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Monopolization with Must-Haves[†]

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An increasing number of monopolization cases have been constructed around the notion of "must-have" items: products that distributors must carry to "compete effectively." Motivated by these cases, we consider a multiproduct setting where upstream suppliers sell their products through competing distributors offering one-stop-shopping convenience to consumers. We show the emergence of products that distributors cannot afford not to carry if their rivals do. A supplier of such products can exploit this must-have property, along with tying and exclusivity provisions, to monopolize adjacent, otherwise-competitive markets. Policy interventions that ban tying or exclusivity provisions may prove ineffective or even backfire. (*JEL* D43, K21, L13, L14, L42, L81)

In recent years, an increasing number of monopolization cases have been constructed around the notion of "must-have" items. This is a notion often mentioned in cases without proper economic definition,[1] but it is informally understood as products that distributors must carry to "compete effectively" in the marketplace (Federal Communication Commision 2015; Chipty 2016, *Sidibe v. Sutter Health*[2]).

In *Cablevision v. Viacom*,[3] for example, Cablevision, a multichannel video programming distributor (MVPD), accused Viacom, a major producer of media content and entertainment, of tying its highly popular networks (e.g., Nickelodeon, Comedy Central) with less popular networks, allegedly curtailing the ability of Cablevision to incorporate more valuable programming for consumers. A key component of the claim was that Viacom's popular networks constituted a must-have (p. 2):

> Cablevision operates in an intensely competitive environment against both established and new distributors of video services. If Cablevision's video

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[1] As Steuer (2017, 448) puts it, "the standard employed for determining 'musthavedness' sometimes is not much more exacting than the 'I know it when I see it' test."

[2] *Sidibe v. Sutter Health*, Case No. 12-cv-04854-LB (N.D. Cal. August 30, 2019).

[3] *Cablevision Systems Corp. v. Viacom International Inc.*, Civil Action No. 13 CIV 1278 (LTS) (JLC), 2013.

> product offerings did not include Viacom's tying networks, a substantial number of subscribers would likely abandon (or refuse to consider) Cablevision and instead choose to receive video services from one of Cablevision's numerous competitors.

Similar considerations have been raised in cases pertaining to other markets. For example, in *LePage's Inc. v. 3M*,[4] it was argued that "Scotch-brand tape is indispensable to any retailer," and in *Sidibe v. Sutter Health*, it was argued that "health plans … *must* include those Sutter hospitals … to assemble health-insurance products that are commercially marketable" (emphasis added). The logic behind all these monopolization cases is essentially the same. Suppliers of these so-called must-have items can use them—in combination with exclusivity and tying arrangements—as leverage to force retailers not to carry the products of rival suppliers. The result is less competition upstream, translating into higher prices for consumers.[5]

Two features make these monopolization cases particularly interesting. First, they have arisen in markets featuring a specific set of conditions: (i) final consumers are usually interested in multiple unrelated products (e.g., different TV channels, a basket of various groceries, health insurance covering different types of care); (ii) upstream suppliers (e.g., content producers, consumer goods manufacturers, and healthcare providers) do not reach these consumers directly but rather indirectly through multiproduct distributors that compete intensely downstream (e.g., MVPDs, grocery retailers, health insurance companies); and (iii) final consumers, for the most part, buy everything from a single distributor (i.e., they one-stop shop).[6]

Second, although useful in many antitrust contexts, existing theories of monopolization (e.g., Whinston 1990; Nalebuff 2004; Greenlee, Reitman, and Sibley 2008; Calzolari, Denicolò, and Zanchettin 2020; de Cornière and Taylor 2021; Chambolle and Molina 2023) provide a poor fit to cases of must-haves. For instance, central to Whinston's (1990) theory of tying and Nalebuff's (2004) theory of bundling is the presence of scale economies (in this case, at the upstream level). However, in none of the existing cases have plaintiffs argued that the anticompetitive nature of must-haves emanates from the presence of scale economies.[7]

Given the lack of any formal theory that could guide us through such cases, in this paper, we build a model with market conditions (i), (ii), and (iii) to study whether monopolization claims involving these so-called must-have items are theoretically sound. Interestingly, we show the emergence of products that a distributor cannot afford not to carry if its rivals carry them. A supplier of such products can then

[4] *LePage's Inc. v. 3M*, 324 F.3d 141 (3rd Cir. 2003).

[5] For example, in *Sidibe v. Sutter Health*, "[The plaintiffs allege that] by tying its hospitals … to its 'must have' hospitals … Sutter forecloses competition by other hospitals. … Health plans [then] have to pay Sutter supra-competitive prices and then, in turn, pass on those costs through to their customers in the form of higher premiums."

[6] There are numerous papers documenting one-stop shopping in different markets. For example, Thomassen et al. (2017) provide a recent example in grocery retailing.

[7] Similarly, key to the theories of Greenlee, Reitman, and Sibley (2008); Calzolari, Denicolò, and Zanchettin (2020); and de Cornière and Taylor (2021) is the presence of contractual frictions at the wholesale level leading to double marginalization. However, the literature has well established that the extent of double marginalization due to such contractual frictions disappears as downstream competition intensifies.

exploit this "must-have" property, along with tying and exclusivity provisions, to monopolize an adjacent, otherwise-competitive market.

Our baseline setting of Section I considers two products, *A* and *B*, and two upstream suppliers, *M* and a competitive fringe of producers. While *M* is the sole supplier of *A*, *M* faces competition from the fringe in product *B*. Both *M* and the fringe, however, reach final consumers only indirectly, through competing distributors that set retail prices. Consumers are interested in both products and engage in one-stop shopping—i.e., they visit at most a single distributor. Finally, while the fringe always offers *B* at cost, *M* makes two-part tariff offers that may include tying and/or exclusivity provisions.[8]

In such a setting, we show that by tying *A* to *B* and imposing exclusives on *B*, *M* can force distributors to accept a more expensive offer for *B* than that of the fringe. This leads to higher retail prices downstream, harming consumers. Intuitively, not carrying *A* when rival distributors do puts a distributor in a weaker competitive position, as consumers no longer enjoy the surplus from *A* when visiting that distributor. It is in this sense that *A* is required to "compete effectively" in the downstream market. Ultimately, this is what *M* uses as leverage to force distributors not to take the fringe's cheaper offer for *B* from the fringe.

As is evident from the previous argument, the surplus that consumers obtain from purchasing *A* plays a prominent role in *M*'s monopolization strategy. Indeed, the higher this surplus is, the more pronounced is the loss in relative quality, or "vertical differentiation disadvantage," experienced by a distributor that does not carry *A* against rivals that do.

This insight serves to convey two messages. First, it clarifies what drives *M*'s monopolization mechanism: *M indirectly* exploits the surplus that *distributors cannot extract from consumers* in product *A* to induce distributors not to take the offer from the fringe. This is done by exploiting shifts in consumer traffic suffered by distributors that lose *A* against rivals that do not.[9] The second message is that not all monopoly products are created equal in terms of leverage (or, more appropriately, "musthavedness"). For instance, when *A*'s demand is highly concave (i.e., rectangular shaped), *M* finds it optimal to extract most of the surplus in its monopoly product *A* rather than to monopolize *B*.

In addition to this nonextractable surplus in *A*, our theory of must-haves relies on three key ingredients: market power on *A*, downstream competition, and one-stop shopping. Without any of them, losing a product does not create vertical differentiation among distributors. In such circumstances, we show that *M* cannot obtain more than the monopoly profit of *A*, i.e., the single-monopoly profit theory holds.

Finally, we consider the consumer welfare implications of various antitrust interventions. For instance, one can imagine that policies that ban tying or exclusivity provisions might dismantle the must-have mechanism, leading to lower retail prices

[8] We assume that *M* can include fixed fees in its offers to show that upstream contractual frictions are not strictly necessary for our monopolization mechanism. However, as we show in Section IV and in the online Appendix, our results remained unchanged in the presence of upstream contractual frictions.

[9] It is important to highlight that this nonextractable surplus in *A* is not explained by contractual frictions between *M* and the distributors (note that fixed fees are available); rather, it remains in the hands of consumers, as distributors compete in prices and demands are downward sloping.

and benefiting all consumers. Interestingly, we show that such interventions may prove ineffective or even backfire.

Indeed, when downstream competition is very intense, *M* can virtually replicate the same monopolization outcome without the need for tying or exclusivity provisions by refusing to deal with all distributors but one. Moreover, when competition is less intense, there are instances in which the equilibrium without tying or exclusives can result in lower overall consumer welfare. This is because *M*, again, has incentives to follow a refusal-to-deal strategy, which forces some consumers to move away from their preferred distributor.

Motivated by these disappointing outcomes, we characterize a "robust antitrust intervention": one that leaves all consumers better off under all circumstances. This intervention involves combining a ban on either tying or exclusives with a prohibition on distributor discrimination and refusal to deal. Whether this can be implemented and enforced in practice is certainly open to debate, as it would require empowering antitrust agencies with the type of information and enforcement capabilities usually associated with regulators. However, we believe it is an important benchmark to keep in mind: it tells us what is potentially achievable in this setting and how much is required to achieve this outcome.

Related Literature.— Our aim in this paper is to develop a new theory of monopolization that better fits market conditions observed in the many cases where the notion of must-have items has emerged. With this goal in mind, we contribute in two ways. First, we document a new monopolization mechanism distinct from previous theories that leads to new (and sometimes unexpected) policy implications. Second, we provide a formal notion of must-haves, clarifying when and why must-haves emerge and their implications for antitrust policy. We discuss the literature related to these contributions here.

Our paper is related to the literature studying monopolization and foreclosure in the context of downstream competition (see, e.g., Simpson and Wickelgren 2007; Abito and Wright 2008; Asker and Bar-Isaac 2014).[10] This is one of the families of anticompetitive exclusive-dealing models where the Chicago critique fails—in this case in particular because competing distributors do not internalize the horizontal externalities that they inflict on each other.[11]

However, the previous literature has focused exclusively on single-product environments.[12] Hence, neither the concept of a must-have nor the idea of exploiting it to monopolize an adjacent market have come up. Furthermore, once we move to a

[10] This literature was initiated by Fumagalli and Motta (2006), who first established that intense downstream competition made foreclosure based on scale economies less likely. The subsequent literature has shown, however, that downstream competition might invalidate the Chicago critique by other means.

[11] See Ide, Montero, and Figueroa (2016) and Fumagalli, Motta, and Calcagno (2018) for an overview of the different families of models pertaining to the literature on monopolization and foreclosure.

[12] One exception is the recent work by de Cornière and Taylor (2024), who also show that upstream tying can be used to monopolize an adjacent market in the presence of downstream competition. Their mechanism, however, is very different from ours. It relies on private offers and on the fact that the multiproduct supplier cannot credibly commit to licensing its monopoly technology to a single downstream competitor. In such a setting, a public commitment to offering the monopoly technology in a pure bundle to everyone can become profitable for the multiproduct supplier, although inefficient for the industry as a whole.

multiproduct environment with one-stop shopping, the implications of various antitrust interventions change dramatically.[13]

Our theory is also related to the "naked exclusion" models of foreclosure (Rasmusen, Ramseyer, and Wiley 1991; Segal and Whinston 2000). As in those articles, in our setting, there are "contractual externalities over nontraders" (Segal 1999): a distributor signing with *M* negatively impacts the reservation payoffs of all the other distributors in their negotiations with *M*. This is the reason a distributor is more inclined to accept *M*'s tying-exclusive contracts when other distributors do the same.

However, the source of the externality over nontraders is different in our setting. While, in the naked-exclusion models, the externality arises due to the presence of scale economies at the upstream level, in our setting it appears due to economies of scope generated by downstream competition and one-stop shopping at the retail level.

Our theory of must-haves also shares with Greenlee, Reitman, and Sibley (2008); Calzolari, Denicolò, and Zanchettin (2020); and de Cornière and Taylor (2021) the idea of exploiting a nonextractable surplus in one market to monopolize an adjacent, otherwise-competitive market. However, there are important differences between our theory and theirs. From a conceptual point of view, all those articles assume that the nonextractable surplus arises due to upstream contractual frictions and is in the hands of distributors, which do not compete but are local monopolies. As we mentioned above, this is not consistent with the actual cases involving must-haves, where competition among distributors is intense.[14]

In contrast, in our setting, bilateral contractual frictions are not strictly needed. Furthermore, the nonextractable surplus is in the hands of final consumers, not distributors. This implies that *M* does not directly leverage the surplus itself, as in those theories, but does so indirectly through the changes in consumer traffic it creates.

Our notion of must-have—that of a product required to compete effectively—fits many antitrust cases. However, it is not the only notion advanced in the antitrust arena. Two alternative notions are worth discussing.

One is the idea of must-have as market power: a must-have is a product that is highly preferred by many consumers or that can only be supplied in large quantities by a dominant supplier (European Commission 2009).[15] This alternative notion is clearly related to ours: if distributors can easily substitute a product, its removal from a distributor's lineup does not cause any vertical differentiation among distributors. However, it yields different policy implications when applied to our setting, where market power is necessary but not sufficient for leverage/musthavedness.

The other notion is that of an "essential facility," an input without which a distributor cannot operate downstream. As stated by Fumagalli, Motta, and Calcagno (2018, 471–472), this notion has the problem that "the very definition of an essential

[13] For instance, in our setting, a ban on exclusives might prompt an upstream supplier to refuse to deal with some distributors, which, to our knowledge, does not occur in single-product environments.

[14] Choi and Jeon (2021) rely on a similar idea, but in the context of two-sided markets. In their paper, the nonextractable surplus arises from the impossibility of charging negative prices.

[15] See Choné and Linnemer (2016) for a foreclosure model based on this notion. They extend Aghion and Bolton's (1987) model by assuming that a distributor's demand can be split into contestable and noncontestable portions. They show that foreclosure of the contestable portion arises in equilibrium when its size is uncertain, and the dominant supplier can include ex ante (i.e., before the arrival of the rival supplier) transfers in its pricing schedule.

facility is fraught with difficulty and most attempts end up in tautological or circular definitions." One may view our theory as offering a formal theory of an essential facility under certain circumstances—i.e., when downstream competition is sufficiently intense and consumers engage in one-stop shopping. The converse, however, is not true: if a local monopoly distributor is unable to operate without an input, that does not make it a must-have according to our theory, since losing a product does not affect the relative competitive position of distributors when the latter do not compete.

The rest of the paper is organized as follows. We present our baseline model in Section I. We use Sections II–IV to show that the results of the baseline model remain qualitatively unchanged to several extensions. Some of these extensions add results that cannot be seen from the baseline model. We close with further policy implications and avenues for future research in Section V. The Appendix contains proofs of propositions associated with the baseline model. The remaining proofs and additional extensions can be found in the online Appendix.

