A Buyer Power Theory of Exclusive Dealing and Exclusionary Bundling

Claire Chambolle, Hugo Molina

A Buyer Power Theory of Exclusive Dealing and Exclusionary Bundling*

Claire Chambolle† Hugo Molina‡

May 20, 2021

Abstract

We develop a unified theory of exclusive dealing and exclusionary bundling. In a framework with two competing manufacturers which supply their product(s) through a monopolist retailer, we show that buyer power restores the profitability of such practices involving inefficient exclusion. The mechanism underlying this exclusion is that the compensation required by the retailer to renounce selling the rival product erodes with its buyer power. Among others, we further show that our theory holds when the buyer power differs across manufacturers or when the retailer can strategically narrow (or expand) its product assortment.

Keywords: Vertical relations, Buyer power, Exclusive dealing, Exclusionary Bundling, Nash-in-Nash bargaining with Threat of Replacement.

JEL classification: C78, L13, L42.

*We would like to thank Robert Porter and three anonymous referees for their remarks and suggestions. We are also grateful to Marie-Laure Allain, Rémi Avignon, Özlem Bedre-Defolie, Clémence Christin, Alexandre de Cornière, Alon Eizenberg, Matthias Hunold, Robin S. Lee, Laurent Linnemer, Guy Meunier, Juan-Pablo Montero, João Montez, Patrick Rey, Howard Smith, Thibaud Vergé, Christian Wey and Yaron Yehezkel for helpful discussions as well as conference and seminar participants at CREST, TSE, INRAE, CRESSE (Heraklion, 2018), and EARIE (Barcelona, 2019) for their valuable comments. We gratefully acknowledge support from the French Agence Nationale de la Recherche (ANR) and the Deutsche Forschungsgemeinschaft (DFG) for the cooperation project "Competition and Bargaining in Vertical Chains". Hugo Molina also thanks the IO research group at KU Leuven for financial support. The authors declare that they have no relevant or material financial interests that relate to the research described in this article. This article supersedes a previous version circulated under the title "Buyer Power, Upstream Bundling, and Foreclosure". All remaining errors are ours.

†Université Paris-Saclay, INRAE, UR ALISS, 94205, Ivry-sur-Seine, France; CREST, Institut Polytechnique de Paris; claire.chambolle@inrae.fr; http://chambolle.io

‡Université Paris-Saclay, INRAE, UR ALISS, 94205, Ivry-sur-Seine, France; hugo.molina@inrae.fr; https://sites.google.com/site/hugomolinaresearch/

1 Introduction

Vertical restrictions imposed by a manufacturer on their retailers' purchases have been the subject of a long-standing debate in the antitrust literature.[1] Prominent examples include exclusive dealing contracts by which a manufacturer prohibits its retailer to buy and distribute products of rival manufacturers.[2] Bundling or full-line forcing practices, whereby a manufacturer sells its products in a package, are also observed in many industries.[3] While these restrictions may enable a manufacturer to foreclose its rivals, the core of the debate is whether such a foreclosure is anticompetitive or not.[4] Starting in the 1950s, the Chicago School argued that inefficient exclusion is unlikely to arise because a retailer cannot accept a bundling or an exclusive dealing restriction without asking for a compensation that the manufacturer cannot afford.[5] Our article offers a new perspective on this debate in showing that the retailer need not require to be (fully) compensated when it has buyer power. As a result, buyer power enables inefficient vertical restrictions such as exclusive dealing or exclusionary bundling to arise.

To formalize our argument, we develop a framework of vertical relations with two manufacturers and a monopolist retailer. One manufacturer offers a leading product while its rival offers a less efficient secondary product. Products are either imperfect substitutes or independent, implying that efficiency requires the sale of the two products. We consider the following sequence of play. First, each manufacturer chooses whether or not to impose an exclusive dealing restriction on the retailer. The retailer

[1] See, e.g., Rey and Vergé (2008) for a survey.

[2] See, for instance, Masterfoods Ltd v HB Ice Cream (European Court of Justice, 2003); United States vs Dentsply case (2005); The Coca-Cola Company (2005) – Case COMP/A.39.116/B2; Google Search – AdSense (2019) – Case AT.40411; FTC v Qualcomm Inc (2019) – Case No 17-cv-00220-LHK.

[3] See, for instance, The Coca-Cola Company (2005) – Case COMP/A.39.116/B2; Cablevision v. Viacom (2013) – Case No. 13 Civ. 1278; Google Android (2018) – Case AT.40099. The use of full-line forcing practices has also been documented in other sectors such as the U.S. video rental industry (Ho, Ho and Mortimer, 2012*a*,*b*).

[4] While a manufacturer inherently excludes its rivals through exclusive dealing, the foreclosure effect of bundling practices is more likely when retailers have a limited stocking capacity. As pointed out by the European Commission (EC) in the Coca-Cola Company (TCCC) case (2005): "making the supply of the strongest TCCC brands conditional upon the purchase of less-selling Carbonated Soft Drinks (CSDs) and non-CSDs [...] has the effect of making sales space in outlets harder to obtain for rival suppliers [...]." See http://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=1_39116

[5] See, e.g., Posner (1976) and Bork (1978).

then selects its product assortment which comprises only one of the two products under exclusive dealing or both products otherwise. Finally, the retailer and the manufacturer(s) of the selected product(s) negotiate over efficient contracts according to the bargaining protocol of Ho and Lee (2019), referred to as "Nash-in-Nash with Threat of Replacement" (NNTR) bargaining solution. This bargaining protocol has the appealing property that when one manufacturer is excluded from the retailer's assortment, its product may still be used by the retailer as a threat of replacement during the course of the negotiation with the other manufacturer.

We show that the retailer's ability to play off manufacturers against each other and obtain a compensation for renouncing to the rival product under exclusive dealing erodes with its buyer power. Indeed, absent buyer power, the retailer is fully compensated for not selling the rival product implying that the standard Chicago School argument applies, that is, exclusive dealing is not profitable. In contrast, when its buyer power increases, the retailer obtains a larger amount of surplus from its negotiation for the exclusive product which alters the credibility to threaten to replace it with the rival product. As a result, the compensation required by the retailer to renounce selling the rival product decreases in its buyer power and, when it is sufficiently high, the manufacturer of the exclusive product need not pay the retailer any compensation. We thus show that a high buyer power restores the profitability of exclusive dealing for the leading product manufacturer to the detriment of the retailer and the industry profit. Hence, what makes the retailer stronger in its negotiations with manufacturers makes it weaker vis-à-vis exclusive dealing practices.

Our exclusionary mechanism readily extends to upstream bundling practices. To formalize this, we adapt our previous framework by allowing the leading product manufacturer to also offer a secondary product which is, however, less efficient than that of its rival. Due to a limited stocking capacity, we consider that the retailer cannot sell more than two products. In the first stage of the game, the leading product manufacturer now decides whether to bundle its products or not. The subsequent stages are as before. We show that buyer power restores the profitability of bundling practices leading to an inefficient exclusion of the rival manufacturer. This provides a new rationale for the so-called "leverage theory" according to which a multi-product firm has the incentive to leverage its monopoly power in one market to foreclose a more efficient rival in a competitive market through bundling practices. We show that the mechanism through which this leverage occurs may hold even if the rival sells the leading product or when the multi-product firm offers a bundle of complementary products (instead of imperfect substitutes or independent products).

We then analyze the profitability of these inefficient vertical restrictions when the buyer power differs across manufacturers. We highlight that our exclusionary mechanism depends only on the presence of buyer power vis-à-vis the manufacturer which excludes its rival. We also study the retailer's incentive to narrow or expand its product assortment. While such a strategy does not affect the profitability of exclusive dealing, we find that the retailer may choose to expand its product assortment and distribute all available products to offset the harmful effect of bundling. Despite inefficient exclusion, we also show that the retailer may find profitable to keep a narrow product assortment and distribute only the bundle of products for a rent-extraction motive.

To further motivate our results, we finally introduce the "Nash-in-Nash with Prior Competition for Slots" (NNPCS) model in which the retailer auctions off a limited number of slots and receives upfront payments before negotiating wholesale contracts with manufacturers according to the "Nash-in-Nash" solution (Horn and Wolinsky, 1988). We highlight that the surplus division in the NNPCS model coincides with the NNTR solution and that the scope of our buyer power theory extends to markets where upfront payments are prevalent.

Our article contributes to a large literature on exclusive dealing and exclusionary bundling. In response to the Chicago School critique, one strand of this literature has put forward the prominent role of scale economies in the profitability of such practices. This is the case in the two seminal contributions of Aghion and Bolton (1987) and Rasmusen, Ramseyer and Wiley (1991) which have formally demonstrated the (inefficient) entry deterrence effect of exclusive dealing.[6] Similarly, since Whinston's (1990)

[6]The main difference between these two articles is that, in contrast to Rasmusen, Ramseyer and Wiley (1991), contracts in Aghion and Bolton (1987) are not designed to deter entry *per se* but to extract rent from the entrant through breakup fees. Among others, this "rent-extraction" theory has been extended to investment choice and contractual renegotiation (Spier and Whinston, 1995), sequential

pioneering work, a large number of articles have relied on scale economies to provide support for the leverage hypothesis.[7] Another body of the literature has highlighted that the profitability of exclusive dealing and exclusionary bundling crucially depends on the presence of imperfect rent extraction due to contracting externalities. For instance, linear contracts (Mathewson and Winter, 1987), moral hazard (Bernheim and Whinston, 1998), or adverse selection (Calzolari and Denicolò, 2013, 2015) create price distortions that may restore the profitability of exclusive dealing.[8] In the same vein, a number of "leverage theories" of bundling have been based on the presence of linear contracts or moral hazard (e.g., de Cornière and Taylor, forthcoming).[9] Our theory abstracts from scale economies and contracting externalities. Instead, we rely on the presence of buyer power which, under exclusive dealing or bundling practices, alters the retailer's ability to exploit the competition between manufacturers and receive a compensation for relinquishing to buy the rival product. Our article thus provides a new theory of competitive harm in vertical markets.[10]

Finally, we also contribute to a growing literature that analyzes the formation of buyer-seller networks in vertically related markets. A strand of research points out that strategic restrictions of a distribution network may work out as a bargaining leverage within a vertical channel (Montez, 2007; Marx and Shaffer, 2010*b*). More recently, Ho

bargaining (Marx and Shaffer, 2010*a*), elastic demand and nonlinear pricing (Choné and Linnemer, 2015), and nonpivotal buyers (Bedre-Defolie and Biglaiser, 2017). Similarly, the "naked-exclusion" theory of Rasmusen, Ramseyer and Wiley (1991), subsequently refined by Segal and Whinston (2000), has been extended in several directions including secret contracts (Miklós-Thal and Shaffer, 2016) and vertical relations with downstream competition (Fumagalli and Motta, 2006; Simpson and Wickelgren, 2007; Wright, 2009).

[7]For instance, when scale economies stem from fixed costs of entry, bundling has been shown to serve as an entry-deterrent strategy in an oligopolistic market (Whinston, 1990; Peitz, 2008) or in multiple markets (Carlton and Waldman, 2002; Nalebuff, 2004). Similar findings have been found with scale economies in R&D activities (Choi, 1996, 2004).

[8]Calzolari, Denicolò and Zanchettin (2020) emphasize that "the source of price distortions is not important: the theory applies whenever marginal prices exceed marginal costs, and for whatever reason."

[9]As pointed out in Fumagalli, Motta and Calcagno (2018), imperfect rent extraction arising from regulated pricing, demand uncertainty (Greenlee, Reitman and Sibley, 2008), or future quality upgrades (Carlton and Waldman, 2012) may also restore the profitability of bundling. Similarly, non-negative price constraints which, for instance, prevent consumers' moral hazard also create room for imperfect rent extraction and restore the profitability of bundling in two-sided markets (Choi and Jeon, 2021).

[10]It is worth noting that, to our knowledge, we provide one of the few "leverage theory" of bundling in vertical relations. Other theories in this strand find that the profitability of bundling relies on the presence of contracting externalities (de Cornière and Taylor, forthcoming) or on retail competition and shopping costs (Ide and Montero, 2019).

and Lee (2019) have developed the NNTR bargaining solution to analyze the strategic decision of an insurer to adjust its hospital network.[11] We show that the NNPCS model developed in our article offers a microfoundation for the NNTR bargaining solution.

The remainder of our article is organized as follows. Section 2 introduces our model and shows that the profitability of exclusive dealing stems from the presence of buyer power. Section 3 extends the analysis to bundling practices and offers a new "leverage theory" in vertical markets. Section 4 discusses key assumptions underlying our exclusionary mechanism and shows that it continues to operate under various extensions. Section 5 highlights that the logic of our argument holds under the NNPCS model which provides a noncooperative microfoundation for the NNTR bargaining solution. Section 6 concludes.

2 Exclusive Dealing

2.1 The model

Consider an industry with two manufacturers at the upstream level, denoted by U_i with $i = 1, 2$, which supply their products through a monopolist retailer at the downstream level, denoted by D. Products are differentiated and indexed by $X \in \{H, M\}$. U_1 supplies products H and U_2 supplies product M.

Industry Profits. The primitive profit functions representing the industry profit (i.e., the profit of a fully integrated firm) generated by each assortment of products are denoted as follows: Π^X when only product X is offered on the market and Π^{HM} when products H and M are both offered on the market. We make the following assumptions:

Assumption A1 *The product assortment HM generates the highest industry profit and*

[11] The use of strategic network size restrictions is also analyzed in Liebman (2018) and Ghili (2021) under alternative frameworks. As in Ho and Lee (2019), the gain in bargaining leverage of a downstream firm stems from its ability to play upstream firms off against each other by exercising threats of replacement during negotiations.

H generates a higher industry profit than M:

$$\Pi^{HM} > \Pi^{H} > \Pi^{M} > 0.$$

Note that the higher industry profit generated by H may be due to a lower marginal cost, a higher quality, or a combination of the two.

Assumption A2 *Products are either independent or imperfect substitutes:*

$$\Pi^{H} + \Pi^{M} \geq \Pi^{HM}$$

Timing and information. We assume that firms interact according to the following sequence of play:

- Stage 1: Each manufacturer decides whether or not to impose an exclusive dealing requirement to D. Under exclusive dealing, D selects either H or M. Otherwise, D selects HM. D's product assortment decision is publicly announced.
- Stage 2: Given D's product assortment decision, trade takes place. Terms of trade are determined through bilateral negotiations and take the form of two-part tariffs. If D purchases from both manufacturers, negotiations take place simultaneously and secretly.
- Stage 3: D sets its price(s) and sells to consumers.

We now discuss each stage of the game in detail including our network formation protocol and bargaining solution.

