A Theory of Must-Haves

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Abstract

"Must-haves"—items that distributors need to "compete effectively"—have played a central role in many recent antitrust cases. We first show how downstream multi-product competition and one-stop shopping give rise to such items: not carrying them impairs distributors' ability to compete for other items in their lineups. We then explain why must-have items make vertical mergers and horizontal mergers of upstream suppliers more anticompetitive, while downstream consolidation helps to mitigate must-haves' anticompetitive effects. Our model provides the first formal theory of must-haves and supports the view that cases involving these products should face greater antitrust scrutiny.

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JEL classifications: D43, K21, L12, L40

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1 Introduction

> At trial, much time was spent debating the "must-have" status of Turner's programming content. According to the Government, distributors literally "must-have" Turner's content in order "to compete effectively" (...) Defendants countered that the term "must-have" is simply a marketing phrase used to mean "popular" and, similarly, that Turner content is not actually necessary to allow distributors to operate their business successfully.
>
> Judge Richard Leon - *17-2511 USA v. AT&T, et al. (RJL)* (2018)

On November 20, 2017, the United States Department of Justice (DOJ), in an unprecedented move, sued to block the AT&T/DirecTV $85.4 billion bid for Time Warner. According to the Government, the merger would substantially lessen competition in the multichannel television market, by enabling the merged company use of Time Warner's *must-have* channels— loosely defined as channels that distributors need to "compete effectively" in the market (e.g., CNN, HBO, TNT)— to hinder AT&T/DirecTV's rival distributors. As the parties were unable to reach a settlement, *U.S. v. AT&T, et al.* became the first fully litigated vertical merger case in the U.S. in the last 40 years, and one of the most closely watched antitrust cases in decades.[1]

Although by far the most prominent example, the multi-channel television market is not the only market in which the notion of must-have items has emerged, nor are authorities' concerns confined exclusively to the alleged effects of these items on vertical mergers. In healthcare, for instance, there is increasing concern that horizontal mergers involving must-have healthcare providers—those perceived to provide the best care for complex and less common conditions—could lead to significant increases in the cost of insurance plans (Glied and Altman, 2017). Similar concerns also arise in retail product markets, where the idea of must-have brands is playing an increasingly important role in the evaluation of mergers of upstream suppliers.[2]

Given the extensive usage of the term, the lack of consensus and absence of any formal economic theory explaining what makes a particular product a must-have, is all the more surprising.[3] In this paper, we aim to fill this gap by providing the first formal theory of must-have items. We then use this theory to explain why must-haves make vertical mergers and horizontal mergers of upstream suppliers more anticompetitive, and how practices conducive to downstream consolidation—such as buyer alliances and horizontal mergers of distributors—help

[1]On June 12, 2018, in a highly controversial decision, Judge Richard Leon approved the merger without conditions, marking a historic defeat for the DOJ. The approval decision was upheld unanimously on February 28, 2019 by a panel of three Judges of the U.S. Appeals Court. The same day, the DOJ communicated that no further actions would be undertaken on the case.

[2]See, for instance, *Procter & Gamble/Gillette*, EU Case No COMP/M.3732 (2005).

[3]Consider, for instance, the following exchange during the AT&T-Time Warner trial: "Q: How about CNN, why is CNN a must-have? A: Well, imagine coming around midterm elections without CNN, right."

to mitigate must-haves' anticompetitive effects.

Our point of departure is the observation that all the above markets (pay-TV, healthcare, and retail) share the following features: (i) distributors (cable operators, insurance companies, supermarkets) procure their products from upstream suppliers (content producers, healthcare providers, manufacturers) through bilateral negotiations, (ii) supplier-distributor negotiations usually yield wholesale unit prices above marginal costs (e.g., Crawford and Yurukoglu, 2012; Ho and Lee, 2017; Noton and Elberg, 2018), (iii) distributors compete downstream to serve customers interested in multiple products,[4] and (iv) many of these consumers buy everything from a single outlet, i.e., they one-stop shop (e.g., Crawford et al., 2018; Dafny, Ho and Lee, 2019; U.K. Office of Fair Trading, 2000).

In such a setting, we show that, under certain conditions, items in which suppliers have market power—either because there are no substitutes, or because all substitutes are controlled by the same supplier—achieve "must-have" status in the following sense: not carrying them impairs a distributor's ability to compete effectively for *other* items in its lineup.[5]

To see why, consider two horizontally differentiated distributors, D_1 and D_2, serving a group of final consumers interested in purchasing two products, A and B, some of whom are forced to one-stop shop. Product A comes in a single variety, has no close substitutes, and is supplied by a single firm, M. Product B, in contrast, comes in different varieties, all very close substitutes for one another, and is supplied by a fringe of competitive producers. Distributors bargain with suppliers over linear (wholesale) prices,[6] have no costs other than those of purchasing the products from suppliers, and compete by simultaneously setting prices downstream.

Starting from a situation in which both distributors carry both products, consider then the removal of product A from one of the distributor's lineups, say from D_1's. Crucially, A's removal makes D_1's offering less attractive (i.e., *vertically inferior*) than D_2's offering to those consumers interested in purchasing both products and who one-stop shop. As a result, one-stop shoppers switch their purchases of both A and B from D_1 to D_2. A's removal, therefore, not only affects D_1's sales of product A but also of product B. Thus, A classifies as a must-have item for D_1.[7]

Moving upstream, the previous result implies that not reaching an agreement with M can have dire consequences for distributors: in addition to losing the potential profits to be made on A, a distributor could also end up losing a significant fraction of the profits to be made on

[4] In pay-TV markets, cable operators offer TV packages of several channels. In healthcare, large employers usually look for insurance plans covering the multiple distinct geographic locations where their employees live and work.

[5] Some practitioners associate the notion of must-haves to that of "essential inputs"—inputs without which competitors cannot operate downstream. Our notion of must-haves is closely connected but different to that of essential inputs. In a nutshell, all essential inputs classify as must-haves, though not all must-haves are essential inputs. As we discuss shortly, this distinction has important practical implications.

[6] The assumption of linear-price contracts is not strictly necessary for our results (see Section 2.3).

[7] An individual variety of B, in contrast, is not a must-have for D_1: its removal has no meaningful effect since there are many other perfectly homogeneous varieties of B readily available for distributors.

B. That is, must-have items decrease distributors' outside options in their negotiations with suppliers, allowing the latter to secure higher wholesale prices, and ultimately leading to higher prices downstream.

Our notion of must-haves rests on two important properties that are easy to overlook. First, even though must-have is a binary classification, there is a degree of intensity inherent to it: some must-haves can cause—through their removal from a distributor's lineup—a large loss in sales of unrelated products, while other such items generate much smaller losses. We call this loss the product's *must-have potential*. The higher an item's must-have potential for a given distributor, the more the distributor's outside option is affected by its removal, and the more leverage the supplier has in the respective bilateral negotiation.

Second, as can be gleaned from the vertical-differentiation argument above, our notion of must-haves is not an intrinsic property of a particular product, but rather the result of a multi-dimensional interaction involving (i) product characteristics (such as the presence or absence of close substitutes), (ii) upstream market conditions (such as distributors' ability to secure those substitutes and the extent of double marginalization in each bilateral negotiation), (iii) downstream market conditions (such as the level of downstream differentiation and the pervasiveness of one-stop shopping), and (iv) distributors' product portfolio decisions. An item's must-have potential, therefore, is a function of all these variables.