I. A Simple Model

In this section, we explain our main results by using the simplest possible setting. In Sections II–IV, we relax many of the simplifying assumptions of this simple model and show that our results remain unchanged.

A. *The Workings of a Must-Have*

To understand our theory of must-haves, it is convenient to begin by considering a single-product environment. Suppose there is a large upstream manufacturer, labeled M, producing a single product, product B, at a constant marginal cost $c_B \geq 0$. This manufacturer faces competition from a fringe of competitive suppliers that are equally efficient in the production of B.

There is also a unit mass of final consumers, each of whom buys $Q_B(p_B)$ units of B when its price is p_B. We assume that $Q_B(p_B)$ is differentiable, downward sloping, and such that $\pi_B(p_B; c_B) \equiv (p_B - c_B)Q_B(p_B)$ is strictly quasiconcave and is maximized at the single-product monopoly price $p_B^m > c_B$. Upstream suppliers, however, reach final consumers only indirectly through two undifferentiated (i.e., Bertrand) distributors, D_1 and D_2, that compete by setting prices.[16] These distributors have no operating costs beyond purchasing the products from suppliers.[17]

When dealing with distributors, M offers two-part tariff contracts, which may include exclusivity provisions. That is, M offers contracts of the form (w_{Bi}, T_{Bi}, e_i) to $i = 1,2$, where $w_{Bi} \in \mathbb{R}_+$ is the per-unit wholesale price, $T_{Bi} \in \mathbb{R}$ is a lump-sum transfer from D_i to M made upon contract acceptance (note that T_{Bi} can be negative), and $e_i \in \{0,1\}$ denotes whether the contract includes an exclusivity provision $(e_i = 1)$ or not $(e_i = 0)$. The fringe, on the other hand, always offers distributors product B at a constant per-unit wholesale price equal to c_B (without fixed fees).

[16] In Section III, we extend our results to an arbitrary number of horizontally differentiated distributors, while in the online Appendix, we extend them to the case where distributors offer nonlinear prices downstream.

[17] Throughout the text, we will refer to M by the pronoun "he," to distributors by "she," and to the fringe by "it."

The timing of events is as follows. At $t = 1$, M and the fringe simultaneously approach distributors with publicly observable offers. Then, at $t = 2$, distributors simultaneously decide which offers to accept and set publicly observable retail prices. Finally, at $t = 3$, final consumers decide which distributor to visit and how much to buy from that distributor.[18]

With this setting in mind, notice that if both distributors accept the fringe's offer in equilibrium, Bertrand competition leads distributors to charge retail prices equal to c_B. This outcome, however, destroys industry profits, $\pi_B(p_B; c_B)$, as the latter are maximized at $p_B^m > c_B$. The question is whether M can increase industry profits—and seize part of this increase—by using exclusives to induce distributors to accept contracts with wholesale prices above c_B. The next proposition shows that M cannot.

PROPOSITION 1: *The unique equilibrium of the single-product "laissez-faire" game is for M to approach distributors with offers $\left(w_{Bi}^{lf} = c_B, T_{Bi}^{lf} = 0, e_i^{lf}\right)$ for $i = 1,2$ (it is irrelevant whether $e_i^{lf} = 0$ or $e_i^{lf} = 1$). Thus, M obtains zero profits, and consumers pay $p_B^{lf} = c_B$.*

PROOF:

We refer to this game as a "laissez-faire game" since there are no interventions restricting M's conduct (we consider different interventions below). For proof, see Appendix A. ∎

To understand this "no-monopolization" result, consider the case where M offers both distributors the same contract, and let w_B be the wholesale price offered by M (the same logic applies if M were to offer different contracts to D_1 and D_2). Note that to induce both distributors to sign exclusively with him, M must leave D_i with at least the profits she would obtain from deviating to the fringe's contract given that both distributors are expected to sign with M. These deviation profits are what we call distributors' "reservation payoffs" in their negotiations with M.

Proposition 1 then follows because any attempt by M to set w_B above c_B increases the sum of distributors' reservation payoffs to $2(w_B - c_B)Q_B(w_B)$ (since a deviating distributor captures the entire market when her rival has wholesale costs $w_B > c_B$), which is strictly more than the corresponding increase in industry profits, $(w_B - c_B)Q_B(w_B)$. Thus, M does not find it profitable to raise wholesale prices for B above the fringe's cost, even though this would increase total industry profits.[19,20]

[18] In Section IV, we consider the implications of offers being private. In footnote 20 and the online Appendix, in turn, we discuss the implications of an alternative timing where distributors first make publicly observable contract-acceptance decisions and only afterward set retail prices.

[19] This result raises a question: what types of contracts are necessary and sufficient for M to maximize industry profits in the single-product case? The answer: multilateral contracts. As we show in the online Appendix, if these contracts are feasible, M can maximize and simultaneously appropriate all of the industry profits in market B. If so, the presence of an additional product does not affect the extent of monopolization of market B (as this market is already fully monopolized), and must-have products play no role in the market outcome.

[20] This no-monopolization result contrasts with Shaffer's (1991), who, in a similar setting, shows the existence of an equilibrium with negative fixed fees (i.e., slotting allowances) and wholesale prices above marginal costs. There are two main differences between Shaffer's (1991) setting and the one in our simple model. First, Shaffer (1991) considers horizontally differentiated distributors. Second, in his model, distributors observe the offers accepted by rivals before setting prices. As we show in later sections of the paper, our no-monopolization result

Let us now move to a multiproduct setting by adding a second product, A, that is only produced by M at a marginal cost $c_A \geq 0$. Final consumers are interested in both products, A and B, and they one-stop shop—i.e., they visit at most a single distributor.[21] As with product B, a consumer buys $Q_A(p_A)$ units of A when its price is p_A, where $Q_A(p_A)$ conforms to the same regularity conditions as $Q_B(p_B)$. We further assume that A and B are neither complements nor substitutes in consumption, so when a consumer buys both products, her surplus is additive over these products:

$$v_A(p_A) + v_B(p_B), \quad \text{where} \quad v_k(p) = \int_p^{\infty} Q_k(x)\,dx.$$

The timing of this multiproduct game is the same as before. The only difference is that M can now include tying/full-line forcing clauses in the offers made at $t = 1$. These provisions preclude a distributor from selectively accepting a subset of M's contract (e.g., accepting only the terms for product A or only the terms for B). For this reason, tying contracts can be written as $(w_{Ai}, w_{Bi}, T_i, e_i)$, with $T_i = T_{Ai} + T_{Bi}$.[22]

Before presenting the "laissez-faire" equilibrium of this multiproduct setting in full detail, suppose that the following condition holds:

$$(1) \qquad v_A(p_A^m) + v_B(p_B^m) \geq v_B(c_B),$$

where, as in the case of product B, p_A^m denotes the single-product monopoly price for product A.

Consider then the case where M approaches both distributors with tying-exclusive offers $(w_{Ai} = p_A^m, w_{Bi} = p_B^m, T_i = 0, e_i = 1)$ for $i = 1,2$. It is not difficult to see that if both distributors accept these offers, M "fully monopolizes" both markets: consumers pay monopoly prices for each product, and M captures the totality of the (fully maximized) industry profits.

The question is whether it is an equilibrium for distributors to accept such offers. It turns out that it is. Indeed, if both distributors accept the offers, they end up with zero profits. If, on the other hand, a distributor deviates to accept the fringe's contract, that distributor also obtains zero profits since she fails to attract any consumers—even if she sells B at c_B—as she loses access to A, her rival carries A and B, and condition (1) holds.

Note the striking difference between Proposition 1 and the equilibrium stated above. When M has only B, he achieves *nothing*: M has no option but to price B at cost. In contrast, when A is also present, there are circumstances in which M can achieve *everything*: she can fully monopolize both markets and appropriate the entire industry profits. What explains these differing results?

remains if we move away from the Bertrand limit, but it does not if we adopt Shaffer's (1991) timing. However, as we illustrate in the online Appendix, the extent of single-product monopolization under this alternative timing is relatively small compared to the monopolization that a must-have can generate.

[21] In Section II, we relax the assumption that consumers face infinite shopping costs from visiting a second distributor.

[22] Note the difference between exclusive and tying provisions: exclusivity clauses preclude distributors from accepting multiple contracts for the same product but allow distributors to source different products from different suppliers. In contrast, tying clauses do not impose exclusivity but force distributors to carry all the products in an offer.

The key is that a distributor cannot afford not to carry A when her rival does, since that would imply failing to attract any consumers. M exploits this "must-have property" of A to curb any increase in distributors' reservation payoffs that arises from an increase in the wholesale price of B. As a result, it is now profitable for M to monopolize market B.

The intuition suggests that the surplus consumers obtain from purchasing A plays a prominent role in M's monopolization strategy. Indeed, the higher this surplus is, the more pronounced is the loss in relative quality, or "vertical differentiation disadvantage," experienced by a distributor that does not carry A against her rival that does, making it easier for M to induce distributors to accept his tying offers.[23] This point serves to convey further intuition on M's monopolization mechanism: M *indirectly* exploits the surplus that *distributors cannot extract from consumers* in product A to induce distributors not to take the offer from the fringe. This is done by exploiting shifts in consumer traffic suffered by distributors that lose A against rivals that do not.[24]

As evident from the previous discussion, our theory of must-haves relies on three key ingredients: market power on product A, downstream competition, and one-stop shopping. Without any of these ingredients, product portfolios do not create vertical differentiation among distributors, so M cannot obtain more than A's monopoly profit—i.e., the single-monopoly profit theory holds. We formalize these results in Sections II and III, respectively.

Restricting attention to condition (1) has been useful in explaining the workings of the must-have mechanism. However, it should be clear that the mechanism carries over more generally—i.e., to situations in which condition (1) does not hold.

PROPOSITION 2: *Suppose that for* $k = A,B$, $(p-c)Q_k'(p)/Q_k(p)$ *is strictly decreasing in p for any* $p > c$ *such that* $Q_k(p) > 0$. *If M is free to include tying and exclusivity provisions in his offers, then in any equilibrium of the multiproduct laissez-faire game, consumers pay* p_A^{lf} *and* p_B^{lf} *for A and B, respectively, and M's profits are* $\pi_A\left(p_A^{lf};c_A\right) + \pi_B\left(p_B^{lf};c_B\right)$, *where*

$$\left(p_A^{lf},p_B^{lf}\right) = \underset{(p_A,p_B)}{\arg\max}\Big\{\pi_A(p_A;c_A) + \pi_B(p_B;c_B) \quad \text{s.t. } v_A(p_A) + v_B(p_B) \geq v_B(c_B)\Big\}. \tag{2}$$

PROOF:

The requirement that $(p-c)Q_k'(p)/Q_k(p)$ is strictly decreasing in p for $k = A,B$ is sufficient to ensure that the solution to (2) is unique when the constraint is binding. This requirement holds when demands are concave and fails only when they are strongly convex. It is satisfied by all the usual demand curves

[23] This can be directly seen from the "full monopolization" condition (1): when $v_A(p_A^m)$ is large, this condition is more likely to hold.

[24] As already discussed in the literature review, the idea of exploiting a "nonextractable" surplus to monopolize an adjacent market is also present in other theories of monopolization, but with important differences in terms of the working mechanism, the context of application, and the antitrust implications.

(linear, isoelastic, constant markup, and logit, among others). For proof of the proposition, see Appendix B. ∎

As Proposition 2 states, M solves a Ramsey pricing problem when deciding which retail prices to induce distributors to charge: M maximizes total industry profits subject to the budget/surplus constraint $v_A(p_A) + v_B(p_B) \geq v_B(c_B)$. This constraint ensures that at the prevailing retail prices, a distributor that deviates to the fringe cannot attract any consumers to her store.[25]

When (1) holds, the solution to this problem is separable in the two prices and coincides with the one provided above, $p_A^{lf} = p_A^m$ and $p_B^{lf} = p_B^m$. In contrast, when (1) does not hold, the constraint binds, and the two prices must be found simultaneously. An interesting aspect of the solution is that M then faces a trade-off between rent extraction in A and monopolization in B. The more M induces distributors to extract from A, the more constrained he is in trying to force distributors to accept contracts with wholesale prices for B above the fringe's cost.

An important implication of this insight is that there are situations in which a monopoly product might not be—for all practical purposes—a must-have. This occurs, for instance, when A's demand is highly concave (i.e., rectangular shaped) compared to that of B's demand.[26] In that case, M finds it optimal to extract most of the surplus in A rather than to increase prices in B.[27] Thus, market power in product A is necessary but not sufficient for that product to be a must-have.[28]

B. *The Effect of Different Antitrust Interventions*

Having characterized the laissez-faire equilibrium, we now consider the effects of different antitrust interventions. We restrict attention to interventions that exert some level of control over the contracts that M can sign with distributors. This analysis also serves to better appreciate the must-have mechanism.

[25] The fact that the market share of a deviating distributor always drops to zero in equilibrium might seem like an unrealistic feature of our model. This feature, however, is an artifact of working directly in the Bertrand limit. Away from the limit (but no matter how close to it), distributors' market shares do not necessarily drop to zero. Importantly, this discontinuity at the Bertrand limit arises only on distributors' market shares; away but arbitrarily close to the Bertrand limit, the equilibrium retail prices and profits continue to be given by Proposition 2 (see Section III for details).

[26] The concavity of a product's demand is measured by the demand's curvature, formally defined as the elasticity of the slope of the inverse demand (see, e.g., Rhodes, Watanabe, and Zhou 2021, 455).

[27] Formally, let $Q_A(p)$ be arbitrarily close to a unit demand, while $Q_B(p)$ is away from it. Suppose M is extracting virtually all surplus in A while pricing B at cost. Consider dropping the price of A by a small amount, say $\epsilon > 0$. This decreases M's profits in A by approximately ϵ and increases consumer surplus by ϵ. The latter then allows M to increase the price of B from c_B to p_B, where $v_B(c_B) - v(p_B) = \epsilon$. This drop in price is therefore profitable for M whenever $(p_B - c_B)Q_B(p_B) > \epsilon = v_B(c_B) - v(p_B)$, which never holds if $Q_B(p)$ is away from the unit demand.

[28] To assess whether a supplier is using a monopoly product to extract rents or to monopolize an adjacent market, a good proxy is the surplus consumers are obtaining from purchasing that product. The latter can be estimated by using a structural model or by using, when available, blackouts and delisting episodes. Interestingly, such episodes have become increasingly common in the retail and cable TV markets (Frieden, Jayakar, and Park 2020). For example, in 2009, Delhaize, a Belgian supermarket, was forced to stop stocking close to 300 Unilever products after price negotiations collapsed. As a result, Delhaize lost more than 30 percent of its customers to rival supermarkets, particularly Colruyt and Carrefour, according to Brandhome, a marketing agency. See Reuters Consumer Products and Retail News, "Delhaize Losing Out over Unilever Battle—Survey," February 16, 2009, https://www.reuters.com/article/delhaize-unilever-idINLG51937220090216 (accessed June 6, 2023).