Product assortment decision. Our first stage builds on the vertical restraints literature as well as that on endogenous networks in which the buyer-seller network formation takes place prior to contract negotiations (we refer to Section 4.1 for a discussion). Given each manufacturer's selling policy, we consider that the announced product assortment commits D to engage in negotiations with manufacturer(s) of the corresponding product(s). As long as an agreement is not formed, however, it is worth mentioning that D can unilaterally terminate a relationship with one manufacturer and, if any, deal with another manufacturer whose product is not included in the announced product assortment (see below for further details on our bargaining solution).[12] To ease exposition, we assume in this section that only manufacturers are able to play a role on D's product assortment size through an exclusive dealing requirement. We relax this assumption in Section 4.3.

Bargaining solution. To determine the terms of trade in stage 2, we use the "Nash-in-Nash with Threat of Replacement" (NNTR) bargaining solution developed by Ho and Lee (2019). This solution concept extends the "Nash-in-Nash" bargaining solution (Horn and Wolinsky, 1988) by allowing a single downstream firm to gain bargaining leverage by threatening to replace each of its upstream trading partners with an excluded alternative one (if any) during negotiations.[13] This implies that, under exclusive dealing, D can threaten to replace its trading partner with the excluded manufacturer to obtain better trading terms while, absent exclusive dealing, the terms of trade between D and manufacturers are simply determined by the "Nash-in-Nash" bargaining solution.[14] We denote by $\alpha \in [0, 1]$ the bargaining weight of D in each bilateral negotiation.[15] Note that, throughout our article, we use the terms "bargaining weight" and "buyer power" interchangeably as α captures one source of the retailer's bargaining power.

As discussed in Ho and Lee (2019), the NNTR solution concept directly relates to the literature on bargaining with outside options (e.g., Shaked and Sutton, 1984;

[12]This stage 1 is similar in spirit to the first stage of the noncooperative extensive form game developed in Section IIID of Ho and Lee (2019).

[13]As for the "Nash-in-Nash", this bargaining game can be formulated as a "delegated agent" model in which the downstream firm sends delegated agents to bargain with each of its upstream trading partners. Given that wholesale contracts are secret, it is assumed that each pair of delegates has passive beliefs over deals reached elsewhere (McAfee and Schwartz, 1994) (i.e., if an unexpected outcome arises from a bilateral negotiation, delegates involved in this transaction do not revise their beliefs about secret deals reached by the other pairs of delegates). This implies that the downstream firm behaves "schyzophrenically" in its negotiations with upstream firms.

[14]In contrast to other bargaining concepts such as those developed in Stole and Zwiebel (1996), Inderst and Wey (2003), or de Fontenay and Gans (2014), trading terms are neither revised nor contingent upon potential bargaining breakdowns in the course of the negotiations.

[15]For the sake of exposition, we consider that D's bargaining weight vis-à-vis U_1 and U_2 is similar. We relax this assumption in Section 4.2.

Binmore, 1985; Binmore, Shaked and Sutton, 1989). More specifically, in each of its bilateral negotiation, the NNTR solution allows the downstream firm to have an outside option defined as the surplus obtained from replacing its current upstream trading partner with another (excluded) one at its reservation price (that is, the price that makes this excluded firm indifferent between replacing or not the downstream firm's current trading partner). Building on Manea (2018), Ho and Lee (2019) have shown that the NNTR solution replicates the Markov perfect equilibrium of a noncooperative bargaining game in which the downstream firm can go "back and forth" between upstream firms during negotiations. To further motivate the use of this solution concept, we provide a novel microfoundation for the NNTR solution in which D plays U_1 and U_2 off against each other by auctioning a limited number of slots (see Section 5).

Bilateral efficiency. The common agency literature has shown that competing manufacturers can use the common agent, D, as a coordination device to replicate a collusive outcome and maximize the industry profit regardless of the distribution of bargaining power in the vertical chain (e.g., Bernheim and Whinston, 1985; O'Brien and Shaffer, 2005).[16] As a result, bilateral efficiency (i.e., cost-based wholesale contracts) prevails whatever manufacturers' selling strategies. This implies that, in stage 3, D always chooses prices that maximize the integrated industry profit Π^X or Π^{HM}. Based on this result, we consider that stages 2 and 3 are gathered in a unique stage where each pair $D-U_i$ bargains over a fixed fee F_i to share the integrated industry profit.

2.2 Buyer power and the profitability of exclusive dealing

In what follows, we solve the subgames absent and with an exclusive dealing requirement and then analyze the optimal selling strategy for manufacturers.

Absent exclusive dealing requirement. Consider first that manufacturers do not impose any exclusive dealing requirement to D in stage 1. In this case, D engages in bilateral negotiations with U_1 for H and U_2 for M. As D deals with both manufacturers, it

[16] Note that this efficiency result would also hold under public contracts.

cannot threaten any of its trading partner of replacement. The NNTR solution is here equivalent to the "Nash-in-Nash" solution, implying that the division of surplus in each bilateral negotiation is determined according to the (asymmetric) Nash bargaining solution given that the other pair of firms comes to an agreement. Formally, the fixed fee negotiated between D and U_1 for H is derived from the following maximization problem:

$$\max_{F_1^{HM}} \left(\Pi^{HM} - F_1^{HM} - F_2^{HM} - (\Pi^M - F_2^{HM})\right)^{\alpha} \left(F_1^{HM}\right)^{1-\alpha} \tag{1}$$

where $\Pi^{HM} - F_1^{HM} - F_2^{HM} - (\Pi^M - F_2^{HM})$ and F_1^{HM} are the gains from trade of D and U_1 respectively. These gains correspond to the difference between the profits obtained by D and U_1 if an agreement is reached (i.e., $\Pi^{HM} - F_1^{HM} - F_2^{HM}$ and F_1^{HM} respectively) and their status quo payoff if the negotiation never comes to an agreement (i.e., $\Pi^M - F_2^{HM}$ and 0 respectively). Similarly, the fixed fee negotiated between D and U_2 for product M is derived from the following maximization problem:

$$\max_{F_2^{HM}} \left(\Pi^{HM} - F_1^{HM} - F_2^{HM} - (\Pi^H - F_1^{HM})\right)^{\alpha} \left(F_2^{HM}\right)^{1-\alpha} \tag{2}$$

From (1) and (2), we obtain that U_1's fixed fee is $F_1^{HM} = (1-\alpha)\left(\Pi^{HM} - \Pi^M\right)$ and U_2's fixed fee is $F_2^{HM} = (1-\alpha)\left(\Pi^{HM} - \Pi^H\right)$. As a result, the equilibrium profit of D, U_1, and U_2 are respectively given by:[17]

$$\pi_D^{HM} = \Pi^{HM} - F_1^{HM} - F_2^{HM}; \quad \pi_1^{HM} = F_1^{HM}; \quad \pi_2^{HM} = F_2^{HM}. \tag{3}$$

The industry profit sharing in (3) shows that each manufacturer obtains a share $1-\alpha$ of its marginal contribution to the industry profit.

Exclusive dealing requirement. Consider that either U_1 or U_2 imposes an exclusive dealing requirement to D in stage 1. In this case, D engages in a bilateral negotiation either with U_1 for H or with U_2 for M. As previously described, the NNTR solution allows D to threaten to replace the product of its current trading partner with that of its (excluded) rival when bargaining. Following Proposition 2 of Ho and Lee (2019), however, the

[17]The superscript stands for the product assortment offered on the market.

NNTR solution requires that each product in D's assortment generates greater bilateral surplus than any product used as a replacement threat (taking as given all other agreements). Otherwise, the selected product assortment would not be stable in the sense that D would wish to terminate a relationship with one of its current trading partner and replace its product with another one which generates a greater surplus when playing them off against each other.[18] Under Assumption A1, we have that H is the unique product assortment which satisfies this stability condition. As a result, there is no equilibrium in which U_2 imposes an exclusive dealing requirement to D. Moreover, D always engages in a bilateral negotiation with U_1 for H when the latter imposes an exclusivity requirement. Following the NNTR solution, the fixed fee resulting from this negotiation is determined as follows:

$$\max_{F_1^H} (\Pi^H - F_1^H)^{\alpha}(F_1^H)^{1-\alpha} \quad \text{such that} \quad \Pi^H - F_1^H \geq \Pi^M - f_2 \tag{4}$$

where the gains from trade of D and U_1 are $\Pi^H - F_1^H$ and F_1^H respectively. In this case, both D and U_1 have a status quo payoff of 0 because there are not involved in other bilateral bargains. The constraint $\Pi^H - F_1^H \geq \Pi^M - f_2$, however, reflects that D's gains from trade must at least be equal to what it would obtain by replacing H with M at U_2's reservation tariff. This tariff, denoted by f_2, is equal to the surplus U_2 would be willing to accept to deal with D taking as given its other agreements (if any). As U_2 has no alternative downstream partner to deal with, it is willing to accept any nonnegative payment to replace H, implying that $f_2 = 0$. From (4), we obtain that U_1's fixed fee equals $F_1^H = \min\{(1-\alpha)\Pi^H, \Pi^H - \Pi^M\}$. Hence, the equilibrium profit of D, U_1, and U_2 are respectively given by:

$$\pi_D^H = \max\{\alpha\Pi^H, \Pi^M\}; \quad \pi_1^H = \min\{(1-\alpha)\Pi^H, \Pi^H - \Pi^M\}; \quad \pi_2^H = 0. \tag{5}$$

[18]More precisely, Ho and Lee's (2019) Proposition 2 establishes that the NNTR solution only applies to stable buyer-seller networks, which requires two main conditions. First, as for the "Nash-in-Nash" solution, every firm involved in a bilateral negotiation must have positive gains from trade. Second, due to the downstream firm's ability to exercise threats of replacement, each of its upstream trading partners must generate a higher surplus than any alternative upstream firm used as a replacement threat.

The industry profit sharing in (5) can be described as follows. When $\alpha > \alpha_C \equiv \frac{\Pi^M}{\Pi^H}$, that is, when D gets a large fraction of the industry profit from its negotiation with U_1, D's option to replace H with M cannot be a credible threat and the surplus division yields the same outcome as the standard (asymmetric) Nash bargaining solution. In contrast, when $\alpha_C > \alpha$, the option of replacing H with M becomes a credible threat and U_1's fixed fee is capped. In particular, this threat ensures that D obtains a profit at least equal to Π^M (i.e., the profit it would obtain from replacing H with M at U_2's reservation tariff).[19] Hence, the NNTR solution allows the excluded manufacturer U_2 to affect the surplus division in the vertical chain following the logic of the "outside option principle" in bargaining theory (e.g., Binmore, Shaked and Sutton, 1989).[20]

We now analyze the profitability of imposing an exclusive dealing requirement. As U_2 has no incentive to impose an exclusive dealing requirement to D, we simply compare U_1's profit in (3) and (5) and obtain the following proposition:

Proposition 1 *Exclusive dealing arises in equilibrium when the buyer power of the retailer vis-à-vis manufacturers is high: $\alpha > \alpha_{ED} \equiv \frac{\Pi^{HM}-\Pi^H}{\Pi^{HM}-\Pi^M}$. Exclusive dealing harms the rival manufacturer, the retailer, and the industry profit.*

Proof. While the harm for the rival manufacturer and the industry profit is straightforward, we show in Appendix A that exclusive dealing also harms the retailer. ■

Several comments are in order. First, Proposition 1 extends the Chicago School argument to the case where the retailer has some bargaining power vis-à-vis manufacturers. The insight is as follows. On the one hand, under exclusive dealing and when $\alpha_C > \alpha$, we have seen that D's option to deal with U_2 is a credible threat and induces U_1 to leave a surplus of Π^M to D, which is tantamount to paying D a compensation for not dealing with U_2. On the other hand, absent exclusive dealing, (3) shows that U_1's profit is $(1-\alpha)(\Pi^{HM} - \Pi^M)$. Focusing on the polar case $\alpha = 0$, the Chicago School argument correctly asserts that exclusive dealing is never profitable because the com-

[19]In this case, the NNTR solution corresponds to the "deal-me-out" outcome obtained in Bolton and Whinston (1993) where the outside option of one bargainer (here D) is equal to the entire surplus that an agreement with an alternative partner would generate (here Π^M).

[20]According to this principle, a bargainer's outside option is irrelevant to the bargaining outcome unless it provides a higher payoff than what the bargainer can get from his negotiation.

pensation U_1 has to pay reduces its profit to $\Pi^H - \Pi^M$ which is lower than what it can obtain absent exclusive dealing (here $\Pi^{HM} - \Pi^M$). Proposition 1 thus generalizes this argument by showing that it holds whenever the buyer power of the retailer is limited (that is, when $\alpha_{ED} > \alpha \geq 0$).

When $\alpha > \alpha_{ED}$, however, Proposition 1 highlights that the Chicago School argument ceases to operate and that exclusive dealing which leads to an inefficient exclusion becomes profitable. The logic underlying this result is that the compensation paid by U_1 under exclusive dealing, that is $\max\{\Pi^M - \alpha\Pi^H, 0\}$, is decreasing in α. Indeed, as D gets a larger share of the surplus generated by its exclusive deal with U_1 (that is, Π^H), its ability to credibly threaten U_1 of replacement with U_2 and receive a compensation erodes. As a result, when $\alpha > \alpha_{ED}$, the compensation paid by U_1 is low enough to make exclusive dealing a profitable strategy. The profitability of exclusive dealing is even more striking when $\alpha > \alpha_C$ as D is unable to require any compensation from U_1. In this case, U_1's profit under exclusive dealing becomes $(1-\alpha)\Pi^H$ which, by Assumption A2, is (weakly) larger than what it can obtain absent exclusive dealing, that is $(1-\alpha)(\Pi^{HM} - \Pi^M)$. Proposition 1 thus shows that the presence of a powerful retailer which is able to negotiate trading terms with manufacturers facilitates the emergence of anticompetitive exclusive dealing. It is worth noting that the use of the NNTR solution allows us to preserve the main essence of the Chicago School argument, that is, the retailer is able to exploit the presence of a rival manufacturer to receive a compensation for accepting an exclusive deal. The central result of Proposition 1 is thus to reconsider the Chicago School argument as a special case of a more general bargaining game in which the retailer's compensation decreases in its buyer power.[21]

As shown in Proposition 1, the condition under which exclusive dealing is profitable depends on the substitution among products. The following corollary summarizes this insight:

[21]Considering instead the "Nash-in-Nash" solution which has emerged as a workhorse model to analyze the surplus division in settings with contracting externalities (Collard-Wexler, Gowrisankaran and Lee, 2019), it is straightforward to see that exclusive dealing is always profitable (except when $\alpha = 1$). However, by ruling out the possibility for the retailer to use an excluded manufacturer as a bargaining leverage and receive a compensation for accepting an exclusive deal, the "Nash-in-Nash" solution does not allow to preserve the logic of the Chicago School argument in a bargaining context.