These two properties yield three important insights. First, the must-have potential of a particular product is not independent of the status quo, and is not necessarily constant across distributors. Hence, strictly speaking, we should talk about "product k being a must-have for D_i given the current set of market conditions." This implies, as we discuss in more detail in Section 2, that estimating an item's must-have potential may require a structural approach.[8]

Second, while any product with any degree of must-have potential classifies as a must-have for a particular distributor, what matters in practice is the magnitude of this potential, not the binary classification. For instance, an item with positive but arbitrarily small must-have potential is not meaningfully different from one without any.[9]

Third and finally, transactions and practices that alter the structure of the upstream or downstream market—such as horizontal and vertical mergers, or the formation of buyer alliances—can build or destroy items' must-have potential by affecting the multi-dimensional interaction that defines them. Hence, in the context of must-haves, there will be an interaction—a "cross-derivative," if you will—between items' must-have potential and transactions that change

[8] In Section 2 we also explain why it is possible to identify this potential from wholesale price data.

[9] Thus, there is a clear analogy between our notion of must-haves and the concept of relevant market and product substitutability in antitrust. Given some market definition, all products in the relevant market have different degrees of substitutability. From a practical perspective however, authorities are only concerned with products that have low substitutability as this gives rise to "significant" market power. In a context of multi-product competition and one-stop shopping, many products may be classified as must-haves. Their must-have potential (and corresponding competitive harm), however, varies across product-distributor pairs depending on the remaining elements of the aforementioned multi-dimensional interaction.

the market's structure.

Horizontal mergers of upstream suppliers, for instance, increase items' must-have potential by affecting distributors' ability to find substitutes for such items (i.e., they increase supplier market power). Buyer alliances and horizontal mergers of distributors, in contrast, decrease this potential because when distributors negotiate jointly there is less scope for asymmetric product portfolios (i.e., a failed negotiation cannot make a distributor vertically inferior to its rivals when they all belong to the same alliance). Finally, vertical mergers involving a supplier of a must-have item, help increase the item's must-have potential by eliminating double marginalization within the merging entity. This makes the latter more aggressive downstream in the event that rival distributors do not carry the must-have item. As a result, rival distributors become more vulnerable to the exodus of one-stop shoppers in the case of a negotiation breakdown.

That is, transactions conducive to upstream and vertical consolidation strengthen items' must-have status, leading to more anticompetitive outcomes.[10] Meanwhile, practices conducive to downstream consolidation weaken items' must-have status, helping to mitigate their anticompetitive effects. Thus, in the context of must-have items, antitrust authorities should unambiguously lean less favorably towards both horizontal mergers of upstream suppliers and vertical mergers. In contrast, they should lean more favorably towards buyer alliances and horizontal mergers of distributors.

Note that in our theory, not carrying A does not force a distributor to exit the market, even though its business is adversely impacted. We cannot think of any item in any market whose removal would leave a distributor in such a life-threatening situation. To some, however, this is precisely what makes an item a must-have: an "essential input" without which a competitor cannot operate downstream.

Our notion of must-haves is closely connected but distinct from that of essential inputs. By definition, all essential inputs classify as must-haves; not carrying them affects a distributor's sales of other items to the extent that the distributor exits the market. However, the reverse is not true; not carrying a must-have does not necessarily lead to a distributor's complete shut down.[11]

The problem, however, of focusing exclusively on essential inputs (instead of adopting our broader notion of must-haves) is that they follow a strict binary classification—either a distributor can operate without them or it cannot. Since it is quite challenging to prove that a distributor would ever be in such a knife-edge situation, and taking into account that exiting the

[10] Note that a supplier's ability to extract better terms using its must-have products does not immediately imply that the practice or transaction under consideration is necessarily more anticompetitive in the presence of these items. This is because the power conveyed by must-haves is also at the supplier's disposal before the practice takes place. Therefore, the reason upstream and vertical consolidation are more anticompetitive in the presence of must-haves is that such practices interact with these items by increasing their must-have potential.

[11] Thus, given that supplier market power is necessary (but not sufficient) for must-have items to emerge, essential inputs are a strict subset of must-haves, which, in turn, are a strict subset of all products over which suppliers have market power.

market is not necessary for anticompetitive harm to emerge, the essential-input interpretation results in too high a standard of proof for authorities and policymakers. This particular issue constituted, in fact, a significant setback in the Government's case against AT&T and Time Warner:

> Based on the evidence, I agree with defendants that Turner's content is not *literally* "must have" in the sense that distributors cannot effectively compete without it.
>
> Judge Richard Leon - *17-2511 USA v. AT&T, et al. (RJL)* (2018)

Consequently, narrowing the focus to essential inputs only serves to divert attention from a real threat: the fact that must-haves, as viewed through the lens of our less stringent notion, can be highly anticompetitive.

Related literature.—First and foremost, our paper relates to the literature studying the antitrust implications of upstream, downstream, and vertical consolidation. This literature has long been aware of the existence of competitive tradeoffs.[12] We review these tradeoffs in more detail in Sections 3–5. Our contribution, however, is not to document the existence of these tradeoffs, but instead to explore how must-have items lead to additional, undocumented forces.

To accomplish this, we borrow from Horn and Wolinsky (1988) and use their "Nash-in-Nash" bargaining framework to model supplier-distributor negotiations.[13] We follow this approach not only for its tractability, but also because this bargaining protocol has become the workhorse empirical model when analyzing settings in which the terms of trade between upstream suppliers and downstream distributors are determined by bilateral negotiations (see, e.g., Chipty and Snyder, 1999; Villas-Boas and Zhao, 2005; Crawford and Yurukoglu, 2012; Lee, 2013; Gowrisankaran, Nevo and Town, 2015; Ho and Lee, 2017; Crawford et al., 2018; Noton and Elberg, 2018; Cuesta, Noton and Vatter, 2019).[14]

Finally, our paper also connects to the literature on one-stop shopping and downstream competition initiated by Bliss (1988) and Klemperer (1992), which is recently receiving increasing attention. For example, Chen and Rey (2012) study how one-stop shopping may allow large multi-product distributors to engage in loss-leading strategies to foreclose rival distributors carrying smaller subsets of products; Zhou (2014) shows how multi-product search creates complementarities between independent products, incentivizing multi-product firms to charge

[12] For horizontal mergers see, for instance, Williamson (1968), Farrell and Shapiro (1990), Farrell and Shapiro (2010); for buyer alliances and horizontal mergers of distributors see Galbraith (1952), Stigler (1954), Dobson and Waterson (1997), and Snyder (2008); and for vertical mergers see Spengler (1950), Salop and Scheffman (1983), Ordover, Saloner and Salop (1990), and Riordan (2008).

[13] By extending Rubinstein's (1982) alternating offers model to multiple upstream and downstream firms, Collard-Wexler, Gowrisankaran and Lee (2019) provide a noncooperative foundation for the Nash-in-Nash solution concept advanced by Horn and Wolinsky (1988).