We consider first a prohibition on tying and exclusivity provisions. As the next proposition shows, this intervention is completely ineffective if M can engage in refusal to deal:

PROPOSITION 3: *Suppose that tying and exclusivity provisions are forbidden. If M can engage in refusal to deal, then in any equilibrium, M achieves the same profits, and consumers face the same prices as in Proposition* 2.

PROOF:

See Appendix C. ∎

To see this result more easily, consider the case in which condition (1) holds. Suppose, moreover, that M publicly refuses to deal with one of the distributors—say, D_2—and approaches D_1 with the following two-part tariff offer: $\left(w_{A1} = c_A, T_{A1} = \pi_A\left(p_A^m; c_A\right) + \pi_B\left(p_B^m; c_B\right)\right)$ and $\left(w_{B1} = c_B, T_{B1} = 0\right)$. Proposition 3 follows because if D_1 accepts M's offer, she prices the two products at their monopoly levels as D_2 fails to attract consumers because she is not carrying A. M can then extract the totality of D_1's profits by using T_{A1} since if D_1 rejects this contract, she is no longer in an advantageous competitive position relative to D_2 and therefore obtains zero profits.

An important implication of Proposition 3 is that M can actually follow two distinct strategies in his goal to monopolize market B, a nondiscriminatory strategy and a discriminatory one. Under the nondiscriminatory strategy, M increases retail prices in B by increasing the wholesale prices of all distributors. This strategy, however, requires both tying and exclusivity provisions. Without exclusives, it is impossible to raise distributors' wholesale price for B above c_B, as nothing precludes a distributor from accepting the fringe's cheaper offer for B.[29] Without tying, on the other hand, rejecting M's offer for B does not imply forgoing A, so inducing all distributors to sign exclusively with him becomes—as in the single-product case—too expensive for M.

Under the discriminatory strategy, in contrast, M withholds A from D_2, impairing her ability to compete against D_1, who does carry A. As a result, D_1 can increase retail prices for A and B without losing market share to her disadvantaged rival D_2. M then fully extracts D_1's profits since those profits arise only because D_1 is carrying A.[30]

From the discussion above, one may conclude that tying and exclusivity provisions may not emerge in the laissez-faire equilibrium. After all, M can achieve the same outcome by using simple two-part tariff contracts. Two important points, however, are to be made on this.

[29] There are situations outside our model in which M can potentially raise w_B above c_B without exclusives. For instance, if distributors are constrained in the number of product lines they can carry, a tying requirement suffices to achieve this, as it makes M's offer mutually exclusive to that of the fringe without the need to include a formal exclusivity provision in the contract.

[30] It is clear that both strategies rely on using A to create vertical differentiation among distributors, but differently. The discriminatory strategy increases retail prices by creating this vertical differentiation on-path. The nondiscriminatory strategy, in contrast, exploits it off-path (i.e., using it to reduce distributors' reservation payoffs).

First, these strategies are outcome equivalent only in the Bertrand limit. As we show in Section III, the nondiscriminatory strategy is strictly preferred by M when distributors are horizontally differentiated. This is because the nondiscriminatory strategy allows M to reach the entire mass of final consumers, while the discriminatory strategy does not. Thus, we expect tying and exclusivity provisions to always emerge in the laissez-faire equilibrium absent any intervention.

Second, the fact that only D_1 carries A under the discriminatory strategy implies that prohibiting tying and exclusives (while allowing refusal to deal) can backfire in terms of consumer surplus if, again, distributors are horizontally differentiated. That is, consumers, on aggregate, might end up worse off with the intervention relative to the laissez-faire outcome. This is because, in an effort to obtain access to A, a subset of consumers are forced to move away from their preferred distributor (we also illustrate this phenomenon in Section III).

In light of the previous discussion, is there a more comprehensive intervention that ensures that consumers always end up better off relative to the laissez-faire outcome? A least in theory, the answer is positive. It involves combining a ban on either tying or exclusives with a prohibition on distributor discrimination and refusal to deal.

Whether this can be implemented and enforced in practice is certainly open to debate, as it would require empowering antitrust agencies with the type of information and enforcement capabilities usually associated with regulators.[31] However, we believe it is an important benchmark to keep in mind when dealing with cases involving must-have items: this intervention tells us what is potentially achievable and how much is required to achieve it. This is the reason we formally state it in the next proposition.

PROPOSITION 4: *Suppose we combine a ban on tying or exclusives with an additional ban on distributor discrimination and refusal to deal. Then, in any equilibrium, M obtains* $\pi_A(p_A^m; c_A)$ *and consumers pay* $p_A^{ri} = p_A^m$ *and* $p_B^{ri} = c_B$ *for products A and B, respectively. This is a "robust intervention" in that it unambiguously leads to higher consumer welfare relative to the laissez-faire outcome.*

PROOF:

By a ban on refusal to deal, we mean that M must offer contracts that are accepted by both distributors in equilibrium. This policy must be implemented on top of a ban on discrimination since even nondiscriminatory offers can generate discriminatory equilibrium outcomes when distributors compete.[32] For the proof, see Appendix D. ∎

[31] Moreover, prohibiting distributor discrimination might create inefficiencies if distributors are heterogeneous in some dimension.

[32] For example, suppose that condition (1) holds and that M offers both distributors the same two-part tariff contracts $\left(w_{Ai} = c_A, T_{Ai} = \pi_A(p_A^m; c_A) + \pi_B(p_B^m; c_B)\right)$ and $(w_{Bi} = c_B, T_{Bi} = 0)$ for $i = 1, 2$. These offers do not violate the ban on discrimination, and still allow M to fully monopolize markets A and B. Intuitively, the fixed fee in A's contract is so high that it prevents more than one distributor from accepting the contract in any pure strategy subgame perfect Nash equilibrium.

The reason such a multifaceted approach works is that it is effective at handling the two alternative strategies that M can exploit to monopolize market B. While a ban on tying or exclusives knocks down M's nondiscriminatory strategy, a ban on discrimination and refusal to deal limits his ability to raise prices through a discriminatory strategy.

This finishes the presentation of our main results. We devote the next three sections to generalizing these insights in various dimensions and to providing additional results that cannot be derived from the baseline model.

II. Market Power in A, One-Stop Shopping, and Full Coverage

In this section, we extend our simple model in three different directions while maintaining the assumption that final consumers are served by two undifferentiated (i.e., Bertrand) distributors. We leave for the following section the case of differentiated distributors, as this requires additional assumptions and modeling techniques.

A. *Market Power in Product A*

In our first extension, we consider the case in which product A may also be manufactured by a fringe of suppliers, possibly at a higher cost $c_A^f \geq c_A$. Thus, how much more efficient is M in producing A relative to the fringe captures—in a simple way—the degree of market power of M over product A.

By using analogous arguments as in the proof of Proposition 2, it is not difficult to show that the retail prices consumers pay in the laissez-faire outcome $\left(p_A^{lf}, p_B^{lf}\right)$ are now given by the solution to

$$(3)\quad \max_{(p_A, p_B)} \left\{ \pi_A(p_A; c_A) + \pi_B(p_B; c_B) \ \text{ s.t. } \ v_A(p_A) + v_B(p_B) \ \geq \ v_A\left(c_A^f\right) + v_B(c_B) \right\}.$$

Thus, the only difference with the baseline setting of Section I is that the budget/surplus constraint is now $v_A(p_A) + v_B(p_B) \geq v_A\left(c_A^f\right) + v_B(c_B)$ instead of $v_A(p_A) + v_B(p_B) \geq v_B(c_B)$. This is intuitive: if a distributor rejects M's tying-exclusive offer for A and B, that distributor can now provide consumers with a surplus of at most $v_A\left(c_A^f\right) + v_B(c_B)$ by accepting the fringe's offers for A and B.

The solution to (3) is therefore qualitatively similar to the outcome described in Proposition 2. The only notable feature of the solution to this new problem is that the extent of monopolization in B, as measured by $p_B^{lf} - c_B$, is decreasing in c_A^f and that $p_B^{lf} \to c_B$ as $c_A^f \to c_A$. That is, the extent of monopolization in B is constrained by the degree of market power of M over A.

B. *One-Stop Shopping*

In the model of Section I, we exogenously assumed that all consumers are one-stop shoppers. This is equivalent to assuming that they face an infinitely high shopping cost from visiting a second distributor. What happens if that is not the case?

To explore this possibility, suppose that consumers now face a shopping cost $\tau \in [0,\infty)$ from visiting a second distributor (visiting the first distributor is still costless as in Section I), and that this cost is homogenous across consumers. Following similar steps as in Proposition 2, it is not difficult to show that the retail prices consumers pay in the laissez-faire equilibrium are given by the solution to

$$\max_{(p_A,p_B)} \{\pi_A(p_A;c_A) + \pi_B(p_B;c_B) \text{ s.t. } v_A(p_A) + v_B(p_B) \geq v_B(c_B) \\ \text{and } v_A(p_A) + v_B(p_B) \geq v_A(p_A) + v_B(c_B) - \tau\}. \tag{4}$$

That is, the introduction of $\tau \in [0,\infty)$ adds a new constraint to *M*'s monopolization problem (2) since *M* must now ensure that consumers do not two-stop shop following a deviation of a distributor to procure *B* from the fringe. The presence of this new constraint changes the retail prices of the laissez-faire equilibrium as follows.

LEMMA 1: *Let p_k^{lsc} for $k = A,B$ be the solution to problem* (4) (*where "lsc" stands for laissez-faire solution under lower shopping costs*). *Define*, *furthermore*, $\bar{p}_A(\tau) = v_A^{-1}(\tau)$ *and* $\bar{p}_B(\tau) = v_B^{-1}(v_B(c_B) - \tau)$. *Then:*

- *If* $v_A(p_A^m) + v_B(p_B^m) \geq v_B(c_B)$,

$$(p_A^{lsc}, p_B^{lsc}) = \begin{cases} (p_A^m, p_B^m), & \text{if } \tau \geq v_B(c_B) - v_B(p_B^m); \\ (p_A^m, \bar{p}_B(\tau)), & \text{if } \tau < v_B(c_B) - v_B(p_B^m). \end{cases}$$

- *If* $v_A(p_A^m) + v_B(p_B^m) < v_B(c_B)$,

$$(p_A^{lsc}, p_B^{lsc}) = \begin{cases} (p_A^{lf}, p_B^{lf}), & \text{if } v_B(c_B) - v_B(p_B^{lf}) \leq \tau; \\ (\bar{p}_A(\tau), \bar{p}_B(\tau)), & \text{if } v_A(p_A^m) \leq \tau < v_B(c_B) - v_B(p_B^{lf}); \\ (p_A^m, \bar{p}_B(\tau)), & \text{if } \tau < v_A(p_A^m); \end{cases}$$

where (p_A^{lf}, p_B^{lf}) *are given as in Proposition* 2.

PROOF:

The proof follows directly from the Kuhn-Tucker conditions of problem (4). ∎

The logic of the lemma can be understood by looking at when constraints (i) and (ii) of problem (4) bind. Consider first the case where $v_A(p_A^m) + v_B(p_B^m) < v_B(c_B)$. When shopping costs are sufficiently large, i.e., $\tau > v_B(c_B) - v_B(p_B^{lf})$, constraint (ii) is not binding, so the solution to (4) is the same as in Proposition 2: $p_k^{lsc} = p_k^{lf} < p_k^m$ for $k = A,B$.

As τ falls below $v_B(c_B) - v_B(p_B^{lf})$, *M* then adjusts the laissez-faire solution in two directions. First, he lowers the price of *B* to satisfy (ii). The latter, however, allows him to increase the price of A closer to its monopoly level while satisfying (i). Hence, in that region, $p_A^{lsc} = \bar{p}_A(\tau) > p_A^{lf}$ and $p_B^{lsc} = \bar{p}_B(\tau) < p_B^{lf}$.

Finally, as τ continues to decrease, eventually $\tau \leq v_A(p_A^m)$. In that case, constraint (ii) holds with slack at A's monopoly price p_A^m, so $p_A^{lsc} = p_A^m$ thereafter, while the retail price of B continues to be given by constraint (ii). That is, p_B^{lsc} solves $v_B(p_B^{lsc}) = v_B(c_B) - \tau$, or, equivalently, $p_B^{lsc} = \bar{p}_B(\tau)$. The case where $v_A(p_A^m) + v_B(p_B^m) \geq v_B(c_B)$ follows a similar logic, except that the price of A always remains at its monopoly level.

From Lemma 1, we immediately conclude that the outcome, in this case, is qualitatively similar to the one described in Proposition 2. The only difference is that the extent of monopolization of B is constrained by the shopping cost τ. Moreover, when τ is sufficiently high, we are exactly in the outcome described in Proposition 2, while when $\tau \to 0$, we converge to the "no-monopolization" outcome of the "robust-intervention" of Proposition 4.

C. *Full Coverage*

In the simple model, we assumed that all consumers are served in equilibrium. A simple way to introduce partial coverage to the model is by assuming that consumers must incur a cost $s \in [0, \infty)$ in their first visit to a distributor (as in the simple model of Section I, we assume that the second visit is infinitely costly). We further assume that this cost s is heterogeneous across the population of consumers and described by the atomless cumulative distribution function $F(s)$.[33]

By using similar arguments as in the proof of Proposition 2, we obtain that the retail prices consumers pay in the laissez-faire outcome are now given by the solution to

$$\max_{(p_A, p_B)} \Big\{ \big(\pi_A(p_A; c_A) + \pi_B(p_B; c_B)\big) F\big(\hat{s}(p_A, p_B)\big) \quad \text{s.t.} \;\; v_A(p_A) + v_B(p_B) \geq v_B(c_B) \Big\}, \tag{5}$$

where $\hat{s}(p_A, p_B) = v_A(p_A) + v_B(p_B)$. This implies that only consumers with shopping costs $s \leq \hat{s}(p_A, p_B)$ make purchases in equilibrium.

Let p_A^{pc} and p_B^{pc} be the solution to (5), where "pc" stands for the laissez-faire solution under partial coverage. If the surplus constraint $v_A(p_A) + v_B(p_B) \geq v_B(c_B)$ does not bind, then the solution to this problem is given by the following first-order conditions:

$$\frac{\pi_k'(p_k; c_k)}{\big(\pi_A(p_A; c_B) + \pi_B(p_B; c_B)\big) Q_k(p_k)} = \frac{f\big(\hat{s}(p_A, p_B)\big)}{F\big(\hat{s}(p_A, p_B)\big)} \quad \text{for} \quad k = A, B.$$

[33] We assume that s is heterogeneous because otherwise the equilibrium has either full coverage or no coverage at all.