Corollary 1 *More substitution among products favor the emergence of exclusive dealing.*

From Assumptions A1 and A2 as well as Proposition 1, we have $\Pi^H + \Pi^M \geq \Pi^{HM} > \Pi^H$ and $\alpha_{ED} = \frac{\Pi^{HM}-\Pi^H}{\Pi^{HM}-\Pi^M}$. In the polar case where products are independent, Π^{HM} tends to $\Pi^H + \Pi^M$ and α_{ED} tends to α_C. Hence, any positive compensation received by D for not dealing with U_2 makes the use of exclusive dealing unprofitable (i.e., $\alpha_C > \alpha$). When this compensation boils down to 0 (i.e., $\alpha > \alpha_C$), U_1 is indifferent between imposing or not an exclusive dealing requirement as it gets $(1-\alpha)\Pi^H$ in any case. Consider now that the degree of substitution between products increases such that Π^{HM} gets closer to Π^H (keeping Π^H and Π^M unchanged).[22] On the one hand, U_1's profit absent exclusive dealing, that is $(1-\alpha)(\Pi^{HM} - \Pi^M)$, decreases as it has a smaller marginal contribution to the industry profit. On the other hand, U_1's profit under exclusive dealing, that is $\min\{(1-\alpha)\Pi^H, \Pi^H - \Pi^M\}$, is unaffected. As a result, exclusive dealing becomes more likely (α_{ED} decreases) when the substitution among products increases.[23] In that case, however, exclusion is less damaging for the industry profit.

Illustrative example. We consider a simple example to illustrate the insights drawn from Proposition 1. We set $\Pi^H = 4$, $\Pi^M = 3$, $\Pi^{HM} = 5$, implying that $\alpha_{ED} = \frac{1}{2}$.[24] Figure 1 depicts how the profit of each firm is affected by D's bargaining weight α.

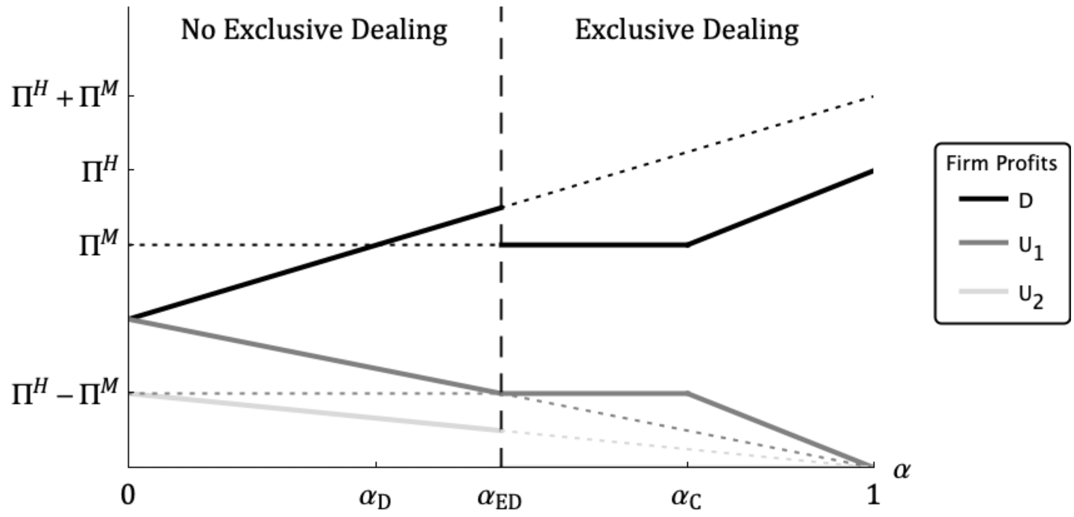
Consider first the case in which $\alpha_{ED} > \alpha$. Following Proposition 1, the Chicago School argument applies and exclusive dealing is not profitable. Solid lines in the figure represent the equilibrium profit of firms and dotted lines are what they would obtain under exclusive dealing. As previously described, the surplus division coincides with the "Nash-in-Nash" solution, which implies that the profit of D is strictly increasing in α (black line) while the profit of both U_1 (grey line) and U_2 (light grey line) are strictly decreasing in α. Consider now that $\alpha > \alpha_{ED}$. In this case, Proposition 1 highlights that exclusive dealing arises and U_2 is excluded from the market. Again, solid lines in the figure represent the equilibrium profit of firms and dotted lines are what they would

[22]Note that the degree of substitution among products may vary due to either a change in their cost differential or in their quality gap.

[23]In the polar case where products are perfect substitutes, however, D gets the entire industry profit regardless of U_1's selling strategy.

[24]In Appendix F, we show that this illustrative example can be derived from a quasi-linear quadratic utility model (Shubik and Levitan, 1980) with an appropriate choice of parameter values.

Figure 1: Exclusive dealing in the presence of buyer power



Notes: This figure is drawn under the following numerical values: $\Pi^H = 4$, $\Pi^M = 3$, $\Pi^{HM} = 5$. The x-axis represents D's bargaining weight $\alpha \in [0, 1]$. The y-axis corresponds to values for profits obtained by each manufacturer and D. The dotted lines represent the counterfactual profits of firms (i.e., firms' profits under exclusive dealing when $\alpha_{ED} > \alpha$ and firms' profits absent exclusive dealing when $\alpha > \alpha_{ED}$).

obtain absent exclusive dealing. The emergence of exclusive dealing generates a discontinuity in D's profit: the gap between the solid and the dotted black line illustrates D's losses from exclusive dealing. In contrast, the gap between the solid and the dotted grey line illustrates the profitability of exclusive dealing for U_1. When $\alpha_C > \alpha > \alpha_{ED}$, D's threat to replace H with M is credible and induces U_1 to provide (at least) a profit of Π^M to D (i.e., the constraint in (4) is binding meaning that absent such a threat D would have obtained a lower profit). As a result, the profits of D (black line) and U_1 (grey line) remain constant with respect to α. The kink arising in the profits of D and U_1 when $\alpha = \alpha_C$ depicts the situation in which D's option to deal with U_2 is no longer a credible threat to exercise. Hence, when $\alpha > \alpha_C$, the surplus division yields the same outcome as the (asymmetric) Nash bargaining solution, implying that D's (resp., U_1's) profit is increasing (resp., decreasing) in α.

3 Upstream bundling

3.1 The model

Consider now that manufacturer U_1 is a multi-product firm which offers both H and L whereas U_2 still offers M. Products are differentiated and we assume that D can purchase and distribute at most two of the three available products indexed by $X, Y \in \{H, M, L\}$. This modeling assumption aims at capturing the limited stocking capacity faced by retailers which is a pre-requisite for the exclusionary concerns of bundling practices in vertical markets.

Industry Profits. The primitive profit functions representing the industry profit (i.e., the profit of a fully integrated firm) generated by each assortment of products are denoted as follows: Π^X when only product X is offered on the market and Π^{XY} when products X and Y are offered on the market (where $Y \neq X$). We make the following assumptions:

Assumption A1' *Among the assortments of one product, H generates a higher industry profit than M which generates a higher industry profit than L:*

$$\Pi^H > \Pi^M > \Pi^L > 0.$$

Among the assortments of two products, HM generates the highest industry profit:

$$\Pi^{HM} > \Pi^{HL} > \Pi^{ML} > 0.$$

Assumption A2' *Products are either independent or imperfect substitutes:*

$$\Pi^X + \Pi^Y \geq \Pi^{XY} > \Pi^X \text{ with } Y \neq X.$$

Timing and information. We assume that firms interact according to the following sequence of play:

- Stage 1: U_1 chooses either a component or a bundling strategy. If U_1 chooses a component strategy, it offers either H, or L, or H and L as a bundle. If instead U_1 chooses a bundling strategy, it offers H and L as a bundle only. Under bundling, D selects either HL or M. Otherwise, D selects either HM, HL, or ML. D's product assortment decision is publicly announced.

- Stages 2 and 3 remain as in Section 2.

We now discuss each stage of the game in detail including our network formation protocol and bargaining solution.

Product assortment decision, bargaining protocol, and bilateral efficiency. By considering that U_1's decision to bundle its products occurs prior to contract negotiations, we build on the textbook examples of the Chicago School critique to the "leverage theory" as developed in Choi (2006) and Fumagalli, Motta and Calcagno (2018) (see Section 4.1 for a discussion). Given U_1's selling strategy, D announces its product assortment and thereby commits to engaging in negotiations with manufacturer(s) of the corresponding product(s). To ease exposition, we assume that D cannot strategically affect the size of its product assortment (we relax this assumption in Section 4.3). Similar to Section 2, we use the NNTR bargaining solution (Ho and Lee, 2019) to determine the surplus division in stage 2. Moreover, based on the common agency literature, we also have that bargaining over two-part tariffs leads to cost-based wholesale contracts, implying that bilateral efficiency always prevails. Throughout this section, we thus consider that each pair $D-U_i$ simply bargains over a fixed fee F_i to share the integrated industry profit.

3.2 Buyer power and the profitability of bundling

In what follows, we solve the subgames in which U_1 chooses a component and a bundling strategy and then analyze the profitability of bundling.

Component strategy. Consider the case in which U_1 chooses a component strategy. In such a situation, D may either select the assortment HM, or HL, or ML due to its limited stocking capacity. As described in Section 2, however, the presence of a third available product may be used by D to exercise threats of replacement and gain bargaining leverage with respect to its current trading partner(s). This requires that each product in D's assortment generates greater bilateral surplus than any product used as a replacement threat, taking as given all other agreements (see Proposition 2 of Ho and Lee, 2019). Under Assumption A1', it is easy to see that HM is the unique product assortment which satisfies this stability condition. Hence, D always engages in bilateral negotiations with U_1 for H and U_2 for M when a component strategy is chosen by U_1. Accounting for D's replacement threats and taking the bargaining outcome between D and U_1 for H as given, the NNTR solution determines the fixed fee negotiated between D and U_2 for M as follows:

$$\begin{aligned}&\max_{\tilde{F}_2^{HM}} \left(\Pi^{HM} - \tilde{F}_1^{HM} - \tilde{F}_2^{HM} - (\Pi^H - \tilde{F}_1^{HM})\right)^{\alpha}\left(\tilde{F}_2^{HM}\right)^{(1-\alpha)}\\ &\text{such that} \quad \Pi^{HM} - \tilde{F}_1^{HM} - \tilde{F}_2^{HM} \geq \Pi^{HL} - \tilde{f}_1\end{aligned} \tag{6}$$

where $\Pi^{HM} - \tilde{F}_1^{HM} - \tilde{F}_2^{HM} - (\Pi^H - \tilde{F}_1^{HM})$ and $\tilde{F}_2^{HM}$ correspond to the gains from trade of D and U_2 respectively. The constraint $\Pi^{HM} - \tilde{F}_1^{HM} - \tilde{F}_2^{HM} \geq \Pi^{HL} - \tilde{f}_1$ reflects that D's profit must at least be equal to what it would obtain by replacing M with L at U_1's reservation tariff (holding fixed the outcome determined in the other negotiation). This tariff, denoted by $\tilde{f}_1$, is equal to the surplus U_1 would be willing to accept to replace U_2 and deal with D for L. Given that U_1 already receives a surplus of $\tilde{F}_1^{HM}$ from its negotiation with D for H, it turns out that the minimum amount of surplus it would be willing to accept for such a replacement is $\tilde{f}_1 = \tilde{F}_1^{HM}$. This shows that D's threat of replacement imposes a cap on U_2's fixed fee: $\Pi^{HM} - \Pi^{HL} \geq \tilde{F}_2^{HM}$.

When bargaining with U_1 for H, however, we consider that D's option to replace H with L cannot be exercised as both H and L are owned by U_1.[25] Taking as given the bargaining outcome between D and U_2 for M, the fixed fee negotiated between D and

[25]While it is intuitive that a downstream firm cannot play off an upstream trading partner against itself (i.e., threatening to replace one of its products with another), we motivate this modeling assumption by showing that it emerges as the equilibrium outcome of the NNPCS model developed in Section 5 (see Chambolle and Molina, 2020, for a comprehensive analysis). It is worth noting that Ho and Lee (2019) focus on hospital-insurer bargaining over reimbursement rates and do not consider the case of multi-product upstream firms.

U_1 for H is thus derived as follows:

$$\max_{\tilde{F}_1^{HM}} \left(\Pi^{HM} - \tilde{F}_1^{HM} - \tilde{F}_2^{HM} - (\Pi^M - \tilde{F}_2^{HM})\right)^{\alpha} \left(\tilde{F}_1^{HM}\right)^{(1-\alpha)} \tag{7}$$

where $\Pi^{HM} - \tilde{F}_1^{HM} - \tilde{F}_2^{HM} - (\Pi^M - \tilde{F}_2^{HM})$ and $\tilde{F}_1^{HM}$ are the gains from trade of D and U_1 respectively. Solving (6) and (7), we obtain that $\tilde{F}_1^{HM} = (1-\alpha)(\Pi^{HM} - \Pi^M)$ and $\tilde{F}_2^{HM} = \min\{(1-\alpha)(\Pi^{HM} - \Pi^H), \Pi^{HM} - \Pi^{HL}\}$. Hence, the equilibrium profits of D, U_1, and U_2 are respectively given by:

$$\tilde{\pi}_D^{HM} = \Pi^{HM} - \tilde{F}_1^{HM} - \tilde{F}_2^{HM}; \quad \tilde{\pi}_1^{HM} = \tilde{F}_1^{HM}; \quad \tilde{\pi}_2^{HM} = \tilde{F}_2^{HM}. \tag{8}$$

The logic underlying the industry profit sharing in (8) is as follows. When $\alpha > \frac{\Pi^{HL} - \Pi^H}{\Pi^{HM} - \Pi^H}$, D gets a large fraction of the industry profit from its negotiations with both manufacturers. Hence, its option to replace M with L cannot be a credible threat and the division of surplus yields the same outcome as the "Nash-in-Nash" bargaining solution. In contrast, when $\alpha < \frac{\Pi^{HL} - \Pi^H}{\Pi^{HM} - \Pi^H}$, D's threat of replacing M with L becomes credible and ensures that U_2's fixed fee does not exceed $\Pi^{HM} - \Pi^{HL}$.

