying group enables the retailers to receive “a larger share of a smaller pie”. As a result, it may be jointly profitable for the retailers to create a buying group when their bargaining power is low, as retailers have relatively more to win from the intense competition for slots than they loose from bargaining over a reduced industry profit. Our most striking result is 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.

[9] Inderst and Shaffer (2007) make similar assumptions.

This article contributes to the growing theoretical literature on buying groups. 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 joint listing decision enhances each retailer's buyer power by increasing its outside option in the negotiation with a supplier: in case of a breakdown in the negotiation, the profit of the retailer decreases less, as its competitors also delist the products of this supplier. We consider instead the incentives of non-competing retailers to form a buying group. Chipty and Snyder (1999) have shown that retailers active on separate markets benefit from buying together when bargaining with a supplier with convex production costs, because it decreases their relative gains from trade with such a supplier (see also Inderst and Wey (2003) and Jeon and Menicucci (2019)). The most closely related paper is Inderst and Shaffer (2007), which analyzes the impact of a cross-border merger between two single product retailers active in two separated markets with different consumer preferences. They show that the merger can enhance the retailers buyer power when they commit to a single sourcing strategy. This creates inefficiency in one market because of the reduction of the overall product variety.[10] Building on the vertical contracting process developed by Chambolle and Molina (2019), 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 in the two markets.

Our model clearly leaves aside product reasons for buying groups to be welfare enhancing, such as the reduction of double marginalization, investment incentives, or synergies leading to cost reduction that may be passed through to consumers (see, for instance, Inderst and Wey (2007)). A recent empirical analysis by Molina (2019) confirms that buying groups may lead to a decrease in retail prices through a countervailing power mechanism. We also do not consider possible pro-collusive effects of buying groups. Piccolo and Miklós-Thal (2012) and Doyle and Han (2014) show that buying groups agreements can improve retailers' ability

[10] See also Dana Jr (2012) in a setting with downstream competition.

to sustain collusive retail prices, by coordinating on high wholesale prices and using back margin payments.[11] Here we consider retailers active on separate markets to abstract from the effects of buying alliances on retail competition.

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 the hospital network reduction of American health insurers 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 organized as follows. Section 2 presents the main insights of our results in a streamlined example. Section 3 presents the setup and notations. Section 4 derives the equilibrium outcomes in the three cases : No buying group, partial buying group, and full buying group. Section 5 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 6 concludes.

2 A simple example

Let us first build a toy model to present the intuitions underlying our main results. We leave the discussions of our assumptions to the next section.

Consider two separated markets (*i.e.* markets 1 and 2) in which respective retailers (*i.e.* retailers r_1 and r_2) are monopolists. On each market i, retailer r_i can sell at most two

[11] These pro-collusive aspects of buying groups have been identified by competition authorities. For instance, section 5 of the above-mentioned Guidelines states that joint purchasing arrangements may lead to a collusive outcome if they facilitate the coordination of the parties' behavior on the selling market (see, *e.g.*, par. 201 and 213).

[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.

products among three available (*i.e.* A, B and C). While products A and C are supplied by a large supplier l in the two markets, product B is supplied on each market i by a small, local supplier s_i. We assume that products are independent, hence the industry profit generated with an assortment of two products is the sum of industry profits generated by each product separately. In market 1 the industry profit generated by each product are: $\Pi_1^A = 8$, $\Pi_1^B = 6$, $\Pi_1^C = 4$. In market 2, the industry profit generated by products A and C are reversed and that of product B is unchanged: $\Pi_2^A = 4$, $\Pi_2^B = 6$ and $\Pi_2^C = 8$.

Contracting between suppliers and retailers follows a two-stage process. First, suppliers compete in slotting fees paid to the retailers to ensure the listing of their products, and each retailer then selects its assortment. The retailer then engages with each selected supplier in an efficient negotiation, in which the bilateral profit is shared equally (since the products are independent, the marginal contribution of a product to the industry profit is not affected by the assortment). Consequently, the profit of r_i is the sum of its bargaining profit and possible slotting fees paid by the selected suppliers.

We compare the equilibrium assortments and profits when the two retailers are independent and when they form a partial buying group. With a partial buying group, the two retailers make a joint listing decision with respect to the large supplier's product(s).

No buying group Retailers make their listing decision independently and thus we can focus in market 1, say, the other being symmetric. Retailer r_1 chooses between assortments AB, AC and BC. Without slotting-fees, r_1 would prefer to list the assortment AB, which leaves it the larger bargaining profit $\frac{\Pi_1^A+\Pi_1^B}{2} = 7$. However, the large supplier is willing to pay a slotting fee to enforce the assortment AC: it is ready to pay up to its bargaining profit on product C, that is, 2. To avoid the threat of being replaced by product C, the small supplier also wishes to pay a slotting fee up to its bargaining profit 3. In equilibrium, the small supplier's maximum bid is more attractive, as $\frac{\Pi^A+\Pi^B}{2} + 3 > \frac{\Pi_1^A+\Pi_1^C}{2} + 2$; hence it wins this competition stage by matching the large supplier's best offer with a fee of 1. In market 1 the equilibrium assortment is thus AB, the small supplier receives 2, the large supplier 2, and the retailer 8. By symmetry, in market 2, the assortment is BC instead of AB and firms make the same profit.

Partial buying group Retailers make their listing decision jointly, *i.e.* to maximize the sum of their profits. Such a joint listing decision only concerns the products offered by the large supplier (*i.e.* products A and C). An immediate consequence is that the efficient assortment with AB and BC respectively listed in markets 1 and 2 is no longer available. For simplicity we focus on competition between assortments AB and AC (AB and BC being symmetric); they both leave the retailers the same joint bargaining profit 12. Assume first that if suppliers do not offer slotting fee, AB is selected. The large supplier is then ready to pay a slotting fee up to 6 to enforce the listing of AC. This amount exceeds its willingness to pay in the case without buying group (that was equal to 4), as product C generates more profit in market 2. Hence in equilibrium each small supplier dissipates all its profit and offers 3 to match the offer of the large supplier and secure the listing of its product. If instead firms anticipate the listing AC, the small suppliers offer 6 to promote the listing of B and the large supplier must pay a slotting fee 6 to avoid one of its products being replaced. With a partial buying group, retailers are indifferent between all assortments. They manage to extract a joint profit of 18, which is larger than 16 the sum of their profits without buying groups. All suppliers are hurt. The small suppliers receive zero, that is a total profit loss of 4, whether they are selected or excluded. The large supplier incurs a profit loss of 2, which is captured by the retailers. The total surplus destroyed is 4.

Full buying group Retailers make their listing decision jointly over all products: when they list either AB or BC in both markets, they must purchase from the same small supplier which incurs an export cost 2. Again, the two assortments AB and AC on the two markets generate the joint bargaining profits for the retailer, that is, 12. Again, the large supplier is ready to pay up to 6 to foster the assortment AC, while the small suppliers compete for the procurement of product B: each of them is thus willing to pay up to $6 - 2$. The equilibrium assortment is then AC, the large supplier pays a fee 4, the retailers' joint profit is 16: the full buying group leaves the retailers the same profit they obtain without buying group but all suppliers are hurt. Compared to the situation without buying groups, the large suppliers incur a profit loss of 2, and the small are excluded and loose 4. The total surplus destroyed is 6.

In this example, a partial buying group is profitable whereas a full is not. Therefore restricting the scope of buying group to the decision regarding the large supplier does neither constrain the retailer's decision nor protect any supplier.

3 The model

We consider two separate markets $i \in \{1, 2\}$, and in each of these markets three active firms r_i, s_i and l. In market i, r_i is a monopolist retailer with a constrained stocking capacity: its shelf space consists of two indivisible slots, hence it can sell at most two products.[13] The suppliers produce three varieties of differentiated products at a constant per unit production cost.[14] Supplier l is a "large supplier" who carries two differentiated products A and C, which it can sell in the two markets through retailers r_1 and r_2. Each supplier s_i is a "small supplier" who carries one product, B. For the sake of simplicity, we assume that s_1 and s_2 supply perfectly substitute products. This assumption can reflect for instance the fact that a small supplier's product is sold under the retailer's own brand. In contrast with the large supplier who features a multinational company able to offer its products indifferently in the two markets, we assume that small suppliers incur an export cost if they wish to offer their product on the foreign market: supplier s_i incurs a fixed cost $E \geq 0$ to sell in market $j \neq i$.[15]

Industry profits To keep things simple, we adopt a reduced-form model of industry profits. We define the maximum industry profit for a given product assortment in market i, that is the profit made by an integrated monopolist on that market. In 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^{a_i} denotes this industry profit where $a_i \in \mathcal{A} \equiv$

[13] There is empirical evidence that retailers' capacity constraints lead them to sell a limited number of references. Marx and Shaffer (2010) state that "the typical supermarket carries less than 30,000 products, and yet, at any given time, there may be over 100,000 products from which to choose. To help supermarket retailers decide which products to carry, it has become common in recent years for them to put at least some of their shelf space up for bid and let manufacturers compete for their patronage." Both theoretical (e.g. Marx and Shaffer (2010), Chambolle and Molina (2019)) and empirical articles (Ho and Lee (2019)) highlight that it may be profitable for retailers to strategically restrict their capacity in order to gain buyer power.

[14] We rule out any externality of production among products and markets, *e.g.* economies of scale or scope.

[15] We follow Melitz (2003) and model the export cost as a fixed cost.

$\{H, M, L, HM, HL, ML\}$ denotes the assortment sold in market i and (a_1, a_2) denotes the assortment chosen in markets 1 and 2. The ranking of products A, B and C according to their profitability differs across markets. Such heterogeneity may come from differences in consumer preferences or in production costs.[16] For instance, product A may generate Π^H in market 1 and Π^M in market 2.

We make the following assumption on industry profits:

Assumption 1.

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

From the industry perspective, HM is thus the "efficient" assortment in a country.[17]

Products can be either imperfect substitutes or independent, hence any assortment of two products does not yield more profit than the sum of profits generated by each product:

Assumption 2. *For all X and Y in the subset $\{H, M, L\}$ and $\Pi^X > \Pi^Y$:*

$$\Pi^X + \Pi^Y \geq \Pi^{XY} > \Pi^X$$

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

Assumption 3.

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

Assumption 3 ensures that we obtain a unique equilibrium outcome. We make this assumption for the sake of simplicity, and it is satisfied for a wide range of standard horizontal

[16]For instance, Pepsi-Cola (resp. Coca-Cola) is the favorite cola brand in the US (resp. EU). We follow Inderst and Shaffer (2007) who assume that consumers located in different regions/ countries differ in their preferences.

[17]Assumption 1 also ensures efficiency for consumers for usual demand functions (see section 5).

differentiation setups, for instance in a Shaked and Sutton (1983) model of vertical differentiation (see Chambolle and Molina (2019)), or in the quadratic utility setup we will develop in section 5 (see online Appendix H for a detailed presentation of that setup).

Timing and buying strategies In an *ex ante* stage the retailers must choose among three buying strategies: *no buying group*, *partial buying group*, and *full buying group*. This decision is common knowledge.

Then, for a given buying 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 its product B listed. The large supplier offers a menu of slotting fees to have either A only, C only or A and C listed. Accepting a slotting fee creates a commitment to listing the corresponding products for the retailer. Each retailer can list at most two products and the listing decision is publicly observed.[18]

- **Stage 2:** Each retailer r_i engages in a bilateral negotiation with the supplier(s) of the products listed. Negotiations are simultaneous, contracts are secret and consist of fixed fee(s) $F_{k,i}^{a_i}$, where $k \in \{l, s_1, s_2\}$ denotes the supplier involved in the bargaining and $a_i \in \mathcal{A}$ the product assortment. Stage 2 is independent of the retailers' buying strategy.

We explicitely assume that the slotting fees offered in stage 1 cannot be conditional on the assortment offered by the retailer. This assumption is in line with antitrust law: such a contract would be likely to be considered as exclusionary. Note that, as in a Bertrand competition model with asymmetric costs, the competition for slots in stage 1 has a multiplicity of Nash equilibria. To select among these equilibria, we rely on Selten's (1975) concept of trembling hand perfection.

The buying strategies have the following distinctive features:

[18]Once it accepts a slotting fee from a supplier, the retailer is committed to entering into the Stage-2 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.

- *No buying group*: The supplier l offers each retailer r_i a menu of slotting fees $(S^A_{l,i}, S^C_{l,i}, S^{AC}_{l,i})$ to have respectively A only, C only, or both A and C listed by r_i; small suppliers s_1 and s_2 offer respectively slotting fee $S^B_{s_1,i}$ and $S^B_{s_2,i}$ to have 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 single menu $S_l = (S^A_l, S^C_l, S^{AC}_l)$ to have its product(s) listed in the two markets by the partial buying group; small supplier s_1 and s_2 offer respectively a slotting fee $S^B_{s_1,i}$ and $S^B_{s_2,i}$. 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 single menu $S_l = (S^A_l, S^C_l, S^{AC}_l)$ to have its product(s) listed in the two markets by the full buying group; each small supplier s_i offers a single slotting fee $S^B_{s_i}$ to be 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).

As by assumption small suppliers are perfect 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.

When a buying alliance is formed, we assume that the buying group is a common entity that collects slotting fees and redistributes them among its participants. 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. As the buying strategy only affects the listing decision stage, we are close to Caprice and Rey (2015) who also assume that within a buying group, downstream firms make common listing decisions,[19] but keep negotiating secretly and bilaterally with their suppliers. This assumption contrasts with the

[19]More precisely, Caprice and Rey (2015) assume that any retailer can veto the offer of a supplier for all the members of the buying group.

setup of Inderst and Shaffer (2007), who focus on cross border mergers and thus assume that once merged, the retailers enter in a joint bargaining with their suppliers. Our setup is thus closer to the case of buying groups, who commonly adopt a two-stage timing of negotiations with their suppliers: the suppliers must first pay a slotting fee to launch commercial negotiation with the buying group, before negotiating individually with all members at national level. Trade press releases suggest that when this fee is not paid, retaliations in the form of collective de-listings at national level are to be expected.[20]

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" bargaining protocol (see Collard-Wexler et al. (2019)). This equilibrium concept 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.[21] We denote by α (resp. $(1-\alpha)$) the exogenous bargaining weight of the retailer (resp. supplier).