[14] Our results, however, do not hinge on this particular bargaining protocol; they are robust to alternative bargaining protocols based on Nash Bargaining (e.g., Stole and Zwiebel's (1996) generalization of Nash Bargaining). See footnote 30 for more details.

less than single-product ones so as to discourage consumers from searching competitors; and Rhodes and Zhou (2019) show how search frictions in multi-product environments can give rise to asymmetric market structures, with different retail formats coexisting.

In contrast to our paper, however, none of these papers consider supplier-distributor negotiations, which are central to our theory. One exception is the empirical work of Dafny, Ho and Lee (2019), who document how mergers of hospitals located in different geographic areas can nevertheless lead to more expensive insurance plans. They attribute this cost increase to the fact that employers not only look for insurance plans covering multiple geographic locations (where their employees live and work) but they also one-stop shop. The theoretical framework we develop in this paper may help explain some of their results.

The rest of this paper is organized as follows. Section 2 contains our model of must-haves. Sections 3, 4, and 5 analyze, respectively, upstream, downstream, and vertical consolidation in the context of these items. Section 6 concludes. The Appendix contains proofs of selected propositions and lemmas. Remaining proofs and additional results can be found in the online Appendix.

2 A Model of Must-Haves

Inspired by the markets mentioned earlier (pay-TV, healthcare, and retail), here we advance a model of must-haves. After presenting the baseline set-up, we first illustrate how downstream multi-product competition and one-stop shopping can generate must-have items, in the sense that not carrying them impairs distributors' ability to compete for other items in their line-ups. We then explore how the presence of these items affects upstream negotiations between distributors and suppliers. We finish the section with a discussion of what exactly determines a product's must-have status, making clear that this is not an intrinsic product characteristic, but rather the result of a multi-dimensional interaction. This interaction will prove key to understanding the results in Sections 3–5.

2.1 The Set-up

We consider a model with two products, A and B; "two" upstream suppliers, M and a competitive fringe of producers; two horizontally differentiated distributors, D_1 and D_2;[15] and a continuum of final consumers with heterogeneous preferences for the two products.[16]

Products. There is a single variety of A, but $N \geq 2$ perfectly homogeneous varieties of B, denoted by $B_1, ..., B_N$. Think of A as a product for which no close substitutes exist, and $\mathbf{B} = \{B_1, ..., B_N\}$ as a set of generic varieties of B that are widely available.

[15]Results do not change with $n \geq 3$ distributors (see footnote 28 and the online Appendix for details).

[16]From now on, we will use female pronouns to refer to downstream distributors and male pronouns to refer to upstream suppliers.

Consumer Valuations. There is a unit mass of final consumers interested in purchasing one unit of A and one unit of B. We assume that consumer valuations are distributed independently and uniformly over the unit square, i.e., $(v_A, v_B) \sim U[0,1]^2$, and that $v_{AB} = v_A + v_B$, that is, the value of consuming A is independent of consuming B and vice versa.[17]

Upstream Suppliers. M is the sole supplier of product A, while a fringe of perfectly competitive producers supply the different varieties of B. For simplicity, we assume that both A and B are costless to produce.

Downstream Distributors. Distributors, D_1 and D_2, have no costs other than those of purchasing the goods from suppliers.[18]

To introduce downstream differentiation in a tractable way, we assume that: (i) final consumers are split evenly and independently in two separate and equally sized downstream markets each of size $1/2$ and indexed by $m = 1, 2$, and that (ii) consumer valuations involve a market- and distributor-specific component in addition to the intrinsic value of each product.

More precisely, and similar to Bernheim and Madsen (2017), we assume that distributor D_i has a "home" advantage in market $m = i$, in that a consumer in that market values product $k \in \{A, B\}$ at $v_k + \gamma$ when purchased from D_i, and at v_k when purchased from $D_j \neq D_i$, where v_k is the intrinsic valuation of product k for that consumer and γ is a positive parameter (constant across consumers) that captures the degree of downstream differentiation. To prevent distributors from becoming local monopolies in their home markets, we will focus on values of γ that ensure effective downstream competition (the precise range for γ will be specified below).

One-Stop Shopping. We let $s \in [0,1]$ be the probability that any given consumer is a "one-stop shopper" forced to visit, at most, a single distributor (with complement probability the consumer is a "two-stop shopper" allowed to visit both distributors). Whether or not a consumer is a one-stop shopper is independent of all other consumer characteristics.[19]

The parameter s can be motivated by assuming that consumers sometimes incur shopping costs when visiting multiple distributors, which are at times large enough to sway them towards one-stop shopping. These shopping costs may reflect, for example, the opportunity cost of time

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[17]Although the value of consuming one product is independent of consuming the other, one-stop shopping economies (described below) will generate complementarities at the consumer level. It is straightforward, but not extremely insightful, to extend the model to include both, one-stop shopping and valuation complementarities (i.e., $v_{AB} > v_A + v_B$). On the opposite side of the spectrum, results do not change if A and B are substitutes (i.e., $v_{AB} < v_A + v_B$), as long as they are substitutes in a "weak" sense (i.e., some fraction of consumers are still interested in both A and B). Intuitively, the presence of consumers interested in both products is necessary (but not sufficient) for the one-stop shopping complementarity to kick in (see Section 2.2).

[18]It is straightforward to extend the model to the case in which distributors have an additional (exogenous) constant marginal cost $\tau \geq 0$ of selling each product. The implications of scale economies at the distributor level, in turn, are discussed in footnote 27.

[19]Results would not change if we instead model shopping costs explicitly. For example, if consumers faced a shopping cost $\sigma \in [0, \infty)$, drawn from some cumulative distribution $G(\sigma)$, and $G(\sigma)$ is such that a fraction of consumers one-stop-shop in equilibrium. In such a model one-stop shopping would be correlated with consumer valuations.

spent in traffic and parking, selecting products, and so forth; or the increasing burden of dealing with multiple distributors, such as paying multiple bills or contacting different companies for customer service, among others.

Wholesale Negotiations. We assume that suppliers and distributors negotiate bilaterally and simultaneously over a linear (wholesale) price denoted by w_{ki}, where $k = A, B$ and $i = 1, 2$.[20] While any of the varieties of good B will always be obtained from the fringe at cost (i.e., $w_{B1} = w_{B2} = w_B = 0$), we model the outcome of the bargaining between M and the two distributors using Nash-in-Nash as our bargaining protocol (Horn and Wolinsky, 1988; Collard-Wexler, Gowrisankaran and Lee, 2019). Bargaining weights are assumed to be the same in both bilateral negotiations, and equal to $\beta \in (0, 1)$ and $1 - \beta$ for M and D_i, respectively.