This case is analogous to the full-monopolization case of the baseline model of Section I. The only difference is that equilibrium retail prices are strictly below the single-product monopoly prices $\left(p_A^m, p_B^m\right)$ since M now accounts for the effect of retail prices on downstream coverage. If, in contrast, the surplus constraint binds, the solution to (5) is identical to the one characterized in Proposition 2, as $\hat{s}\left(p_A, p_B\right) = v_B\left(c_B\right)$. In sum, in this extension with partial coverage, the equilibrium is qualitatively the same as the one characterized in the simple model of Section I.

III. Distributor Differentiation

We now extend our analysis to an arbitrary number of horizontally differentiated distributors. This serves not only to confirm the results of the simple model but also to derive additional results concerning the implications of different antitrust interventions.

A. *Additional Notation and Assumptions*

Consumer Shopping Preferences and Demands.— The model is identical to the multiproduct version of the model in Section I except that there are now $n \geq 2$ distributors and consumers differ in how much they value shopping at each distributor.

More precisely, consumer l enjoys an extra utility ξ_i^l/γ when shopping at distributor $i = 1, \ldots, n$, where ξ_i^l is a random shock and $\gamma \in (0, \infty)$ is the reciprocal of the degree of distributor (horizontal) differentiation.[34] This implies that if distributor D_i charges retail prices p_{Ai} and p_{Bi} for A and B, respectively, then visiting D_i gives consumer l an (indirect) utility of

$$U^l\left(p_{Ai}, p_{Bi}\right) = v_A\left(p_{Ai}\right) + v_B\left(p_{Bi}\right) + \xi_i^l/\gamma.$$

We assume that the elements of the vector of consumer l's utility shocks, $\boldsymbol{\xi}^l = \left(\xi_1^l, \ldots, \xi_n^l\right)$, are i.i.d. draws from the same atomless cumulative distribution function $G(x)$ with support over $\mathbb{R}$ and bounded, differentiable, and strictly log-concave probability density function $g(x)$. We further assume that the vectors of utility shocks are independent across consumers.

Moreover, as in the simple model of Section I, we assume that final consumers are one-stop shoppers and that the downstream market is fully covered. Hence, every consumer visits a single distributor, the one that gives her the highest utility.[35] We make these assumptions to compare the results of this section to those in Section I and thus isolate the effects of distributor differentiation.

Finally, we continue to assume that the demand for $k = A, B$, $Q_k(p)$ is differentiable, is downward sloping, and is such that $(p - c)Q_k'(p)/Q_k(p)$ is strictly

[34] As $\gamma \to 0$, distributors become "local monopolies," while as $\gamma \to \infty$, they become "Bertrand competitors."

[35] Given that the utility shocks are distributed over $\mathbb{R}$, the full coverage assumption implies that not visiting a distributor (the "outside good" in this context) reports a utility of $-\infty$. Although this assumption may sound extreme, it would be equivalent to normalizing the utility of the outside good to zero while restricting the support of $G(x)$ to $\mathbb{R}_+$ (rather than $\mathbb{R}$). We opted for the first specification since it is more convenient for our simulations (as we can have shocks distributed according to an extreme value type I distribution).

decreasing in p for any $p > c$ such that $Q_k(p) > 0$. However, for what follows, we impose the more stringent condition that $\pi_k(p;c) \equiv (p-c)Q_k(p)$ is strictly concave in p (rather than strictly quasiconcave). This stronger assumption allows us to greatly simplify the characterization of our results (as Lemma 2 below makes clear).

Payoffs.— Since the varieties of B produced by M and the fringe are perfect substitutes, if a distributor accepts more than one contract for B, she will optimally chooses to only sell units of the variety with the lowest wholesale price.[36] With some abuse of notation, denote by $\mathbf{w}_i = (w_{Ai}, w_{Bi})$ distributor D_i's "effective" wholesale prices (i.e., those of the products actually sold by the distributor in equilibrium) and by $\mathbf{p}_i = (p_{Ai}, p_{Bi})$ the prices she charges downstream, where we use the convention that $p_{ki} = w_{ki} = \infty$ if D_i does not carry k. Thus, the vectors $\mathbf{w} = (\mathbf{w}_1, \ldots, \mathbf{w}_n)$ and $\mathbf{p} = (\mathbf{p}_1, \ldots, \mathbf{p}_n)$ denote the (effective) wholesale prices and retail prices of all distributors in the market.

To obtain a distributor's payoff, note that the indirect utility of consumer l from visiting distributor i is $U^l(\mathbf{p}_i) = u(\mathbf{p}_i) + \xi_i^l/\gamma$, where $u(\mathbf{p}_i) = v_A(p_{Ai}) + v_B(p_{Bi})$ (if $p_{ki} = \infty$, then $v_k(p_{ki}) = 0$). Hence, the fraction of consumers visiting distributor i is given by

$$s(\mathbf{p}_i, \mathbf{p}_{-i}) = \Pr\Big(u(\mathbf{p}_i) + \xi_i^l/\gamma \geq \max_{j \neq i}\big\{u(\mathbf{p}_j) + \xi_j^l/\gamma\big\}\Big). \tag{6}$$

Since D_i makes a per-consumer profit of $\pi_k(p_{ki}; w_{ki}) = (p_{ki} - w_{ki})Q_k(p_{ki})$ on product k (where we use the convention that $\pi_k(p_{ki} = \infty; w_k = \infty) = 0$), her overall profit before fixed fees is

$$\Pi_i = \Pi_D(\mathbf{p}_i, \mathbf{p}_{-i}; \mathbf{w}_i) = \Big[\sum_{k=A,B} \pi_k(p_{ki}; w_k)\Big] s(\mathbf{p}_i, \mathbf{p}_{-i}).$$

Her profit after fixed fees, in turn, is equal to $\hat{\Pi}_i = \Pi_i - \sum_{k=A,B} T_{ki} \mathbf{1}\{i \in \mathcal{D}_k^M\}$, where $\mathcal{D}_k^M$ denotes the set of distributors that accept M's contract for product $k = A, B$, and $\mathbf{1}\{X\}$ is the indicator function of event X.

To obtain M's payoff, on the other hand, denote by $\tilde{\mathcal{D}}_k^M \subseteq \mathcal{D}_k^M$ the set of distributors whose effective wholesale price for k is that offered by M. M's profits before fixed fees are then given by $\Pi_M = \sum_{k=A,B} \sum_{i \in \tilde{\mathcal{D}}_k^M} (w_{ki} - c_k) Q_k(p_{ki}) s(\mathbf{p}_i, \mathbf{p}_{-i})$, while his profits after fixed fees are $\hat{\Pi}_M = \Pi_M + \sum_{k=A,B} \sum_{i \in \mathcal{D}_k^M} T_{ki}$.

Equilibrium Concept.—Given that the fringe is a nonstrategic player, M and the n distributors are playing a bilateral contracting game with externalities (e.g., Segal 1999). As a result, the game might exhibit multiple subgame perfect Nash equilibria (SPNEs).

As shown in Section I, this was not an issue when distributors were Bertrand competitors, as all equilibria led to the same outcome. Unfortunately, showing the same set of results with that level of generality has proven impossible away from the

[36] If the distributor faces the same wholesale prices for both products, we assume she sells the fringe's. This arbitrary tie-breaking rule plays no role in the results of the paper.

Bertrand limit. Hence, to manage the potential multiplicity, in this section we follow Segal (1999) and focus on *M*'s preferred SPNE.

B. *The Laissez-Faire Equilibrium*

As mentioned above, *M* and the distributors are playing a bilateral contracting game with externalities. This implies that the equilibrium can be characterized by solving *M*'s contracting problem. In this subsection, we briefly describe *M*'s laissez-faire problem and then extend Propositions 1 and 2. In the next subsection, in turn, we revisit the effect of the different antitrust interventions analyzed in Section IB.

To start, note that in the laissez-faire equilibrium, it is without loss of generality to (i) focus on *M* offering all distributors tying-exclusive contracts $(w_{Ai}, w_{Bi}, T_i, e_i = 1)$ for $i = 1, \ldots, n.$, and (ii) assume that every distributor accepts *M*'s offer.[37] Suppose then that *M* offers contracts with wholesale prices $\mathbf{w} = (\mathbf{w}_1, \ldots, \mathbf{w}_n)$ and let $\mathbf{p}^*(\mathbf{w}) = (\mathbf{p}_i^*(\mathbf{w}), \mathbf{p}_{-i}^*(\mathbf{w}))$ be the vector of equilibrium retail prices when every distributor (correctly) conjectures that everyone else is accepting *M*'s offer (as formally shown in the online Appendix, $\mathbf{p}^*(\mathbf{w})$ always exists).

All distributors accepting *M*'s contract constitute a Nash equilibrium at $t = 2$ if and only if the following participation constraints are then satisfied:

$$\Pi_D(\mathbf{p}_i^*(\mathbf{w}), \mathbf{p}_{-i}^*(\mathbf{w}); w_{Ai}, w_{Bi}) - T_i \geq \max_{\tilde{p}_{Ai}=\infty, \tilde{p}_{Bi}} \Pi_D(\tilde{\mathbf{p}}_i, \mathbf{p}_{-i}^*(\mathbf{w}); \infty, c_B) \quad \text{for all} \quad i = 1, \ldots, n. \tag{7}$$

The left-hand side of (7) is the payoff that distributor D_i expects to obtain upon accepting *M*'s contract while anticipating that the remaining distributors also accept *M*'s offer. The right-hand side of (7), in turn, represents D_i's reservation payoff. It is the payoff that she obtains if she deviates and accepts the fringe's offer while all her rivals conjecture that everyone, including D_i, is accepting *M*'s offer.

In *M*'s preferred SPNE, all distributors' participation constraints must be binding (otherwise, *M* could profitably raise some transfers without violating participation constraints). Obtaining the equilibrium transfers from the binding constraints and substituting them into *M*'s payoff function, *M*'s laissez-faire problem becomes

$$\max_{\mathbf{w}} \hat{\Pi}_M^{lf} = \sum_i \left[\pi_A(p_{Ai}^*(\mathbf{w}); c_A) + \pi_B(p_{Bi}^*(\mathbf{w}); c_B)\right] s(\mathbf{p}_i^*(\mathbf{w}), \boldsymbol{p}_{-i}^*(\mathbf{w})) - \sum_i \left[\max_{\tilde{p}_{Ai}=\infty, \tilde{p}_{Bi}} \Pi_D(\tilde{\mathbf{p}}_i, \mathbf{p}_{-i}^*(\mathbf{w}); \infty, c_B)\right]. \tag{8}$$

[37] To see (i), consider an arbitrary equilibrium in which distributors' effective wholesale prices are given by $\mathbf{w}$. *M* can always implement $\mathbf{w}$ using contracts of the form $(w_{Ai}, w_{Bi}, T_i, e_i = 1)$ and end up weakly better off, as these are the contracts that further restrict distributors' flexibility, allowing *M* to extract a greater share of distributors' profits. For (ii), note that *M* can always offer the contract $(w_{Ai}, w_{Bi}, T_i, e_i) = (\infty, c_B, 0, 1)$, which is equivalent to letting distributor D_i buy only *B* from the fringe.

That is, M chooses $\mathbf{w}$ to maximize the difference between total industry profits and the sum of distributors' reservation payoffs.

Although problem (8) might seem daunting, it can be greatly simplified. To do this, let $R(p_A, p_B)$ be the reservation payoff of a distributor if all her rivals charge p_A and p_B for A and B, respectively, i.e.,

$$R(p_A, p_B) \equiv \max_{\tilde{p}_B} \pi_B(\tilde{p}_B; c_B) H\big(\gamma v_B(\tilde{p}_B) - \gamma v_A(p_A) - \gamma v_B(p_B)\big),$$

where $H(x) = \int_{-\infty}^{+\infty} G(x+\zeta)^{n-1} g(\zeta) d\zeta$ is the cumulative distribution function of the random variable $\max_{j \neq i}\{\xi_j^\ell\} - \xi_i^\ell$. We then have the following result:

LEMMA 2: *Suppose that $Q_k(p)$ is such that $\pi_k(p; c) \equiv (p - c) Q_k(p)$ is strictly concave in p. Let $\mathbf{w}^{lf}$ be the solution to (8). Then, $p_{ki}^*(\mathbf{w}^{lf}) = p_k^{lf}$ for $k = A, B$, where*

$$\left(p_A^{lf}, p_B^{lf}\right) \equiv \arg\max_{p_A, p_B} \left\{\pi_A(p_A; c_A) + \pi_B(p_B; c_B) - nR(p_A, p_B)\right\}.$$

Moreover, M's equilibrium profits in the laissez-faire equilibrium are equal to $\hat{\Pi}_M^{lf} = \pi_A\left(p_A^{lf}; c_A\right) + \pi_B\left(p_B^{lf}; c_B\right) - nR\left(p_A^{lf}, p_B^{lf}\right)$.

PROOF:

The proofs for all subsequent results are in the online Appendix. ∎

Lemma 2 reveals two important insights about the laissez-faire equilibrium. First, we can characterize it as if M is choosing distributors' retail prices directly. Second, M induces all distributors to charge the same retail prices for product k. With these results in mind, we are ready to extend Propositions 1 and 2.

PROPOSITION 5:

- *When A does not exist,*[38] *M optimally sets $w_B^{lf} = c_B$ and obtains zero profits. Moreover, all distributors charge the same retail price as if they have procured B from the fringe, i.e.,*

$$p_B^{lf}(\text{without } A) = \arg\max_{p_{Bi}} \pi_B(p_{Bi}; c_B) H\left(\gamma v_B(p_{Bi}) - \gamma v_B\left(p_B^{lf}\right)\right).$$

[38] Mathematically speaking, this case is obtained by multiplying A's demand by a constant z, $zQ_A(p_A)$, and setting $z = 0$.

- *When A is present, M optimally sets $w_B^{lf} > c_B$ and obtains profits of $\hat{\Pi}_M^{lf} > \pi_A(p_A^m; c_A)$. Moreover, the retail price for B charged by distributors on-path, $p_B^{lf}(\text{with } A)$, satisfies*

$$p_B^{lf}(\text{without } A) < p_B^{lf}(\text{with } A) < p_B^m.$$

The intuition for Proposition 5 is the same as that for Propositions 1 and 2. When M only has B at his disposal, inducing distributors to accept wholesale prices for B above the fringe's cost increases the sum of distributors' reservation payoffs more than the corresponding increase in industry profits. As a result, M has no option but to price B at c_B even if this destroys industry profits.