This Nash-in-Nash bargaining takes place in Stage 2 within the selected network of suppliers previously determined in Stage 1. As in Stage 1 all suppliers compete for a restricted number of slots, our setting enables products that are not sold in equilibrium to affect the equilibrium profits. Yet, the 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 (2019) who show that the outcome of this two-stage game coincides with that of a one-stage Nash-in-Nash bargaining with outside option, or to the Nash-in-Nash bargaining with threat of replacement equilibrium concept developed by Ho

[20] See for instance the example of the negotiations between Nestlé and the buying group Agecore: https://www.reuters.com/article/us-nestle-retailers-prices/nestle-in-talks-to-end-supermarket-row-as-pricing-pressures-build-idUSKCN1G522P. See also contributions by professionals at the European Commission DG Agri Workshop on Retail Alliances, *e.g.* https://ec.europa.eu/jrc/sites/jrcsh/files/ra_3_3_larrachoechea_a_manufacturers_perspective_on_ra.pdf.

[21] 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)).

and Lee (2019).[22] 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 if it were listed, *i.e.* if the outside option assortment were selected by the retailer. If equilibrium slotting fees are zero, the equilibrium profit sharing among the retailer and its selected suppliers is the outcome of the Nash-in-Nash bargaining. In contrast, when equilibrium slotting fees are positive, that is when the outside option is binding, it affects the profit sharing.

Bilateral efficiency Stage 2 involves bargaining over a fixed fee. First, we rule out linear tariffs, as these inefficient tariffs create a source of efficiencies for the buying groups through the increase in buyer power, which we want to exclude from our model (see for instance Dobson and Waterson (1997), Chipty and Snyder (1999) and von Ungern-Sternberg (1996)). Furthermore, Stage 2 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 its 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 between their products through their common monopolist retailer and therefore maximize the industry profit irrespective of the distribution of bargaining power in the vertical chain.[23] Such a result implies that, when selling an assortment a_i, r_i always chooses prices or quantities that maximize the integrated industry profit previously defined by Π^{a_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 supplier-retailer pair bargains over a fixed fee to share the integrated industry profit.

[22] See also Manea (2018) and Ho and Lee (2019) who provide non cooperative microfoundations for the Nash-in Nash bargaining with outside option equilibrium concept when these outside options are to deal with rival partners.

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

In our model the heterogeneity of product positioning among the two markets plays a key role. In section 4, we solve the model under the following assumption:

Assumption 4.

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

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

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

An extensive discussion of the robustness of our results to a change in this ranking, for all possible combinations of product positioning, is available online.[24]

4 Equilibrium outcomes for each buying strategy

In this section, we determine the equilibrium outcomes, *i.e.* the equilibrium assortment and firm's profits, under each buying strategy. We thus solve the two-stage game under each possible buying strategy (no buying group, partial or full buying group) under the assumptions 1-4.

4.1 Bargaining outcomes

The stage-2 continuation equilibria on each market i depend only on the listing decisions of the retailer –that are public at this stage–, irrespective of the buying strategies. Regardless of the assortment, suppliers have a zero status-quo profit.[25] We denote by $\pi_{k,i}^{a_i}$, where $k \in \{l, s_1, s_2, r_i\}$, the gross profit (*i.e.* gross of slotting fees and of export costs) obtained in market i by firm k active in a negotiation for assortment a_i.

If the assortment HL is listed, then the retailer bargains with a unique supplier. Each of the negotiator has a zero status-quo profit, hence the joint profit is split according to the

[24]See Section 5 of Allain et al. (2020).

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

Nash bargaining weight: The retailer receives $\pi^{HL}_{r_i,i} = \alpha\Pi^{HL}$, while the large supplier receives $\pi^{HL}_{l,i} = (1-\alpha)\Pi^{HL}$.

If by contrast the assortment is XM (with $X \in \{H, L\}$), then the retailer benefits from a positive status-quo profit in its negotiation with each supplier; equilibrium profits are then as follows:

$$\begin{aligned}
\pi^{XM}_{r_i,i} &= \alpha\Pi^{XM} + (1-\alpha)(\Pi^{X} + \Pi^{M} - \Pi^{XM}) \\
\pi^{XM}_{l,i} &= (1-\alpha)(\Pi^{XM} - \Pi^{M}) \\
\pi^{XM}_{s_i,i} &= (1-\alpha)(\Pi^{XM} - \Pi^{X})
\end{aligned}$$

In online Appendix A we consider in turn all potential assortment decisions. Comparing the equilibrium profits yields the following lemma.

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

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

Proof. We provide a complete proof of lemma 1 in online Appendix A.4. ■

Lemma 1 highlights that the gross profit of a retailer is the largest with the efficient assortment HM. The large supplier is better off when it sells its two products, and it benefits more from the sale of product H than from that of product L. Finally, a small supplier earns a larger gross profit when listed with product L rather than when listed with product H.

4.2 Listing decisions

We now solve the stage 1 of the game which depends on the buying strategy chosen by the retailers in the *ex ante* stage. In this stage, the capacity constrained retailer (resp. buying group) makes the listing decision that maximizes its profit (resp. their joint profits), which is the sum of the slotting fees collected and the gross profit(s) obtained in the bargaining stage. First we provide some general properties of the equilibrium listing decision that hold irrespective of the buying strategy (lemma 2). Then for each buying strategy we characterize the listing decisions of the retailers in stage 1.

Lemma 2. *Under Assumptions 1-4, for any buying 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 to ensure the listing of one of its products only.*

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

Lemma 2 (i) derives from two properties: first, each retailer's gross profit is larger when it sells two products than when it sells only one (see lemma 1); second, as the menu of slotting fees offered by suppliers is fixed when the retailer makes its listing decisions, listing several suppliers (weakly) increases the amount of slotting fees it receives. Lemma 2 (ii) highlights that whenever the large supplier wishes to place only one of its two products on a retailer's shelves, its incentives are aligned with those of the retailer irrespective of the buying strategy. Therefore the large supplier does not need to pay a positive slotting fee to ensure that product H or L is listed. Henceforth, we simplify the notation and denote by $S_{l,i} \equiv S_{l,i}^{HL}$ the slotting fee offered by supplier l to secure the listing of its two products in market i.

We now consider in turn the equilibrium listing decisions for each of the three buying strategies.

4.2.1 No buying group

Absent buying group, retailers' listing decisions are independent across markets. The large supplier and the small suppliers are in symmetric positions in the two markets: in 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 suppliers offer product B positioned as

M. Therefore without loss of generality we solve the game considering the assortments HM, HL, and ML for a given market i, with $i \in \{1, 2\}$.

Product assortment Note first that small suppliers cannot enforce the inefficient assortment ML which maximizes their gross profit, as by assumption, the slotting fees offered by the small suppliers cannot be conditional on the other product listed, and the retailer is always better off with the assortment HM: she receives a larger bargaining profit with the assortment HM (see lemma 1), no slotting fee is offered by l in both cases (see lemma 2).

Hence the suppliers compete in slotting fees to influence the retailer's choice between the three possible assortments: HL or HM, M being possibly supplied by the local or by the foreign small supplier. The large supplier is willing to push for the assortment HL in which it obtains the larger gross profit (see lemma 1). By contrast, the small suppliers are willing to push for being listed. Consider now the suppliers' willingness to pay (that is, the maximum amount they are ready to bid as a slotting fee) to influence the retailer r_i's listing decision.

- The maximum fee the large supplier is willing to pay to impose HL instead of HM is the amount that leaves him indifferent between these two assortments: $\overline{V}_{l,i} \equiv \pi_{l,i}^{HL} - \pi_{l,i}^{HM}$.
- The local small supplier s_i makes no profit in market i if its product is not listed, hence the maximum amount it is ready to pay to be listed is: $\overline{V}_{s_i,i} \equiv \pi_{s_i,i}^{HM}$.
- Similarly, the maximum amount the foreign small supplier s_j is ready to pay to be listed in market i is: $\overline{V}_{s_j,i} \equiv \max\{\pi_{s_j,i}^{HM} - E, 0\}$.

The outcome of the first stage competition process is detailed in the following proposition.

Proposition 1. *Under Assumptions 1-4, absent buying group, the efficient equilibrium assortment HM is offered on each market, and product M is provided by the local small supplier.*

Proof. Competition for the two slots drives the retailer to list the assortment that leaves it the highest profit. Comparing the suppliers' willingness to pay reveals which supplier can outbid its competitors. Under Assumptions 1-4, in market i we have:

$$\underbrace{\pi_{r_i,i}^{HM} + \overline{V}_{s_i,i}}_{HM,\text{ local small supplier}} \geq \max\Big\{\underbrace{\pi_{r_i,i}^{HL} + \overline{V}_{l,i}}_{HL}, \underbrace{\pi_{r_i,i}^{HM} + \overline{V}_{s_j,i}}_{HM,\text{ foreign small supplier}}\Big\} \quad (1)$$

Hence, in equilibrium, the efficient assortment HM is chosen and the local small supplier is selected. We provide a complete proof and characterization of the equilibrium profits in online Appendix C. ■

Equilibrium slotting fees and profits In equilibrium, the local small supplier may have to pay a positive slotting fee to ensure the listing of its product.

The slotting fee paid by the local small supplier is the minimum non-negative value that outbids the two competing offers, that is, that precludes the threats of replacements from the large supplier, and from the foreign small supplier.

$$\overline{S}_{s_i,i} = \max\{\pi_{r_i,i}^{HL} - \pi_{r_i,i}^{HM} + \overline{V}_{l,i}, \overline{V}_{s_j,i}\} \quad (2)$$

These threats of replacement are strengthened when α decreases because suppliers anticipate a higher gross profit in stage 2, and they are willing to compete fiercely to enforce their favorite listing decision. Hence, the equilibrium slotting fee is positive if and only if the retailers' bargaining power is sufficiently low.[26] Whenever the small supplier offers a zero slotting fee, each retailer obtains itsgross profit with the assortment HM. By contrast when the slotting fee is positive, the retailer obtains the profit that leaves itindifferent with the second most profitable offer, the "threat of replacement". The relative profitability of product M (that is, the comparison between $\Pi^{HM} - \Pi^{HL}$ and E) is key to determine the binding threat of replacement: when product M is very profitable, the second best option is to sell the same assortment but buying product M from the foreign supplier (that is, the binding terms in the right-hand side of equation 1 is the second term); by contrast, when it is less profitable, the second best option is to sell the two products of the large supplier (assortment

[26]Namely, when $\alpha \leq \frac{\max\{\Pi^{HL}-\Pi^{H},\Pi^{HM}-\Pi^{H}-E\}}{\Pi^{HM}-\Pi^{H}}$).

HL).

Equilibrium profits are as follows:

$$\overline{\Pi}_{r_i,i} \equiv \pi^{HM}_{r_i,i} + \overline{S}_{s_i,i}, \qquad \overline{\Pi}_{s_i,i} \equiv \pi^{HM}_{s_i,i} - \overline{S}_{s_i,i}, \qquad \overline{\Pi}_{s_j,i} \equiv 0, \qquad \overline{\Pi}_{l,i} \equiv \pi^{HM}_{l,i}$$

4.2.2 Partial buying group

Assume now that retailers r_1 and r_2 have opted for a partial buying-group: they commit to adopting a common listing decision regarding the large supplier's product(s), but keep deciding separately from which of the small suppliers they buy product B if they wish to list it. This implies that the product assortment is the same in both markets: it is either AB, BC, or AC.

The listing decision AB leads to product assortment HM in market 1 and ML in market 2, we denote this assortment by (HM, ML). Similarly, the listing decisions BC and AC respectively result in product assortments (ML, HM) and (HL, HL). As the markets are symmetric, we can focus without loss of generality on the choice between the product assortments (HL, HL) and (HM, ML). In the latter case, each retailer can choose its supplier of product M.

Product assortment Consider first the suppliers' willingness to pay for being listed.

- In market 1, the suppliers' willingness to pay are the same than in the absence of buying group, because the listing decisions are either HM or HL. Again, the large supplier is willing to impose the listing of product L; the maximum amount it is ready to pay for this leaves him indifferent between the assortments HL and HM: $\widehat{V}_{l,1} \equiv \pi^{HL}_{l,1} - \pi^{HM}_{l,1} = \overline{V}_{l,1}$. The small suppliers are ready to offer their whole profit, namely, $\widehat{V}_{s_1,1} \equiv \pi^{HM}_{s_1,1} = \overline{V}_{s_1,1}$ and $\widehat{V}_{s_2,1} \equiv \max\{\pi^{HM}_{s_2,1} - E, 0\} = \overline{V}_{s_2,1}$.

- In market 2, the two possible assortments are ML or HL. From lemma 1 we know that $\pi^{ML}_{s_i,2} \geq \pi^{HM}_{s_i,2}$ and $\pi^{ML}_{l,2} \leq \pi^{HM}_{l,2}$. The large supplier is now ready to pay up to $\widehat{V}_{l,2} \equiv \pi^{HL}_{l,2} - \pi^{ML}_{l,2} \geq \overline{V}_{l,2}$ to secure the assortment HL, while the local supplier s_2 is ready to pay up to $\widehat{V}_{s_2,2} \equiv \pi^{ML}_{s_2,2} \geq \overline{V}_{s_2,2}$ and the foreign supplier s_1 $\widehat{V}_{s_1,2} \equiv \max\{\pi^{ML}_{s_1,2} - E, 0\} \geq \overline{V}_{s_1,2}$. As a result, the suppliers are competing more fiercely to impose their favorite assortment with a partial buying group than without buying group.

The competition for slots results in the assortment decision detailed in the following proposition:

Proposition 2. *Under Assumptions 1-4, with a partial buying group, two types of assortments may arise in equilibrium:*

- *When $\Pi^{HM} + \Pi^{ML} \geq 2\Pi^{HL}$ the efficient equilibrium assortment HM is offered in one market, but the inefficient assortment ML is offered in the other market. Product M is provided by the local small supplier.*
- *When $\Pi^{HM} + \Pi^{ML} \leq 2\Pi^{HL}$ the inefficient equilibrium assortment HL is offered in both markets.*

Proof. First, whenever product M is listed, in each market, the local small supplier wins the competition for the slot against the foreign small supplier, because $\widehat{V}_{s_i,i} > \widehat{V}_{s_j,i}$. With a partial buying group, the assortment chosen in equilibrium for the two markets maximizes the retailers' joint profit under the constraint that they must list the same product(s) from l. Therefore, the buying group chooses to list (HM, ML) if the following condition is satisfied:

$$\begin{aligned} \underbrace{\pi^{HM}_{r_1,1} + \pi^{ML}_{r_2,2} + \widehat{V}_{s_1,1} + \widehat{V}_{s_2,2}}_{(HM,ML)\text{ with local small suppliers}} &\geq \underbrace{\pi^{HL}_{r_1,1} + \pi^{HL}_{r_2,2} + \widehat{V}_{l,1} + \widehat{V}_{l,2}}_{(HL,HL)} \\ \Leftrightarrow \qquad \Pi^{HM} + \Pi^{ML} &\geq 2\Pi^{HL} \end{aligned} \tag{3}$$

and chooses (HL, HL) otherwise. We provide a complete characterization of the equilibrium in online Appendix D. ∎

Equilibrium slotting fees and profits We consider now equilibrium slotting fees and profits for each product assortment.