Downstream Competition. D_1 and D_2 simultaneously set publicly available prices in each of the downstream markets. Since consumers have unit demands for each product, "non-linear pricing" simply entails the ability to offer a discount for the joint purchase of A and B. Hence, a distributor's tariff in each downstream location consists of just three prices $(p_{Ai}^{(m)}, p_{Bi}^{(m)}, p_{ABi}^{(m)})$, where $p_{Ai}^{(m)}$ denotes D_i's stand-alone price in market m for A, $p_{Bi}^{(m)}$ her standalone price in market m for any of the varieties $B_n \in \mathbf{B}$, and $p_{ABi}^{(m)} \leq p_{Ai}^{(m)} + p_{Bi}^{(m)}$ the price in market m for the joint purchase of A and any of the varieties $B_n \in \mathbf{B}$.[21]

Timing. At $t = 1$, distributors and suppliers negotiate over wholesale prices. At $t = 2$, and after observing the terms of trade governing all wholesale transactions, distributors compete for final consumers in each downstream market. Finally, at $t = 3$ and after observing all distributors' prices, consumers in each downstream location decide which distributor to visit and what to buy.[22]

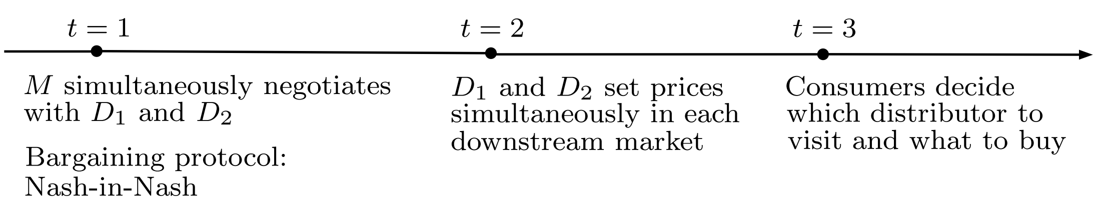


Figure 1: Timeline

[20]The role of this assumption is discussed at length in Section 2.3 (see also the online Appendix). As a preview, results do not qualitatively change as long as contractual or informational frictions preclude negotiated wholesale prices to drop all the way to M's marginal cost. If that is not the case, must-haves still have a relevant effect on negotiations, but all the effect is absorbed in the lump-sum transfer component of the contract. In any case, departure from marginal-cost pricing is not only supported in practice (see Introduction) but also in theory. It endogenously arises when bilateral negotiations are subject to moral hazard (Rey and Tirole, 1986; Bernheim and Whinston, 1998) or adverse selection (Calzolari and Denicolo, 2015).

[21]Because generic varieties of B are perfectly homogenous and all cost the same, it is without loss of generality to focus on a single price for all such varieties. For this reason, we will sometimes refer to all such varieties simply as product B.

[22]When necessary, we use the following tie-breaking rules: (i) a consumer indifferent between purchasing a

Equilibrium Concept. We use subgame perfection as our solution concept. An equilibrium of the game then consists of: (i) a pair of wholesale prices (w^*_{A1}, w^*_{A2}) such that w^*_{Ai} is the (generalized) Nash solution to the bargaining problem between M and D_i, given that both parties correctly anticipate the wholesale price w^*_{Aj} that will be agreed between M and D_j; and (ii) a tuple of prices for each downstream location as a function of (w^*_{A1}, w^*_{A2}) and $w^*_{B1} = w^*_{B2} = 0$, such that each distributor is maximizing her profits given the prices set by her rival in each location.

Finally, due to the symmetry of distributors in our set-up, we will focus on symmetric upstream (Nash-in-Nash) equilibria, i.e., $w^*_{A1} = w^*_{A2} = w^*_A$.[23]

2.2 Must-Have Items

In every negotiation, two scenarios are of paramount importance: what happens when parties reach an agreement, and what happens when they do not. In this subsection we show why, in the presence of multi-product competition and one-stop shopping, not reaching an agreement with M can have dire consequences for distributors: in addition to losing the potential profits to be made on A, the distributor could also end up losing a significant fraction of the profits to be made on B. When this happens, we say that product A is a must-have for that distributor.

Consider the bilateral negotiation, say, between M and D_1, when both parties anticipate that M and D_2 will reach an agreement at the equilibrium wholesale price $w^*_{A2} = w^*_A$. As we will later see, $w^*_A \in (0, 1/2)$, so we can restrict attention to these values in what follows. If M and D_1 then agree on w_{A1} in a neighborhood around w^*_A, they then expect the downstream markets to clear according to the next lemma.[24]

Lemma 1. *Suppose $w_{A1} \approx w_{A2} = w^*_A \in (0, 1/2)$. The Bertrand-Nash downstream equilibrium involves no downstream bundling (i.e., $p^{(m)*}_{ABi} = p^{(m)*}_{Ai} + p^{(m)*}_{Bi}$ for $i, m = 1, 2$) and standalone prices in each downstream location are given by:*

$$p^{(i)*}_{Ai} = \begin{cases} w_{Aj} + \gamma - \epsilon & \text{if } \gamma \le 1 - w_{Aj} + (w_{Ai} - w_{Aj}) + 2\epsilon \\ (1 + w_{Ai} + \gamma)/2 & \text{otherwise} \end{cases} \qquad p^{(i)*}_{Bi} = \gamma - \epsilon$$

$$p^{(j)*}_{Ai} = w_{Ai} \qquad p^{(j)*}_{Bi} = 0$$

for $i, j = 1, 2$ and $j \neq i$, with $\epsilon \downarrow 0$.

standalone unit of $k = A, B$ and a bundle AB always purchases the bundle; (ii) a consumer indifferent between (a) purchasing a standalone unit of A and a standalone unit B and (b) a unit of the bundle AB, always purchases the bundle; and (iii) a consumer indifferent between purchasing $k \in \{A, B, AB\}$ from D_i or D_j visits D_i with probability 1/2. It is possible to change these tie-breaking rules without altering the results at the cost of some additional notation.

[23] We discuss the implications of asymmetries among distributors in Section 2.4. Asymmetric distributors also come up in Section 5, where we study the interaction between must-have items and vertical mergers.

[24] The downstream demands supporting this and all downstream market equilibria are formally derived in Appendix A.

Proof. See Appendix B. □

Lemma 1 accepts two cases depending on the value of γ. For high values of γ, the distributor with home advantage will charge monopoly prices for A; otherwise there is Bertrand competition for this product. To preserve downstream competition in all items, we rule out this possibility by restricting attention to $\gamma \leq 1 - w_{Aj} + (w_{Ai} - w_{Aj}) + 2\epsilon$. And since $w_{A1} \approx w_{A2} = w_A^* \in (0, 1/2)$ and $\epsilon \downarrow 0$, this leads to $\gamma \leq 1/2$. Under this parameter restriction, the equilibrium prices in Lemma 1 are:

$$\begin{array}{llll} p_{A1}^{(1)*} = w_A^* + \gamma - \epsilon & p_{A2}^{(1)*} = w_A^* & p_{A1}^{(2)*} = w_{A1} & p_{A2}^{(2)*} = w_{A1} + \gamma - \epsilon \\ p_{B1}^{(1)*} = \gamma - \epsilon & p_{B2}^{(1)*} = 0 & p_{B1}^{(2)*} = 0 & p_{B2}^{(2)*} = \gamma - \epsilon \end{array}$$

This downstream equilibrium follows a standard Bertrand logic. In each location, distributors compete on three fronts simultaneously: for each of the two stand-alone goods and for the bundle. On each front, they engage in Bertrand-like competition. Since B is procured at zero cost, this implies that the equilibrium "quality-adjusted" price of B is driven all the way to zero (i.e., $p_{Bi}^{(i)*} - \gamma \approx p_{Bj}^{(i)*} \approx 0$), so all consumers buy B: some consumers will buy only B, while others purchase A and B. As stated in the lemma, the resulting outcome involves no retail bundling.[25]

Enjoying a quality advantage in her home market, D_i is the sole seller in market $m = i$, selling a total of $(1 - p_{Ai}^{(i)*} + \gamma)/2$ units of product A and $1/2$ units of product B. Based on these quantities, M and D_1's payoffs as a function of w_{A1} and w_A^* when $\epsilon \downarrow 0$ are, respectively:

$$\begin{aligned} \hat{\pi}_M \equiv \pi_M(w_{A1}, w_A^*) &= \frac{1}{2}\big[w_{A1}(1 - w_A^*) + w_A^*(1 - w_{A1})\big] \\ \hat{\pi}_1 \equiv \pi_1(w_{A1}, w_A^*) &= \frac{1}{2}\big[(\gamma + w_A^* - w_{A1})(1 - w_A^*) + \gamma\big] \end{aligned} \tag{1}$$

where $\hat{\pi}$ is used to denote payoff in case of agreement.