Bundling strategy. Consider now the case in which U_1 chooses a bundling strategy. In such a situation, D may either engage in a bilateral negotiation with U_1 for HL or in a bilateral negotiation with U_2 for M. Similar to the exclusive dealing case, while D deals with only one manufacturer, it can exploit the presence of a rival manufacturer to exercise threats of replacement and gain bargaining leverage. Again, this requires that every product in D's assortment generates greater bilateral surplus than any product used as a replacement threat. Under Assumption A1', we have that the bundle HL is the unique product assortment satisfying this stability condition. Hence, D always engages in a bilateral negotiation with U_1 for HL when the latter chooses a bundling strategy. The NNTR solution determines U_1's fixed fee for the bundle HL as follows:

$$\max_{\tilde{F}_1^{HL}} \left(\Pi^{HL} - \tilde{F}_1^{HL}\right)^{\alpha} \left(\tilde{F}_1^{HL}\right)^{(1-\alpha)} \quad \text{such that} \quad \Pi^{HL} - \tilde{F}_1^{HL} \geq \Pi^M - \tilde{f}_2 \tag{9}$$

where the gains from trade of D and U_1 are $\Pi^{HL} - \tilde{F}_1^{HL}$ and $\tilde{F}_1^{HL}$ respectively. The constraint $\Pi^{HL} - \tilde{F}_1^{HL} \geq \Pi^M - \tilde{f}_2$ reflects that D's gains from trade must at least be equal to what it would get by replacing HL with M at U_2's reservation tariff. This tariff, denoted by $\tilde{f}_2$, is equal to the surplus U_2 would be willing to deal with D taking as given its other agreements. Having no alternative downstream partner to deal with, U_2 is willing to accept any nonnegative payment to distribute M, implying that $\tilde{f}_2 = 0$. From (9), we obtain that U_1's fixed fee for HL equals $\tilde{F}_1^{HL} = \min\{(1-\alpha)\Pi^{HL}, \Pi^{HL} - \Pi^M\}$. Hence, the equilibrium profit of D, U_1, and U_2 are respectively given by:

$$\tilde{\pi}_D^{HL} = \max\{\alpha\Pi^{HL}, \Pi^M\}; \quad \tilde{\pi}_1^{HL} = \min\{(1-\alpha)\Pi^{HL}, \Pi^{HL} - \Pi^M\}; \quad \tilde{\pi}_2^{HL} = 0. \qquad (10)$$

The industry profit sharing in (10) is fairly similar to that of the exclusive dealing case described in (5). When $\alpha > \tilde{\alpha}_C \equiv \frac{\Pi^M}{\Pi^{HL}}$, D obtains a large fraction of the industry profit from its negotiation with U_1, making the threat of replacing its bundle of products with M not credible. In contrast, when $\tilde{\alpha}_C > \alpha$, D's threat of replacement becomes credible and ensures that its profit is at least equal to Π^M. As a result, even if U_2 is excluded from the market, its presence affects the sharing of industry profit following the logic of the "outside option principle".

We now analyze the profitability of choosing a bundling strategy. Comparing U_1's profit in (8) and (10), we obtain the following proposition:

Proposition 2 *Bundling arises in equilibrium when the buyer power of the retailer vis-à-vis manufacturers is high: $\alpha > \alpha_B \equiv \frac{\Pi^{HM} - \Pi^{HL}}{\Pi^{HM} - \Pi^M}$. Bundling harms the rival manufacturer, the retailer, and the industry profit.*

Proof. While the harm for the rival manufacturer and the industry profit is straightforward, we show in Appendix A that bundling also harms the retailer. ■

In the same vein as for the exclusive dealing restrictions, the Chicago School critique to the "leverage theory" of bundling states that a multi-product manufacturer cannot find profitable to bundle its products for exclusionary motives because it would have to pay the retailer a prohibitive compensation for giving up the opportunity to sell the rival product whenever this is efficient for the industry. Initially framed in the polar case $\alpha = 0$, Proposition 2 extends the Chicago School argument to situations where the retailer has some bargaining power vis-à-vis manufacturers. The insight is similar to that described in Proposition 1. On the one hand, under bundling, D's threat to leave the negotiation table and deal with U_2 for M leads U_1 to concede a surplus of (at least) Π^M to D whenever $\alpha_B > \alpha$. This implies that its profit equals $\Pi^{HL} - \Pi^M$, which is tantamount to paying D a compensation equals to $\max\{\Pi^M - \alpha\Pi^{HL}, 0\}$ for not dealing with U_2. On the other hand, under a component selling strategy, U_1 gets a profit proportional to the marginal contribution of its product H to the industry profit, that is $(1-\alpha)\left(\Pi^{HM} - \Pi^M\right)$. Straightforwardly, we can see that bundling cannot be a profitable strategy for U_1 when α is low (that is, $\alpha_B > \alpha \geq 0$).

When $\alpha > \alpha_B$, however, Proposition 2 highlights that a bundling strategy leading to an inefficient exclusion becomes profitable, which breaks down the logic of the Chicago School argument. Again, the reason is similar to that described in Proposition 1. The amount of compensation received by D depends on its credibility to threaten U_1's bundle of replacement with U_2's product. Such a credibility, however, weakens as D gets stronger in its bargaining with U_1 (i.e., the compensation paid by U_1 is decreasing in α). When $\alpha > \alpha_B$, the compensation paid by U_1 is low enough to make bundling a profitable strategy. This result is even more straightforward when $\alpha > \tilde{\alpha}_C$ as U_1 has no compensation to pay for ensuring that D does not deal with U_2. In this case, U_1's profit under bundling equals $(1-\alpha)\Pi^{HL}$ which, by Assumption A2', is greater than what it gets under a component selling strategy, that is $(1-\alpha)\left(\Pi^{HM} - \Pi^M\right)$. Proposition 2 thus restores the "leverage theory" of bundling by highlighting that the presence of a powerful retailer which is able to negotiate trading terms with manufacturers facilitates the emergence of anticompetitive bundling. Overall, a nice feature of our model is that the buyer power parameter allows us to go from the Chicago School argument to the "leverage theory" of bundling.

As shown in Proposition 2, the condition under which bundling is profitable depends on the products' characteristics. The following corollary characterizes two other conditions for the profitability of bundling:

Corollary 2 *Bundling is more likely to arise in equilibrium when:*

(i) products L and M are closer substitutes,

(ii) product H is a must-stock item.

First, when M and L become closer substitutes, Π^{HL} increases toward Π^{HM} which decreases α_B and implies that a bundling strategy is more likely to arise in equilibrium.[26] In that case, however, bundling is less damaging for the industry profit. Second, when H is a must-stock item, it generates most of the industry profit implying that Π^H tends to Π^{HL} or Π^{HM} which decreases α_B and facilitates the emergence of a bundling strategy. However, the following remark shows that the presence of a must-stock item is not a necessary condition for the profitability of bundling:

Remark 1 *Proposition 2 holds when $\Pi^{HL} > \Pi^M > \Pi^H$.*

Proof. See Appendix B. ■

For the sake of exposition and motivated by the case law in Section 1, we have considered that $\Pi^H > \Pi^M$ (Assumption A1'). However, when $\Pi^M > \Pi^H$, Proposition 2 still holds as long as $\Pi^{HL} > \Pi^M$ (i.e., the bundle of products generates a higher industry profit than the rival's product). In that case, bundling excludes the product generating the highest surplus which is even more detrimental for the industry profit.

Proposition 2 states that anticompetitive upstream bundling may arise under the case of independent or imperfect substitutes products (Assumption A2'). The following remark shows that our result carries over to the case of complementary products extensively analyzed in the bundling literature (Whinston, 2001):

Remark 2 *Proposition 2 holds when M and L are complements to H and the form of complementarity between M and H is limited to:* $\Pi^{HL} + \Pi^M \geq \Pi^{HM} > \Pi^H + \Pi^M$.

Proof. See Appendix C. ■

[26]Note that the convergence between M and L can result from a reduction in their quality gap or in their cost differential.

This result highlights that our buyer power argument provides a new rationale to the "leverage theory" of bundling whether products are substitutes, independent, or complements. To apply the NNTR solution, however, we restrict the degree of complementarity between H and M.[27] Indeed, the complementarity makes the marginal contribution of every product to the industry profit greater when other agreements have been formed, which implies that the sum of tariffs determined by the NNTR solution and paid by D may be greater than the value of the industry profit. In particular, if $\Pi^{HL} + \Pi^{M} \geq \Pi^{HM}$ does not hold, we show in Appendix C that D would wish to reject one of its agreements at the NNTR tariffs.[28]

Illustrative example with independent products. We consider a simple example to illustrate the insights drawn from Proposition 2. In particular, we focus on the case of independent products in which only A1' matters as it implies that A2' holds. We set $\Pi^{H} = 4$, $\Pi^{M} = 3$, $\Pi^{L} = 1$, implying that $\alpha_B = \frac{1}{2}$ and $\tilde{\alpha}_C = \frac{3}{5}$.[29] Figure 2 depicts how firms' profits are affected by D's bargaining weight α.[30]

Consider first the case in which $\alpha_B > \alpha$. Following Proposition 2, the Chicago School critique to the "leverage theory" of bundling holds and U_1 chooses a component selling strategy. Solid lines in the figure represent the equilibrium profit of firms and dotted lines are what they would obtain under bundling. As shown in (8), the surplus division between D and U_1 coincides with the "Nash-in-Nash" solution, implying that U_1's profit (grey line) is strictly decreasing in α. Instead, the surplus division between D and U_2 follows the logic of the "outside option principle" which explains the presence of a kink in their profit with respect to α. On the left-side of this kink, for low values of α, D's threat to replace M with L induces U_2 to concede a surplus equals to Π^{L} in its bargaining with D (i.e., the constraint in (6) is binding). U_2's profit thus remains constant

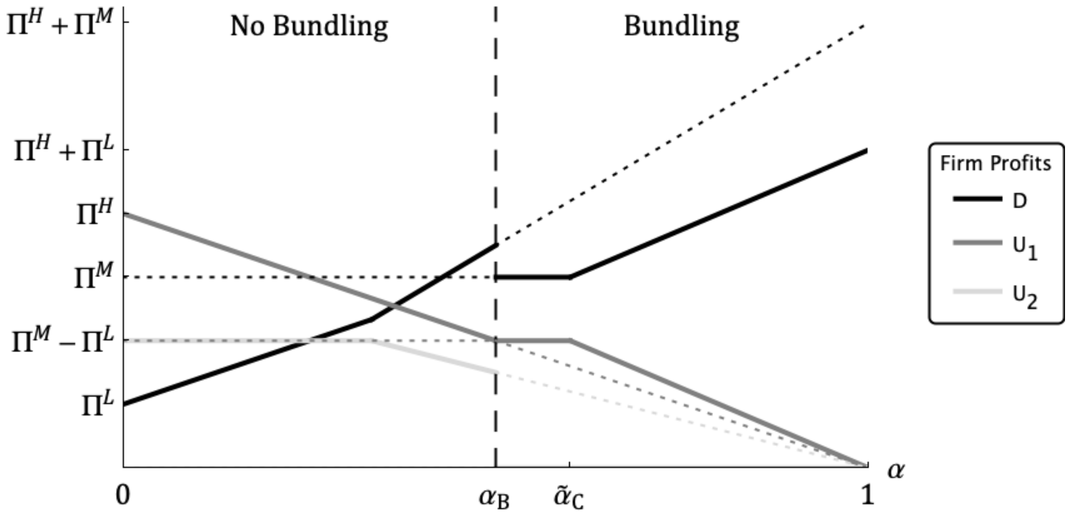
[27]More precisely, the condition $\Pi^{HL} + \Pi^{M} \geq \Pi^{HM}$ ensures that $\tilde{\pi}_D^{HM} = \Pi^{HM} - \tilde{F}_1^{HM} - \tilde{F}_2^{HM} > 0$. This is similar in spirit to the feasibility assumption in Collard-Wexler, Gowrisankaran and Lee (2019) which is used to guarantee the existence of a "Nash-in-Nash" equilibrium.

[28]It is worth noting that this condition rules out cases where products are perfect complements or where H is essential for all uses of M as in Section 3 of Whinston (1990).

[29]Again, Appendix F shows that this illustrative example can be derived from a quasi-linear quadratic utility model (Shubik and Levitan, 1980) with an appropriate choice of parameter values.

[30]Note that the market outcome when $\alpha = 0$ directly relates to the textbook examples of the Chicago School critique to the "leverage theory" of bundling as developed in Choi (2006) and Fumagalli, Motta and Calcagno (2018).

Figure 2: Bundling in the presence of buyer power



Notes: This figure is drawn under the following numerical values: $\Pi^H = 4$, $\Pi^M = 3$, $\Pi^L = 1$. The x-axis represents D's bargaining weight $\alpha \in [0,1]$. The y-axis corresponds to values for profits obtained by each manufacturer and D. The dotted lines represent the counterfactual profits of firms (i.e., firms' profits under bundling when $\alpha_B > \alpha$ and firms' profits absent bundling when $\alpha > \alpha_B$).

(light grey line) while that of D (black line) is increasing due to its profit obtained in the negotiation with U_1 (otherwise, it would remain equal to Π^L). On the right-side of the kink, D's threat of replacement is no longer credible and the surplus division in the negotiation with U_2 follows the "Nash-in-Nash" solution.

Consider now that $\alpha > \alpha_B$. In this case, Proposition 2 highlights that bundling arises and excludes U_2 from the market. Again, solid lines in the figure represent the equilibrium profit of firms and dotted lines are what they would obtain under a component selling strategy. The figure shows that U_1's bundling strategy generates a discontinuity in D's profit: the gap between the solid and the dotted black line illustrates D's losses from bundling. In contrast, the gap between the solid and the dotted black line illustrates the profitability of U_1's bundling strategy. When $\tilde{\alpha}_C > \alpha > \alpha_B$, D credibly threatens U_1's bundle of replacement with U_2's product, which induces U_1 to concede a surplus equals to Π^M and implies that D's profit (black line) and U_1's profit (grey line) remain constant with respect to α (i.e., the constraint in (9) is binding). When $\alpha > \tilde{\alpha}_C$, however, the threat of replacement is no longer credibly exercised by D. This generates a kink in the profits of D and U_1 reflecting that the division of surplus coincides with the (asymmetric) Nash bargaining solution.

4 Discussion

We discuss now the timing and commitment assumptions required in our buyer power theory and relate them to previous work in the literature (Section 4.1). We also extend our theory to the cases where D has a different bargaining weight vis-à-vis U_1 and U_2 (Section 4.2) and where D is able to strategically choose the number of products to distribute (Section 4.3). Finally, we discuss the welfare implications of exclusive dealing and bundling practices (Section 4.4).