- **Local product M listed:** Whenever $\Pi^{HM} + \Pi^{ML} \geq 2\Pi^{HL}$, in equilibrium the small suppliers s_1 and s_2 are listed in their respective local market because (HM, ML) is more efficient than (HL, HL) for the industry. To ensure the listing of their products, they may have to pay a positive slotting fee, as the buying group decides to list M when the total amount of slotting fees offered by the two small suppliers satisfies the following constraints:

$$\begin{aligned} S_{s_1,1} + S_{s_2,2} &\geq \pi^{HL}_{r_1,1} + \pi^{HL}_{r_2,2} + \widehat{V}_{l,1} + \widehat{V}_{l,2} - \pi^{HM}_{r_1,1} - \pi^{ML}_{r_2,2} \\ S_{s_1,1} &\geq \widehat{V}_{s_2,1} \ (\geq 0) \\ S_{s_2,2} &\geq \widehat{V}_{s_1,2} \ (\geq 0) \end{aligned}$$

The first constraint ensures that the buying group prefers to list product M, and the other two constraints ensure that, on each market, it is supplied by the local small supplier. As a result, there is a continuum of equilibria, in which the slotting fees jointly preclude the threat of replacement from the large supplier, and individually preclude the threat of replacement by the foreign small suppliers. The sum of the equilibrium fees is characterized as follows:

$$\widehat{S}^{ne}_{s_1,1} + \widehat{S}^{ne}_{s_2,2} \equiv \max \left\{ \widehat{V}_{l,1} + \widehat{V}_{l,2} + \pi^{HL}_{r_1,1} + \pi^{HL}_{r_2,2} - \pi^{HM}_{r_1,1} - \pi^{ML}_{r_2,2} \ , \ \widehat{V}_{s_2,1} + \widehat{V}_{s_1,2} \right\} \quad (4)$$
$$\text{with } \ \pi^{HM}_{s_2,1} - E \leq \widehat{S}^{ne}_{s_1,1} \leq \pi^{HM}_{s_1,1} \ \text{ and } \ \pi^{ML}_{s_1,2} - E \leq \widehat{S}^{ne}_{s_2,2} \leq \pi^{ML}_{s_2,2},$$

where the superscript ne stands for "no exclusion of local supplier M" (that is, in both countries product M is sold and provided by the local supplier).

Competition for slots leads the local small suppliers to pay slotting fees if and only if retailer's bargaining power is low.[27] In this case, the retailers are left with the joint profit they would obtain by choosing the second best offer, which is the assortment

[27]Namely, *i.e.* $\alpha \leq \widehat{\alpha}^{ne} \equiv \max\{1 - \frac{E}{\Pi^{ML} - \Pi^{L}}, \frac{2\Pi^{HL} - \Pi^{H} - \Pi^{L}}{\Pi^{HM} - \Pi^{H} + \Pi^{ML} - \Pi^{L}}\}$. Indeed, if $\alpha \geq 1 - \frac{E}{\Pi^{ML} - \Pi^{L}}$, no positive fee is necessary to overcome the threat of replacement by the foreign local supplier. Similarly, if $\alpha \geq \frac{2\Pi^{HL} - \Pi^{H} - \Pi^{L}}{\Pi^{HM} - \Pi^{H} + \Pi^{ML} - \Pi^{L}}$, no positive fee is necessary to overcome the threat of replacement by the large supplier.

(HL, HL) if the export cost is high[28], or the assortment (HM, ML) with M offered by at least one foreign supplier when the export cost is low.[29] Equilibrium profits can be written as follows, with $\widehat{\Pi}_r^e$ the aggregated profit of the two retailers and $\widehat{\Pi}_s^{ne}$ the aggregated profit of the two small suppliers:

$$\begin{aligned}
\widehat{\Pi}_r^{ne} &\equiv \widehat{\Pi}_{r_1,1}^{ne} + \widehat{\Pi}_{r_2,2}^{ne} \equiv \pi_{r_1,1}^{HM} + \pi_{r_2,2}^{ML} + \widehat{S}_{s_1,1}^{ne} + \widehat{S}_{s_2,2}^{ne} \\
\widehat{\Pi}_s^{ne} &\equiv \widehat{\Pi}_{s_1,1}^{ne} + \widehat{\Pi}_{s_2,2}^{ne} \equiv \pi_{s_1,1}^{HM} + \pi_{s_2,2}^{ML} - \widehat{S}_{s_1,1}^{ne} - \widehat{S}_{s_2,2}^{ne} \\
\widehat{\Pi}_l^{ne} &\equiv \widehat{\Pi}_{l,1} + \widehat{\Pi}_{l,2} \quad\;\; \equiv \pi_{l,1}^{HM} + \pi_{l,2}^{ML}
\end{aligned}$$

- **Product M excluded:** Whenever $\Pi^{HM} + \Pi^{ML} \leq 2\Pi^{HL}$, the retailers list the assortment (HL, HL), because (HL, HL) is more efficient than (HM, ML) for the industry. The large supplier has its two products listed in both markets and pays a positive slotting fee defined as follows:

$$\widehat{S}_l^e \equiv \max\{\pi_{r_1,1}^{HM} + \pi_{r_2,2}^{ML} - \pi_{r_1,1}^{HL} - \pi_{r_2,2}^{HL} + \widehat{V}_{s_1,1} + \widehat{V}_{s_2,2}, 0\}, \tag{5}$$

  where the superscript e stands for "exclusion" (that is, the local small supplier is excluded in both countries).

  Competition for slots leads the large supplier to pay a slotting fee if and only if the retailers' bargaining power is low.[30] In this case, the retailers are left with the joint profit they would obtain by choosing instead the assortment (HM, ML) with product

[28] *i.e.* $E > \max\{\frac{\Pi^{HM}+\Pi^{ML}-2\Pi^{HL}}{2}, (1-\alpha)\Pi^{HM} + \alpha\Pi^{H} + \Pi^{ML} - 2\Pi^{HL}\}$

[29] The foreign small supplier is more threatening on the market in which ML is offered than in market where HM is offered, because the small supplier's profit is higher in the assortment ML. When the export cost decreases, both threats of importation become credible.

[30] Namely, *i.e.* $\alpha \leq \alpha^e \equiv \frac{2\Pi^M}{2\Pi^{HL}-\Pi^{HM}-\Pi^{ML}+2\Pi^M}$

M being supplied by the local producer. Equilibrium profits are as follows:

$$\begin{aligned}
\widehat{\Pi}_r^e &\equiv \widehat{\Pi}_{r_1,1}^e + \widehat{\Pi}_{r_2,2}^e \equiv \pi_{r_1,1}^{HL} + \pi_{r_2,2}^{HL} + \widehat{S}_l^e \\
\widehat{\Pi}_s^e &\equiv \widehat{\Pi}_{s_1,1}^e + \widehat{\Pi}_{s_2,2}^{ne} \equiv 0 \\
\widehat{\Pi}_l^e &\equiv \widehat{\Pi}_{l,1} + \widehat{\Pi}_{l,2} \quad \equiv \pi_{l,1}^{HL} + \pi_{l,2}^{HL} - \widehat{S}_l^e
\end{aligned}$$

Profitability of a partial buying group We now analyze whether it is profitable for retailers to create a partial buying group. A first remark that directly derives from lemma 1 and Propositions 1 and 2 is that a partial buying group cannot be profitable without slotting fees. Indeed, in the absence of buying group, Proposition 1 shows that the efficient assortment HM is offered on each market. In contrast, Proposition 2 shows that the creation of a partial buying group leads to an inefficient assortment on at least one market. Hence from Lemma 1, in the absence of slotting fees, the creation of a partial buying group can only decrease the retailers' joint profits.

Second, we have seen that, for both types of equilibrium, slotting fees are positive if and only if the bargaining power of retailers is low enough. We thus obtain the following proposition:

Proposition 3. *A partial buying group is profitable for the retailers when they have a low bargaining power, the export cost is high, and the profitability of product M is not too close to that of H or L.*

Proof. We provide a complete proof in online Appendix D.2. ■

Intuitively, the commitment on a joint listing decision regarding the products of the large supplier reinforces the competition for slots and therefore enables the retailers to capture a larger share of smaller total profit through higher slotting fees. As mentioned above, by creating a partial buying group, the retailers commit to not offering the efficient assortment (HM, HM). Suppliers thus compete to enforce their favorite product assortment between (HM, ML) and (HL, HL). If the small suppliers manage to have their products listed, the assortment is (HM, ML). As, from lemma 1, the gross profit of the small supplier is larger when the assortment is ML than when it is HM, one small supplier has the same gross profit than in the absence of buying group, while the other is better off: the total willingness to pay of the small suppliers to have their products listed is thus larger than in the absence of buying group. By contrast, the large supplier is worse off with the assortment (HM, ML) than with the assortment (HM, HM), so it is willing to pay more to avoid this assortment and secure (HL, HL). Competition for slots is therefore fiercer than in the absence of buying groups. Although the retailers' joint gross profit is lower, this increased competition leads to higher slotting fees in both types of equilibria (HM, ML) or (HL, HL) and may thus be profitable for retailers when their bargaining power is low as the weight of the slotting fee in their profit is then larger. This result displays common features with Inderst and Shaffer (2007), who find that a cross-border merger among retailers resulting in a commitment to a common sourcing strategy increases retailers profits; However, in their paper, it is through their bargaining with suppliers that the share of the industry profit the retailers are able to capture increases.

Consider now the role of the export cost on the profitability of partial buying groups. First, note that the partial buying group is never profitable when the threat of replacement comes from the foreign small supplier – this happens when the profitability of product M is relatively large compared to the export cost E. Indeed, creating a partial buying group does not enable the retailers to increase competition between the local and the foreign small suppliers. To see that, suppose that the threat of replacement with a partial buying group is the importation of product M from a foreign small supplier. In that case, it is also the threat of replacement in the absence of buying group.[31] In equilibrium the local small supplier earns the same profit E with and without a partial buying group. By contrast, by creating a partial buying group, the retailers reduce the profit they leave to the large supplier: they save $(1-\alpha)(\Pi^{HM} - \Pi^{ML})$. However, the joint profit drops by $(\Pi^{HM} - \Pi^{ML})$, hence the net profit of the retailers also drops, and the partial buying group is not profitable. By contrast, when the slotting fee is determined by the competition between the local small supplier and the

[31] See the complete characterization of equilibrium absent buying group and with a partial buying group in online Appendix C and D.

large supplier, then the creation of a partial buying group enables the retailers to strengthen that competition and to improve their profits.

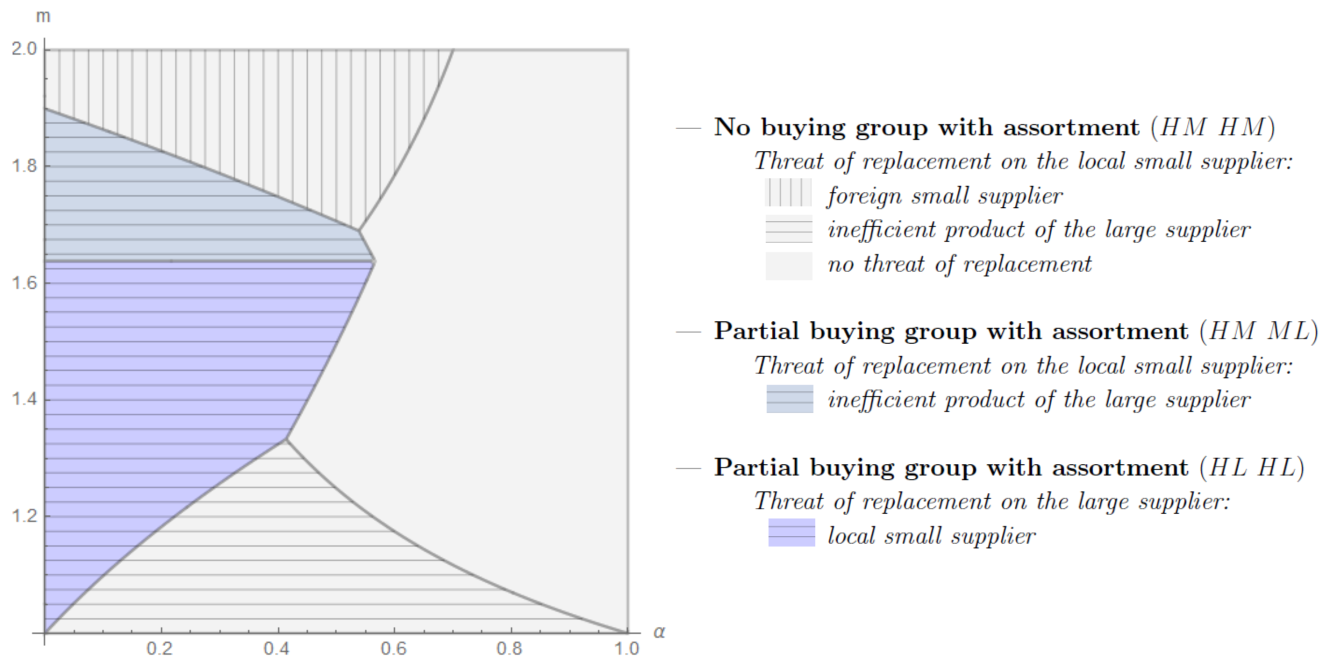
More insight can be derived from Figure 1 which illustrates Proposition 2 with a numerical example that relies on the demand specification of Singh and Vives (1984): a representative consumer has a valuation for imperfect substitutes products $X \in \{H, M, L\}$ of respective weights $\{h, m, l\}$, which can be interpreted as a quality index (the full setup is presented in online Appendix H).[32] Figure 1 displays the areas in which a partial buying group is profitable for the retailers. On the horizontal axis, the bargaining power parameter α goes from zero to 1; on the vertical axis, the quality parameter m goes from l to h. A partial buying group is profitable in the blue areas, and not profitable in the white ones. The hatching indicates the nature of the threat of replacement in equilibrium (binding constraint): horizontal hatching signals that the threat of replacement comes from a local supplier (from M in the equilibrium with exclusion (HL, HL), and from L or H in the equilibrium with no exclusion, (HM, ML)), while vertical hatching signals that the threat comes from the foreign small supplier.