Consider now what would happen if M and D_1 fail to reach an agreement, forcing D_1 to compete downstream without product A. Although this is an off-path situation that we do not expect to occur in equilibrium, it determines parties' outside options, and hence, what the

[25] The lack of retail bundling in Lemma 1 is the by-product of three different assumptions: (i) Bertrand competition, (ii) distributors' home advantage; and (iii) the fact that distributors can procure B from the fringe at zero cost. As explained in the text, assumptions (i) and (iii) imply that consumers will buy only B, or A and B. Furthermore, assumptions (i) and (ii) imply that all units sold in market $m = i$ will be sold by D_i. Together, this implies that only two prices are relevant in equilibrium for D_i in market $m = i$: the price for serving consumers interested in only B and the price for serving consumers interested in both A and B, so downstream bundling becomes irrelevant. Note that this result is independent of consumers' correlation of valuations, so the same argument applies if v_A and v_B are negatively or positively correlated. If any of the assumptions (i)-(iii) does not hold, however, then retail bundling might potentially emerge. For instance, when $(v_A, v_B) \sim U[0, 1]^2$ but the fringe has a cost $c_B > 0$ of producing B, it is not difficult to prove that retail bundling emerges in the configuration of Lemma 1 for intermediate values of γ (for low values of γ the equilibrium when $c_B > 0$ is identical to the one when $c_B = 0$). The implications of retail bundling for our theory of must-haves are discussed in detail in Section 2.4.

surplus parties expect to obtain from a successful negotiation. The corresponding downstream equilibrium associated with a negotiation breakdown is characterized in the next lemma.

Lemma 2. *Suppose D_1 does not carry A, i.e., $w_{A1} \to \infty$, and $w_{A2} = w_A^* \in (0, 1/2)$. The Bertrand-Nash downstream equilibrium involves no downstream bundling (i.e., $p_{ABi}^{(m)*} = p_{Ai}^{(m)*} + p_{Bi}^{(m)*}$ for $i, m = 1, 2$) and standalone prices are given by:*

$$
\begin{array}{llll}
p_{A1}^{(1)*} = \infty & p_{A2}^{(1)*} = (1 + w_A^* - \epsilon)/2 & p_{A1}^{(2)*} = \infty & p_{A2}^{(2)*} = (1 + w_A^* + \gamma)/2 \\
p_{B1}^{(1)*} = \gamma - \epsilon & p_{B2}^{(1)*} = 0 & p_{B1}^{(2)*} = 0 & p_{B2}^{(2)*} = \gamma - \epsilon
\end{array}
$$

for $\epsilon \downarrow 0$.

Proof. See Appendix B. □

If M and D_1 fail to reach an agreement, then distributors continue competing in a Bertrand fashion for B, but D_2 now charges monopoly prices for good A in the two downstream locations (regardless of the value of γ). Similarly to Lemma 1, the resulting outcome does not involve retail bundling.[26] Parties' payoffs in this hypothetical scenario are then given by:

$$
\begin{aligned}
\bar{\pi}_{M1} \equiv \pi_M(\infty, w_A^*) &= \frac{w_A^*}{2}\left(\frac{1 - w_A^*}{2}\right) + \frac{w_A^*}{2}\left(\frac{1 + \gamma - w_A^*}{2}\right) \\
\bar{\pi}_1 \equiv \pi_1(\infty, w_A^*) &= \frac{\gamma}{2}\left[1 - \frac{s(1 - w_A^*)}{2}\right]
\end{aligned} \tag{2}
$$

where $\bar{\pi}$ is used to denote outside-option or "off-path" payoff.

If we compare (1) and (2), it is evident that not carrying A badly hits D_1's profits: she loses not only the entire profits she could have made on A, $(\gamma + w_A^* - w_{A1})(1 - w_A^*)/2$, but more importantly, also a fraction, $s(1 - w_A^*)/2$, of the profits she could have made on B, $\gamma/2$. It is in this very sense that we classify A as a must-have for D_1: not carrying it impairs D_1's ability to compete for other items in her lineup, in this case, product B.[27]

Product A's must-have status responds to a simple logic: starting from a situation in which both distributors carry both products, removing A from D_1's lineup creates *vertical differentiation* among distributors. This occurs because D_1's offering is now less attractive than

[26] The reason, however, is different from that of Lemma 1, since it is no longer true that the distributor with home advantage will sell everything in her home market. Retail bundling does not emerge in Lemma 2 because consumers' intrinsic valuations for A and B are independent. For instance, if v_A and v_B were perfectly negatively correlated, $v_A = 1 - v_B \sim U[0, 1]$, instead of being distributed uniformly and independently over the unit square, then retail bundling would emerge in the configuration of Lemma 2 even when the cost of procuring B from the fringe is zero. Again, see Section 2.4 for the implications of retail bundling for our theory.

[27] Note that if D_1 does not carry A, she still makes strictly positive profits for all $s \in [0, 1]$. Hence, even though A is a must-have when $s > 0$, it is never an "essential input"—an input without which a competitor cannot stay in business. As we document in the online Appendix, essential inputs arise within the constant-returns-to-scale environment of our baseline setting when intrinsic valuations for each product are homogenous (i.e., (v_A, v_B) are constants rather than being distributed over the unit square), all consumers are one-stop shoppers, and the valuation for A is particularly high. Another way to generate essential inputs is to assume that distributors have fixed costs of operation.

D_2's to those consumers interested in both products who are forced to one-stop shop. As a consequence, D_1 is no longer the sole seller of B in market $m = 1$, despite her home advantage. All one-stop shoppers interested in purchasing A and B in equilibrium —those with $v_A \geq p_{A2}^{(1)*} = (1 + w_A^*)/2$— now visit D_2, reducing D_1's business for B in market 1 by exactly $s(1 - p_{A2}^{(1)*}) = s(1 - w_A^*)/2$.[28,29]

Our notion of must-haves rests on two important properties. First, even though must-have is a binary classification, there is a degree of intensity inherent to it: some must-haves can cause—through their removal from a distributor's lineup—a large loss in sales of unrelated products, while other such items generate much smaller losses. We call this loss the product's *must-have potential*. The higher the must-have potential of a particular item, the more distributors' outside options are affected by its removal.

Second, as we discuss in depth below, our notion of must-haves is not an intrinsic property of a particular product, but rather the result of the interaction between (i) product characteristics (such as the presence or absence of close substitutes), (ii) upstream market conditions (such as distributors' ability to secure those substitutes and the extent of double marginalization in each bilateral negotiation), (iii) downstream market conditions (such as the level of downstream differentiation and the pervasiveness of one-stop shopping), and (iv) distributors' product portfolio decisions.