4.1 Timing and commitment

Timing. In what follows, we discuss the assumption that manufacturers can impose a vertical restraint prior to contract negotiations. While this aims at capturing the long-term nature of exclusive dealing and bundling contracts which may typically cover several years, we rely on two distinct literature to further motivate this timing assumption. First, we build on a recent stream of articles that develop game theoretical frameworks in which a model of network formation is followed by a surplus sharing rule conditional upon the realized network (see, e.g., Liebman, 2018; Nocke and Rey, 2018; Ho and Lee, 2019; Rey and Vergé, 2020). Similar to us in which the vertical restraint affects the product assortment that D can select, this timing involves a commitment to a buyer-seller network before bargaining take place. Second, the assumption that manufacturers choose their contractual form (e.g., exclusive dealing or territories, resale price maintenance) in an initial stage is customary in the vertical restraints literature (see, e.g., Rey and Tirole, 1986; Mathewson and Winter, 1987; Rey and Stiglitz, 1995; Martimort and Piccolo, 2010; Calzolari, Denicolò and Zanchettin, 2020). This also entails a certain degree of commitment that we discuss below.[31]

[31] An alternative approach to our sequential structure is that manufacturers offer a menu of contracts (e.g., a two-part tariff with and without exclusivity) from which D can choose. In addition to frequently create a multiplicity of Nash equilibria (see, e.g., Bernheim and Whinston, 1998; Calzolari, Denicolò and Zanchettin, 2020), incorporating a menu of contracts in a bargaining game is beyond the scope of this article.

Commitment. Our timing assumption involves two types of commitment. First, we assume that U_1 is able to commit to exclusive dealing or bundling, implying that it engages not to offer H to D if the latter were to deal with U_2 for M. We motivate this commitment assumption on the ground that U_1 may build a reputation for enforcing a particular selling policy.[32] It is worth noting, however, that this requires a lower level of commitment than Whinston (1990) in which bundling is profitable only to the extent that entry is deterred (see also Choi and Stefanadis, 2001; Carlton and Waldman, 2002, among others).[33] Instead, along the lines of Peitz (2008), our Proposition 2 highlights that bundling is an optimal selling strategy in the presence of an actual (rather than a potential) rival.[34]

Second, we also assume that D is able to commit to a particular product assortment. As no agreement is formed in stage 1, it is noteworthy that this assumption is weaker than that in the "rent-extraction" theory (Aghion and Bolton, 1987) and the "naked-exclusion" theory (Rasmusen, Ramseyer and Wiley, 1991; Segal and Whinston, 2000).[35] Once an exclusive dealing or bundling contract is signed with U_1 in stage 2, however, we rule out any Pareto-improving renegotiation leading D to also deal with U_2 while leaving the same profit to U_1 (thereby eliminating the inefficiency of U_1's vertical restraint).[36] The presence of prohibitive transaction costs (e.g., renegotiation efforts,

[32]In practice, this "all-or-nothing" deal is often used by manufacturers which own "must-have" products. A prominent example can be find in United States vs Dentsply (2005) in which the artificial teeth manufacturer Dentsply (75–80 per cent of market shares) imposed an "all-or-nothing" deal stating that: "In order to effectively promote Dentsply/York products, dealers that are recognized as authorized distributors may not add further tooth lines to their product offering." (https://www.justice.gov/atr/case-document/us-v-dentsply-brief-united-states-redacted). See also The Coca-Cola Company (2005) in which the European Commission gathered evidence that: "TCCC and its bottlers refused to supply a customer with only one of their brands unless the customer was willing to carry other CSDs or non-CSD NABs of TCCC or its bottlers." (Case COMP/A.39.116/B2).

[33]More precisely, the fact that bundling is a suboptimal selling strategy absent entry implies that these alternative "leverage theories" only apply to technical bundling.

[34]As a consequence, our commitment assumption is also weaker than that in Aghion and Bolton (1987) and the ensuing literature which require the incumbent to commit on both the contractual form and the terms of trade with the retailer before the entrant shows up.

[35]As pointed out in Ide, Montero and Figueroa (2016), these theories rely on the assumption that the retailer contractually commits to exclusivity with the incumbent before the entrant shows up. In contrast, while bargaining with U_1, we consider that the retailer remains free to leave the negotiation table and deal with U_2 without having to pay any penalty for contractual breach.

[36]A similar commitment assumption is found in the "rent-extraction" literature (e.g., Aghion and Bolton, 1987; Marx and Shaffer, 1999). We refer to Spier and Whinston (1995) for an extensive discussion on the role of contract renegotiation.

delaying production, breach penalties) helps sustain this commitment. Moreover, as previously stated, U_1 is much likely to engage in costly judicial disputes to sustain its reputation in the enforcement of such selling policies.

4.2 Manufacturer-specific bargaining weights

So far, we have assumed that D has the same bargaining weight vis-à-vis each manufacturer. In what follows, we show that relaxing this assumption does not affect our results.

Let us denote by α_i the bargaining weight of D vis-à-vis U_i with $i = 1, 2$. Rewriting (1) and (4) accordingly, U_1's profit equals $(1-\alpha_1)\left(\Pi^{HM} - \Pi^M\right)$ absent exclusive dealing and $\min\{(1-\alpha_1)\Pi^H, \Pi^H - \Pi^M\}$ under exclusive dealing. Thus, we find that exclusive dealing is profitable for U_1 whenever $\alpha_1 > \alpha_{ED}$. Similarly, rewriting (7) and (9), U_1's profit equals $(1-\alpha_1)\left(\Pi^{HM} - \Pi^M\right)$ under the component strategy and $\min\{(1-\alpha_1)\Pi^{HL}, \Pi^{HL} - \Pi^M\}$ under bundling. As a result, we find that bundling is profitable for U_1 whenever $\alpha_1 > \alpha_B$.

Interestingly, these profitability conditions for U_1's vertical restrictions do not depend on D's bargaining weight vis-à-vis U_2. Indeed, α_2 only increases D's losses caused by U_1's restrictions.[37] This result has two implications: U_1 does not find less profitable to exclude M from the market even if it is sold at cost by a competitive fringe or if U_2 is vertically integrated with D (i.e., $\alpha_2 = 1$); conversely, the use of vertical restrictions are not more profitable for U_1 when U_2 is powerful (i.e., $\alpha_2 = 0$).

4.3 Endogenous product assortment size

According to Ho and Lee (2019), a downstream firm may have an incentive to strategically narrow its product assortment to strengthen its bargaining leverage with respect to upstream firms (see also, e.g., Marx and Shaffer, 2010*b*). Moreover, one may also consider that the downstream firm can widen its product assortment to prevent any harmful effect of bundling practices. We explore both strategies by allowing D to

[37] More specifically, D's losses from U_1's exclusive dealing or bundling are increasing in α_2 at a rate $\Pi^{HM} - \Pi^H$ (i.e., the marginal contribution of U_2's product to the industry profit).

choose the number of products to distribute.

Exclusive dealing. Consider first the framework of exclusive dealing as developed in Section 2. In stage 1, we now allow D to select either HM or H when either U_1 or U_2 chooses not to impose any exclusive dealing restriction.[38] If D selects the assortment HM, the equilibrium outcome is given by (3). Instead, if D selects the assortment H, it gets the same profit as under exclusive dealing which is given by (5). Comparing D's profit in (3) and (5) we obtain that, absent exclusive dealing, D chooses to narrow its product assortment to H when $\alpha_D \equiv \frac{\Pi^{HM}-\Pi^{H}}{2\Pi^{HM}-\Pi^{H}-\Pi^{M}} > \alpha$ (see Figure 1 for an illustrative example). As $\alpha_{ED} > \alpha_D$, D's strategy to narrow its product assortment has no effect on U_1's incentive to impose an exclusive dealing, which implies that Proposition 1 still holds. However, this highlights a close relationship between D's product assortment size and its bargaining power in negotiations with manufacturers. When D is strong in its bargaining (α is high), its threats of replacement are not credible to exercise. The sharing of profit is thus determined by the "Nash-in-Nash" solution in which the surplus captured by each manufacturer is proportional to its marginal contribution to the industry profit. Hence, by expanding its product assortment to HM, D not only increases the industry profit to be divided but also decreases the marginal contribution of each manufacturer. This strategy strengthens D's bargaining position which extracts a larger share of a larger pie. In contrast, when D is weak in its bargaining (α is low), it has an incentive to narrow its product assortment to intensify upstream competition by playing manufacturers off against each other. Although such a strategy shrinks the industry profit to H, it ensures a profit of Π^M to D, even when α tends to 0.

Bundling. A similar reasoning applies to the case of upstream bundling. While D may have an incentive to narrow its assortment to a single product when α is low, this strategy is unlikely to affect U_1's incentive to bundle its products which only arises when α is high. Instead, one may consider that D has an incentive to expand its product assortment to annihilate any harmful effect of bundling. To explore such a strategy, we

[38] Considering that D can also select M is irrelevant as it is not a stable product assortment under Assumption A1.

consider the framework of upstream bundling as developed in Section 3 and modify stage 1 as follows. When U_1 chooses a bundling strategy, D is now able to select either HML or HL; otherwise, D can select either HML or HM.[39] In addition to Assumptions A1' and A2', we further assume that the largest industry profit is generated when all products are offered to consumers: $\Pi^{HML} > \Pi^{HM}$. In what follows, we sketch the solution of this game and refer to Appendix D for further details.

First, regardless of U_1's selling strategy, if D selects HML the surplus division in the vertical chain is determined by the "Nash-in-Nash" solution. The equilibrium fixed fees are thus given by $\tilde{F}_1^{HML} = (1-\alpha)\left(\Pi^{HML} - \Pi^{M}\right)$ and $\tilde{F}_2^{HML} = (1-\alpha)\left(\Pi^{HML} - \Pi^{HL}\right)$ and D's profit equals $\tilde{\pi}_D^{HML} = \Pi^{HML} - \tilde{F}_1^{HML} - \tilde{F}_2^{HML}$. Alternatively, if D selects HL (resp., HM) when U_1 chooses a bundling (resp., component) strategy, the equilibrium outcome is given by (10) (resp., (8)). Comparing $\tilde{\pi}_D^{HML}$ and $\tilde{\pi}_D^{HL}$ we obtain that, if U_1 has opted for a bundling strategy, D chooses to expand its product assortment to HML when $\alpha > \min\{\tilde{\alpha}_C, \tilde{\alpha}_D\}$ where $\tilde{\alpha}_D \equiv \frac{\Pi^{HML}-\Pi^{HL}}{2\Pi^{HML}-\Pi^{HL}-\Pi^{M}}$. This strategy offsets the harmful effect of bundling to the benefit of D and the industry profit. In contrast, when $\min\{\tilde{\alpha}_C, \tilde{\alpha}_D\} > \alpha$ and despite the bundling restriction, narrowing the product assortment to HL remains an appealing rent-extraction mechanism for D through the use of threats of replacement. Similarly, comparing $\tilde{\pi}_D^{HML}$ and $\tilde{\pi}_D^{HM}$ we obtain that, if U_1 opts for a component strategy, D chooses to expand its product assortment to HML when $\alpha > \min\{\frac{\Pi^{HL}-\Pi^{H}}{\Pi^{HM}-\Pi^{H}}, \tilde{\alpha}'_D\}$ where $\tilde{\alpha}'_D \equiv \frac{\Pi^{HML}-\Pi^{HM}}{2\Pi^{HML}-\Pi^{HL}-\Pi^{HM}}$.

To analyze the profitability of bundling, we compare U_1's profit under both selling strategies and obtain that bundling arises in equilibrium when $\min\{\frac{\Pi^{HL}-\Pi^{H}}{\Pi^{HM}-\Pi^{H}}, \tilde{\alpha}'_D\} > \alpha > \alpha_B$. While the condition from Proposition 2 still holds (that is, $\alpha > \alpha_B$), this result shows that the profitability of bundling practices is less likely when the D is able to expand its product assortment. In the following illustrations, we show that this strategy does not always neutralize U_1's bundling practices (see Appendix D for a general condition). Consider two simple examples with independent products. In the example already analyzed in Section 3, we have $\Pi^{H} = 4$, $\Pi^{M} = 3$, and $\Pi^{L} = 1$, implying that $\min\{\frac{\Pi^{HL}-\Pi^{H}}{\Pi^{HM}-\Pi^{H}}, \tilde{\alpha}'_D\} = \frac{1}{4}$ and $\alpha_B = \frac{1}{2}$. Thus, in this case, the expansion of D's product

[39] Again, considering any other assortment of two products is irrelevant as none of them is stable under Assumption A1'.

assortment prevents the emergence of bundling practices. Considering instead that $\Pi^M = \frac{3}{2}$, we have $\min\{\frac{\Pi^{HL}-\Pi^H}{\Pi^{HM}-\Pi^H}, \tilde{\alpha}'_D\} = \frac{2}{5}$ and $\alpha_B = \frac{1}{8}$, implying that bundling arises in equilibrium when $\frac{2}{5} > \alpha > \frac{1}{8}$. Moreover, we have that bundling excludes U_2 from the market when $\frac{3}{13} > \alpha > \frac{1}{8}$.[40]

4.4 Welfare implications

To discuss the welfare implications of exclusive dealing and bundling, we denote by CS^X the consumer surplus when the product assortment X is offered on the market and assume that:

Assumption A3 $CS^{HML} > CS^{HM} > CS^H > CS^M > CS^L$.

Assumption A3 is satisfied when preferences exhibit a taste for variety. Among others, this arises under most linear demand systems for differentiated products (see Choné and Linnemer, 2020, for a comprehensive overview). We thus obtain the following corollary:

Corollary 3 *Under Assumption A3, exclusive dealing and bundling harm consumers surplus and total welfare.*

This result offers a new perspective on the commonly held view that vertical restrictions imposed by a dominant firm are more likely to raise anticompetitive concerns. Instead, our theory suggests that the presence of buyer power, which countervails the market power of dominant manufacturers, makes the emergence of vertical restrictions more likely to the detriment of both consumers and welfare. This is in stark contrast with the EU guidelines on vertical restraints according to which: "Buying power is relevant, as important buyers will not easily be forced to accept tying without obtaining at least part of the possible efficiencies. Tying not based on efficiency is therefore mainly a risk where buyers do not have significant buying power."[41] Moreover, as highlighted

[40] As previously mentioned, allowing D to narrow its product assortment to a single product when U_1 opts for a component strategy is unlikely to affect the profitability of bundling practices. Indeed, if U_1 opts for a component strategy, it can be shown that D selects H instead of HML or HM only when $\frac{1}{8} > \alpha$.

[41] See https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010SC0411&from=EN.

in Remark 1, bundling can also arise when $\Pi^{HL} > \Pi^{M} > \Pi^{H}$. In this case, we may have $CS^{M} > CS^{H}$ which exacerbates the harmful effect of bundling practices on welfare as the product generating both the highest industry profit and consumer surplus is excluded from the market.