As predicted by Proposition 3, we observe that a partial buying group is profitable for relatively low values of α. Furthermore, the dark blue area represents the equilibrium with exclusion of small suppliers, whereas the light blue area represents the equilibrium with local small suppliers. The horizontal frontier ($\Pi^{HM} + \Pi^{HL} = 2\Pi^{HL}$) is the limit between the two equilibria: exclusion arises only when the quality index of product M is relatively low. Finally, we can see that the export cost directly affects the upper frontier between the light blue area, in which a partial buying group is profitable and leads to an equilibrium without exclusion, and the grey area, in which a partial buying group is not profitable. The vertical hatching indicates that, in the latter, the threat of replacement comes from the foreign small supplier. When the quality index m is relatively high, the slotting fees that the small local supplier pays in equilibrium with a partial buying group is determined by the offer of the foreign small supplier. Therefore creating a partial buying group, which raises the slotting

[32] 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. Equilibrium computations for the numerical example are available upon request.

fee offered by l, has no effect on the slotting fee offered by the small local supplier: the buying group is not profitable. When the export cost decreases, the light blue area shrinks. In contrast, when the export cost is much higher, a partial buying group may be profitable even for larger values of m (when M and H are closer).

Figure 1: Profitability of a partial buying group



(a) Application with $E = 0.2$ and $a = 0.2$

Effect of a partial buying group on supplier's profits

Proposition 4. *When it is profitable, a partial buying group always (weakly) reduces the large and the small suppliers' profit.*

Proof. A complete proof is provided in online Appendix D.3. ∎

As a partial buying group leads to an inefficient equilibrium assortment when it is profitable, the suppliers' aggregated profit is negatively affected. Interestingly, although the small suppliers are out of the scope of such a buying group, both the large supplier's profit and the small suppliers' aggregated profit decrease. When the partial buying group leads to the assortment (HL, HL), small suppliers are excluded and the large supplier bears the loss of industry profit as it must pay a high slotting fee. When the assortment is (HM, ML), the large supplier does not pay a fee but its profit decreases because its bargaining position is weaker in the market, in which it sells product L. For the small suppliers, two countervailing effects are operating. On the one hand, the assortment ML yields a higher gross profit in one of the markets, but on the other hand the increased competition for slots leads to higher slotting fees, and the latter effect dominates the former.[33]

4.2.3 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 in both markets. More precisely, if the retailers choose to list product B, they commit to selecting one of the two small suppliers to supply both markets, which generates a fixed export cost E for the selected small supplier.[34] Again, three types of listing decisions may arise in equilibrium, AB, BC or AC in both markets, hence we can restrict the analysis to the the buying group's choice between the assortments (HM, ML) and (HL, HL) without loss of generality.

Product assortment As with a partial buying group, the outcome of the competition for slots depends on the suppliers' willingness to pay to influence the retailers' listing decision. The candidate product assortments are the same than with a partial buying group, hence suppliers' willingness to pay to have their favorite listing decision are unchanged. The small supplier i is willing to pay up to $\widetilde{V}_{s_i,i} = \widehat{V}_{s_i,i}$ to ensure the listing of its product in market i and $\widetilde{V}_{s_i,j} = \widehat{V}_{s_i,j}$ in market j. Similarly, the large supplier is willing to pay $\widetilde{V}_{l,i} = \widehat{V}_{l,i}$ to ensure the listing of its product and the assortment (HL, HL).[35] The important change brought out by the full buying group, as compared to partial buying group, is that a symmetric

[33]Note that, as there is then a continuum of equilibria, in which only the sum of slotting fees is fixed, one small supplier may obtain a larger profit than absent buying group. However, in this case the other supports a larger profit reduction.

[34]Note that buying groups often argue that, by doing so, they facilitate the access of small suppliers to foreign markets – See for instance the above mentioned quotes by Carrefour and Horizon in footnotes 6 and 7. Our results are qualitatively robust when we assume that a full buying group enables a small producer to access both markets, by reducing the export cost of SMEs (for instance through the help of a well established retail network) - see Allain et al. (2020).

[35]We report the complete proof in online Appendix E.

Bertrand competition now arises between the two small suppliers. Indeed, they are perfectly symmetric in their ability to serve the two markets. Therefore in equilibrium the choice between (HM, ML) and (HL, HL) directly depends on the export cost, and we obtain the following proposition:

Proposition 5. *Under Assumption 1-4, with a full buying group two types of assortments may arise in equilibrium:*

- *When $\Pi^{HM} + \Pi^{ML} - E \geq 2\Pi^{HL}$ the efficient equilibrium assortment HM is offered on one market, but the inefficient assortment ML is offered on the other market. Product M is offered by a unique small supplier bearing an export cost E.*
- *When $\Pi^{HM} + \Pi^{ML} - E \leq 2\Pi^{HL}$ the inefficient equilibrium assortment HL is offered in both markets.*

Proof. With a full buying group, when product M is listed, the same small supplier serves the two markets. The assortment chosen in equilibrium is the one that leaves the highest joint profit to the retailers. Hence the listing decision is (HM, ML) if the following condition is satisfied:

$$\underbrace{\pi^{HM}_{r_1,1} + \pi^{ML}_{r_2,2} + \widetilde{V}_{s_1,1} + \widetilde{V}_{s_1,2}}_{(HM,ML)\text{ with a unique small supplier}} \geq \underbrace{\pi^{HL}_{r_1,1} + \pi^{HL}_{r_2,2} + \widetilde{V}_{l,1} + \widetilde{V}_{l,2}}_{(HL,HL)}$$
$$\Leftrightarrow \; \Pi^{HM} + \Pi^{ML} - E \geq 2\Pi^{HL}, \tag{6}$$

and (HL, HL) otherwise.

We provide a complete characterization of the equilibrium with full buying group in online Appendix E. ■

The equilibrium assortment is thus the same with a partial and with a full buying group. However, competition between the two small suppliers plays out differently in the two cases, and this affects the sharing of profits between the firms.

Equilibrium slotting fees and profits Consider now the slotting fees paid by the suppliers in the two possible equilibrium configurations.

- **Product M listed:** Whenever $\Pi^{HM} + \Pi^{ML} - E \geq 2\Pi^{HL}$, in equilibrium the retailers list the assortment (HM, ML) and a unique small supplier is chosen to supply the two markets. In equilibrium, the two small suppliers compete in a symmetric Bertrand game to be listed, and each of them offers a slotting fees that dissipate its total profit in the two markets:

$$\widetilde{S}_{s_i}^{pe} \equiv \widetilde{V}_{s_i,1} + \widetilde{V}_{s_i,2}, \tag{7}$$

where the superscript pe stands for partial exclusion (exclusion of the local supplier in one country). Note that these fees are higher than with a partial buying group. Under Assumptions 1-4, this fee is positive when retailers bargaining power is not too large as compared to the export cost.[36]

In this equilibrium the retailers' joint profit amounts to the profit they would obtain with the second best offer, that is the assortment (HM, ML) if M were offered by the rival small supplier (*i.e.* $\pi_{r_1,1}^{HM} + \pi_{r_2,2}^{ML} + \widetilde{V}_{s_i,1} + \widetilde{V}_{s_i,2}$). Equilibrium profits are as follows:

$$\begin{aligned}
\widetilde{\Pi}_r^{pe} &\equiv \widetilde{\Pi}_{r_1,1}^{pe} + \widetilde{\Pi}_{r_2,2}^{pe} \equiv \pi_{r_1,1}^{HM} + \pi_{r_2,2}^{ML} + \widetilde{S}_{s_i}^{pe} \\
\widetilde{\Pi}_s^{pe} &\equiv \widetilde{\Pi}_{s_1,1}^{pe} + \widetilde{\Pi}_{s_2,2}^{pe} \equiv 0 \\
\widetilde{\Pi}_l^{pe} &\equiv \widetilde{\Pi}_{l,1} + \widetilde{\Pi}_{l,2} \equiv \pi_{l,1}^{HM} + \pi_{l,2}^{ML}.
\end{aligned}$$

- **Product M is excluded:** Whenever $\Pi^{HM} + \Pi^{ML} - E \leq 2\Pi^{HL}$, in equilibrium the retailers list the assortment HL in the two markets. The equilibrium slotting fee is as follows:

$$\widetilde{S}_l^{e} \equiv \max\{\pi_{r_i,i}^{HM} + \pi_{r_j,j}^{ML} - 2\pi_{r_i,i}^{HL} + \widetilde{V}_{s_i,i} + \widetilde{V}_{s_i,j}, 0\} \tag{8}$$

[36]Namely, iff. $\alpha \leq \widetilde{\alpha}^{pe} \equiv 1 - \frac{E}{\Pi^{HM} - \Pi^{H} + \Pi^{ML} - \Pi^{L}}$. Indeed, if $\alpha \geq \widetilde{\alpha}^{pe}$, no positive fee is necessary to overcome the threat of replacement by the large supplier.

Under Assumptions 1-4, competition for slots leads the large supplier to pay a positive slotting fee whenever the retailers' bargaining power is low compared to the export cost.[37] Again, the retailers obtain their outside option profit (the profit they would obtain by listing (HM, ML) and buying product M from a single supplier for both markets, that is, $\pi_{r_1,1}^{HM} + \pi_{r_2,2}^{ML} + \widetilde{V}_{s_i,1} + \widetilde{V}_{s_i,2}$). Equilibrium aggregated profits can be written as follows:

$$\begin{aligned}
\widetilde{\Pi}_r^e &\equiv \widetilde{\Pi}_{r_1,1}^e + \widetilde{\Pi}_{r_2,2}^e \equiv \pi_{r_1,1}^{HM} + \pi_{r_2,2}^{ML} + \widetilde{S}_l^e \\
\widetilde{\Pi}_s^e &\equiv \widetilde{\Pi}_{s_1,1}^e + \widetilde{\Pi}_{s_2,2}^e \equiv 0 \\
\widetilde{\Pi}_l^e &\equiv \widetilde{\Pi}_{l,1} + \widetilde{\Pi}_{l,2} \quad\ \equiv \pi_{l,1}^{HM} + \pi_{l,2}^{ML} - \widetilde{S}_l^e.
\end{aligned}$$

Note that when a positive slotting fee is paid, the retailers' joint profit is independent of the product assortment. Indeed for both listing decisions, the retailers' best outside option is the same: to choose the assortment (HM, ML) with a unique small supplier of product M for the two markets.

Profitability of a full buying group We now analyze whether it is profitable for retailers to create a full buying group. As with a partial buying group, the sum of the retailers' gross profits is lower with a full buying group than in the absence of buying group. Hence a full buying group can be profitable for the retailers only if the collected slotting fees increase sufficiently to offset this reduction. We thus obtain the following proposition:

Proposition 6. *A full buying group is profitable for the retailers when they have a low bargaining power, and for intermediate values of the export cost.*

Proof. We provide a complete proof in online Appendix E.3. ■

With a full buying group, the retailers commit to a joint listing decision on all products. As with a partial buying group, suppliers compete to enforce their favourite listing decision

[37] Namely iff. $\alpha \leq \widetilde{\alpha}^e \equiv \frac{2\Pi^M - E}{2\Pi^{HL} - \Pi^{HM} - \Pi^{ML} + 2\Pi^M}$. Indeed, when $\alpha \geq \widetilde{\alpha}^e$, no positive fee is necessary to overcome the threat of replacement by a small supplier.

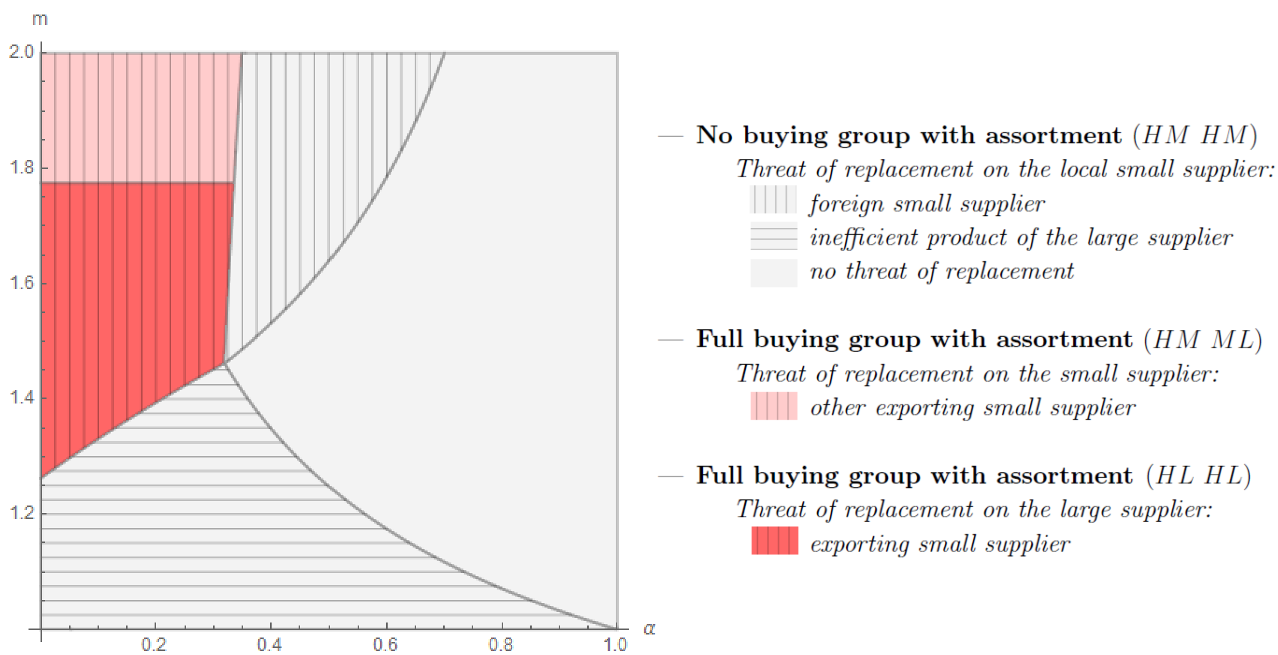
between (HM, ML) and (HL, HL); the difference is that when product M is listed, a unique supplier is now selected for the two markets. The retailers may jointly benefit from creating a full buying group through two different channels: the increased competition between the large and the small suppliers, and the increased competition between the two small suppliers.

- First, competition for slots between the large and the small supplier is affected. Note that this profit extraction mechanism is not as effective as with a partial buying group, because when the assortment (HL, HL) is selected, the large supplier pays a larger fee with a partial than with a full buying group. Indeed, the small supplier still attempts to impose the assortment (HM, ML), whereas the large supplier instead pushes for (HL, HL), but the listed small supplier now incurs the export cost E, which reduces its profit and hence its total willingness to pay.

- Second, a full buying group generates perfect competition between the two small suppliers. They compete in a symmetric Bertrand game to be listed in the two markets, and in equilibrium they both make zero profit. This is particularly profitable when the profit of the small local suppliers is high without buying group, that is when M is highly profitable and E is relatively high (but not too high to ensure that the threat of replacement comes from the foreign small supplier).