In contrast, when A is also present, distributors know that they will be at a competitive disadvantage if they fail to carry A when their rivals do. M exploits this fact to induce distributors to accept high wholesale prices for B by threatening to withhold A from those distributors that take the fringe's contract. With this strategy, M finds it profitable to monopolize product B.

As we also mentioned in Section I, the presence of downstream competition was a key ingredient in our theory of must-haves. The following proposition formalizes this result. It also states that the laissez-faire equilibrium with distributor differentiation converges to the equilibrium characterized in Section I as distributors become Bertrand competitors:

PROPOSITION 6:

- *If $\gamma \to 0$, $(p_A^{lf}, p_B^{lf}) \to (p_A^m, p_B^m)$ and $\hat{\Pi}_M^{lf} \to \pi_A(p_A^m; c_A)$.*
- *If $\gamma \to \infty$, then:*

$$(p_A^{lf}, p_B^{lf}) \to \arg\max_{(p_A, p_B)} \{\pi_A(p_A; c_A) + \pi_B(p_B; c_B) \ \text{ s.t. } \ v_A(p_A) + v_B(p_B) \geq v_B(c_B)\},$$

$$\hat{\Pi}_M^{lf} \to \pi_A\left(\lim_{\gamma\to\infty} p_A^{lf}; c_A\right) + \pi_B\left(\lim_{\gamma\to\infty} p_B^{lf}; c_B\right).$$

Proposition 6 shows that as distributors become local monopolies, the retail prices for A and B converge to the single-product monopoly prices (p_A^m, p_B^m). However, in such a limit, M obtains no more than A's monopoly profit. This is intuitive: when distributor differentiation is high, consumers are de facto captive of a particular distributor. As a result, the portfolio of products offered by distributors does not affect consumers' shopping behavior.

C. *Revisiting the Effects of Different Antitrust Interventions*

We now revisit the effect of the different antitrust interventions analyzed in Section IB. We begin by providing the analog of Proposition 3 to the current setting: when γ is sufficiently high (so distributors are close to being Bertrand competitors), M can approximate the laissez-faire outcome by dealing with just a single distributor by using a simple two-part tariff contract. Hence, near the Bertrand limit, a policy that bans tying and/or exclusivity provisions is almost completely ineffective.

PROPOSITION 7: *Let $\hat{\Pi}_M^{hd}$ and CS^{hd}, where the superscript "hd" stands for "highly discriminatory" offers, denote M's profit and overall consumer surplus, respectively, if M makes the following offers:*

- *Distributor i: $(w_{Ai} = c_A, T_{Ai})$ and $(w_{Bi} = c_B, T_{Bi} = 0, e_i = 0)$, where T_{Ai} is chosen such that D_i is just indifferent between accepting and not accepting A's contract.*
- *Distributor $j = 1, \ldots, i-1, i+1, \ldots, n$: $(w_{Aj} = \infty\ , T_{Aj})$ and $(w_{Bj} = c_B$, $T_{Bj} = 0, e_i = 0)$.*

Then,

$$\lim_{\gamma\to\infty} \hat{\Pi}_M^{hd} = \lim_{\gamma\to\infty} \hat{\Pi}_M^{lf} \quad and \quad \lim_{\gamma\to\infty} CS^{hd} = \lim_{\gamma\to\infty} CS^{lf},$$

where $\hat{\Pi}_M^{lf}$ and CS^{lf} denote M's profit and overall consumer surplus in the laissez-faire equilibrium, respectively.

The intuition for Proposition 7 is the same as that for Proposition 3. When γ is sufficiently high, *M* has an alternative way to increase retail prices in market *B* without increasing distributors' wholesale prices: *M* can withhold *A* from some distributors, impairing their ability to compete against distributors that do carry the product.

Of course, dealing with all distributors by using tying and exclusivity provisions (as in the laissez-faire) is strictly superior for *M* to this "refusal to deal" strategy. This phenomenon is illustrated in Figure 1.[39] Intuitively, in the laissez-faire equilibrium, *M* reaches the entire mass of final consumers, while in this alternative refusal-to-deal strategy, he does not. However, as γ increases, each individual distributor becomes progressively less important to accessing final consumers, with a single distributor becoming sufficient to freely reach the entire mass when $\gamma \to \infty$.

As we also mentioned in Section I, *M*'s incentives to engage in discrimination and refusal to deal once tying and/or exclusivity provisions are banned immediately suggest that such interventions might backfire in the presence of horizontally differentiated distributors. This is because, in an effort to obtain access to product *A*, a subset of final consumers may end up moving away from their preferred distributor.[40]

[39] Check the supplementary material for the MATLAB codes used to create the different figures found throughout the paper.

[40] This source of consumer welfare loss is absent in Proposition 7, as we focus on the limit $\gamma \to \infty$, where consumers' idiosyncratic preferences for distributors are negligible.

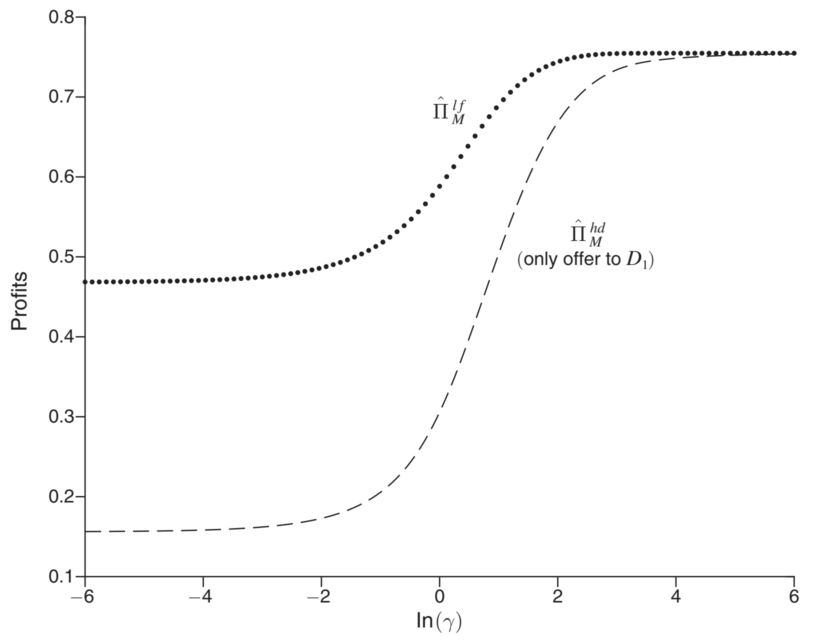

Figure 1. An Illustration of Proposition 7

Notes: Demands: $Q_k(p) = \lambda_k[1 - (1 - \rho_k)p]^{\rho_k/(1-\rho_k)}$. Distribution: $G(x) = e^{-e^{-x}}$. Parameter values: $n = 3$, $c_A = 1/4$, $c_B = 1/4$, $\lambda_A = 2$, $\rho_A = 3/2$, $\lambda_B = 1$, $\rho_B = 1$.

As an example, consider an intervention that bans only exclusivity clauses. In an earlier version of this paper, we showed that irrespective of whether M offers tying contracts or simple two-part tariffs, M's contracting problem in this case is

$$\max_{\substack{\mathbf{w}_A,\mathbf{w}_B \\ \mathbf{w}_B=\mathbf{c}_B}} \hat{\Pi}_M = \sum_i \left[\pi_A\left(p^*_{Ai}(\mathbf{w});c_A\right) + \pi_B\left(p^*_{Bi}(\mathbf{w});c_B\right)\right] s\left(\mathbf{p}^*_i(\mathbf{w}),\mathbf{p}^*_{-i}(\mathbf{w})\right)$$

$$- \sum_i \max_{p_{Ai}=\infty,p_{Bi}} \Pi_D\left(\mathbf{p}_i,\mathbf{p}^*_{-i}(\mathbf{w});\infty,c_B\right).$$

That is, M faces the same problem as in the laissez-faire scenario (see equation (8)), but with the additional constraint that $(w_{B1},\dots,w_{Bn}) = (c_B,\dots,c_B)$.

Figure 2 compares the solution to this problem against the laissez-faire outcome for a given set of parameters. Panels A and B plot the equilibrium retail prices for A and B resulting from M's optimal offers as a function of $\ln(\gamma)$. Building on these prices, panel C plots the change in consumer welfare over the laissez-faire outcome resulting from the intervention, and panel D plots M's profit.

As the figure shows, when distributors are close to local monopolies, M grants distributors nondiscriminatory access to A and B both in the laissez-faire equilibrium and

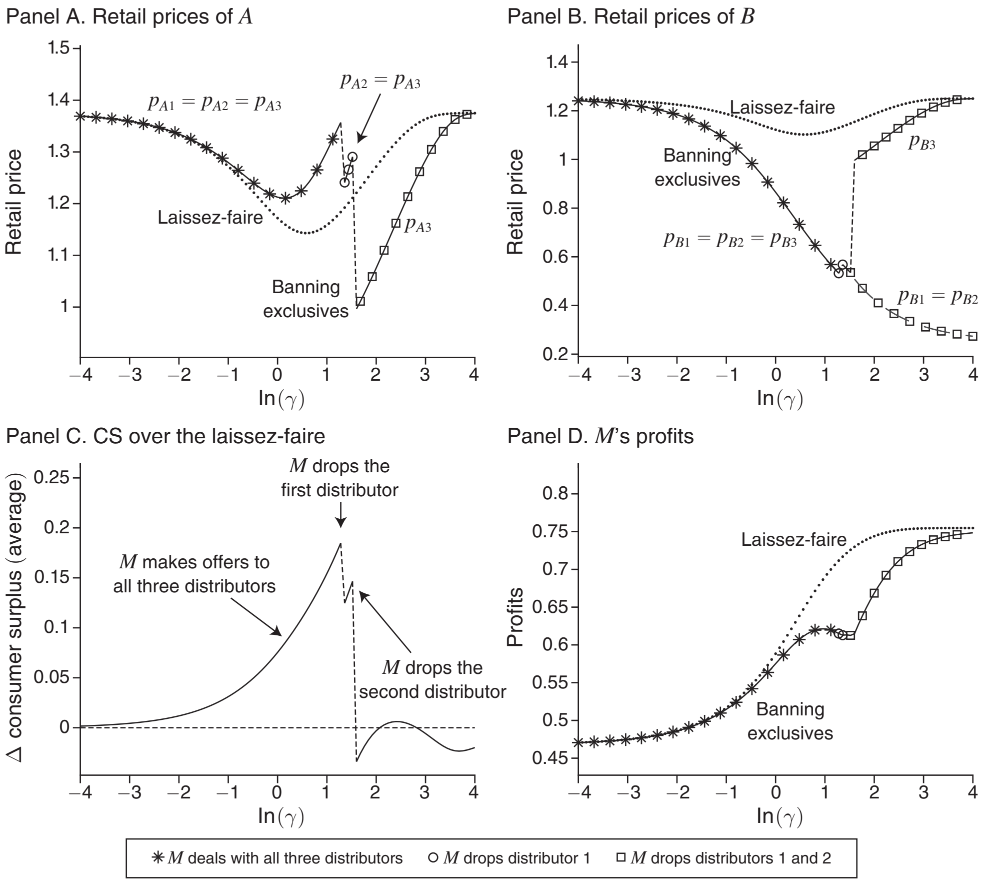

FIGURE 2. THE EFFECTS OF BANNING EXCLUSIVES

Notes: Demands: $Q_k(p) = \lambda_k\left[1 - (1 - \rho_k)p\right]^{\rho_k/(1-\rho_k)}$. Distribution: $G(x) = e^{-e^{-x}}$. Population size: 100.000. Parameter values: $n = 3$, $c_A = 1/4$, $c_B = 1/4$, $\lambda_A = 2$, $\rho_A = 3/2$, $\lambda_B = 1$, $\rho_B = 1$.

after exclusives are banned. In this case, the intervention produces strict gains in consumer welfare despite the fact that retail prices move in opposite directions following the intervention.[41] However, as distributor differentiation decreases, M engages in refusal to deal and starts dropping distributors—one at a time—until he eventually serves a single distributor. Under some parameter configurations, this leads to a reduction in average consumer welfare compared to that of the laissez-faire equilibrium, as shown in Figure 2, panel C.

[41] Intuitively, the ban on exclusives forces M to allow distributors to procure B from the fringe at a lower cost, increasing distributors' pricing intensity in the downstream market (compared to the laissez-faire). When distributor differentiation is high (so not offering A to a distributor prevents a significant fraction of consumers from purchasing the product), M partially offsets this increase in intensity by increasing wholesale prices for A (note that retail prices for product k depend on the wholesale prices of A and B). This explains why retail prices for A and B move in opposite directions following the intervention when γ is low enough.

Thus, banning exclusives and/or tying can sometimes improve welfare, can backfire in other cases, or can be ineffective. Consequently, to ensure that consumers always end up better off relative to the laissez-faire outcome, a more comprehensive intervention is needed. This leads to Proposition 8, which generalizes Proposition 4 for an arbitrary level of distributor horizontal differentiation.

PROPOSITION 8: *Consider a "robust intervention" combining a ban on either tying or exclusives with a prohibition on distributor discrimination and refusal to deal. Denote by* CS^{lf} *and* CS^{ri} *the overall consumer welfare under the laissez-faire and robust-intervention equilibrium, respectively. Then,* $\Delta CS^{ri} \equiv CS^{ri} - CS^{lf} > 0$, *and the intervention results in a Pareto improvement for all consumers with respect to the laissez-faire equilibrium.*

IV. Private Offers

In our last extension, we consider the implications of M's offers being private.[42] In particular, we show that our must-have mechanism continues to hold under private offers with passive beliefs, but only in the presence of upstream contractual frictions (e.g., linear contracts). Intuitively, private offers lead to supplier opportunism, and such opportunism is maximized when fixed fees are available. Hence, in this last case, M is unable to raise wholesale prices above the products' marginal costs. However, upstream contractual frictions ameliorate M's opportunism, restoring the must-have monopolization mechanism.