5 Alternative microfoundation for NNTR

Throughout this article, we rely on the NNTR bargaining solution to reconsider the Chicago School critique of exclusive dealing and the leverage doctrine in a bargaining context. To motivate this surplus division rule, Ho and Lee (2019) have offered a noncooperative foundation for the NNTR solution which hinges on two key elements. First, the downstream firm can commit to engage in negotiations with a particular network of upstream firms. Second, each delegated agent sent by the downstream firm to negotiate on its behalf is able to go "back and forth" between upstream firms inside and outside its network (thereby playing them off against one another during negotiations). Following the same purpose, we introduce the "Nash-in-Nash with Prior Competition for Slots" (NNPCS) framework in which a downstream firm is auctioning a limited number of slots before negotiating wholesale contracts with upstream firms according to the "Nash-in-Nash" solution.[42] We show that the NNPCS provides an alternative microfoundation for the NNTR solution.

For the sake of exposition, we consider the same market structure as in Section 2 where U_1 and U_2 supply products H and M respectively.[43] To distribute these products on the market, D has a stocking capacity of either one or two slots.[44] In addition to Assumptions A1 and A2, we consider the following sequence of decisions. In an *ex ante* stage (Stage 0), a restriction on D's stocking capacity may be required. This restriction can either result from an exclusive dealing requirement or from D's decision to reduce its stocking capacity to one slot. Subsequently, firms behave according to the NNPCS

[42] It is worth noticing that this framework is closely related to Marx and Shaffer (2010*b*). However, in contrast to us, they consider that bilateral negotiations take place sequentially.

[43] Considering a more sophisticated market structure as in Section 3 does not affect the analysis. We refer to a previous version of this article for further details (see Chambolle and Molina, 2020).

[44] As in Marx and Shaffer (2010*b*), we consider that the sale of a product requires exactly one slot (that is, a slot enables a manufacturer to satisfy any amount of consumer demand for its product).

model which can be described by the following three-stage game:

- Stage 1: If a restriction on D's stocking capacity is required U_1 and U_2 simultaneously offer slotting fees (non-negative lump sump payments) to secure this slot and D selects either H or M.[45] Absent any restriction, there is no competition for slots and D selects HM.
- Stages 2 and 3 remain as in Section 2.

Competition for slots and bargaining protocol. As pointed out by the Federal Trade Commission (2001), slotting fees: "may serve as devices for retailers to auction their shelf space and efficiently determine its highest-valued use." The "auction" for slots conducted by D in stage 1 is modelled as an asymmetric Bertrand competition, which is known to have a multiplicity of Nash equilibria. To select among equilibria, we rely on Selten's (1975) concept of trembling hand perfection. Furthermore, we use the "Nash-in-Nash" bargaining solution to determine terms of trade in stage 2.

Solving for the above NNPCS model yields the following proposition:

Proposition 3 *The equilibrium surplus division in the NNPCS model coincides with the NNTR bargaining solution.*

The intuition for this result is as follows. Absent any restriction on D's stocking capacity, there is no competition for slots and D selects HM. Similar to the NNTR solution when all upstream firms are included in the downstream firm's network, the NNPCS yields here the same surplus division as the "Nash-in-Nash" bargaining solution. In contrast, when a restriction reduces D's assortment to one product, D is able to exploit the scarcity of its slot by threatening each manufacturer of replacement with the other. Two key features of the NNPCS model are worth mentioning here. First, D always selects the product that generates the highest industry profit (here H).[46] This efficiency result provides theoretical grounds for the stability condition required

[45] Slotting fees are used here in their broad sense. As mentioned by the Federal Trade Commission (2003), researchers use the term "slotting fees" to describe both "introduction fees" which are paid for new products and "pay-to-stay fees" which are paid to maintain shelf presence for continuing products.

[46] The intuition is that the manufacturer of the most efficient product is always able to offer a mutually profitable transfer, through a slotting fee, such that D selects its product.

in the NNTR solution. Second, when replacement threats are credible to exercise, the manufacturer of the most efficient product offers a strictly positive slotting fee to secure D's unique slot. This reduces the total amount paid by D to the manufacturer and yields the same surplus division as the NNTR solution. Hence, leveraging on recent microfoundations for the "Nash-in-Nash" solution (Collard-Wexler, Gowrisankaran and Lee, 2019; Rey and Vergé, 2020), Proposition 3 implies that the NNPCS model provides a noncooperative foundation for the NNTR solution. This result sheds new light on the threats of replacement exercised by the retailer in the NNTR solution, especially in explaining why the retailer can threaten its upstream trading partner to deal with an excluded alternative one at its reservation price.

We now provide computation details for Proposition 3. First, as already discussed in Section 2.1, bilateral efficiency prevails implying that stages 2 and 3 can be gathered in a unique stage where each pair $D-U_i$ bargains over a fixed fee to divide the integrated industry profit. When no restriction on D's stocking capacity is required, a slot is available for each product and manufacturers do not offer any slotting fees. In this case, D selects the assortment HM and the equilibrium profit of firms is determined according to the "Nash-in-Nash" bargaining solution as in (3). When a restriction is required, either H or M is offered on the market. In stage 2, D thus engages in only one bilateral negotiation with U_i for product X and the corresponding fixed fee is determined according to the following Nash bargaining solution:

$$\max_{\hat{F}_i^X} \left(\Pi^X - \hat{F}_i^X\right)^{\alpha} \left(\hat{F}_i^X\right)^{1-\alpha} \tag{11}$$

where the gains from trade of D and U_i are $\Pi^X - \hat{F}_i^X$ and $\hat{F}_i^X$ respectively. From (11), we find that the surplus obtained by U_i and D from this bilateral negotiation is respectively given by $\hat{\pi}_i^X = (1-\alpha)\Pi^X (= \hat{F}_i^X)$ and $\hat{\pi}_D^X = \alpha \Pi^X$. In stage 1, D plays off manufacturers against each other offering them to compete for its unique available slot. To secure this slot, each manufacturer can at most offer what it would gain from trading with D, that is $\hat{\pi}_1^H$ for U_1 and $\hat{\pi}_2^M$ for U_2. As $\hat{\pi}_D^H + \hat{\pi}_1^H > \hat{\pi}_D^M + \hat{\pi}_2^M \Leftrightarrow \Pi^H > \Pi^M$, U_1 can always offer a slotting fee to secure D's slot for H. Given that U_2 can offer at most a slotting fee equals to $S_2 = \hat{\pi}_2^M$, U_1's slotting fee is such that D is indifferent between selecting

H or replacing it with M (at U_2's highest slotting fee), that is $\hat{\pi}_D^H + S_1 = \hat{\pi}_D^M + \hat{\pi}_2^M \Leftrightarrow S_1 = \max\{\Pi^M - \alpha\Pi^H, 0\}$.[47] U_1's slotting fee is thus equivalent to a compensation paid to D for not selling M instead of H. As described in Section 2, the amount of this compensation hinges on D's credibility to threaten H of replacement with M, implying that U_1 offers a positive slotting fee only to the extent that D is a weak bargainer (that is, $\alpha_C > \alpha$). Combining the outcome of stages 1 and 2, we obtain that D distributes H and the division of surplus is similar to the NNTR solution given in (5). Based on Proposition 3, we obtain the following corollary:

Corollary 4 *Under the NNPCS model, exclusive dealing is profitable for U_1 when $\alpha > \alpha_{ED}$ whereas D profitably narrows its product assortment when $\alpha_D > \alpha$.*

Our exclusionary mechanism is well suited to industries in which a downstream firm plays off upstream manufacturers against one another by going "back and forth" between them during negotiations as, for instance, in the health care sector (Ho and Lee, 2019). Corollary 4 further shows that it can also apply to markets in which firms behave according to the NNPCS framework. For instance, this reflects well the conduct of firms in the retail industry where manufacturers frequently provide retailers with upfront payments for the carriage of their products.[48] Hence, in addition to offering a new theoretical foundation for the NNTR solution, the NNPCS framework developed in this section extends the scope of our exclusionary mechanism to industries where upfront payments (e.g., slotting fees) are prevalent.[49]

6 Conclusion

This article offers a unified theory to the analysis of exclusive dealing and exclusionary bundling. We consider a framework with two competing manufacturers which interact

[47] While there exist other pure-strategy Nash equilibria, we show in Appendix E that they are not trembling-hand perfect.

[48] For instance, Hristakeva (2020) estimate that such payments correspond to 20 percent of retailers' variables profits in the U.S. grocery yogurt market. Elberg and Noton (2021) also provide empirical evidence on the substantial magnitude of upfront payments in the Chilean supermarket industry.

[49] For instance, our "leverage theory" of bundling fits particularly well with the EC claim that "making the supply of the strongest TCCC brands conditional upon the purchase of less-selling Carbonated Soft Drinks (CSDs) and non-CSDs [...] has the effect of making sales space in outlets harder to obtain for rival suppliers and of raising sale space prices for those suppliers."

with a powerful retailer in a two-stage game. First, manufacturers choose whether or not to impose a vertical restriction on the retailer's purchases (i.e., exclusive dealing or bundling) which then selects its product assortment accordingly. Second, trade takes place following the "Nash-in-Nash with Threat of Replacement" bargaining protocol à la Ho and Lee (2019). We show that the presence of buyer power allows the emergence of exclusive dealing and bundling, which leads to the exclusion of an efficient rival manufacturer at the expense of the retailer, the industry profit, and consumers. Our main contribution is thus to provide a unifying framework which, through a single parameter capturing the retailer's buyer power, either supports or rejects the Chicago School argument for both exclusive dealing and bundling practices.

From a competition policy perspective, our theory highlights that a large buyer power which countervails the exercise of upstream market power paradoxically favors the emergence of anticompetitive practices by manufacturers. This results sharply contrasts with the classic competition policy view on the procompetitive effects of buyer power as stated, for instance, in the EU guidelines on vertical restraints. More generally, our article provides guidance for the antitrust treatment of buyer power which has become a major issue these last decades.

Finally, we introduce a game-theoretic framework, referred to as "Nash-in-Nash with Prior Competition for Slots" (NNPCS), in which manufacturers compete for getting access to the retailer's limited number of slots before bargaining takes place. We argue that the NNPCS offers a new noncooperative foundation for the NNTR solution as well as a tractable building block which provides interesting perspectives for future research (e.g., downstream competition, multi-product bilateral oligopoly).

Appendix

A Proof of Proposition 1 and 2: Exclusive dealing and bundling harm the downstream firm

This section shows that D is always harmed whenever U_1 imposes a bundling or an exclusive dealing restriction. We demonstrate that U_1 and D always bargain to share a (weakly) lower joint profit under exclusive dealing or bundling. As a result, whenever exclusive dealing or bundling is profitable for U_1, it must be to the detriment of D.

Exclusive dealing. Absent exclusive dealing, the amount of surplus divided between D and U_1 is given by $\Pi^{HM} - F_2^{HM} = \alpha\Pi^{HM} + (1-\alpha)\Pi^H$. Under exclusive dealing, this surplus equals Π^H. By Assumption A1, we obtain that the surplus shared between D and U_1 is strictly lower under exclusive dealing.

Bundling. When U_1 chooses a component selling strategy, the amount of surplus divided between D and U_1 is given by $\Pi^{HM} - \tilde{F}_2^{HM} = \alpha\Pi^{HM} + (1-\alpha)\Pi^H$ if $\alpha > \frac{\Pi^{HL}-\Pi^H}{\Pi^{HM}-\Pi^H}$ and $\Pi^{HM} - \tilde{F}_2^{HM} = \Pi^{HL}$ otherwise. When U_1 chooses instead a bundling strategy, this surplus equals Π^{HL}. If $\frac{\Pi^{HL}-\Pi^H}{\Pi^{HM}-\Pi^H} > \alpha$, the surplus shared between D and U_1 is not affected by U_1's selling strategy. If $\alpha > \frac{\Pi^{HL}-\Pi^H}{\Pi^{HM}-\Pi^H}$, the surplus shared between D and U_1 is strictly lower when U_1 chooses a bundling strategy if $\alpha\left(\Pi^{HM} - \Pi^H\right) + \Pi^H - \Pi^{HL} > 0$. By Assumption A1', it can be shown that this condition is satisfied when $\alpha = 1$ and $\alpha = \alpha_B$. Furthermore, as $\alpha\left(\Pi^{HM} - \Pi^H\right) + \Pi^H - \Pi^{HL}$ is strictly increasing in α, the condition holds for $1 \geq \alpha \geq \alpha_B$.

B Proof of Remark 1

In this section, we prove that Proposition 2 holds if Assumption A1' is replaced by $\Pi^{HL} > \Pi^M > \Pi^H > \Pi^L > 0$. To this end, we first show that bargaining outcomes determined by (6), (7), and (9) are unaffected. As previously discussed, two conditions are required for applying the NTTR solution to these bilateral negotiations: (i) firms involved in each negotiation have positive gains from trade taking as given their other agreements (if any), (ii) each product for which the tariff is negotiated generates a higher bilateral surplus than any product used by D as a replacement threat taking as given all other agreements (if any).

Under the negotiation described by (6), the first condition requires that $\Pi^{HM} > \Pi^H$ and $\Pi^{HL} > \Pi^H$ (Assumption A2') and the second condition requires that $\Pi^{HM} > \Pi^{HL}$ (second part of Assumption A1'). Similarly, under the negotiation described by (7) in which no replacement threat is exercised, the first condition requires that $\Pi^{HM} > \Pi^{M}$ (Assumption A2'). Finally, under the negotiation described by (9), the first condition requires that $\Pi^{HL} > 0$ and $\Pi^{M} > 0$ and the second condition requires $\Pi^{HL} > \Pi^{M}$ (second part of Assumption A1' and Assumption A2'). Hence, replacing A1' by Assumption does not affect any bargaining outcome.

Furthermore, from the comparison of U_1's profit in (8) and (10), Proposition 2 requires that $\Pi^{HM} > \Pi^{HL}$ (second part of Assumption A1') and $\Pi^{HM} > \Pi^{M}$ (Assumption A2'). Consequently, relaxing the first part of Assumption A1' by using the weaker condition on M's surplus $\Pi^{HL} > \Pi^{M} > \Pi^{H} > \Pi^{L} > 0$ does not affect any of our results.