Using the same demand specification as in Figure 1, we introduce Figure 2 to deliver more insight on the profitability of a full buying group. Areas in which building a full buying group is profitable for the retailers are represented in red. The dark red area represents the equilibrium in which the retailers list assortment (HL, HL), in this case the profitability comes from the first profit channel which is common with the partial buying group. The light red area represents the equilibrium in which the retailers list assortment (HM, ML) with a unique small supplier for the two markets, in this case the profitability comes from the second profit channel, that is from the perfect competition between the two small suppliers. The horizontal frontier between the light red and the dark red area represents the limit between the two equilibrium assortments $(\Pi^{HM} + \Pi^{ML} - E = 2\Pi^{HL})$: the equilibrium with exclusion arises when the quality index of product M is relatively low as compared to the export cost. In these two equilibria, the retailers have the same best outside option, which is to list a unique small supplier to serve the two markets (as indicated by the vertical hatching in these two cases). As a result, in both cases the retailers joint profit amounts to this unique outside option profit. When the export cost increases, this outside option profit decreases and the profitability of the buying group is negatively affected: the right frontier separating the equilibrium with buying group from the no buying group equilibrium is moved to the left. Finally, note that the full buying group remains profitable when m is high, this is intuitive as it allows retailers to fully capture the small suppliers' contribution to the industry profit, which increases with m.

Figure 2: Profitability of a full buying group



(a) Application with $E = 0.2$ and $a = 0.2$

Effect of a full buying group on supplier's profits

Proposition 7. *When it is profitable for the retailers, a full buying group induces a reduction in suppliers' equilibrium profits. Whether they are excluded or not, small suppliers obtain zero profit.*

Proof. The proof is straightforward from the proof of Proposition 4 presented in online Appendix D.3. ■

A full buying group leads to a perfect competition between small suppliers which make zero profit. The effect on the large supplier's profit is less clear. In fact, when the assortment is (HL, HL), a high export cost could reduce the threat of replacement from small suppliers and increase the large supplier's profit in comparison to the case absent buying group. However, in this case the buying group is not profitable for the retailers.

5 Alliance strategy and welfare effects

In this section, we compare the relative profitability of the different types of buying groups. We also provide some insights on their welfare effects and discuss implications for competition policy.

5.1 Comparing the alliance benefits for 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 do not explicitly model the strategic decision of creating a buying group, but it is clear that, as soon as the joint profit of the retailers is larger in one of the three scenarios, the preferred scenario may arise at the equilibrium of a non cooperative game, provided that some kind of transfer is possible between the buying group and the retailers. This may be the case, for instance, in the following setting: in a preliminary stage (stage 0) the retailers choose the nature of their buying alliance, and in stage 1 the buying group collects all the slotting fees and redistributes this amount to its members according to a predefined rule that guarantees each member its profit absent buying group (as seen in sections 4.2.2 and 4.2.3, the buying group is profitable whenever the amount of the fees is sufficient to compensate the total loss of gross profit by the retailers).[38]

[38] The issue of how a buying group can transfer money to its members is out of the scope of our model, as it depends on the legal and financial structure of the alliance. In practice, however, there is evidence

Proposition 8. *Under Assumptions 1-4, when their bargaining power is relatively low and the export cost is relatively high, the retailers are better off with either a partial or a full buying group:*

- *a partial buying group when* $E \geq \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}$ *(either with or without exclusion of small suppliers).*
- *a full buying group when* $E < \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}$ *(in that case they always list the product of one of the small suppliers).*

Proof. We compare the profits of the retailers in the three situations in online Appendix F. ■

First, assume that $\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq 0$, which means that the overall industry profit (in both markets) is larger when product M is excluded. In that case, the retailers choose the assortment (HL, HL): the total gross profit of the retailers is thus the same with both types of buying group. Furthermore, with a partial buying group the sum of the slotting fees offered by the two local small suppliers (*i.e.* $\pi^{HM}_{s_i,i} + \pi^{ML}_{s_j,j}$) is higher than the total slotting fee offered by each small supplier with a full buying group (*i.e.* $\pi^{HM}_{s_i,i} + \pi^{ML}_{s_i,j} - E$), because with a full buying group the small supplier must pay the export cost E if it is selected. As a result, in equilibrium the large supplier pays a larger slotting fee with a partial buying group, and the retailers are always better off with a partial rather than with a full buying group. In this area, the industry profit is the same with the two types of buying group

Second, assume that $0 < \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq E$. In that case, with a partial buying group, the retailers select the assortment (HM, ML). By contrast, with a full buying group, because of the export cost E, the assortment is (HL, HL) in both markets. Hence the retailers choose a partial rather than a full buying group. Indeed, as mentioned in the previous case, a full buying group with assortment (HL, HL) brings less profit to the retailers than the assortment (HL, HL) under partial buying group, because of the export cost; furthermore,

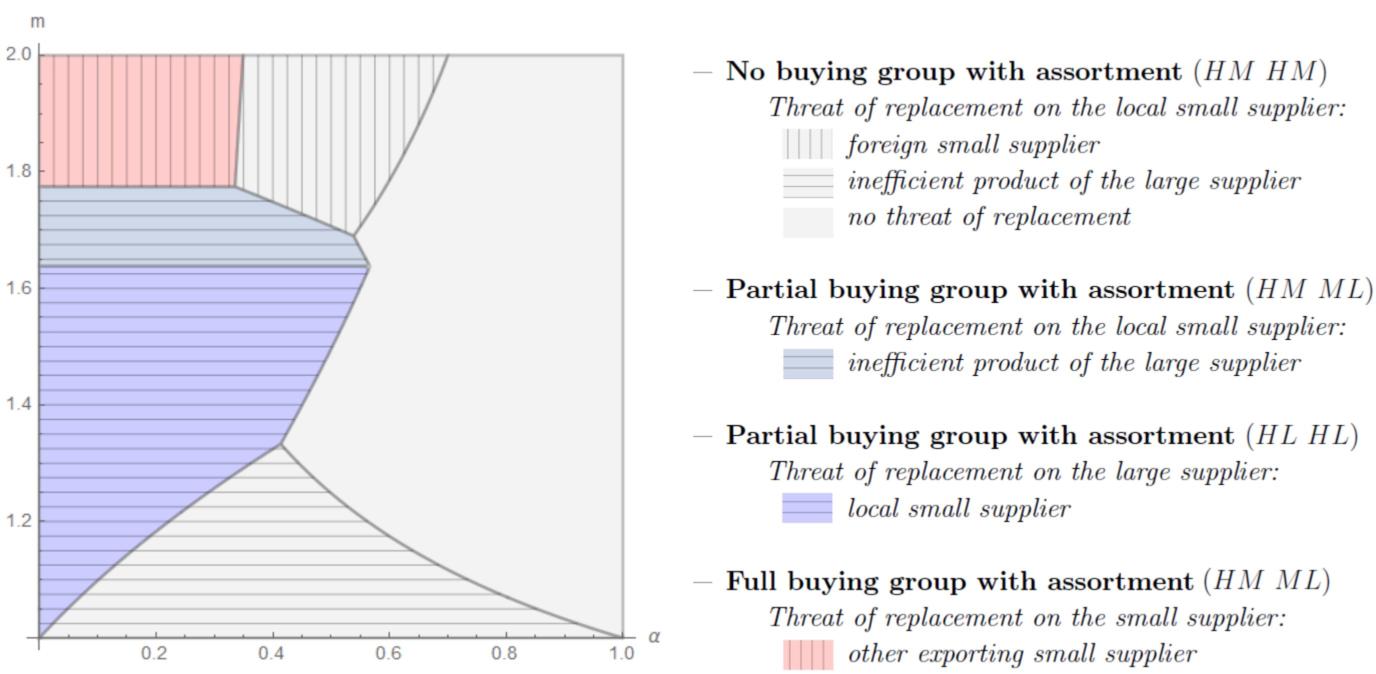
that these transfers exist. For instance, buying groups collect slotting fees, they may also implement central billing (a process through which all payments to a supplier are aggregated and paid by the buying group), invoice services to their members, etc.

with a partial buying group the equilibrium assortment (HM, ML) leads to a larger joint profit for the retailers than the assortment (HL, HL). In this area, the industry profit is lower with a full buying group than with a partial one.

Finally, suppose that $0 < E < \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}$. The assortment is now (HM, ML) under both types of buying groups. With a partial buying group, the retailers obtain their outside option profit (that is, their profit should they list the assortment (HL, HL)) and the small suppliers keep a positive profit; with a full buying group however, competition for slots induces the small suppliers to leave the retailers all of their profits: the retailers are then better off with a full buying group. In this case, the industry profit is lower with a full buying group than with a partial one, because the cost E is wasted in the former case.

Figure 3 illustrates these results in the numerical example, and displays the buying group strategy that gives the highest joint profit to the retailers. The retailers' bargaining power α is on the horizontal axis, and m, the consumers' relative preference for the variety M, on the vertical axis.

Figure 3: Most profitable alliance strategy



(a) Application with $E = 0.2$ and $a = 0.2$

5.2 Implications for Competition Policy

In this section, we analyze the effect of buying groups on the efficiency of the whole industry profit and consumer surplus, and we derive some implications for competition policy by analyzing the effect of a policy banning full buying groups.

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 setup, is always inefficient from the industry perspective, as it dissipates part of the joint profit. To analyze the effects of buying groups on consumer surplus, we need additional assumptions. We denote C^{XY} the consumer surplus in the reduced form equilibrium with assortment XY on a market. Note that, 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. We make the following assumption:

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 satisfied with usual demand systems such as the linear demand specification used in our numerical example, or with a model with vertical differentiation à la Shaked and Sutton (1983). A direct consequence of Assumption 5 is that the ranking of total welfare in the different assortment follows the ranking of industry profits.

We thus obtain the following proposition:

Proposition 9. *Under Assumptions 1-5, buying groups are always detrimental for industry profit, consumer surplus and welfare.*

Proof. See online Appendix G. ■

We further investigate whether a policy aiming at limiting the scope of buying groups, which in our setting would be equivalent to banning full buying groups, would be efficient. We obtain the following proposition:

Proposition 10. *Under Assumption 1-5 a regulation limiting the scope of buying groups to partial buying groups increases industry profit, consumer surplus and welfare. However, such a regulation does not protect small suppliers from exclusion and does not fully prevent their profit losses.*

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

The intuition for proposition 10 is as follows. Comparing the equilibrium outcomes under *laissez faire* (as illustrated in Figure 3) to the outcomes with a partial buying group (as in Figure 1), we see that a ban of full buying group may have two types of effects. Instead of a full buying group with the assortment (HM, ML) under *laissez faire*, the regulation may lead the retailers to:

- either form a partial buying group without exclusion. Under both the *laissez faire* and the regulation, there is a net loss in industry profit $\Pi^{HM} - \Pi^{ML}$, but the regulation saves the fixed export cost E. Such regulation increases industry profit but leaves the consumers surplus unchanged. In that case the regulation improves small suppliers' profit.

- or to give up creating a buying group. Instead of a net loss $\Pi^{HM} - \Pi^{ML} + E$ with the *laissez faire* the regulation restores the efficiency and therefore both industry profit and consumer surplus increase. The two small suppliers are better off with the regulation.

Finally, as exclusion of small suppliers always arises under partial buying group, the regulation has no effect on such exclusion and thus does not protect them from being excluded.

Partial buying groups thus appear to have adverse effects on welfare. In some cases, they may be profitable and thus lead to welfare distortions in situations, in which full buying groups would not, as seen by comparing Figures 2 and 3. Furthermore, in the areas where the two kind of buying groups are profitable and lead to the exclusion of small suppliers, partial buying groups are preferred by retailers. Partial buying groups then lead to less welfare distortions than full buying groups, because the export cost is saved, however, they are even more harmful for large supplier.

Applying the Chicago School logic to buying groups, it is worth noticing that if ex ante the retailers could threaten suppliers to create a joint listing decision, in theory, the sole threat would be sufficient to extract some rent from the suppliers to prevent such alliance, and alliances would not be created. However, this rent extraction relies on transfers that are likely to be illicit, as the retailers are not supposed to ask suppliers for advantages of any kind without performing a service related to this advantage.[39] Furthermore, this reasoning does not alleviate the need for a policy controlling such alliances, as such a control would also be efficient against the threat.

6 Conclusion

This article analyzes the impact of retailers' buying groups on product variety and profit sharing within a vertical chain, and we focus on the welfare effect of buying groups according to their scope (full or partial). 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 profit sharing within 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 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 between 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. We show that when buying groups are created, both types of suppliers are worse off, and small suppliers can be excluded.

Our results have implications for competition policy. Although retailers argue that full buying groups may create an opportunity for SMEs to access new markets, we show that there is little benefit to expect for small suppliers in this instance. We confirm that restricting

[39] "Report from the Commission to the European Parliament and the council on unfair business-to-business trading practices in the food supply chain", COM(2016)32.

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 favor 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 groups lead to a decrease in profit for the small suppliers, and does not prevent their exclusion from the market. Note that our paper is focused on joint listing alliances implemented by purchasing alliances, but our analysis also holds if the joint listing strategy follows a cross-border merger. Indeed, such a merger between non competing retailers does not affect the bargaining or the price setting stages. The above policy implications thus readily extend to cross-border mergers.

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.

Avenues for future research encompass the analysis of retail competition to combine the effect of buying groups on product variety and prices, and that of more complex upstream market structure to explore the role of bundling in our analysis.

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Appendix

A Nash Bargaining equilibrium

A.1 Assortment HL

Consider first the subgame where r_i has listed the assortment HL. There is a unique bilateral negotiation between r_i and l for both products. The retailer's profit when it succeeds in the negotiation is $\Pi^{HL} - F_{l,i}^{HL}$, while its status-quo profit in case of a breakdown is zero. The supplier's profit if the negotiation succeeds is $F_{l,i}^{HL}$, while its status-quo profit in case of a breakdown is zero.

The equilibrium outcome is derived from the bilateral Nash product (where the superscripts relate to the subgame equilibrium assortment on which we focus):

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

Hence we have the following equilibrium values:

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

A.2 Assortment XM

Consider now the subgames where retailer r_i sells product M, that is, assortment is XM, with $X \in \{H, L\}$. Retailer r_i engages in a simultaneous bilateral negotiation with each of the two suppliers listed.

The retailer now has a positive status-quo profit in the bargaining because it negotiates with two different suppliers. Retailer r_i engages in a bilateral negotiation with each listed supplier.

Consider the negotiation between r_i and l. The retailer's profit when it succeeds in both negotiations is $\Pi^{XM} - F_{l,i}^{XM} - F_{s_i,i}^{XM}$, while its 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 $F_{l,i}^{XM}$, while its status quo profit in case of a breakdown is zero.