To make these points formal, consider the setting with horizontally differentiated distributors of the previous section but with private offers. We use "pairwise-proofness" with passive beliefs (also referred to as a "contract equilibrium") as our equilibrium concept (Crémer and Riordan 1987; O'Brien and Shaffer 1992; Segal 1999). That is, (i) equilibrium offers must be immune to bilateral deviations between M and each of the distributors, and (ii) even after observing an unexpected offer from M, a distributor believes that other distributors still face their equilibrium offers.[43]

Suppose first that fixed fees are feasible. As in the model with public offers, it is without loss to assume that M offers distributors tying-exclusive contracts $(w_{Ai}, w_{Bi}, T_i, e_i = 1)$ and that every distributor accepts M's offer. However, since distributors never see each other's contracts, the prices charged by D_i depend only on the offer made to that distributor:

$$\text{(9)} \qquad \mathbf{p}_i^*(\mathbf{w}_i) = \underset{(p_{Ai}, p_{Bi})}{\arg\max}\, \Pi_D\big(\mathbf{p}_i, \mathbf{p}_{-i}^e; w_{Ai}, w_{Bi}\big)$$

$$= \underset{(p_{Ai}, p_{Bi})}{\arg\max} \Big\{ \big(\pi_A(p_{Ai}; w_{Ai}) + \pi_B(p_{Bi}; w_{Bi})\big) s\big(\mathbf{p}_i, \mathbf{p}_{-i}^e\big) \Big\},$$

[42] In the online Appendix, we discuss further extensions such as (i) considering more products, (ii) introducing bilateral contractual frictions in the public offers case, (iii) changing the bargaining protocol from take-it-or-leave-it offers to a "Nash-in-Nash" bargaining protocol, and (iv) making the fringe strictly more efficient than M or replacing it with a single-product strategic rival, among many others.

[43] We use the weaker notion of pairwise-proofness with passive beliefs, rather than the stronger notion of perfect Bayesian equilibrium with passive beliefs since the latter might not exist when downstream competition is sufficiently intense (see Rey and Vergé 2004 for details).

where $\mathbf{p}^e_{-i}$ is D_i's conjecture about the retail prices charged by her rivals. If D_i holds passives beliefs, she accepts M's offer if and only if $\Pi_D\big(\mathbf{p}_i^*(\mathbf{w}_i), \mathbf{p}^e_{-i}; w_{Ai}, w_{Bi}\big) - T_i \geq \max_{\tilde{p}_{Ai}=\infty, \tilde{p}_{Bi}} \Pi_D\big(\tilde{\mathbf{p}}_i, \mathbf{p}^e_{-i}; \infty, c_B\big)$. Pairwise-proofness then implies that M's equilibrium offer to D_i must maximize M's profits subject to the aforementioned participation constraint while taking the offers to other distributors fixed:

$$\max_{(w_{Ai}, w_{Bi}, T_i)} \Big\{ \Big[(w_{Ai} - c_A) Q_A\big(p^*_{Ai}(\mathbf{w}_i)\big) + (w_{Bi} - c_B) Q_B\big(p^*_{Bi}(\mathbf{w}_i)\big)\Big] s_i^*(\mathbf{w}) + T_i$$

$$+ \sum_{j \neq i} \Big[\Big((w_{Aj} - c_A) Q_A\big(p^*_{Aj}(\mathbf{w}_j)\big) + (w_{Bj} - c_B) Q_B\big(p^*_{Bj}(\mathbf{w}_j)\big)\Big) s_j^*(\mathbf{w}) + T_j\Big]$$

$$\text{s.t. } \Pi_D\big(\mathbf{p}_i^*(\mathbf{w}_i), \mathbf{p}^e_{-i}; w_{Ai}, w_{Bi}\big) - T_i \geq \max_{\tilde{p}_{Ai}=\infty, \tilde{p}_{Bi}} \Pi_D\big(\tilde{\mathbf{p}}_i, \mathbf{p}^e_{-i}; \infty, c_B\big) \Big\},$$

where $\mathbf{w} \equiv (\mathbf{w}_i)_{i=1,\ldots,n}$ and $s_i^*(\mathbf{w}) \equiv s\Big(\mathbf{p}_i^*(\mathbf{w}_i), \big(\mathbf{p}_j^*(\mathbf{w}_j)\big)_{j \neq i}\Big)$. Since the participation constraint in the above program must be binding (otherwise, M could profitably deviate by increasing the transfer), we can solve for T_i from the binding constraint. Substituting the newly found expression in the objective function and omitting terms that do not depend on $\mathbf{w}_i = (w_{Ai}, w_{Bi})$, we find that the wholesale prices that M offers D_i must satisfy

$$\max_{(w_{Ai}, w_{Bi})} \Big\{ \Big[\pi_A\big(p^*_{Ai}(\mathbf{w}_i); c_A\big) + \pi_B\big(p^*_{Bi}(\mathbf{w}_i); c_{Bi}\big)\Big] s_i^*(\mathbf{w})$$

$$+ \Big[\pi_A\big(p^*_{Ai}(\mathbf{w}_i); w_{Ai}\big) + \pi_B\big(p^*_{Bi}(\mathbf{w}_i); w_{Bi}\big)\Big]\Big[s\big(\mathbf{p}_i^*(\mathbf{w}_i), \mathbf{p}^e_{-i}\big) - s_i^*(\mathbf{w})\Big]$$

$$+ \sum_{j \neq i} \Big[\Big((w_{Aj} - c_A) Q_A\big(p^*_{Aj}(\mathbf{w}_j)\big) + (w_{Bj} - c_B) Q_B\big(p^*_{Bj}(\mathbf{w}_j)\big)\Big) s_j^*(\mathbf{w})\Big] \Big\}.$$

From here, it is easy to see that there exists an equilibrium in which $\mathbf{w}_i^{lf} = (c_A, c_B)$ for all $i = 1, \ldots, n$. Indeed, if we set $\mathbf{w}_j^{lf} = \big(w_{Aj}^{lf}, w_{Bj}^{lf}\big) = (c_A, c_B)$ for all $j \neq i$ in the above expression, then the equilibrium is given by the following conditions:

$$\mathbf{p}^e_{-i} = \big(\mathbf{p}_j^*(c_A, c_B)\big)_{j \neq i},$$

$$\mathbf{w}_i^{lf} = \arg\max_{(w_{Ai}, w_{Bi})} \Big\{ \Big[\pi_A\big(p^*_{Ai}(\mathbf{w}_i); c_A\big) + \pi_B\big(p^*_{Bi}(\mathbf{w}_i); c_{Bi}\big)\Big] s_i^*(\mathbf{w})$$

$$+ \Big[\pi_A\big(p^*_{Ai}(\mathbf{w}_i); w_{Ai}\big) + \pi_B\big(p^*_{Bi}(\mathbf{w}_i); w_{Bi}\big)\Big]$$

$$\times \Big[s\big(\mathbf{p}_i^*(\mathbf{w}_i), \mathbf{p}^e_{-i}\big) - s_i^*(\mathbf{w})\Big] \Big\},$$

which has solution $\mathbf{w}_i^{lf} = (c_A, c_B)$.[44] This result can, in fact, be strengthened: O'Brien and Shaffer (1992) show that the unique contract equilibrium of a game involving private offers, horizontally differentiated distributors, and nonlinear contracts (as in our setting) involves marginal-cost pricing, i.e., $\mathbf{w}_i^{lf} = (c_A, c_B)$ for all $i = 1, \ldots, n$. Hence, when fixed fees are available, M cannot monopolize market B, as he is unable to raise products' wholesale prices above their marginal costs.

Note, however, that this marginal-cost pricing result applies to both A and B despite the former product being perfectly monopolized by M. Hence, the lack of monopolization in B is presumably explained solely by the emergence of supplier opportunism, not because A's must-have nature is lost when offers are private.

To evaluate this conjecture, suppose fixed fees are unfeasible and consider the case where M offers all distributors tying-exclusive contracts of the form $(w_{Ai}, w_{Bi}, e_i = 1)$. As before, the retail prices charged by D_i are given by (9), although her participation constraint is now $\Pi_D\big(\mathbf{p}_i^*(\mathbf{w}_i), \mathbf{p}_{-i}^e; w_{Ai}, w_{Bi}\big) \geq \max_{\tilde{p}_{Ai}=\infty, \tilde{p}_{Bi}} \Pi_D\big(\tilde{\mathbf{p}}_i, \mathbf{p}_{-i}^e; \infty, c_B\big)$. Pairwise-proofness then implies that M's equilibrium offer to D_i must solve

$$\max_{(w_{Ai}, w_{Bi})} \Bigg\{ \Big[(w_{Ai} - c_A) Q_A\big(p_{Ai}^*(\mathbf{w}_i)\big) + (w_{Bi} - c_B) Q_B\big(p_{Bi}^*(\mathbf{w}_i)\big)\Big] s_i^*(\mathbf{w})$$

$$+ \sum_{j \neq i} \Big[\Big((w_{Aj} - c_A) Q_A\big(p_{Aj}^*(\mathbf{w}_j)\big) + (w_{Bj} - c_B) Q_B\big(p_{Bj}^*(\mathbf{w}_j)\big)\Big) s_j^*(\mathbf{w})\Big]$$

$$\text{s.t. } \Pi_D\big(\mathbf{p}_i^*(\mathbf{w}_i), \mathbf{p}_{-i}^e; w_{Ai}, w_{Bi}\big) \geq \max_{\tilde{p}_{Ai}=\infty, \tilde{p}_{Bi}} \Pi_D\big(\tilde{\mathbf{p}}_i, \mathbf{p}_{-i}^e; \infty, c_B\big) \Bigg\}.$$

From here, it is easy to see $w_{Ai}^{lf} > c_A$ and $w_{Bi}^{lf} > c_B$ by considering, for instance, the case where D_i's participation constraint is not binding (so M is, in effect, acting as a blockaded monopolist in both markets).

To see that it is A's must-have nature that drives the monopolization in market B (rather than a new mechanism arising from offers being private), consider the case where A does not exist. Then, D_i's participation constraint becomes

$$\underbrace{\max_{p_{Bi}} \pi_B(p_{Bi}; w_{Bi}) s\big(\mathbf{p}_i, \mathbf{p}_{-i}^e\big)}_{D_i\text{'s payoff from accepting } M\text{'s contract}} \geq \underbrace{\max_{p_{Bi}} \pi_B(p_{Bi}; c_B) s\big(\mathbf{p}_i, \mathbf{p}_{-i}^e\big)}_{D_i\text{'s payoff from accepting the fringe's contract}}.$$

This can be satisfied only if $w_{Bi} \leq c_B$, so in equilibrium, M sets $w_{Bi}^{lf} = c_B$. Hence, just as in the case of public offers, when A is not present, M has no option but to offer B at cost. Distributors' reservation payoffs increase too rapidly as M tries to increase w_{Bi} above c_B.

[44] This follows because the first term of the second expression is maximized at $\mathbf{w}_i^{lf} = (c_A, c_B)$, while the derivative of the second term with respect to w_{ki} is always equal to zero when $\mathbf{p}_{-i}^e = \big(\mathbf{p}_j^*(c_A, c_B)\big)_{j \neq i}$ irrespective of the value of $\mathbf{w}_i = (w_{Ai}, w_{Bi})$ (as both $\big[s\big(\mathbf{p}_i^*(\mathbf{w}_i), \mathbf{p}_{-i}^e\big) - s_i^*(\mathbf{w})\big]$ and $\partial/\partial w_{ki}\big[s\big(\mathbf{p}_i^*(\mathbf{w}_i), \mathbf{p}_{-i}^e\big) - s_i^*(\mathbf{w})\big]$ are equal zero when $\mathbf{p}_{-i}^e = \big(\mathbf{p}_j^*(c_A, c_B)\big)_{j \neq i}$.

Similarly, if A is present but tying offers are unfeasible, D_i's participation constraint becomes

$$\overbrace{\max_{(p_{Ai},p_{Bi})}\left\{\left(\pi_A(p_{Ai};w_{Ai}) + \pi_B(p_{Bi};w_{Bi})\right)s(\mathbf{p}_i,\mathbf{p}^e_{-i})\right\}}^{D_i\text{'s payoff from accepting } M\text{'s contracts for } A \text{ and } B}$$

$$\geq \underbrace{\max_{(p_{Ai},p_{Bi})}\left\{\left(\pi_A(p_{Ai};w_{Ai}) + \pi_B(p_{Bi};c_B)\right)s(\mathbf{p}_i,\mathbf{p}^e_{-i})\right\}}_{D_i\text{'s payoff from accepting } M\text{'s contract for } A \text{ and the fringe's contract for } B},$$

which, again, can only be satisfied if $w_{Bi} \leq c_B$. Hence, without tying A to B, M is unable to increase B's wholesale price above the fringe's cost.

It is important to highlight that in our setting with private offers, upstream contractual frictions are needed for monopolization because they ameliorate supplier opportunism. This is in contrast to the papers by Greenlee, Reitman, and Sibley (2008); Calzolari, Denicolò, and Zanchettin (2020); and de Cornière and Taylor (2021) discussed in the "Related Literature" subsection, where contractual frictions are needed because they create double marginalization.

Although this might seem like a mere theoretical curiosity, it has an important policy implication: while in those papers the extent of monopolization disappears as downstream competition intensifies (since double marginalization vanishes), in our setting it does not. Hence, our theory—whether under public offers with or without contractual frictions[45] or under private offers with contractual frictions—provides a better fit for monopolization cases involving must-haves, where it has been established that competition among distributors is relatively intense.

V. Final Remarks

In this article, we have developed a new theory of monopolization that better fits the market conditions observed in the antitrust cases involving so-called "must-have" items. Our theory should prove useful not only to courts housing such cases (see the Introduction for examples) but also to regulators and policymakers in charge of, for example, drafting new regulations or screening different types of mergers.

For an example concerning new regulations, consider the rules governing retransmission consent negotiations (RCNs): these are guidelines under which over-the-air television broadcasters negotiate with cable operators for billions of dollars in compensation in return for permission to retransmit their signals.[46] In 2014, the US Congress directed the Federal Communication Commission (FCC) to review the guidelines governing RCNs. In response, the FCC released a Notice of Proposed

[45] In Sections I to III, we assumed that M's public offers can include fixed fees. However, as we show in the online Appendix, our results continue to hold when M makes public offers that are subject to upstream contractual frictions.

[46] Only in 2013 did broadcasters receive approximately \$3.3 billion in retransmission consent payments. See NERA Economic Consulting: Delivering for Television Viewers: Retransmission Consent and the US Market for Video Content. https://www.nera.com/content/dam/nera/publications/2014/PUB_Retransmission_Consent_0714.pdf (accessed February 7, 2022).

Rulemaking seeking comments on whether the tying of broadcast signals with other networks should be prohibited in the context of RCNs.

The FCC was particularly concerned that tying arrangements might force cable operators to purchase less popular programming that they did not want—potentially foreclosing smaller content producers and increasing prices paid by final consumers—to have access to "must-have" broadcast programming needed to retain subscribers.[47] Our theory supports these concerns but, at the same time, warns us that simply prohibiting tying may sometimes harm consumers unless additional measures designed to curb suppliers' incentives to engage in refusal to deal are incorporated into the rules governing RCNs.