These two properties yield a very important insight: while any product with must-have potential classifies as a must-have for a particular distributor, what matters in practice is the magnitude of this potential, not the binary classification. For instance, an item with positive but arbitrarily small must-have potential is not meaningfully different from one without any.

Thus, there is a clear analogy between our notion of must-haves and the concept of relevant market and product substitutability in antitrust. Given some market definition, all products in the relevant market have different degrees of substitutability. From a practical perspective however, authorities are only concerned with products that have low substitutability as this gives rise to "significant" market power. In a context of multi-product competition and one-

[28] Note that this loss of consumers would be even higher in the presence of two or more rival distributors since this extra presence would suppress, if not eliminate, any possibility for them to increase the price of product A. In the online Appendix we replicate Lemmas 1 and 2 for the case of $n \geq 3$ distributors and formalize this intuition.

[29] Note that moving to asymmetric product portfolios has no effects on the price charged by D_1, the single-product distributor, on B. This is in contrast, for example, to Rhodes and Zhou (2019), where single-product distributors increase their prices after moving to an asymmetric portfolio configuration. This "softening-competition effect," which acts as a counterweight to the "must-have effect," arises in their sequential-search model because single-product distributors are able to identify and exploit "niche" consumers who visit them after visiting multi-product distributors. In richer settings involving sequential search—with more realistic patterns of substitution among products or different levels of downstream differentiation, for instance—the must-have and softening-competition effects will both be present and will vary across products and possibly also distributors, as we discuss in Section 2.4. Thus, some products will qualify as must-haves for some distributors while others will not, depending on which of the two effects dominates. Luckily, this would be immediately picked up from the observable data: if for some distributor the softening-competition effect overcomes the must-have effect, then, on-path, the distributor will not be carrying the product in question.

stop shopping, many products may be classified as must-haves. Their must-have potential (and corresponding competitive harm), however, will vary across product-distributor pairs depending on the remaining elements of the multi-dimensional interaction previously described.

2.3 Wholesale Equilibrium

We are now in a position to characterize the bargaining equilibrium at the upstream level. Given our focus on symmetric upstream equilibria, it suffices to consider a single bilateral negotiation, say, between M and D_1 as in the previous subsection, and impose symmetry. This implies that A's equilibrium wholesale price, w_A^*, must satisfy:

$$w_A^* \in \arg\max_{w_{A1}} \left\{ (\hat{\pi}_M - \bar{\pi}_{M1})^\beta \, (\hat{\pi}_1 - \bar{\pi}_1)^{1-\beta} \quad \text{s.t. } \bar{\pi}_{M1} \leq \hat{\pi}_M \text{ and } \bar{\pi}_1 \leq \hat{\pi}_1 \right\}$$

where $\hat{\pi}_M \equiv \pi_M(w_{A1}, w_A^*)$ and $\hat{\pi}_1 \equiv \pi_1(w_{A1}, w_A^*)$ are parties' payoffs when they reach a deal, and $\bar{\pi}_{M1} \equiv \pi_M(\infty, w_A^*)$ and $\bar{\pi}_1 \equiv \pi_1(\infty, w_A^*)$ are parties' payoffs when they do not. If in equilibrium there are strictly positive gains from reaching an agreement (i.e., $\bar{\pi}_{M1} < \hat{\pi}_M$ and $\bar{\pi}_1 < \hat{\pi}_1$), then we have the following equilibrium condition:

$$\left(\frac{\beta}{\hat{\pi}_M - \bar{\pi}_{M1}} \frac{\partial \hat{\pi}_M}{\partial w_{A1}} + \frac{1-\beta}{\hat{\pi}_1 - \bar{\pi}_1} \frac{\partial \hat{\pi}_1}{\partial w_{A1}} \right) \Bigg|_{w_{A1} = w_A^*} = 0 \tag{3}$$

Proposition 1. *The Nash-in-Nash unique symmetric equilibrium, w_A^*, is given by the smallest root of the quadratic equation:*

$$\frac{\beta\,(1 - 2w_A^*)}{w_A^* \left(2 - 2w_A^* - \gamma\right)} - \frac{1-\beta}{\gamma(2+s)} = 0 \tag{4}$$

where $w_A^* \in (0, 1/2)$.

Proof. Substituting (1)–(2) into (3) we arrive at (4). This quadratic equation has two solutions, one contained in $(0, 1/2)$ and the other in $(1-\gamma/2, 1)$, but only the first satisfies both $\bar{\pi}_{M1} \leq \hat{\pi}_M$ and $\bar{\pi}_1 \leq \hat{\pi}_1$. Thus, $w_A^* \in (0, 1/2)$ is the unique Nash-in-Nash symmetric equilibrium. □

It is not difficult to prove that w_A^* is monotone-increasing in β. Furthermore, from (4) it is easy to see that $w_A^* \to 0$ as $\beta \to 0$ (i.e., when distributors enjoy all the bargaining power) and that $w_A^* \to 1/2$ as $\beta \to 1$ (i.e., when M enjoys all the bargaining power). All this implies that our presumption that $w_A^* \in (0, 1/2)$ was indeed correct.

From (3) it is also immediate that A's must-have status will allow M to secure higher wholesale prices: since $\partial \hat{\pi}_M / \partial w_{A1} > 0$ and $\partial \hat{\pi}_1 / \partial w_{A1} < 0$, a reduction in $\bar{\pi}_1$ occasioned by A's must-have status must necessarily be accompanied by an increase in w_A^* for this condition to continue holding. This explains why w_A^* is strictly increasing in s, as there is a strictly increasing mapping between the pervasiveness of one-stop shopping and A's must-have potential as seen from Lemmas 1 and 2. Obviously, M's better terms come at the detriment of distributors and consumers alike.[30]

So far we have assumed that supplier-distributor negotiations are governed by linear prices. What is the effect of relaxing this assumption? In the online Appendix we explore the implications of allowing parties to sign "partially" non-linear (or "semi-linear") contracts.

More precisely, we extend our baseline setting to allow contracts to also include lump-sum transfers. These transfers, however, are constrained to be less than or equal to a fraction $\beta\kappa$ of M's marginal contribution to D_i's profits, i.e., $T_i \leq \beta\kappa(\hat{\pi}_i - \bar{\pi}_i)$. The parameter $\kappa \in [0, 1]$, therefore, captures the degree of "non-linearity" of contracts. As we mentioned earlier, less-than-perfect non-linear contracts can be motivated by assuming that supplier-distributor negotiations are subject to informational frictions, such as moral hazard or adverse selection.

This non-linear-contract model has two appealing properties. First, it nests both linear prices and "unrestricted" two-part tariffs (plus everything in between) as κ goes from 0 to 1. Second, when $\kappa \in [0, 1)$ the model generates, in a reduced-form and tractable fashion, above-marginal-cost pricing (i.e., $w_A^* > 0$), just as models involving informational frictions predict.[31]

With semi-linear contracts, must-haves still have a relevant effect on negotiations, but the effect is split between the negotiated wholesale price and the lump-sum transfer. The higher κ, the larger the fraction of the must-have effect that is absorbed by the transfer; in the extreme case of $\kappa = 1$ the negotiated wholesale prices is always equal to zero, so the transfer absorbs the entire must-have effect. This intuition explains why w_A^* continues to be strictly increasing in A's must-have potential as long as $\kappa < 1$, though the effect is attenuated as κ approaches 1.