Consider now the negotiation between r_i and s_i. The retailer's profit when it succeeds in both negotiations is $\Pi^{XM} - F_{l,i}^{XM} - F_{s_i,i}^{XM}$, while its 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 its status-quo profit in case of a breakdown is zero.

We solve the following Nash bargaining :

$$
\begin{aligned}
&\max_{F_{l,i}^{XM}} (\Pi^{XM} - F_{s_i,i}^{XM} - F_{l,i}^{XM} - (\Pi^{M} - F_{s_i,i}^{XM}))^{\alpha} (F_{l,i}^{XM})^{1-\alpha} \\
&\quad \Leftrightarrow (1-\alpha)(\Pi^{XM} - F_{l,i}^{XM} - F_{s_i,i}^{XM} - (\Pi^{M} - F_{s_i,i}^{XM})) = \alpha F_{l,i}^{XM} \\
&\max_{F_{s_i,i}^{XM}} (\Pi^{XM} - F_{s_i,i}^{XM} - F_{l,i}^{XM} - (\Pi^{X} - F_{l,i}^{XM}))^{\alpha} (F_{s_i,i}^{XM})^{1-\alpha} \\
&\quad \Leftrightarrow (1-\alpha)(\Pi^{XM} - F_{l,i}^{XM} - F_{s_i,i}^{XM} - (\Pi^{M} - F_{l,i}^{XM})) = \alpha F_{s_i,i}^{XM}
\end{aligned}
$$

Hence we have the following equilibrium values:

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

If instead s_j supplies M we assume that the fixed export cost is sunk and therefore the above stage-2 equilibrium gross profit are unchanged.

A.3 Assortment X

Consider now the subgames where retailer r_i sells product X with $X \in \{H, M, L\}$. Retailer r_i engages in a bilateral negotiation with its unique supplier.

The retailer's profit when it succeeds in this negotiation is $\Pi^X - F_{k,i}^X$, while its status-quo profit in case of a breakdown is zero. The supplier's profit if the negotiation succeeds is $F_{k,i}^X$ while its status-quo profit in case of a breakdown is zero. The resolution of the Nash bargaining is as follows:

$$\begin{aligned} &\max_{F_{k,i}^X} (\Pi^X - F_{k,i}^X)^\alpha (F_{k,i}^X)^{1-\alpha} \\ &\Leftrightarrow (1-\alpha)(\Pi^X - F_{k,i}^X) = \alpha F_{k,i}^X \end{aligned}$$

Hence we have the following equilibrium values:

$$\begin{aligned} F_{k,i}^X &= (1-\alpha)\Pi^X \\ \pi_{r_i,i}^X &= \Pi^X - F_{k,i}^X = \alpha \Pi^X \\ \pi_{k,i}^X &= F_{l,i}^{XM} = (1-\alpha)\Pi^X \end{aligned}$$

A.4 Proof lemma 1

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

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

Under Assumption 3, on each market, supplier l sells product H and L and supplier s_i sells product M. We compare continuation profits obtained in stage 2 for each assortment.

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

- $\pi^{HM}_{r_i,i} - \pi^{HL}_{r_i,i} = \alpha(\Pi^{HM} - \Pi^{HL}) + (1-\alpha)(\Pi^H + \Pi^M - \Pi^{HM}) \geq 0$ because $\Pi^{HM} - \Pi^{HL} > 0$ under Assumption 1 and $\Pi^H + \Pi^M - \Pi^{HM} > 0$ under Assumption 2.
- $\pi^{HM}_{r_i,i} - \pi^{ML}_{r_i,i} = \alpha(\Pi^{HM} - \Pi^{ML}) + (1-\alpha)(\Pi^{ML} - \Pi^L - (\Pi^{HM} - \Pi^H)) \geq 0$ because $\Pi^{HM} - \Pi^{ML} > 0$ under Assumption 1 and $(\Pi^{ML} - \Pi^L - (\Pi^{HM} - \Pi^H))$ under Assumption 4.
- 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 $\pi^{ML}_{r_i,i} - \pi^H_{r_i,i} = \alpha(\Pi_{ML} - \Pi_H) + (1-\alpha)(\Pi^M + \Pi^L - \Pi^{ML}) \geq 0$ because $\Pi^{ML} - \Pi^H > 0$ under Assumption 1 and $\Pi^M + \Pi^L - \Pi^{ML} > 0$ under Assumption 2.

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

B Proof of lemma 2

(i) Under Assumptions 1 - 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) increases slotting-fees paid by suppliers as slotting fees are not conditional on the other suppliers' product listed.

(ii) Under Assumptions 1 - 4, for any alliance strategy, supplier l is never willing to pay a positive slotting fee to sell only one product.

- **Absent buying group** Assume that r_i decides to list M. From lemma 2 *(i)* it then chooses between listing HM or ML, hence supplier l knows that one of its products is listed for sure. From lemma 1, in the continuation equilibrium supplier l obtains a higher gross profit with the assortment HM than with ML and is thus not wiling to pay a positive fee for L to be listed. Besides, under Assumptions 2 and 3, in the continuation equilibrium r_i also obtains a higher gross profit with the assortment HM. Hence, l does not need to pay a positive slotting fee to convince the retailer to list product H because their incentives are aligned.

- **With a partial/full buying group** Whenever the buying group decides to list M, it must choose to list the assortment HM on one market and ML on the other. Under Assumption 1, l makes a higher gross profit by selling the two products H and L in both markets rather than by selling only one product on each market. Hence, it is never profitable for l to pay a positive slotting fee for selling only one product. Furthermore, it is not willing to pay a positive fee to convince the buying group to choose one product rather than the other, because it obtains the same profit regardless of the product that is selected (A or C).

C Equilibrium absent buying group

Under Assumptions 1-4, absent buying group, in equilibrium the efficient assortment HM is sold on each market (*i.e.* AB in market 1 and BC in market 2), the retailer accepts the corresponding slotting fees.[40]

[40]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.

Equilibrium slotting fee offers are: $\overline{S}_{s_i,i} = \max\{\pi^{HL}_{r_i,i} - \pi^{HM}_{r_i,i} + \overline{V}_{l,i}, \overline{V}_{s_j,i}, 0\}$, $\overline{S}_{s_j,i} = \max\{\overline{V}_{s_j,i}, 0\}$ and $\overline{S}_{l,i} \equiv \big(0, 0, \overline{V}_{l,i}\big)$

$$\overline{S}_{s_i,i} \equiv \begin{cases} (\Pi^{HL} - \Pi^{H}) - \alpha(\Pi^{HM} - \Pi^{H}) & \text{if } \alpha \leq \overline{\alpha}_1 \textit{ and } E \geq \Pi^{HM} - \Pi^{HL} \\ (1-\alpha)(\Pi^{HM} - \Pi^{H}) - E & \text{if } \alpha \leq \overline{\alpha}_2 \textit{ and } E \leq \Pi^{HM} - \Pi^{HL} \\ 0 & \text{otherwise} \end{cases}$$

$$\overline{S}_{s_j,i} \equiv \begin{cases} (1-\alpha)(\Pi^{HM} - \Pi^{H}) - E & \text{if } \alpha \leq \overline{\alpha}_2 \textit{ and } E \leq \Pi^{HM} - \Pi^{HL} \\ 0 & \text{otherwise} \end{cases}$$

$$\overline{S}_{l,i} \equiv \big(0, 0, (1-\alpha)(\Pi^{HL} - \Pi^{HM} + \Pi^{M})\big)$$

with $\overline{\alpha}_1 \equiv \frac{\Pi^{HL} - \Pi^{H}}{\Pi^{HM} - \Pi^{H}}, \overline{\alpha}_2 \equiv \frac{\Pi^{HM} - \Pi^{H} - E}{\Pi^{HM} - \Pi^{H}}$.

Equilibrium profits are: $\overline{\Pi}_{r_i,i} = \max\{\pi^{HL}_{r_i,i} + \overline{V}_{l,i}, \pi^{HM}_{r_i,i} + \overline{V}_{s_j,i}, \pi^{HM}_{r_i,i}\}$, $\overline{\Pi}_{s_i,i} = \min\{\pi^{HM}_{s_i,i} - (\pi^{HL}_{r_i,i} - \pi^{HM}_{r_i,i} + \overline{V}_{l,i}), \pi^{HM}_{s_i,i} - \overline{V}_{s_j,i}, \pi^{HM}_{s_i,i}\}$ and $\overline{\Pi}_{l,i} = \pi^{HM}_{l,i}$.

$$\overline{\Pi}_{r_i,i} \equiv \begin{cases} \overline{\Pi}^1_{r_i} = \Pi^{HL} - (1-\alpha)(\Pi^{HM} - \Pi^{M}) & \text{if } \alpha \leq \overline{\alpha}_1 \textit{ and } E \geq \Pi^{HM} - \Pi^{HL} \\ \overline{\Pi}^2_{r_i} = \Pi^{HM} - (1-\alpha)(\Pi^{HM} - \Pi^{M}) - E & \text{if } \alpha \leq \overline{\alpha}_2 \textit{ and } E \leq \Pi^{HM} - \Pi^{HL} \\ \overline{\Pi}^3_{r_i} = \Pi^{HM} - (1-\alpha)\big[(\Pi^{HM} - \Pi^{H}) + (\Pi^{HM} - \Pi^{M})\big] & \text{otherwise} \end{cases}$$

$$\overline{\Pi}_{s_i,i} \equiv \begin{cases} \Pi^{HM} - \Pi^{HL} & \text{if } \alpha \leq \overline{\alpha}_1 \textit{ and } E \geq \Pi^{HM} - \Pi^{HL} \\ E & \text{if } \alpha \leq \overline{\alpha}_2 \textit{ and } E \leq \Pi^{HM} - \Pi^{HL} \\ (1-\alpha)(\Pi^{HM} - \Pi^{H}) & \text{otherwise} \end{cases}$$

$$\overline{\Pi}_{s_j,i} \equiv 0$$

$$\overline{\Pi}_{l,i} \equiv (1-\alpha)(\Pi^{HM} - \Pi^{M})$$

D Equilibrium with a partial buying group

D.1 Characterization of the equilibrium

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. Small suppliers offer $\widehat{S}^e_{s_i,i} = \pi^{HM}_{s_i,i}$ and $\widehat{S}^e_{s_j,j} = \pi^{ML}_{s_j,j}$ and the large supplier offers $\widehat{S}^e_l \equiv \max\{\pi^{HM}_{r_i,i} + \pi^{ML}_{r_i,i} - 2\pi^{HL}_{r_i,i} + \widehat{S}^e_{s_i,i} + \widehat{S}^e_{s_j,j}, 0\}$.

Equilibrium slotting fees:

- The large supplier may offer a positive slotting fee only to have its two products listed:

$$\widehat{S}^e_l \equiv \begin{cases} \alpha(\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}) + 2(1-\alpha)\Pi^M \ if\ \alpha \leq \widehat{\alpha}^e \\ 0 \ if\ \alpha > \widehat{\alpha}^e \end{cases}$$

- The two small suppliers offer:[41]

$$\widehat{S}^e_{s_i,i} \equiv (1-\alpha)(\Pi^{HM} - \Pi^H), \text{ and } \widehat{S}^e_{s_j,i} \equiv \max\{(1-\alpha)(\Pi^{HM} - \Pi^H) - E, 0\} \text{ in market } i$$

$$\widehat{S}^e_{s_i,j} \equiv \max\{(1-\alpha)(\Pi^{ML} - \Pi^L) - E, 0\} \text{ and } \widehat{S}^e_{s_j,j} \equiv (1-\alpha)(\Pi^{ML} - \Pi^L) \text{ in market } j$$

The resulting total profits in both markets are such that $\widehat{\Pi}^e_r = \max\{\pi^{HM}_{r_i,i} + \pi^{ML}_{r_i,i} + \widehat{S}^e_{s_i,i} + \widehat{S}^e_{s_j,j}, 2\pi^{HL}_{r_i,i}\}$, $\widehat{\Pi}^e_{s_i} = 0$ and $\widehat{\Pi}^e_l = \min\{\Pi^{HL} - \pi^{HM}_{r_i,i} - \pi^{ML}_{r_i,i} - \widehat{S}^e_{s_i,i} - \widehat{S}^e_{s_j,j}, 2\pi^{HL}_{l,i}\}$

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

$$\widehat{\Pi}_r^e \equiv \begin{cases} \widehat{\Pi}_r^1 = \alpha(\Pi^{HM} + \Pi^{ML}) + 2(1-\alpha)\Pi^M & \text{if } \alpha \leq \widehat{\alpha}^e \\ \widehat{\Pi}_r^2 = 2\alpha\Pi^{HL} & \text{if } \alpha > \widehat{\alpha}^e \end{cases}$$

$$\widehat{\Pi}_s^e = \widehat{\Pi}_{s_1,1}^e \equiv \widehat{\Pi}_{s_2,2}^e = 0 \tag{9}$$

$$\widehat{\Pi}_l^e \equiv \begin{cases} \alpha 2\Pi^{HL} - \alpha(\Pi^{HM} + \Pi^{ML}) - 2(1-\alpha)\Pi^M & \text{if } \alpha \leq \widehat{\alpha}^e \\ 2(1-\alpha)\Pi^{HL} & \text{if } \alpha > \widehat{\alpha}^e \end{cases}$$

With $\widehat{\alpha}^e \equiv \frac{2\Pi^M}{2\Pi^{HL} - \Pi^{HM} - \Pi^{ML} + 2\Pi^M}$.

Equilibrium without exclusion of the local small suppliers: when $\Pi^{HM} + \Pi^{ML} \geq 2\Pi^{HL}$, there are two mirror equilibria where the retailers list the product of the local small supplier with one product of the large supplier (the assortment is either AB or BC in both markets). Let's consider that the product listed of the large supplier is H in market i and L in market j.

Equilibrium slotting fees:

- The large supplier offers its maximum willingness to pay to impose its two products in the two markets:[42]
  $\widehat{S}_l^{ne} \equiv \widehat{V}_{l,1} + \widehat{V}_{l,2} \equiv (1-\alpha)(2\Pi^{HL} - \Pi^{HM} - \Pi^{ML} + 2\Pi^M)$.