Our theory should also prove useful when screening conglomerate mergers. For instance, in their evaluation of the merger between Procter and Gamble and Gillette (EU Case No. COMP/M.3732, 2005), EU authorities expressed concerns about the increased incentives of the newly created entity to leverage its strong market position from one market to another given the significant number of "must-have brands" that the two parties owned (e.g., Ariel and Head and Shoulders for Procter and Gamble and Oral B and Gillette razors and blades for Gillette). Our theory suggests that those concerns are justified, although the implications of must-have items for such types of transactions are certainly worth exploring more closely in future work.[48]

Appendix A. Proof of Proposition 1

We show that if in equilibrium $w_{Bi} > c_B$ for some $i = 1,2$, then M must be obtaining strictly negative profits, a contradiction. We do this by characterizing an upper bound of M's equilibrium payoff.

To start, in equilibrium, there is no loss of generality (i) to focus on the case where M offers all distributors contracts with exclusivity provisions and (ii) to assume that every distributor accepts M's offer.[49] Suppose then that in equilibrium M offers contracts with wholesale prices $\mathbf{w} \equiv (w_{B1}, w_{B2})$, where $w_{Bi} \leq p_B^m \equiv \arg\max_{p_B} \pi_B(p_B; c_B)$ for $i = 1,2$ (the proof for when $w_{Bi} > p_B^m$ for some i follows the exact same logic). The on-path downstream equilibrium prices are $p_{Bi}^* = p_{Bj}^* = \max\{w_{B1}, w_{B2}\} \equiv p_B^*(\mathbf{w})$. It is then an equilibrium for both distributors to accept M's offers if and only if the following participation constraints are satisfied:

$$\text{(A1)} \qquad \overbrace{\left[p_B^*(\mathbf{w}) - w_{Bi}\right] Q_B\left(p_B^*(\mathbf{w})\right) - T_{Bi}}^{D_i\text{'s on-path profits from accepting } M\text{'s offer}}$$

$$\geq \underbrace{\left[p_B^*(\mathbf{w}) - c_B\right] Q_B\left(p_B^*(\mathbf{w})\right)}_{D_i\text{'s deviating profits from accepting the fringe's offer}} \qquad \text{for } i = 1,2.$$

[47] "Implementation of Section 103 of the STELA Reauthorization Act of 2014/Totality of the Circumstances Test," 80 FR 59706 (October 2, 2015).

[48] See Ide (2023) for a new explanation for why conglomerate mergers can increase wholesale and retail prices. His theory, however, does not involve must-have items or foreclosure/monopolization.

[49] To see (i), consider an arbitrary equilibrium in which distributors' wholesale prices are $\mathbf{w} = (w_{B1}, w_{B2})$. M can always implement the same vector using contracts of the form $(w_{Bi}, T_{Bi}, e_i = 1)$ and end up weakly better off, as exclusivity provisions restrict distributors' flexibility, allowing M to extract a greater share of distributors' profits (crucial in this argument is the fact that the fringe is a nonstrategic player). For (ii), M can always offer the contract $(w_{Bi} = c_B, T_{Bi} = 0, e_i = 1)$, which is equivalent to letting D_i buy B only from the fringe.

While D_i's on-path profits—the left-hand side of (10)—are clear, D_i's profits from deviating to the fringe's contract are equal to $\left[p_B^*(\mathbf{w}) - c_B\right] Q_B\left(p_B^*(\mathbf{w})\right)$ because, following the deviation, D_i's optimal response is to undercut D_j's on-path price by a small amount and to capture the entire market.

Now, M's payoff in any equilibrium is bounded above by M's payoff in his preferred SPNE. Moreover, in M's preferred SPNE, both distributors' participation constraints must be binding (Segal 1999), which implies that $T_{Bi} = -(w_{Bi} - c_B) Q_B\left(p_B^*(\mathbf{w})\right)$. Substituting these fixed fees into M's payoff function and assuming, without loss, that $w_{B1} \leq w_{B2}$ implies that M's profits in his preferred SPNE are

$$\Pi_M^{pSPNE} = (w_{B1} - c_B) Q_B(w_{B2}) + T_{B1} + T_{B2} = -(w_{B2} - c_B) Q_B(w_{B2}).$$

This expression is strictly negative unless $w_{B2} = c_B$, which immediately implies that $w_{B1} = c_B$ (recall that we set $w_{B1} \leq w_{B2}$). Hence, in equilibrium, it must be that $w_{Bi} = c_B$ and $T_{Bi} = 0$ for $i = 1,2$; otherwise, M obtains strictly negative profits in his preferred SPNE and, therefore, in any equilibrium.

Appendix B. Proof of Proposition 2

Let $\Delta \equiv v_A(p_A^m) + v_B(p_B^m) - v_B(c_B)$. The solution to (2) is given by

If $\Delta \geq 0$, $p_A^{lf} = p_A^m$ and $p_B^{lf} = p_B^m$.

If $\Delta < 0$, $p_A^{lf} = \bar{p}_A$ and $p_B^{lf} = \bar{p}_B$, where

$$(\bar{p}_A, \bar{p}_B) = \underset{(p_A, p_B)}{\arg\max} \Big\{ \pi_A(p_A; c_A) + \pi_B(p_B; c_B) \quad \text{s.t. } v_A(p_A) + v_B(p_B) = v_B(c_B) \Big\}, \tag{B1}$$

and where we are using the property that $(p - c) Q_k'(p) / Q_k(p)$ is strictly decreasing in p for $k = A, B$, to ensure that the solution to (11) is unique. Now, regarding the proof of the proposition, for ease of exposition, we have split it into two cases: (i) $\Delta \geq 0$ and (ii) $\Delta < 0$.

LEMMA 3: *If $\Delta \geq 0$, then in any equilibrium, M obtains $\pi_A(p_A^m; c_A) + \pi_B(p_B^m; c_B)$ and consumers pay p_A^m and p_B^m.*

PROOF:

To simplify notation, let $\Psi^m \equiv \pi_A(p_A^m; c_A) + \pi_B(p_B^m; c_B)$ be the maximized industry profits, and define Π_M^* as M's payoff in an SPNE. We will first show that $\Pi_M^* = \Psi^m$, and then we use it to show that consumers therefore must be paying p_A^m and p_B^m in any equilibrium.

To show $\Pi_M^* = \Psi^m$, we will establish that both $\Pi_M^* \leq \Psi^m$ and $\Psi^m \leq \Pi_M^*$. That $\Pi_M^* \leq \Psi^m$ is immediate: since distributors must earn nonnegative profits in equilibrium (they can always reject all contracts), M's profits cannot be (strictly) higher than the total industry profits generated. Thus, $\Pi_M^* \leq \Psi^m$ as Ψ^m is the maximum possible level of industry profits attainable.

To prove $\Psi^m \leq \Pi_M^*$, on the other hand, suppose that M offers $\left(w_{Ai} = p_A^m, w_{Bi} = p_B^m, T_i = -\epsilon/2, e_i = 1\right)$ to $i = 1,2$, with $\epsilon > 0$. If we can show that the unique equilibrium of the continuation game involves both distributors accepting M's offers, then we have established that $\Psi^m \leq \Pi_M^*$ since the above offers secure M a payoff of Ψ^m as $\epsilon \to 0$.

Because a distributor that rejects M's exclusive offer is always weakly better off accepting the fringe's contract (rather than not accepting a contract at all), the continuation game accepts the following equilibrium candidates:

- Both distributors reject M's offers and accept the fringe's contract. If so, both distributors charge c_B on-path and obtain zero profits. This candidate, however, cannot be an equilibrium, since a distributor who deviates and takes M's offer would secure at least $\epsilon/2 > 0$.
- One distributor—say, D_1—accepts M's offer, while the other distributor accepts the fringe's offer. This cannot be an equilibrium either. Because $v_A\left(p_A^m\right) + v_B\left(p_B^m\right) \geq v_B\left(c_B\right)$, D_2 would be making no profit on-path, while deviating to accept M's offer would secure her at least $\epsilon/2 > 0$.
- Both distributors accept M's exclusive offers. If so, both distributors charge p_A^m and p_B^m and obtain each $\epsilon/2$ profit on-path. This is clearly an equilibrium (and, thus, the only one), for if a distributor deviates and takes the fringe's contract, she fails to attract any consumer—as $v_A\left(p_A^m\right) + v_B\left(p_B^m\right) \geq v_B\left(c_B\right)$—and, hence, makes no profits.

Having shown that $\Pi_M^* = \Psi^m$, it is then immediate that consumers must be paying p_A^m and p_B^m. Otherwise, total industry profits are strictly less than Ψ^m, implying that $\Pi_M^* < \Psi^m$, as M's profits cannot be larger than the total industry profits achieved, a contradiction. ∎

LEMMA 4: *If* $\Delta < 0$, *then in any equilibrium,* M *obtains* $\bar{\Psi} \equiv \pi_A\left(\bar{p}_A; c_A\right) + \pi_B\left(\bar{p}_B; c_B\right)$ *and consumers pay* $\bar{p}_A$ *and* $\bar{p}_B$.

Proving this lemma is slightly more involved, so we split its proof into three smaller claims. As before, let Π_M^* be M's payoff in an SPNE, and define Π_M^{pSPNE} as M's payoff in his preferred SPNE, which by construction cannot be smaller than Π_M^*, i.e., $\Pi_M^* \leq \Pi_M^{pSPNE}$.

CLAIM 1: *If* $\Delta < 0$, *then in any equilibrium,* M *can secure at least* $\bar{\Psi}$, *i.e.,* $\Pi_M^* \geq \bar{\Psi}$.

PROOF:

Suppose M offers $\left(w_{Ai} = \bar{p}_A, w_{Bi} = \bar{p}_B, T_i = -\epsilon/2, e_i = 1\right)$ to $i = 1,2$, with $\epsilon > 0$. By using similar reasoning as in Lemma 3, it is possible to prove that the unique equilibrium of the continuation game following these offers involves both distributors accepting the offers. This implies that $\Pi_M^* \geq \bar{\Psi}$, since these offers secure M a payoff of at least $\bar{\Psi}$ as $\epsilon \to 0$. ∎

CLAIM 2: *If* $\Delta < 0$, *then in any equilibrium,* M *can secure at most* $\bar{\Psi}$, *i.e.,* $\Pi_M^* \leq \bar{\Psi}$.

PROOF:

Since M's payoff in any SPNE is bounded above by M's payoff in his preferred SPNE, i.e., $\Pi_M^* \leq \Pi_M^{pSPNE}$, the idea of the proof is to show that M can secure at most $\bar{\Psi}$ in his preferred SPNE, i.e., $\Pi_M^{pSPNE} \leq \bar{\Psi}$. To characterize this upper bound, we proceed as in the proof of Proposition 1.

First, in any Nash equilibrium, it is without loss of generality to (i) focus on M offering all distributors the most complex contracts available, i.e., tying contracts with exclusivity provisions $(w_{Ai}, w_{Bi}, T_i, e_i = 1)$, and (ii) assume that every distributor accepts M's offer. Suppose then that in equilibrium, M offers contracts with a vector of wholesale prices $\mathbf{w} \equiv (w_{A1}, w_{B1}, w_{A2}, w_{B2})$, and without loss of generality, assume that $v_A(w_{A1}) + v_B(w_{B1}) \geq v_A(w_{A2}) + v_B(w_{B2})$. To further simplify the proof, assume that if both distributors offer consumers the same surplus, the tie-breaking rule is that all consumers buy from D_1 (the proof can easily be generalized to an arbitrary tie-breaking rule).

The fact that $v_A(w_{A1}) + v_B(w_{B1}) \geq v_A(w_{A2}) + v_B(w_{B2})$ plus Bertrand competition implies that on-path D_2 charges $p_{A2}^*(\mathbf{w}) = w_{A2}$ and $p_{B2}^*(\mathbf{w}) = w_{B2}$ for A and B, respectively. The retail prices charged by D_1, in turn, satisfy the following problem:

$$\left(p_{A1}^*(\mathbf{w}), p_{B1}^*(\mathbf{w})\right) = \underset{(p_{A1}, p_{B1})}{\arg\max}\Big\{\pi_A(p_{A1}; w_{A1}) + \pi_B(p_{B1}; w_{B1}) \quad \text{s.t. } v_A(p_{A1}) + v_B(p_{B1}) \geq v_A(w_{A2}) + v_B(w_{B2})\Big\}.$$

This implies that only D_1 is selling strictly positive units on-path. Accepting M's offers is a Nash equilibrium if and only if the following participation constraints are satisfied:

$$\pi_A\left(p_{Ai}^*(\mathbf{w}); w_{Ai}\right) + \pi_B\left(p_{Bi}^*(\mathbf{w}); w_{Bi}\right) - T_i \geq R_i\left(p_{Aj}^*(\mathbf{w}), p_{Bj}^*(\mathbf{w})\right) \quad \text{for } i = 1, 2,$$

where

$$\text{(B2)} \qquad R_i(p_{Aj}, p_{Bj}) \equiv \Big\{\max_{\tilde{p}_B} \pi_B(\tilde{p}_B; c_B) \quad \text{s.t. } v_B(\tilde{p}_B) \geq v_A(p_{Aj}) + v_B(p_{Bj}) - \epsilon \mathbf{1}\{i = 2\}\Big\}$$

is D_i's reservation payoff given that on-path D_j is expected to charge (p_{Aj}, p_{Bj}). That is, $R_i(p_{Aj}, p_{Bj})$ is the maximum profit that D_i can obtain by deviating to the fringe's contract. Regarding problem (B2), two clarifying remarks are made: (i) we use the convention that $R_i(p_{Aj}, p_{Bj}) = 0$ if the solution to the problem is unfeasible, and (ii) the term $\epsilon \mathbf{1}\{i = 2\}$ is due to the assumed tie-breaking rule.