From an antitrust perspective, the previous result implies that, under a consumer-welfare standard, must-haves are irrelevant when $\kappa = 1$. In such a case, must-haves only affect negotiated transfers, not wholesale prices, so total consumer surplus is unaffected by products' must-have status. Matters radically change, however, as soon as non-linearities are less than perfect ($\kappa < 1$) and/or authorities also care about distributors' profits (for example, because healthy and profitable distributors invest more in quality).

2.4 The Multi-Dimensional Interaction that Gives Rise to Must-Haves

As we already advanced—and can be gleaned from the vertical-differentiation argument that gives rise to must-have items—our notion of must-haves is not an intrinsic characteristic of a particular product, but rather the result of a multi-dimensional interaction involving (i) product

[30]Note that our results are qualitatively robust to alternative bargaining protocols based on Nash Bargaining. For instance, following Stole and Zwiebel (1996), assume that M and D_j renegotiate w_{Aj} in the event that M and D_i fail to reach an agreement. In that scenario, if M and D_1 fail to reach an agreement, the renegotiation between M and D_2 would lead to a higher w_{A2}, increasing D_1's outside option, $\bar{\pi}_1$, as seen from (2). Hence, this alternative protocol tempers A's must-have potential but does not eliminate it.

[31]When there is moral hazard or adverse selection on the side of the distributor, negotiated wholesale prices are usually distorted upwards in an effort to diminish informational frictions/rents (see Rey and Tirole, 1986; Bernheim and Whinston, 1998; Calzolari and Denicolo, 2015; Calzolari, Denicolo and Zanchettin, forthcoming).

characteristics, (ii) upstream market conditions, (iii) downstream market conditions, and (iv) distributors' product portfolio decisions. This multi-dimensional interaction is so central to our theory, and to the results that follow, that it is worth discussing it in more detail.

The Absence of Substitutes.—Distributors' inability to find substitutes for A is key to its must-have status; otherwise A's removal would have no meaningful effect as distributors could simply overcome it by carrying one or more of A's substitutes. Failure to find substitutes for A could either stem from A having no closes substitutes (a product characteristic), or from A and its close substitutes being controlled by the same supplier (an upstream market condition). The easier it is for distributors to find substitutes for A, the lower A's must-have potential.[32] That is, supplier market-power is a necessary (but not sufficient) condition for must-have items.[33]

Double Marginalization.—As we saw from (2), A's must-have potential from D_1's perspective is strictly decreasing in the wholesale price at which D_2 procures A (i.e., $w_{A2} = w_A^*$). This is because a lower w_{A2} makes D_2 more aggressive downstream, allowing her to steal a higher fraction of one-stop shoppers from D_1 if the latter fails to carry A. Hence, the higher the extent of double marginalization in the M-D_j relationship, the lower A's must-have potential from D_i's viewpoint.

Downstream Market Conditions.—Several downstream market conditions have an impact on an item's must-have status. Among these, are consumers' valuations (i.e., their interest in multiple products) and the pervasiveness of one-stop shopping. This follows immediately from the vertical-differentiation argument.[34] Another is the presence of downstream competition, either from rival distributors (as in our baseline model) or due to the presence of an "outside good." If consumers have no choice but to buy from a given distributor, no consumer will abandon the distributor in response to A's removal.

Product Portfolio Decisions.—In our baseline setting, it is not difficult to see that A would not classify as a must-have for D_1 if either: (i) D_1 did not carry B, as in this case A's removal cannot affect D_1's sales for B; or (ii) D_2 did not carry A, as in this case D_1 would always be the sole seller of B in her home market irrespective of whether she carries A or not. Either situation could arise, for example, if one of the distributors had limited capacity and is unable to carry both products. Hence, product portfolio decisions play a crucial role in determining

[32]For expositional simplicity we focused above on the extreme case in which distributors are unable to find any substitute for A, however, such a stark assumption is not essential. If distributors were able to substitute for A, albeit imperfectly, A would still classify as a must-have though with significantly diminished must-have potential.

[33]This explains, for instance why an individual variety $B_n \in \mathbf{B}$ is not a must-have in our base setting: its removal has no meaningful effect since there are many other perfectly homogeneous varieties of B readily available for distributors.

[34]In our baseline model, one-stop shopping is uncorrelated with other consumer characteristics. In richer settings, one would expect one-stop shopping to be correlated with consumers' valuations. This will induce more realistic patterns of one-stop shopping (depending, for instance, on the basket of products a particular consumer is interested in buying), and induce additional heterogeneity into the must-have potential of different products.

items' must-have status and potential.[35]

Of all the above ingredients, one-stop shopping deserves further discussion. In Section 2.2, the presence of exogenous one-stop shopping ($s > 0$) was key to generate must-have items. One may wonder, however, whether there might be endogenous ways to generate similar one-stop shopping economies even if $s = 0$. An obvious possibility is downstream bundling—offering consumers discounts for the joint purchase of multiple products. It is important to distinguish, however, that what matters for the emergence of must-haves is not "on-path" bundling in the event of agreement (as in Lemma 1), but rather "off-path" bundling in the event that one of the negotiations breaks down (as in Lemma 2).

This distinction raises two important observations. The first is that exogenous one-stop shopping might still be needed to generate must-haves despite the (on-path) observation of downstream bundling, as on-path bundling does not necessarily imply the emergence of off-path bundling. For instance, when the fringe has a cost $c_B > 0$ of producing B, downstream bundling emerges in the configuration of Lemma 1 for intermediate values of γ, but never emerges in the configuration of Lemma 2 (as discussed in footnotes 25 and 26 of Section 2.2).

Conversely, not observing on-path bundling does not mean that must-haves will never emerge when $s = 0$. For an example, take $c_B = 0$ and let v_A and v_B be perfectly negatively correlated, i.e., $v_A = 1 - v_B \sim U[0, 1]$. Following Lemmas 1 and 2, it can be shown that bundling does not emerge on-path but does arise off-path. In sum, when $s = 0$, on-path bundling is neither necessary nor sufficient for the emergence of must-haves.

Implications.—The fact that must-have items and their corresponding potential are the result of a multi-dimensional interaction has two important implications.

The first of these is that the must-have potential of a particular product is not independent of the status quo, and is not necessarily constant across distributors. Thus, strictly speaking, we should talk about "product k being a must-have for distributor D_i given the current set of market conditions." This implies, for instance, that in a world with heterogenous distributors—who target different segments of consumers or provide different product offerings for example—one must be careful of extrapolating an item's must-have potential from one distributor to another.

The previous point leads us to the conclusion that a structural approach is almost certainly necessary to estimate an item's must-have potential.[36] Luckily, it is possible, at least in principle, to identify this potential for different product-distributor pairs (k, D_i) based on wholesale

[35] In richer settings, with more distributors and more realistic patterns of downstream differentiation, product portfolio decisions will probably affect items' must-have potential in a smoother fashion.