- Small suppliers offers are such that:
  $\widehat{S}_{s_j,i} \equiv \widehat{V}_{s_j,i} \leq \widehat{S}_{s_i,i}^{ne} \leq \widehat{V}_{s_i,i}$ and $\widehat{S}_{s_i,j} \equiv \widehat{V}_{s_i,j} \leq \widehat{S}_{s_i,j}^{ne} \leq \widehat{V}_{s_j,j}$ and,

$$\widehat{S}_{s_1,1}^{ne} + \widehat{S}_{s_2,2}^{ne} \equiv \begin{cases} 2\Pi^{HL} - (1-\alpha)(\Pi^H + \Pi^L) - \alpha(\Pi^{HM} + \Pi^{ML}) & \text{if } E \geq \max\{\widehat{E}_1, \widehat{E}_2\} \text{ and } \alpha \leq \widehat{\alpha}_1 \\ (1-\alpha)(\Pi^{ML} - \Pi^L) - E & \text{if } \widehat{E}_3 \leq E \leq \widehat{E}_2 \text{ and } \alpha \leq \widehat{\alpha}_2 \\ (1-\alpha)(\Pi^{HM} - \Pi^H + \Pi^{ML} - \Pi^L) - 2E & \text{if } E \leq \min\{\widehat{E}_1, \widehat{E}_3\} \text{ and } \alpha \leq \widehat{\alpha}_3 \\ 0 & \text{otherwise} \end{cases}$$

[42] The large supplier offer to have only one product listed (A or C) is zero.

$$\widehat{\Pi}_r^{ne} \equiv \begin{cases} \widehat{\Pi}_r^3 = 2\Pi^{HL} - (1-\alpha)(\Pi^{HM} + \Pi^{ML} - 2\Pi^M) & \text{if } E \geq \max\{\widehat{E}_1, \widehat{E}_2\} \text{ and } \alpha \leq \widehat{\alpha}_1 \\ \widehat{\Pi}_r^4 = \alpha(\Pi^{HM} + \Pi^{ML}) + 2(1-\alpha)\Pi^M - (1-\alpha)(\Pi^{HM} - \Pi^H) - E & \text{if } \widehat{E}_3 \leq E \leq \widehat{E}_2 \text{ and } \alpha \leq \widehat{\alpha}_2 \\ \widehat{\Pi}_r^5 = -2E + \alpha(\Pi^{HM} + \Pi^{ML}) + 2(1-\alpha)\Pi^M & \text{if } E \leq \min\{\widehat{E}_1, \widehat{E}_3\} \text{ and } \alpha \leq \widehat{\alpha}_3 \\ \widehat{\Pi}_r^6 = (1-\alpha)(\Pi^H + \Pi^L + 2\Pi^M) - (2\alpha-1)(\Pi^{HM} + \Pi^{ML}) & \text{otherwise} \end{cases}$$

$$\widehat{\Pi}_s^{ne} \equiv \begin{cases} \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} & \text{if } E \geq \max\{\widehat{E}_1, \widehat{E}_2\} \text{ and } \alpha \leq \widehat{\alpha}_1 \\ (1-\alpha)(\Pi^{HM} - \Pi^H) + E & \text{if } \widehat{E}_3 \leq E \leq \widehat{E}_2 \text{ and } \alpha \leq \widehat{\alpha}_2 \\ 2E & \text{if } E \leq \min\{\widehat{E}_1, \widehat{E}_3\} \text{ and } \alpha \leq \widehat{\alpha}_3 \\ (1-\alpha)((\Pi^{HM} - \Pi^H) + (\Pi^{ML} - \Pi^L)) & \text{otherwise} \end{cases}$$

$$\widehat{\Pi}_l^{ne} \equiv (1-\alpha)(\Pi^{HM} + \Pi^{ML} - 2\Pi^M)$$

Resulting profits are:

with $\widehat{E}_1 \equiv \frac{\Pi^{HM}+\Pi^{ML}-2\Pi^{HL}}{2}$, $\widehat{E}_2 \equiv (1-\alpha)\Pi^H + \alpha\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}$, $\widehat{E}_3 \equiv (1-\alpha)(\Pi^{HM} - \Pi^H)$, $\widehat{\alpha}_1 \equiv \frac{2\Pi^{HL}-\Pi^H-\Pi^L}{\Pi^{HM}-\Pi^H+\Pi^{ML}-\Pi^L}$, $\widehat{\alpha}_2 \equiv 1 - \frac{E}{\Pi^{ML}-\Pi^L}$ $\widehat{\alpha}_3 \equiv 1 - \frac{2E}{\Pi^{HM}-\Pi^H+\Pi^{ML}-\Pi^L}$.

D.2 Profitability of a partial buying group (Proof of Proposition 3)

First, note that because a partial buying group leads to listing inefficiency it can be profitable only if the threat of replacement is active (*i.e.* equilibrium slotting fees are positive).

- When $\Pi^{HM} + \Pi^{ML} \leq 2\Pi^{HL}$, the listing decision is (HM, HM) without buying group and (HL, HL) with a partial buying group. A partial buying group can be profitable only if the equilibrium slotting fee is positive, that is: $\alpha \leq \widehat{\alpha}^e$.
  - if $E \geq \Pi^{HM} - \Pi^{ML}$ the threat of replacement absent buying group comes from l.
    - ∗ When $\alpha < \overline{\alpha}_1$, this threat of replacement is binding. The partial buying group is profitable when: $\widehat{\Pi}_r^1 > 2\overline{\Pi}_{r_i}^1 \Leftrightarrow \alpha < \frac{2(\Pi^{HM}-\Pi^{HL})}{\Pi^{HM}-\Pi^{ML}}$.
    - ∗ When $\alpha \geq \overline{\alpha}_1$ there is no slotting fee paid absent buying group. The partial buying group is profitable when: $\widehat{\Pi}_r^1 > 2\overline{\Pi}_{r_i}^3 \Leftrightarrow \alpha < \frac{2(\Pi^{HM}-\Pi^H)}{3\Pi^{HM}-2\Pi^H-\Pi^{ML}}$.

It is straightforward that $\frac{2(\Pi^{HM}-\Pi^{HL})}{\Pi^{HM}-\Pi^{ML}} < \frac{2(\Pi^{HM}-\Pi^{H})}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}} \Leftrightarrow \alpha < \overline{\alpha}_1$.

To sum-up if $\alpha \leq \min\{\frac{2(\Pi^{HM}-\Pi^{HL})}{\Pi^{HM}-\Pi^{ML}}, \frac{2(\Pi^{HM}-\Pi^{H})}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}\}$ the partial buying group is profitable and leads to exclusion of small suppliers. Otherwise, partial buying group is not profitable.

- if $E < \Pi^{HM} - \Pi^{ML}$, the threat of replacement absent buying group comes from the small foreign supplier.

  * When $\alpha < \overline{\alpha}_2$ this threat is binding. The partial buying group is profitable when $\widehat{\Pi}_r^1 > 2\overline{\Pi}_{r_i}^2 \Leftrightarrow \alpha < \frac{2E}{\Pi^{HM}-\Pi^{ML}}$.
  * There is no slotting fee when $\alpha \geq \overline{\alpha}_2$. In that case, the partial buying group is profitable when $\widehat{\Pi}_r^1 > 2\overline{\Pi}_{r_i}^3 \Leftrightarrow \alpha < \frac{2(\Pi^{HM}-\Pi^{H})}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}$.

  It is straightforward that $\frac{2E}{\Pi^{HM}-\Pi^{ML}} < \frac{2(\Pi^{HM}-\Pi^{H})}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}} \Leftrightarrow \alpha < \overline{\alpha}_2$. To sum-up if $\alpha \leq \min\{\frac{2E}{\Pi^{HM}-\Pi^{ML}}, \frac{2(\Pi^{HM}-\Pi^{H})}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}\}$ the partial buying group is profitable and leads to exclusion of small suppliers. Otherwise, no buying group is created.

To sum-up when $\Pi^{HM} + \Pi^{ML} \leq 2\Pi^{HL}$, the partial buying is profitable for

$$\alpha \leq \min\{\frac{2E}{\Pi^{HM}-\Pi^{ML}}, \frac{2(\Pi^{HM}-\Pi^{H})}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}, \frac{2(\Pi^{HM}-\Pi^{HL})}{\Pi^{HM}-\Pi^{ML}}\},$$

and it is not profitable otherwise.

- When $\Pi^{HM}+\Pi^{ML} \geq 2\Pi^{HL}$, a necessary condition for the buying group to be profitable is that slotting fees must be positive.

  - If $E > \Pi^{HM} - \Pi^{ML}$, it is straightforward that $E > \max\{\widehat{E}_1, \widehat{E}_2\}$. Absent buying group and with partial buying group, the threat of replacement comes from the large supplier.

    * When $\alpha < \overline{\alpha}_1$ this threat of replacement is binding in the absence of buying groups. The partial buying group is always profitable because $\widehat{\Pi}_r^3 > 2\overline{\Pi}_{r_i}^1$ is always satisfied.

* When $\alpha \geq \overline{\alpha}_1$, there is no slotting fee in the absence of buying group. The partial buying group is profitable when $\widehat{\Pi}^3_r > 2\overline{\Pi}^3_{r_i} \Leftrightarrow \alpha < \frac{\Pi^{HM}+2\Pi^{HL}-2\Pi^{H}-\Pi^{ML}}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}$.

- If $\Pi^{HM} - \Pi^{ML} > E > \max\{\widehat{E}_1, \widehat{E}_2\}$, with a partial buying group the threat of replacement comes from the large supplier. Absent buying group the threat of replacement comes from the foreign small suppliers.

  * When $\alpha < \overline{\alpha}_2$, the threat of replacement is active without buying group. In that case the partial buying group is profitable when $\widehat{\Pi}^4_r > 2\overline{\Pi}^2_{r_i} \Leftrightarrow \alpha < \frac{2E+2\Pi^{HL}-\Pi^{HM}-\Pi^{ML}}{\Pi^{HM}-\Pi^{ML}}$.
  * When $\alpha \geq \overline{\alpha}_2$, there is no slotting fee without buying group. The partial buying group is profitable when $\widehat{\Pi}^4_r > 2\overline{\Pi}^2_{r_i} \Leftrightarrow \alpha < \frac{2\Pi^{H}-2\Pi^{HL}-\Pi^{HM}+\Pi^{ML}}{2\Pi^{H}-3\Pi^{HM}+\Pi^{ML}}$.

  It is straightforward that $\frac{2E+2\Pi^{HL}-\Pi^{HM}-\Pi^{ML}}{\Pi^{HM}-\Pi^{ML}} < \frac{2\Pi^{H}-2\Pi^{HL}-\Pi^{HM}+\Pi^{ML}}{2\Pi^{H}-3\Pi^{HM}+\Pi^{ML}} \Leftrightarrow \alpha < \overline{\alpha}_2$. To sum-up if $\alpha \leq \min\{\frac{2E+2\Pi^{HL}-\Pi^{HM}-\Pi^{ML}}{\Pi^{HM}-\Pi^{ML}}, \frac{\Pi^{HM}-2\Pi^{H}+2\Pi^{HL}-\Pi^{ML}}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}\}$ the partial buying group is profitable and leads to exclusion of small suppliers. Otherwise, no buying group is created.

- If $\widehat{E}_3 < E \leq \widehat{E}_2$ then $\alpha > \overline{\alpha}_2$ and there is no slotting fees absent buying group. With a partial buying group, the threat of replacement comes only from the foreign small supplier with assortment ML. A partial buying group could be profitable for $\widehat{\Pi}^5_r > 2\overline{\Pi}^2_{r_i} \Leftrightarrow \alpha < \frac{\Pi^{HM}-\Pi^{H}-E}{2\Pi^{HM}-\Pi^{H}-\Pi^{ML}}$. However, it is straightforward to show that $\frac{\Pi^{HM}-\Pi^{H}-E}{2\Pi^{HM}-\Pi^{H}-\Pi^{ML}} < \overline{\alpha}_2$ and therefore a partial buying group is never profitable.

- If $E \leq \min\{\widehat{E}_1, \widehat{E}_3\}$ then $\alpha < \overline{\alpha}_2$ and there is no slotting fees absent buying group. With a partial buying group the threat of replacement comes from the small suppliers trying to exports their products. However it is straightforward to show that a buying group is never profitable in that case.

To sum-up when $\Pi^{HM}+\Pi^{ML} > 2\Pi^{HL}$ a buying group is profitable when $E > \max\{\widehat{E}_1, \widehat{E}_2\}$ and when $\alpha \leq \min\{\frac{2E+2\Pi^{HL}-\Pi^{HM}-\Pi^{ML}}{\Pi^{HM}-\Pi^{ML}}, \frac{\Pi^{HM}-2\Pi^{H}+2\Pi^{HL}-\Pi^{ML}}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}\}$.

D.3 Effect of a partial buying group on suppliers profit (Proof of Proposition 4).

To asses the effect of a profitable buying group on suppliers profit we have to consider the two possible assortments (HL, HL) and (HM, ML).

Recall that, without buying group, the equilibrium assortment is (HM, HM), the local small suppliers are listed and may have to pay a positive slotting fee. Retailers' joint profit can be written as the difference between the industry profit and suppliers' profit:

$$\overline{\Pi}_r = \Pi^{HM} + \Pi^{HM} - (\pi_l^{HM} + \pi_l^{HM}) - \overline{\Pi}_s$$
$$\Leftrightarrow \overline{\Pi}_r = 2(\alpha\Pi^{HM} - (1-\alpha)\Pi^{M}) - \overline{\Pi}_s$$

Consider first a profitable partial buying group with assortment (HM, ML). In this case slotting fee(s) are paid by the small suppliers, retailers' joint profit can be written as:

$$\widehat{\Pi}_r^{ne} = \Pi^{HM} + \Pi^{ML} - (\pi_l^{HM} + \pi_l^{ML}) - \widehat{\Pi}_s$$
$$\Leftrightarrow \widehat{\Pi}_r^{ne} = \alpha(\Pi^{HM} + \Pi^{ML}) - 2(1-\alpha)\Pi^{M} - \widehat{\Pi}_s$$

We have $\widehat{\Pi}_r^{ne} > \overline{\Pi}_r \Leftrightarrow \alpha(\Pi^{ML} - \Pi^{HM}) + (\widehat{\Pi}_s - \overline{\Pi}_s) > 0$. From Assumption 4 $\Pi^{ML} - \Pi^{HM} < 0$, hence small suppliers' joint profit must be negatively affected if the partial buying group is profitable. Moreover, it is straightforward that the large supplier is negatively affected because it sells an inefficient product on one of the two markets.

Consider now the case of a partial buying group with assortment (HL, HL). Small suppliers are excluded, hence it is straightforward their profit is reduced. Large supplier have their two products listed but obtain a lower profit than absent buying group. Indeed, without buying group, the minimum fee they have to pay to impose their two products is lower than with a partial buying group and they prefer to sell only one product.