In M's preferred SPNE, both distributors' participation constraints must be binding; otherwise, M could increase his equilibrium payoff. Obtaining the equilibrium transfers from the binding constraints, substituting them into M's payoff function, and using the fact that D_1 is the only distributor selling on-path implies that M's payoff in his preferred SPNE is the solution to the following problem:

$$\begin{aligned}\Pi_M^{pSPNE} &= \max_{\mathbf{w}}\left\{(w_{A1}-c_A)Q_A(p_{A1}^*(\mathbf{w})) + (w_{B1}-c_B)Q_B(p_{B1}^*(\mathbf{w})) + T_1 + T_2\right\}\\ &= \max_{\mathbf{w}}\left\{\pi_A(p_{A1}^*(\mathbf{w});c_A) + \pi_B(p_{B1}^*(\mathbf{w});c_B)\right.\\ &\qquad\left. - R_1(p_{A2}^*(\mathbf{w}),p_{B2}^*(\mathbf{w})) - R_2(p_{A1}^*(\mathbf{w}),p_{B1}^*(\mathbf{w}))\right\}.\end{aligned}$$

With this in mind, define Φ^* as the value function of the following auxiliary problem:

$$\text{(B3)} \qquad \max_{p_{A1},p_{B1}}\left\{\pi_A(p_{A1};c_A) + \pi_B(p_{B1};c_B) - R_2(p_{A1},p_{B1})\right\}.$$

It is clear that $\Phi^* \geq \Pi_M^{pSPNE}$: in the auxiliary problem, (i) M controls prices directly (instead of indirectly via $\mathbf{w}$), and (ii) D_1's reservation payoff is assumed to be zero. Using the property that $(p-c)Q_k'(p)/Q_k(p)$ is strictly decreasing in p for $k = A,B$, it is then possible to prove that $\Phi^* = \bar{\Psi}$. Thus, $\Pi_M^* \leq \Pi_M^{pSPNE} \leq \Phi^* = \bar{\Psi}$, so $\Pi_M^* \leq \bar{\Psi}$. ∎

CLAIM 3: *If* $\Delta < 0$, *then in any equilibrium, M obtains of* $\bar{\Psi} \equiv \pi_A(\bar{p}_A;c_A) + \pi_B(\bar{p}_B;c_B)$ *and consumers pay* $\bar{p}_A$ *and* $\bar{p}_B$.

PROOF:

From Claims 1 and 2, we have that $\Pi_M^* = \bar{\Psi}$. To prove that consumers must be paying $\bar{p}_A$ and $\bar{p}_B$, we follow the proof in Lemma 3 and suppose otherwise, in which case total industry profits are strictly less than $\bar{\Psi}$. However, we know that M's payoff in any equilibrium is bounded above by the total industry profits (since distributors must earn nonnegative profits in equilibrium), which implies that $\Pi_M^* < \bar{\Psi}$, a contradiction. ∎

Appendix C. Proof of Proposition 3

Suppose that M offers nothing to D_j and the following two-part-tariff contract to D_i: $(w_{Ai} = c_A, T_{Ai} = T_A)$ and $(w_{Bi} = c_B, T_{Bi} = 0)$, where $T_A = \pi_A\left(p_A^{lf};c_A\right) + \pi_B\left(p_B^{lf};c_B\right) - \epsilon$ with $\epsilon \to 0$. Suppose also that the unique equilibrium of the continuation game following these offers is for D_i to accept M's offer (we later verify that this is indeed the equilibrium).

Since $v_A(c_A) + v_B(c_B) \geq v_B(c_B)$, Bertrand competition implies that on-path D_j charges $p_{Bj}^* = c_B$ for product B (the only product that she carries). The retail prices charged by D_i on-path must therefore satisfy the following condition:

$$\begin{aligned}(p_{Ai}^*,p_{Bi}^*) = \arg\max_{(p_{Ai},p_{Bi})}&\left\{\pi_A(p_{Ai};c_A) + \pi_B(p_{Bi};c_B)\right.\\ &\left.\text{s.t. } v_A(p_{Ai}) + v_B(p_{Bi}) \geq v_B(c_B)\right\}.\end{aligned}$$

That is, D_i charges the retail prices of Proposition 2, i.e., $p^*_{Ai} = p^{lf}_A$ and $p^*_{Bi} = p^{lf}_B$. This implies that on-path D_j makes no profit, D_i obtains $\Pi^*_i = \pi_A\left(p^{lf}_A; c_A\right) + \pi_B\left(p^{lf}_B; c_B\right) - T_{Ai} = \epsilon$, and M obtains $\Pi^*_M = T_{Ai} = \pi_A\left(p^{lf}_A; c_A\right) + \pi_B\left(p^{lf}_B; c_B\right) - \epsilon$.

Given D_i's payoff, accepting M's offer is clearly an equilibrium. A deviation to take the fringe's contract would leave her with nothing as opposed to ϵ because D_j is charging c_B for B on-path. To verify that this is indeed the unique equilibrium of the continuation game, let us look at the other possible equilibrium candidate, which is for D_i to reject M's offer and accept the fringe's offer along with D_j. Doing so reports D_i no profit on-path, while deviating to take M's offer reports her ϵ, implying that this candidate cannot be an equilibrium.

Thus, the unique equilibrium of the continuation game involves D_i accepting M's offer. However, if so, then in any equilibrium, $\Pi^*_M \geq \pi_A\left(p^{lf}_A; c_A\right) + \pi_B\left(p^{lf}_B; c_B\right)$, as M can always secure this amount with the above offers by letting $\epsilon \to 0$. Moreover, by Proposition 2, we know that $\pi_A\left(p^{lf}_A; c_A\right) + \pi_B\left(p^{lf}_B; c_B\right)$ is the maximum possible profit when tying and exclusives are available, so $\Pi^*_M \leq \pi_A\left(p^{lf}_A; c_A\right) + \pi_B\left(p^{lf}_B; c_B\right)$ in the absence of tying and exclusives. Consequently, in equilibrium, it must be that $\Pi^*_M = \pi_A\left(p^{lf}_A; c_A\right) + \pi_B\left(p^{lf}_B; c_B\right)$. By the exact same reasoning as in Proposition 2, the fact that $\Pi^*_M = \pi_A\left(p^{lf}_A; c_A\right) + \pi_B\left(p^{lf}_B; c_B\right)$ immediately implies that in any equilibrium, consumers must be paying retail prices p^{lf}_A and p^{lf}_B.

Appendix D. Proof of Proposition 4

We first show that if either tying or exclusives are forbidden, and discrimination and refusal to deal are banned, then in equilibrium, M obtains $\pi_A\left(p^m_A; c_A\right)$ and consumers pay $p^{ri}_A = p^m_A$ and $p^{ri}_B = c_B$. We do this by first analyzing the case where exclusives are banned and then the case where tying provisions are forbidden. Afterward, we show that consumer welfare is strictly higher than in Propositions 2 and 3.

A. *Equilibrium If Exclusives Are Forbidden*

Given the restrictions on the space of contracts, the equilibrium involves M offering either tying contracts or two-part tariff contracts. We show that in both situations, $\Pi^*_M = \pi^m_A\left(p^m_A; c_A\right)$, and consumers pay $p^{ri}_A = p^m_A$ and $p^{ri}_B = c_B$ for products A and B, respectively.

Equilibrium with Tying Offers.—First, we consider an equilibrium where M offers tying contracts. The ban on discrimination implies that M must offer both distributors the same contract $\left(w_A, w_B, T\right)$.

We first claim that in equilibrium, it is without loss to focus on $w_B \leq c_B$. Indeed, because exclusivity provisions are forbidden, and given that the fringe's contract does not involve a fixed fee, a distributor is always weakly better off accepting the fringe's contract. Hence, if M sets $w_B > c_B$, distributors ex post choose to source B from the fringe even if they also accept M's offers, so setting $w_B > c_B$ is outcome equivalent to setting $w_B = c_B$.

We additionally claim that the ban on refusal to deal implies that $T < 0$. Recall that the ban forces M to offer contracts that are accepted by both distributors in equilibrium. With this in mind, notice that because both distributors have wholesale costs of w_A and w_B for A and B, respectively, equilibrium retail prices are equal to $p^*_{Ai} = w_A$ and $p^*_{Bi} = w_B$ for $i = 1,2$ (recall that $w_B \leq c_B$), so distributors are making no profits before fixed fees. Hence, for both distributors to accept M's offer, it must be that $T < 0$.[50]

Thus, if M makes tying offers, his profits in equilibrium are $\Pi^*_M = (w_A - c_A)Q_A(w_A) + (w_B - c_B)Q_B(w_B) + 2T$, where $w_B \leq c_B$ and $T < 0$. Since in equilibrium, M is maximizing his profits, it must be then that $w_A = p^m_A$, $w_B = c_B$, and $T = -\epsilon$ (with $\epsilon > 0$ but $\epsilon \to 0$), which implies that $\Pi^*_M = \pi_A(p^m_A; c_A)$ and that consumers pay prices equal to $p^{ri}_A = p^m_A$ and $p^{ri}_B = c_B$ for A and B, respectively.

Equilibrium with Two-Part Tariffs.—Consider now a potential equilibrium where M offers two-part tariff contracts. The ban on discrimination implies that M must offer both distributors the same contracts (w_A, T_A) and (w_B, T_B). Following the same logic as in the tying-offers case, the lack of exclusivity provisions implies that $w_B \leq c_B$. The ban on refusal to deal, on the other hand, implies that $T_A + T_B < 0$.

Thus, if M makes two-part tariff offers, his profits in equilibrium are $\Pi^*_M = (w_A - c_A)Q_A(w_A) + (w_B - c_B)Q_B(w_B) + 2(T_A + T_B)$, where $T_A + T_B < 0$. Since in equilibrium, M is maximizing his profits, it must be that $w_A = p^m_A$, $w_B = c_B$, and $T_A + T_B = -\epsilon$ (with $\epsilon > 0$ but $\epsilon \to 0$), which implies that $\Pi^*_M = \pi_A(p^m_A; c_A)$ and that consumers pay prices equal to $p^{ri}_A = p^m_A$ and $p^{ri}_B = c_B$ for A and B, respectively.

Equilibrium Existence.—Formally speaking, the above arguments only showed that if an equilibrium in pure strategies exists, then it must be that $\Pi^*_M = \pi_A(p^m_A; c_A)$ and that $p^{ri}_A = p^m_A$ and $p^{ri}_B = c_B$ (we showed this by considering the only two possibilities: equilibrium in tying and equilibrium in two-part tariffs).

However, it is easy to see that M offering $(w_A = p^m_A, T_A = -\epsilon)$ and $(w_B = c_B, T_B = -\epsilon)$ to both distributors is an equilibrium of the game and that such offerings satisfy all the contract restrictions. The same can be said about M offering $(w_A = p^m_A, w_B = c_B, T = -\epsilon/2)$ to both distributors.

B. *Equilibrium If Tying Provisions Are Forbidden*

Given the restrictions on the space of contracts, the equilibrium involves M offering either exclusive or nonexclusive two-part tariff contracts. We will show that in the exclusive two-part tariff case, $\Pi^*_M = \pi_A(p^m_A; c_A)$, and consumers pay $p^{ri}_A = p^m_A$ and $p^{ri}_B = c_B$ for products A and B, respectively. This is sufficient to prove the

[50] Since we have not specified a particular tie-breaking rule for when a distributor is indifferent between accepting a contract or not, the strict inequality in $T < 0$ is needed to ensure that both distributors are strictly better off by accepting the contract (to fulfill the no-refusal-to-deal requirement). If we instead assumed that distributors break indifferences in favor of M's contract, a weak inequality is sufficient. It is important to highlight that the tie-breaking rule is irrelevant for equilibrium prices and profits, as in the optimum $T \uparrow 0$.

statement since in the previous subsection we already showed that the outcome with nonexclusive two-part tariffs was the same.

Equilibrium with Exclusive Two-Part Tariffs.—In this case, the ban of discrimination implies that M must offer both distributors the same contracts (w_A, T_A) and $(w_B, T_B, e = 1)$.

We now claim that in the absence of tying provisions, the ban on refusal to deal implies that the following inequalities must hold:

$$\text{(D1)} \qquad \begin{aligned} -(T_A + T_B) &> \max\left\{0, -T_A + (w_B - c_B)Q_B(w_B)\mathbf{1}\{w_B \geq c_B\}\right\}, \\ -(T_A + T_B) &> \max\{0, -T_A\}, \\ -(T_A + T_B) &> \max\{0, -T_B\}. \end{aligned}$$

Indeed, given that both distributors must be accepting M's contracts for A and B in equilibrium, on-path retail prices must be $p^*_{Ai} = w_A$ and $p^*_{Bi} = w_B$ for $i = 1,2$, so the equilibrium profits of distributor D_i are $-(T_A + T_B)$. The first inequality in (D1) comes from the fact that a distributor can always deviate and accept M's contract for A plus the fringe's offer for B only and obtain at least $\max\left\{0, -T_A + (w_B - c_B)Q_B(w_B)\mathbf{1}\{w_B \geq c_B\}\right\}$. Hence, for D_i to accept both contracts, a necessary condition is that $-(T_A + T_B) > \max\left\{0, -T_A + (w_B - c_B)Q_B(w_B)\mathbf{1}\{w_B \geq c_B\}\right\}$. In turn, the second and third inequalities in (D1) come from the fact that distributor D_i can always accept M's contract for $k = A, B$ exclusively and obtain a payoff of *at least* $\max\{0, -T_k\}$. Thus, to satisfy the no-refusal-to-deal condition, a necessary condition is that $-(T_A + T_B) > \max\{0, -T_k\}$ for $k = A, B$.

Consequently, if M makes two-part tariff offers with exclusives, his profits in equilibrium are $\Pi^*_M = (w_A - c_A)Q_A(w_A) + (w_B - c_B)Q_B(w_B) + 2(T_A + T_B)$, where T_A, T_B, and w_B must satisfy (14). Since in equilibrium, M is maximizing his profits, this implies that $w_A = p^m_A$, $w_B = c_B$, and $T_A = T_B = -\epsilon$ (with $\epsilon > 0$ but $\epsilon \to 0$). Hence, $\Pi^*_M = \pi_A(p^m_A; c_A)$, and consumers pay prices equal to $p^{ri}_A = p^m_A$ and $p^{ri}_B = c_B$ for A and B, respectively.

C. *Consumer Welfare Is Higher than in Propositions 2 and 3*

Consumer welfare in this case is $CS^{ri} = v_A(p^m_A) + v_B(c_B)$, while in Propositions 2 and 3 it is equal to

$$CS^{lf} = v_A\left(p^{lf}_A\right) + v_B\left(p^{lf}_B\right) = \max\left\{v_A(p^m_A) + v_B(p^m_B), v_B(c_B)\right\}.$$

Hence, $\Delta CS \equiv CS^{ri} - CS^{lf}$ is equal to $v_B(c_B) - v_B(p^m_B) > 0$ when $v_A(p^m_A) + v_B(p^m_B) \geq v_B(c_B)$ and equal to $\Delta CS = v_A(p^m_A) > 0$ otherwise.

D. *A Caveat*

We have focused on contracts of the form $(w_{Ai}, w_{Bi}, T_{Ai}, T_{Bi}, e_i)$. Expanding the contract space to allow for contingent contracts—where, for example, any fixed fee is not paid up front but is contingent on making a positive sale—calls for tightening our robust intervention. To prevent distributors from signing contracts that result in no sales, the robust intervention must require M offering nondiscriminatory and meaningful contracts—that is, contracts that lead to positive and meaningful sales in equilibrium by all distributors. In a world of heterogeneous distributors, this can only make monitoring such interventions even more difficult.

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