C Proof of Remark 2: Bundling of complementary products

In this section, we show that bundling may arise in equilibrium when M and L are complements to H. To this end, let us keep Assumption A1' unchanged and modify Assumption A2' as follows:

Assumption A2" *Products M and L are imperfect complements to H and independent or imperfect substitutes to each other:*

$$\Pi^{HX} > \Pi^{H} + \Pi^{X} > \Pi^{H} \text{ with } X \in \{M, L\}$$
$$\Pi^{M} + \Pi^{L} \geq \Pi^{ML} > \Pi^{M}$$

Moreover, we introduce the following restriction on the form of product complementarity:

Assumption A3" *The complementarity between products H and M is limited as follows:*

$$\Pi^{HL} + \Pi^{M} \geq \Pi^{HM}$$

The presence of complementarity across products implies that the marginal contribution of a manufacturer's product to the industry profit is greater when other agreements have been formed (e.g., $\Pi^{HM} - \Pi^{M} > \Pi^{H}$). As highlighted in Collard-Wexler, Gowrisankaran and Lee (2019), this may prevent the existence of an equilibrium in which all agreements are formed at tariffs determined by the "Nash-in-Nash" solution because some agreements would be rejected.[50] Indeed, as shown below in the component strategy case, D may have an incentive to reject one of its agreement at the NNTR tariffs. By limiting the form of complementarity between products, Assumption A3" plays the same role as the fea-

[50] More precisely, this violates the weak conditional decreasing marginal contribution assumption of Collard-Wexler, Gowrisankaran and Lee (2019).

sibility assumption in Collard-Wexler, Gowrisankaran and Lee (2019) and ensures that D always prefers maintaining all of its agreements at the NNTR tariffs.

As in Section 3, we solve the subgames in which U_1 chooses a component and a bundling strategy before analyzing the profitability of bundling.

Component strategy. Consider first the case in which U_1 chooses a component strategy, implying that D may either select the assortment HM, HL, or ML. The use of Assumption A2" instead of Assumption A2' does not affect the result that HM is the unique stable product assortment (see Appendix B for a detailed discussion on the stability conditions in this case). Hence, D always engages in bilateral negotiations with U_2 for M and U_1 for H when the latter chooses a component selling strategy. These negotiations are determined by the NNTR solution as in (6) and (7) respectively, implying that the surplus division is similar to (8). However, the fact that the marginal contribution of H (resp., M) to the industry profit is greater when M (resp., H) is also sold (Assumption A2") implies that D may obtain a negative profit. Indeed, (8) shows that $\pi_D^{HM} = \Pi^{HM} - \tilde{F}_1^{HM} - \tilde{F}_2^{HM} = \max\{(2\alpha - 1)\Pi^{HM} + (1-\alpha)\left(\Pi^H + \Pi^M\right), \Pi^{HL} - (1-\alpha)\left(\Pi^{HM} - \Pi^M\right)\}$ which, under Assumptions A1' and A2", is increasing in α (i.e., $\frac{\partial \pi_D^{HM}}{\partial \alpha} > 0$). When $\alpha = 0$, we have that $\pi_D^{HM} = \Pi^{HL} - \Pi^{HM} + \Pi^M$ which may be negative in the presence of a large complementarity between H and M. Thus, by limiting the degree of complementarity, Assumption A3" ensures that D always gets a positive profit from dealing with both U_1 and U_2 at tariffs determined by the NNTR solution.

Bundling strategy. Consider now the case in which U_1 chooses a bundling strategy, implying that D may either select the assortment HL or M. Again, the use of Assumption A2" instead of Assumption A2' does not affect the result that HL is the unique stable product assortment (see also Appendix B). Hence, D always engages in a bilateral negotiation with U_1 for HL when the latter chooses a bundling strategy. Such a negotiation is determined by the NNTR solution as in (9) and the surplus division is similar to (10).

The comparison of U_1's profit in (8) and (10) leads to Proposition 2 in a setting with bundling of complementary products.

D Endogenous product assortment size

In this section, we extend our "leverage theory" of bundling developed in Section 3 by allowing D to strategically expand its product assortment to counteract the harmful effect of U_1's bundling practices (the extension of our exclusive dealing framework developed in Section 2 is entirely treated in Section 4.3).

Consider the same framework as developed in Section 3 with the following three-stage game. In stage 1, U_1 either chooses a component or a bundling strategy. Under bundling, D selects either HML

or HL. Otherwise, D selects either HML or HM. D's product assortment decision is publicly observable, and stages 2 and 3 remain as before. In addition to Assumptions A1' and A2', we assume that the largest industry profit is generated when all products are offered to consumers: $\Pi^{HML} > \Pi^{HM}$.

Component strategy. Consider first that U_1 chooses a component strategy. In this case, D either selects the assortment HML or HM. If D selects HML, it engages in bilateral negotiations with U_1 for HL and U_2 for M, implying that the NNTR solution yields the same outcome as the "Nash-in-Nash" solution. The fixed fee negotiated between D and U_1 is thus determined as follows:

$$\max_{\tilde{F}_1^{HML}} \left(\Pi^{HML} - \tilde{F}_1^{HML} - \tilde{F}_2^{HML} - (\Pi^M - \tilde{F}_2^{HML})\right)^{\alpha} \left(\tilde{F}_1^{HML}\right)^{1-\alpha} \tag{12}$$

where $\Pi^{HML} - \tilde{F}_1^{HML} - \tilde{F}_2^{HML} - (\Pi^M - \tilde{F}_2^{HML})$ and $\tilde{F}_1^{HML}$ correspond to the gains from trade of D and U_1 respectively.[51] Similarly, the fixed fee between D and U_2 is determined as follows:

$$\max_{\tilde{F}_2^{HML}} \left(\Pi^{HML} - \tilde{F}_1^{HML} - \tilde{F}_2^{HML} - (\Pi^{HL} - \tilde{F}_1^{HML})\right)^{\alpha} \left(\tilde{F}_2^{HML}\right)^{1-\alpha} \tag{13}$$

where $\Pi^{HML} - \tilde{F}_1^{HML} - \tilde{F}_2^{HML} - (\Pi^{HL} - \tilde{F}_1^{HML})$ and $\tilde{F}_2^{HML}$ correspond to the gains from trade of D and U_2 respectively. From (12) and (13), we obtain that U_1's fixed fee is $\tilde{F}_1^{HML} = (1-\alpha)\left(\Pi^{HML} - \Pi^M\right)$ and U_2's fixed fee is $\tilde{F}_2^{HML} = (1-\alpha)\left(\Pi^{HML} - \Pi^{HL}\right)$. As a result, the equilibrium profit of D, U_1, and U_2 are respectively given by:

$$\tilde{\pi}_D^{HML} = \Pi^{HML} - \tilde{F}_1^{HML} - \tilde{F}_2^{HML}; \quad \tilde{\pi}_1^{HML} = \tilde{F}_1^{HML}; \quad \tilde{\pi}_2^{HML} = \tilde{F}_2^{HML}. \tag{14}$$

Alternatively, if D selects HM, it engages in bilateral negotiations with U_1 for H and U_2 for M and the equilibrium outcome is given by (8). Comparing D's profit in (8) and (14), we obtain that D selects the assortment HML when $\alpha > \min\{\frac{\Pi^{HL}-\Pi^H}{\Pi^{HM}-\Pi^H}, \tilde{\alpha}'_D\}$ where $\tilde{\alpha}'_D \equiv \frac{\Pi^{HML}-\Pi^{HM}}{2\Pi^{HML}-\Pi^{HL}-\Pi^{HM}}$; otherwise, D selects HM.

Bundling strategy. Consider now that U_1 chooses a bundling strategy. In this case, D either selects the assortment HML or HL. If D selects HML, it engages in bilateral negotiations with U_1 for HL and U_2 for M and the equilibrium outcome is given by (14). Instead, if D selects HL, it engages in a bilateral negotiation with U_1 for HL and the equilibrium outcome is given by (10). Comparing D's profit in (10) and (14), we obtain that D selects the assortment HML when $\alpha > \min\{\tilde{\alpha}_C, \tilde{\alpha}_D\}$ where $\tilde{\alpha}_D \equiv \frac{\Pi^{HML}-\Pi^{HL}}{2\Pi^{HML}-\Pi^{HL}-\Pi^{M}}$; otherwise, D selects HM.

[51] We assume here that there is a unique fixed fee negotiated for both H and L as in the bundling case. An alternative modeling approach would be to consider that D and U_1 engage in two separate and simultaneous negotiations for each product (i.e., each firm sends two delegates to negotiate fixed fees on their behalf). This would imply, however, that U_1 competes against itself, thereby conferring a higher status quo payoff to D which would decrease U_1's profit.

Profitability of bundling. Given D's product assortment choice, we analyze U_1's incentive to bundle its products:

(i) When $\min\{\tilde{\alpha}_C, \tilde{\alpha}_D, \frac{\Pi^{HL}-\Pi^H}{\Pi^{HM}-\Pi^H}, \tilde{\alpha}'_D\} > \alpha$, D selects HM if U_1 chooses a component strategy and HL if U_1 chooses a bundling strategy. Comparing U_1's profit in (8) and(10), we obtain that U_1 chooses a bundling strategy if $\alpha > \alpha_B$.

(ii) When $\min\{\frac{\Pi^{HL}-\Pi^H}{\Pi^{HM}-\Pi^H}, \tilde{\alpha}'_D\} > \alpha > \min\{\tilde{\alpha}_C, \tilde{\alpha}_D\}$, D selects HM if U_1 chooses a component strategy and HML if U_1 chooses a bundling strategy. Comparing U_1's profit in (8) and(14), we obtain that U_1 always chooses a bundling strategy.

(iii) When $\min\{\tilde{\alpha}_C, \tilde{\alpha}_D\} > \alpha > \min\{\frac{\Pi^{HL}-\Pi^H}{\Pi^{HM}-\Pi^H}, \tilde{\alpha}'_D\}$, D selects HML if U_1 chooses a component strategy and HL if U_1 chooses a bundling strategy. Comparing U_1's profit in (10) and(14), U_1 has an incentive to choose a bundling strategy only if $\alpha > \frac{\Pi^{HML}-\Pi^{HL}}{\Pi^{HML}-\Pi^M} > \tilde{\alpha}_D$ which contradicts the initial condition. Hence, when $\min\{\tilde{\alpha}_C, \tilde{\alpha}_D\} > \alpha > \min\{\frac{\Pi^{HL}-\Pi^H}{\Pi^{HM}-\Pi^H}, \tilde{\alpha}'_D\}$, U_1 always chooses a component strategy.

(iv) When $\alpha > \max\{\min\{\tilde{\alpha}_C, \tilde{\alpha}_D\}, \min\{\frac{\Pi^{HL}-\Pi^H}{\Pi^{HM}-\Pi^H}, \tilde{\alpha}'_D\}\}$, D select HML regardless of U_1's selling strategy implying that the latter is indifferent between opting for a component or a bundling strategy.[52]

Given (i) and (ii), bundling arises in equilibrium when $\min\{\frac{\Pi^{HL}-\Pi^H}{\Pi^{HM}-\Pi^H}, \tilde{\alpha}'_D\} > \alpha > \alpha_B$. Moreover, given (i), such a selling strategy excludes U_2 from the market when $\min\{\tilde{\alpha}_C, \tilde{\alpha}_D, \frac{\Pi^{HL}-\Pi^H}{\Pi^{HM}-\Pi^H}, \tilde{\alpha}'_D\} > \alpha > \alpha_B$.

E Multiplicity of equilibria in the NNPCS framework

As previously mentioned, the first stage in the NNPCS framework is modelled as an asymmetric Bertrand competition which has a multiplicity of pure-strategy Nash equilibria. Indeed, it can be shown that D keeps selecting H even if U_2 offers any slotting fee $\check{S}_2 \in]S_2, \hat{\pi}_1^H + \hat{\pi}_D^H - \hat{\pi}_D^M]$ and U_1 offers $\check{S}_1 = \check{S}_2 + \hat{\pi}_D^M - \hat{\pi}_D^H$. However, these alternative equilibria rely on weakly dominated strategies and the equilibrium $S_1 = \max\{\Pi^M - \alpha\Pi^H, 0\}$ and $S_2 = \hat{\pi}_2^M$ can be obtained from the trembling-hand selection criterion.

F Quasi-linear quadratic utility specification

In this section, we show that our illustrative examples developed in Section 2 and 3 can be obtained from a generalized version of the quasi-linear quadratic utility model pioneered by Shubik and Levitan (1980).

[52]Absent any gain from bundling, we consider that U_1 chooses a component strategy as a tie-breaking rule.

Following Choné and Linnemer's (2020) notations, we consider a representative consumer whose utility from consuming $n+1$ products is specified as follows:

$$U(\mathbf{q}, q_0) = \mathbf{a}^\top \mathbf{q} - \frac{1}{2}\mathbf{q}^\top \mathbf{B}\mathbf{q} + q_0 \tag{15}$$

where q_0 is the quantity consumed of the numéraire good, $\mathbf{q}$ is a n-dimensional vector of quantity consumed of each of the n other products, $\mathbf{a}$ is a n-dimensional vector of parameters capturing the marginal quality of each of these products, and $\mathbf{B}$ is a $n \times n$ positive definite matrix of parameters capturing the pattern of substitution among these products. We consider that the diagonal elements of $\mathbf{B}$ equal 1 while the off-diagonal elements equal b_{XY} with $X \neq Y$ (these elements capture the pattern of substitutability and complementarity among products). Based on (15), the representative consumer maximizes his utility of follows:

$$\max_{\mathbf{q}, q_0} U(\mathbf{q}, q_0) \quad \text{such that} \quad \mathbf{p}^\top \mathbf{q} + p_0 q_0 = m \tag{16}$$

where $\mathbf{p}$ is a n-dimensional vector of prices, p_0 is the price of the numéraire that we normalize to 1, and m denotes the consumer's wealth. Alternatively, (16) can be written as: $\max_{\mathbf{q}} U(\mathbf{q}) - \mathbf{p}^\top \mathbf{q} + m$, which yields the following vector of direct demand: $\mathbf{q}(\mathbf{p}) = \mathbf{B}^{-1}(\mathbf{a} - \mathbf{p})$.