E Equilibrium with a full buying group

E.1 Maximum willingness to pay of suppliers in Stage 1

- In market 1, the suppliers' willingness to pay are the same than with a partial buying group or without buying group, because the listing decisions are either HM or HL. Again, the large supplier is willing to impose the listing of product L too; the maximum amount it is ready to pay for this leaves him indifferent between the assortments HL and HM: $\widetilde{V}_{l,1} \equiv \pi_{l,1}^{HL} - \pi_{l,1}^{HM} = \widehat{V}_{l,1} = \overline{V}_{l,1}$. To ensure the listing of their product, the small suppliers are willing to pay up to $\widetilde{V}_{s_1,1} \equiv \pi_{s_1,1}^{HM} = \widehat{V}_{s_1,1} = \overline{V}_{s_1,1}$ and $\widetilde{V}_{s_2,1} \equiv \pi_{s_2,1}^{HM} - E = \widehat{V}_{s_2,1} = \overline{V}_{s_2,1}$.

- In market 2, the two competing listing decisions are unchanged compared to the situation with partial buying group (*i.e.* either ML or HL). The large supplier is willing to pay up to $\widetilde{V}_{l,2} \equiv \pi_{l,2}^{HL} - \pi_{l,2}^{ML} = \widehat{V}_{l,2} \geq \overline{V}_{l,2}$ to secure the assortment HL, while the local supplier s_2 is willing to pay up to $\widetilde{V}_{s_2,2} \equiv \pi_{s_2,2}^{ML} = \widehat{V}_{s_2,2} \geq \overline{V}_{s_2,2}$, and the foreign supplier s_1 up to $\widetilde{V}_{s_1,2} \equiv \pi_{s_1,2}^{ML} - E = \widehat{V}_{s_2,2} \geq \overline{V}_{s_2,2}$, to secure the product M in assortment ML.

E.2 Characterization of the equilibrium

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 retailers choose to list the two products of the large supplier (the assortment is (HL, HL)) and thus exclude the small suppliers in both markets. Each small supplier bids its willingness to pay to have its product listed in both markets: $\widetilde{S}_{s_i}^{e} = \widetilde{V}_{s_i,j} + \widetilde{V}_{s_i,i} \equiv \max\{\pi_{s_i,i}^{HM} + \pi_{s_i,j}^{ML} - E, 0\}$. To ensure that its two products are listed, the large supplier offers a fee that leaves the buying group with the outside option profit (listing a small supplier), that is $\widetilde{S}_{l}^{e} \equiv \max\{\pi_{r_i,i}^{HM} + \pi_{r_j,j}^{ML} - 2\pi_{r_i,i}^{HL} + \widetilde{S}_{s_i}^{e}, 0\}$. Consider now the equilibrium slotting fees:

- The large supplier may offer a positive slotting fee only to have its two products listed:

$$\widetilde{S}_l^e \equiv \begin{cases} \alpha(\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}) + 2(1-\alpha)\Pi^M - E \text{ if } \alpha \leq \widetilde{\alpha}^e \\ 0 \text{ if } \alpha > \widetilde{\alpha}^e \end{cases}$$

- Each small supplier offers:[43]

$$\widetilde{S}_{s_i}^e = \max\{(1-\alpha)(\Pi^{HM} + \Pi^{ML} - \Pi^M - \Pi^L) - E, 0\}$$

The resulting profits are such that $\widetilde{\Pi}_r^e = \max\{\pi_{r_i,i}^{HM} + \pi_{r_j,j}^{Ml} + \widetilde{S}_{s_i}^e, 2\pi_{r_i,i}^{HL}\}$, $\widetilde{\Pi}_{s_i}^e = 0$ and $\widetilde{\Pi}_l^e = \min\{2\Pi^{HL} - \pi_{r_i,i}^{HM} - \pi_{r_j,j}^{ML} - \widetilde{S}_s^e, 2\pi_{l,i}^{HL}\}$.

$$\widetilde{\Pi}_r^e \equiv \begin{cases} \widetilde{\Pi}_r^1 = 2(1-\alpha)\Pi^M + \alpha(\Pi^{ML} + \Pi^{HM}) - E \text{ if } \alpha \leq \widetilde{\alpha}^e \\ \widetilde{\Pi}_r^2 = 2\alpha\Pi^{HL} \text{ if } \alpha > \widetilde{\alpha}^e \end{cases}$$
$$\widetilde{\Pi}_s^e = \widetilde{\Pi}_{s_1}^e = \widetilde{\Pi}_{s_2}^e \equiv 0$$
$$\widetilde{\Pi}_l^e \equiv \begin{cases} 2\Pi^{HL} - 2(1-\alpha)\Pi^M - \alpha(\Pi^{HM} + \Pi^{ML}) + E \text{ if } \alpha \leq \widetilde{\alpha}^e \\ 2(1-\alpha)\Pi^{HL} \text{ if } \alpha > \widetilde{\alpha}^e \end{cases}$$

With, $\widetilde{\alpha}^e \equiv \frac{2\Pi^M - E}{2\Pi^{HL} - \Pi^{HM} - \Pi^{ML} + 2\Pi^M}$.

Equilibrium with a partial exclusion a local small supplier: 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 with one product of the large supplier (the assortment is either AB or BC in both markets). Let's consider that the product listed of the large supplier is H in market i and L in market j. Equilibrium slotting fees:

- The large supplier offers its maximum willingness to pay to impose its two products in

[43] we select the equilibrium among a continuum by the trembling-hand criterion.

the two markets:[44]

$$\widetilde{S}_l^{pe} \equiv (0, 0, \widetilde{V}_{l,1} + \widetilde{V}_{l,2}) = (0, 0, (1-\alpha)(2\Pi^{HL} - \Pi^{HM} - \Pi^{ML} + 2\Pi^{M}))$$

- Each small supplier s_i's offer is such that the buying group is indifferent as when buying the two products from l:

$$\widetilde{S}_{s_i}^{pe} \equiv \widetilde{V}_{s_i,i} + \widetilde{V}_{s_i,j} = \begin{cases} (1-\alpha)((\Pi^{HM} - \Pi^{H}) + (\Pi^{ML} - \Pi^{L})) - E \text{ if } \alpha \leq \widetilde{\alpha}^{pe} \\ 0 \text{ if } \alpha > \widetilde{\alpha}^{pe} \end{cases}$$

Resulting profits are such that $\widetilde{\Pi}_r^{pe} = \max\{\pi_{r_i,i}^{HM} + \pi_{r_i,i}^{ML} + \widetilde{S}_{s_i}^{pe}, \pi_{r_i,i}^{HM} + \pi_{r_i}^{ML}\}$, $\widetilde{\Pi}_{s_i}^{pe} = 0$ and $\widetilde{\Pi}_l^{pe} = \pi_{l,i}^{HM} + \pi_{l,j}^{ML}$.

$$\widetilde{\Pi}_r^{pe} \equiv \begin{cases} \widetilde{\Pi}_r^3 = 2(1-\alpha)\Pi^M + \alpha(\Pi^{HM} + \Pi^{ML}) - E \text{ if } \alpha \leq \widetilde{\alpha}^{pe} \\ \widetilde{\Pi}_r^4 = (1-\alpha)(2\Pi^M + \Pi^L + \Pi^H) + (2\alpha - 1)(\Pi^{HM} + \Pi^{ML}) \text{ if } \alpha > \widetilde{\alpha}^{pe} \end{cases}$$

$$\widetilde{\Pi}_s^{pe} = \widetilde{\Pi}_{s_1}^{pe} = \widetilde{\Pi}_{s_2}^{pe} \equiv 0$$

$$\widetilde{\Pi}_l^{pe} \equiv (1-\alpha)((\Pi^{HM} - \Pi^M) + (\Pi^{ML} - \Pi^M))$$

With $\widetilde{\alpha}^{pe} \equiv 1 - \frac{E}{\Pi^{HM} - \Pi^{H} + \Pi^{ML} - \Pi^{L}}$.

E.3 Profitability of a full buying group (Proof of Proposition 6)

Similarly to the proof of Proposition D.2, a full buying group leads to listing inefficiency and thus can be profitable only if the threat of replacement is active (*i.e.* it leads to positive slotting fees). Note also that although there are two types of equilibrium listing decisions with a full buying group, the joint profit of the retailers is uniquely defined when suppliers pay a positive slotting fee (*i.e.* $\widetilde{\Pi}_r^1 = \widetilde{\Pi}_r^3$) because there is perfect competition among small suppliers.

[44]Again, the large supplier' slotting fees to have only product A or C listed is zero.

- If $E \geq \Pi^{HM} - \Pi^{ML}$ the threat of replacement absent buying group comes from the large supplier.
  - When $\alpha < \overline{\alpha}_1$, this threat is binding. A full buying group is profitable when $\widetilde{\Pi}_r^1 > 2\overline{\Pi}_{r_i}^1 \Leftrightarrow \alpha < \frac{2(\Pi^{HM}-\Pi^{HL})-E}{\Pi^{HM}-\Pi^{ML}}$.
  - When $\alpha \geq \overline{\alpha}_1$ there is no slotting fee without buying group. A full buying group is profitable when $\widetilde{\Pi}_r^1 > 2\overline{\Pi}_{r_i}^3 \Leftrightarrow \alpha < \frac{2(\Pi^{HM}-\Pi^{H})-E}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}$

  It is straightforward that $\frac{2(\Pi^{HM}-\Pi^{HL})-E}{\Pi^{HM}-\Pi^{ML}} < \frac{2(\Pi^{HM}-\Pi^{H})-E}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}} \Leftrightarrow \alpha < \overline{\alpha}_1$.

  To sum-up if $\alpha \leq \min\{\frac{2(\Pi^{HM}-\Pi^{HL})-E}{\Pi^{HM}-\Pi^{ML}}, \frac{2(\Pi^{HM}-\Pi^{H})-E}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}\}$ the full buying group is profitable and leads to exclusion of small suppliers. Otherwise, full buying group is not profitable.

- if $E < \Pi^{HM} - \Pi^{ML}$, the threat of replacement absent buying group comes from the foreign small suppliers.
  - When $\alpha < \overline{\alpha}_2$, this threat is binding. A full buying group is profitable when $\widetilde{\Pi}_r^1 > 2\overline{\Pi}_{r_i}^2 \Leftrightarrow \alpha < \frac{E}{\Pi^{HM}-\Pi^{ML}}$
  - When $\alpha \geq \overline{\alpha}_2$, there is no slotting fee without buying group. In that case, the full buying group is profitable when $\widetilde{\Pi}_r^1 > 2\overline{\Pi}_{r_i}^3 \Leftrightarrow \alpha < \frac{2(\Pi^{HM}-\Pi^{H})-E}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}$

  It is straightforward that $\frac{E}{\Pi^{HM}-\Pi^{ML}} < \frac{2(\Pi^{HM}-\Pi^{H})}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}} \Leftrightarrow \alpha < \overline{\alpha}_2$. Hence, if $\alpha \leq \min\{\frac{E}{\Pi^{HM}-\Pi^{ML}}, \frac{2(\Pi^{HM}-\Pi^{H})}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}\}$ the full buying group is profitable and leads to exclusion of small suppliers. Otherwise, no buying group is created.

To sum-up the full buying group is profitable for

$$\alpha \leq \min\{\frac{E}{\Pi^{HM}-\Pi^{ML}}, \frac{2(\Pi^{HM}-\Pi^{H})-E}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}, \frac{2(\Pi^{HM}-\Pi^{HL})-E}{\Pi^{HM}-\Pi^{ML}}\}$$

and is not profitable otherwise.

F Retailers' best strategy (Proof of Proposition 8)

We now compare the retailers' joint profit for each of the three buying strategies (no buying group, partial buying group and full buying group). Again a buying group can be profitable only if the threat of replacement is binding (*i.e.* equilibrium slotting fees are positive).

- When $0 < \Pi^{HM} + \Pi^{ML} \leq 2\Pi^{HL}$ and $\forall E$, the listing decision is (HM, HM) without buying group and (HL, HL) with a buying group. A simple comparison of equilibrium profit gives that: $\widetilde{\Pi}_r^1 < \widehat{\Pi}_r^1$. Hence, a partial buying group is always preferred to a full buying group. From proof D.2, we thus have that a partial buying group is created when

  $$\alpha \leq \min\{\tfrac{2E}{\Pi^{HM}-\Pi^{ML}}, \tfrac{2(\Pi^{HM}-\Pi^{H})}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}, \tfrac{2(\Pi^{HM}-\Pi^{HL})}{\Pi^{HM}-\Pi^{ML}}\}$$

  and no buying group is created otherwise.

- When $0 < \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq E$, the listing decision is (HM, HM) without buying group, (HM, ML) with a partial buying group and (HL, HL) with a full buying group. In this case, $E \geq \max\{\widehat{E}_1, \widehat{E}_2\}$. A simple comparison of equilibrium profit gives that: $\widetilde{\Pi}_r^1 < \widehat{\Pi}_r^3 \Leftrightarrow \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq E$. Hence, a partial buying group is always preferred to a full buying group. From proof D.2, a partial buying group is created when

  $$\alpha \leq \min\{\tfrac{2E+2\Pi^{HL}-\Pi^{HM}-\Pi^{ML}}{\Pi^{HM}-\Pi^{ML}}, \tfrac{\Pi^{HM}-2\Pi^{H}+2\Pi^{HL}-\Pi^{ML}}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}\}$$

  and otherwise no buying group is created.

- When $0 < E < \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}$, the listing decision is (HM, HM) without buying group, (HM, ML) with a buying group. A simple comparison of profit gives that $\widetilde{\Pi}_r^1 > \max\{\widehat{\Pi}_r^3, \widehat{\Pi}_r^4, \widehat{\Pi}_r^5\}$ and therefore a full buying group is always preferred to a partial buying group. Because $\Pi^{HM} - \Pi^{ML} > \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL}$, from online Appendix E.3. we know that a full buying group is created when

  $$\alpha \leq \min\{\tfrac{E}{\Pi^{HM}-\Pi^{ML}}, \tfrac{2(\Pi^{HM}-\Pi^{H})}{3\Pi^{HM}-2\Pi^{H}-\Pi^{ML}}\}$$

and no buying group is created otherwise.

G Proof of proposition 9

- If $\Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} \leq 0$, then both types of buying groups lead to the same equilibrium assortment (HL in both markets), and joint profit is thus the same with the two types of buying groups. Compared to no buying group, joint profit is lower, because $2\Pi^{HL} \leq 2\Pi^{HM}$.

- If $0 < \Pi^{HM} + \Pi^{ML} - 2\Pi^{HL} < E$, then in equilibrium the assortment is HL in 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, both types of buying groups create distortions in the assortment that reduce industry profit.

- 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. Again, both types of buying groups create distortions in the assortment that reduce industry profit, but a partial buying group is less harmful.

Under Assumption 5, these results extend to consumer surplus and welfare.

H Numerical application

We use the demand specification of Singh and Vives (1984). We consider that in each market, there are three differentiated products H, M, L, and as the retailers have limited capacity, only two products are available on each market. When the two products 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 products 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 products 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.