Exclusive dealing. In the framework developed in Section 2, there are at most two products offered on the market, that is, either the assortment HM or $X \in \{H, M\}$. Hence, we have $\mathbf{q} = (q_H, q_M)^\top$, $\mathbf{p} = (p_H, p_M)^\top$, $\mathbf{a} = (a_H, a_M)^\top$, and $\mathbf{B} = \begin{pmatrix} 1 & b_{HM} \\ b_{HM} & 1 \end{pmatrix}$ when the assortment HM is offered. Otherwise, we have $\mathbf{q} = q_X$, $\mathbf{p} = p_X$, $\mathbf{a} = a_X$, and $\mathbf{B} = 1$. The vector of direct demand when HM is offered is given by:

$$\begin{pmatrix} q_H \\ q_M \end{pmatrix} = \frac{1}{1 - b_{HM}^2} \begin{pmatrix} a_H - p_H - b_{HM}(a_M - p_M) \\ a_M - p_M - b_{HM}(a_H - p_H) \end{pmatrix}$$

and the direct demand when only $X \in \{H, M\}$ is offered is given by: $q_X = a_X - p_X$. Maximizing $\mathbf{p}^\top \mathbf{q}(\mathbf{p})$ with respect to $\mathbf{p}$, the industry profit is given by $\Pi^{HM} = \frac{a_H^2 - 2b_{HM}a_H a_M + a_M^2}{4 - 4b_{HM}^2}$ when HM is offered and $\Pi^X = \frac{a_X^2}{4}$ when X is offered.[53] The parameter values $b_{HM} = \frac{2\sqrt{3} - \sqrt{2}}{5}$, $a_H = 4$, and $a_M = 2\sqrt{3}$ lead to $\Pi^{HM} = 5$, $\Pi^H = 4$, and $\Pi^M = 3$.

Bundling. In the framework developed in Section 3, there are also at most two products that can be offered on the market: that is, either HM, or HL, or ML, or $X \in \{H, M, L\}$. When either HM or X is offered, the expression for the vector of direct demand and the industry profit are as in the exclusive

[53]Without loss of generality, we set the marginal cost of each product to 0.

dealing framework described above. When YL is offered with $Y \in \{H, M\}$, we have $\mathbf{q} = (q_Y, q_L)^\top$, $\mathbf{p} = (p_Y, p_L)^\top$, $\mathbf{a} = (a_Y, a_L)^\top$, and $\mathbf{B} = \begin{pmatrix} 1 & b_{YL} \\ b_{YL} & 1 \end{pmatrix}$. The vector of direct demand is thus given by:

$$\begin{pmatrix} q_Y \\ q_L \end{pmatrix} = \frac{1}{1 - b_{YL}^2} \begin{pmatrix} a_Y - p_Y - b_{YL}(a_L - p_L) \\ a_L - p_L - b_{YL}(a_Y - p_Y) \end{pmatrix}$$

Maximizing $\mathbf{p}^\top \mathbf{q}(\mathbf{p})$ with respect to $\mathbf{p}$, the industry profit is given by $\Pi^{YL} = \frac{a_Y^2 - 2b_{YL}a_Y a_L + a_L^2}{4 - 4b_{YL}^2}$ when YL is offered. The parameter values $a_H = 4$, $a_M = 2\sqrt{3}$, and $a_L = 2$ lead to $\Pi^H = 4$, $\Pi^M = 3$, and $\Pi^L = 1$. Furthermore, the case of independent products can be obtained by setting $b_{HM} = b_{HL} = b_{ML} = 0$.

References

Aghion, Philippe, and Patrick Bolton. 1987. "Contracts as a Barrier to Entry." *American Economic Review*, 77(3): 388–401.

Bedre-Defolie, Özlem, and Gary Biglaiser. 2017. "Contracts as a Barrier to Entry in Markets with Nonpivotal Buyers." *American Economic Review*, 107(7): 2041–2071.

Bernheim, Douglas B., and Michael D. Whinston. 1985. "Common Marketing Agency as a Device for Facilitating Collusion." *RAND Journal of Economics*, 16(2): 269–281.

Bernheim, Douglas B., and Michael D. Whinston. 1998. "Exclusive Dealing." *Journal of Political Economy*, 106(1): 64–103.

Binmore, Kenneth George. 1985. "Game-Theoretic Models of Bargaining." Chapter 13: Bargaining and coalitions, 269–304. Cambridge University Press.

Binmore, Kenneth George, Avner Shaked, and John Sutton. 1989. "An Outside Option Experiment." *Quarterly Journal of Economics*, 104(4): 753–770.

Bolton, Patrick, and Michael D. Whinston. 1993. "Incomplete Contracts, Vertical Integration, and Supply Assurance." *Review of Economic Studies*, 60(1): 121–148.

Bork, Robert H. 1978. *Antitrust Paradox: A Policy at War With Itself.* Basic Books.

Calzolari, Giacomo, and Vincenzo Denicolò. 2013. "Competition with Exclusive Contracts and Market-Share Discounts." *American Economic Review*, 103(6): 2384–2411.

Calzolari, Giacomo, and Vincenzo Denicolò. 2015. "Exclusive Contracts and Market Dominance." *American Economic Review*, 105(11): 3321–3351.

Calzolari, Giacomo, Vincenzo Denicolò, and Piercarlo Zanchettin. 2020. "The demand-boost theory of exclusive dealing." *RAND Journal of Economics*, 51(3): 713–738.

Carlton, Dennis W., and Michael Waldman. 2002. "The Strategic Use of Tying to Preserve and Create Market Power in Evolving Industries." *RAND Journal of Economics*, 33(2): 194–220.

Carlton, Dennis W., and Michael Waldman. 2012. "Upgrades, Switching Costs and The Leverage Theory of Tying." *Economic Journal*, 122(561): 675–706.

Chambolle, Claire, and Hugo Molina. 2020. "Buyer Power, Upstream Bundling, and Foreclosure." Unpublished. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3511692.

Choi, Jay Pil. 1996. "Preemptive R&D, Rent Dissipation, and the "Leverage Theory"." *Quarterly Journal of Economics*, 111(4): 1153–1181.

Choi, Jay Pil. 2004. "Tying and Innovation: A Dynamic Analysis of Tying Arrangements." *Economic Journal*, 114(492): 83–101.

Choi, Jay Pil. 2006. *Recent Developments in Antitrust: Theory and Evidence.* Vol. 1, The MIT Press.

Choi, Jay Pil, and Christodoulos Stefanadis. 2001. "Tying, Investment, and the Dynamic Leverage Theory." *RAND Journal of Economics*, 32(1): 52–71.

Choi, Jay Pil, and Doh-Shin Jeon. 2021. "A Leverage Theory of Tying in Two-Sided Markets with Non-Negative Price Constraints." *American Economic Journal: Microeconomics*, 13(1): 283–337.

Choné, Philippe, and Laurent Linnemer. 2015. "Nonlinear pricing and exclusion: I. buyer opportunism." *RAND Journal of Economics*, 46(2): 217–240.

Choné, Philippe, and Laurent Linnemer. 2020. "Linear Demand Systems for Differentiated Goods: Overview and User's Guide." *International Journal of Industrial Organization*, 73: 102663.

Collard-Wexler, Allan, Gautam Gowrisankaran, and Robin S. Lee. 2019. ""Nash-in-Nash" Bargaining: A Microfoundation for Applied Work." *Journal of Political Economy*, 127(1): 163–195.

de Cornière, Alexandre, and Greg Taylor. forthcoming. "Upstream Bundling and Leverage of Market Power." *Economic Journal*.

de Fontenay, Catherine C., and Joshua S. Gans. 2014. "Bilateral Bargaining with Externalities." *Journal of Industrial Economics*, 62(4): 756–788.

Elberg, Andrés, and Carlos Noton. 2021. "What Drives Trade Allowances? New Evidence from Actual Payments to a Big-Box Retailer." Unpublished. Available at: `https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3452974`.

Federal Trade Commission. 2001. "Report on the Federal Trade Commission Workshop on Slotting Allowances and Other Marketing Practices in the Grocery Industry." Federal Trade Commission Report.

Federal Trade Commission. 2003. "Slotting Allowances in the Retail Grocery Industry: Selected Case Studies in Five Product Categories." Federal Trade Commission Report.

Fumagalli, Chiara, and Massimo Motta. 2006. "Exclusive Dealing and Entry, when Buyers Compete." *American Economic Review*, 96(3): 785–795.

Fumagalli, Chiara, Massimo Motta, and Claudio Calcagno. 2018. *Exclusionary Practices. The economics of Monopolisation and Abuse of Dominance.* Cambridge University Press.

Ghili, Soheil. 2021. "Network Formation and Bargaining in Vertical Markets: The Case of Narrow Networks in Health Insurance." Unpublished. Available at: `https://sites.google.com/view/soheil-ghili/nfb`.

Greenlee, Patrick, David Reitman, and David S. Sibley. 2008. "An antitrust analysis of bundled loyalty discounts." *International Journal of Industrial Organization*, 26(5): 1132–1152.

Ho, Justin, Katherine Ho, and Julie Holland Mortimer. 2012*a*. "Analyzing the Welfare Impacts of Full-line Forcing Contracts." *Journal of Industrial Economics*, 60(2): 468–498.

Ho, Justin, Katherine Ho, and Julie Holland Mortimer. 2012*b*. "The Use of Full-Line Forcing Contracts in the Video Rental Industry." *American Economic Review*, 102(2): 686–719.

Ho, Katherine, and Robin S. Lee. 2019. "Equilibrium Provider Networks: Bargaining and Exclusion in Health Care Markets." *American Economic Review*, 109(2): 473–522.

Horn, Henrik, and Asher Wolinsky. 1988. "Bilateral Monopolies and Incentives for Merger." *RAND Journal of Economics*, 19(3): 408–419.

Hristakeva, Sylvia. 2020. "Vertical Contracts with Endogenous Product Selection: An Empirical Analysis of Vendor Allowance Contracts." Unpublished. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3506265.

Ide, Enrique, and Juan-Pablo Montero. 2019. "A Theory of Must-Have." Unpublished. Available at: https://sites.google.com/site/jpmontero1812/research/working-papers-and-work-in-progress/Must-have.pdf?attredirects=0&d=1.

Ide, Enrique, Juan-Pablo Montero, and Nicolás Figueroa. 2016. "Discounts as a Barrier to Entry." *American Economic Review*, 106(7): 1849–1877.

Inderst, Roman, and Christian Wey. 2003. "Bargaining, Mergers, and Technology Choice in Bilaterally Oligopolistic Industries." *RAND Journal of Economics*, 34(1): 1–19.

Liebman, Eli. 2018. "Bargaining in Markets with Exclusion: An Analysis of Health Insurance Networks." Unpublished. Available at: https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxlbGlibGllYm1hbnxneDoxMzdlNjg2ZWRhMWVlNzM3.

Manea, Mihai. 2018. "Intermediation and Resale in Networks." *Journal of Political Economy*, 126(3): 1250–1301.

Martimort, David, and Salvatore Piccolo. 2010. "The Strategic Value of Quantity Forcing Contracts." *American Economic Journal: Microeconomics*, 2(1): 204–229.

Marx, Leslie M., and Greg Shaffer. 1999. "Predatory Accommodation: Below-Cost Pricing without Exclusion in Intermediate Goods Markets." *RAND Journal of Economics*, 30(1): 22–43.

Marx, Leslie M., and Greg Shaffer. 2010*a*. "Break-up fees and bargaining power in sequential contracting." *International Journal of Industrial Organization*, 28(5): 451–463.

Marx, Leslie M., and Greg Shaffer. 2010*b*. "Slotting Allowances and Scarce Shelf Space." *Journal of Economics & Management Strategy*, 19(3): 575–603.

Mathewson, G. Frank, and Ralph A. Winter. 1987. "The Competitive Effects of Vertical Agreements: Comment." *American Economic Review*, 77(5): 1057–1062.

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

Miklós-Thal, Jeanine, and Greg Shaffer. 2016. "Naked Exclusion with Private Offers." *American Economic Journal: Microeconomics*, 8(4): 174–194.

Montez, João V. 2007. "Downstream mergers and producer's capacity choice: why bake a larger pie when getting a smaller slice?" *RAND Journal of Economics*, 38(4): 948–966.

Nalebuff, Barry. 2004. "Bundling as an Entry Barrier." *Quarterly Journal of Economics*, 119(1): 159–187.

Nocke, Volker, and Patrick Rey. 2018. "Exclusive dealing and vertical integration in interlocking relationships." *Journal of Economic Theory*, 177: 183–221.

O'Brien, Daniel P., and Greg Shaffer. 2005. "Bargaining, Bundling, and Clout: The Portfolio Effects of Horizontal Mergers." *RAND Journal of Economics*, 36(3): 573–595.

Peitz, Martin. 2008. "Bundling may blockade entry." *International Journal of Industrial Organization*, 16(1): 41–58.

Posner, Richard A. 1976. *Antitrust Law: An Economic Perspective.* University of Chicago Press.

Rasmusen, Eric B., J. Mark Ramseyer, and John S. Jr. Wiley. 1991. "Naked Exclusion." *American Economic Review*, 81(5): 1137–1145.

Rey, Patrick, and Jean Tirole. 1986. "The Logic of Vertical Restraints." *American Economic Review*, 76(5): 921–939.

Rey, Patrick, and Joseph Stiglitz. 1995. "The Role of Exclusive Territories in Producers' Competition." *RAND Journal of Economics*, 26(3): 431–451.

Rey, Patrick, and Thibaud Vergé. 2008. "Economics of Vertical Restraints." In *Handbook of Antitrust Economics*. 353–390. MIT Press.

Rey, Patrick, and Thibaud Vergé. 2020. "Secret contracting in multilateral relations." Unpublished. Available at: https://www.tse-fr.eu/sites/default/files/TSE/documents/doc/by/rey/744_version2020.pdf.

Segal, Ilya R., and Michael D. Whinston. 2000. "Naked Exclusion: Comment." *American Economic Review*, 90(1): 296–309.

Selten, Reinhard. 1975. "Reexamination of the Perfect Concept for Equilibrium Points in Extensive Games." *International Journal of Game Theory*, 4(1): 25–55.

Shaked, Avner, and John Sutton. 1984. "Involuntary Unemployment as a Perfect Equilibrium in a Bargaining Model." *Econometrica*, 52(6): 1351–1364.

Shubik, Martin, and Richard Levitan. 1980. *Market Structure and Behavior.* Harvard University Press.

Simpson, John, and Abraham L. Wickelgren. 2007. "Naked Exclusion, Efficient Breach, and Downstream Competition." *American Economic Review*, 97(4): 1305–1320.

Spier, Kathryn E., and Michael D. Whinston. 1995. "On the Efficiency of Privately Stipulated Damages for Breach of Contract: Entry Barriers, Reliance, and Renegotiation." *RAND Journal of Economics*, 26(2): 180–202.

Stole, Lars A., and Jeffrey Zwiebel. 1996. "Intra-firm Bargaining under Non-binding Contracts." *Review of Economic Studies*, 63(3): 375–410.

Whinston, Michael D. 1990. "Tying, Foreclosure, and Exclusion." *American Economic Review*, 80(4): 837–859.

Whinston, Michael D. 2001. "Exclusivity and Tying in U.S. v. Microsoft: What We Know, and Don't Know." *Journal of Economic Perspectives*, 15(2): 63–80.

Wright, Julian. 2009. "Exclusive Dealing and Entry, when Buyers Compete: Comment." *American Economic Review*, 99(3): 1070–1081.