[36] Although data-intensive and resource-demanding, such an approach is no different from the one currently followed in the literature and by antitrust authorities in the evaluation of merger proposals, or of any change in market structure for that matter (see, for instance, Crawford and Yurukoglu, 2012; Lee, 2013; Gowrisankaran, Nevo and Town, 2015; Ho and Lee, 2017; Crawford et al., 2018).

price data.[37] The reason is that wholesale terms agreed in equilibrium depend to a large extent on parties' outside options, and D_i's outside option comes precisely from the counterfactual experiment that determines k's must-have potential for that distributor.

The second and more important implication for what follows, is that transactions and practices that alter the structure of the upstream or downstream market—such as horizontal and vertical mergers, or the formation of buyer alliances—can build or destroy items' must-have potential by affecting the different elements of this multi-dimensional interaction. Indeed, as we will show in the upcoming sections, transactions conducive to upstream and vertical consolidation strengthen items' must-have status, leading to more anticompetitive outcomes. Meanwhile, practices conducive to downstream consolidation weaken items' must-have status, helping to mitigate their anticompetitive effects.

3 Application I: Upstream Consolidation

Horizontal mergers of upstream suppliers pose a difficult challenge for antitrust policy. The challenge lies, primarily, in the need to balance any price increase from fewer post-merger competitors, against any price decrease from efficiency gains (i.e., marginal-cost synergies) that may occur due to the merger (Williamson, 1968; Farrell and Shapiro, 1990).[38]

In this first application, we show how a horizontal merger of upstream suppliers may increase a product's must-have potential, amplifying the merger's anticompetitive effects. Consequently, even though estimating the overall effect of a proposed horizontal merger is ultimately an empirical matter, our theory suggests that extra antitrust concern is warranted in the presence of must-haves.

3.1 The Set-up

The environment is similar to that of Section 2, except that we now consider two varieties of product A: A_1 and A_2. To keep things simple, we assume that consumers regard these two varieties as perfect substitutes but, as we discuss below, results extend naturally to the case of imperfect substitution.

We will compare a pre-merger situation in which A_1 and A_2 are each produced by a different upstream supplier, denoted by U_1 and U_2, respectively, against the post-merger situation in which both A_1 and A_2 are produced by a single firm, M. To incorporate merger synergies, we further assume that the pre-merger marginal cost of producing A_n is equal to $c_A \in [0, 1)$ for

[37] Examples where this type of data has been used include Crawford and Yurukoglu (2012) and Crawford et al. (2018) in pay-TV, and Ho and Lee (2017) in healthcare.

[38] As documented by Farrell and Shapiro (2010), a large and increasing number of horizontal mergers are investigated by antitrust authorities along these dimensions, including hospital and TV-content mergers, to name a few. A prime example of the latter is the \$52.4 billion acquisition of 21st Century Fox by Disney in March 2019.

$n = 1, 2$, while the post-merger marginal cost is equal to zero. Merger efficiencies, therefore, are captured by the drop in the cost of producing the different varieties of A from c_A to 0.

The rest of the model remains identical to that of the previous section, including pre- and post-merger bargaining protocols (see Figure 2).

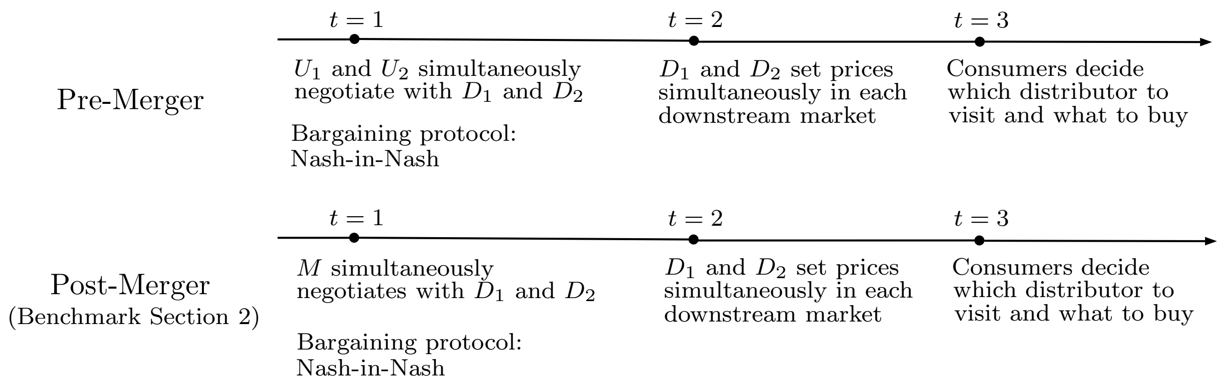


Figure 2: Timeline Application I

3.2 The Must-Have Horizontal-Merger Effect

Because the different varieties of A are perfect substitutes, the pre-merger equilibrium is straightforward: each supplier U_n offers his variety A_n at marginal cost c_A (despite the Nash-in-Nash protocol), so downstream equilibrium prices are:

$$p_{A1}^{(1)*} = c_A + \gamma \qquad p_{A2}^{(1)*} = c_A \qquad p_{A1}^{(2)*} = c_A \qquad p_{A2}^{(2)*} = c_A + \gamma$$
$$p_{B1}^{(1)*} = \gamma \qquad p_{B2}^{(1)*} = 0 \qquad p_{B1}^{(2)*} = 0 \qquad p_{B2}^{(2)*} = \gamma.$$

when $\epsilon \downarrow 0$. Importantly, in this scenario each individual variety of A does not classify as a must-have since distributors can completely overcome the removal of one by carrying the other.

The post-merger outcome, in turn, corresponds exactly to the benchmark outcome of Section 2 (Proposition 1). In equilibrium, M and the two distributors will agree on a wholesale price $w_A^{**} \in (0, 1/2)$, where w_A^{**} is given by the smallest root of:

$$\frac{\beta\,(1 - 2w_A^{**})}{w_A^{**}\left(2 - 2w_A^{**} - \gamma\right)} - \frac{1 - \beta}{\gamma(2 + s)} = 0, \tag{5}$$

so equilibrium downstream prices when $\epsilon \downarrow 0$ are:

$$p_{A1}^{(1)*} = w_A^{**} + \gamma \qquad p_{A2}^{(1)*} = w_A^{**} \qquad p_{A1}^{(2)*} = w_A^{**} \qquad p_{A2}^{(2)*} = w_A^{**} + \gamma$$
$$p_{B1}^{(1)*} = \gamma \qquad p_{B2}^{(1)*} = 0 \qquad p_{B1}^{(2)*} = 0 \qquad p_{B2}^{(2)*} = \gamma$$

Critically, w_A^{**} is strictly increasing in s thanks to the post-merger must-have status acquired by both varieties of A. The latter occurs because if the negotiation with M breaks down, D_i

will not be able to substitute one variety of A with the other, as they are now both controlled by the same supplier.

Comparing pre- and post-merger outcomes, it is clear that the merger is beneficial whenever $c_A \geq w_A^{**}(\beta, \gamma, s) \equiv \underline{c}_A(\beta, \gamma, s)$. The cutoff $\underline{c}_A(\beta, \gamma, s)$ is, therefore, the minimum level of synergy that merging parties need to provenly document before an authority can approve the merger.

From (5), it is easy to see that $\underline{c}_A(\beta, \gamma, s) > 0$ irrespective of β, γ, and s. The reason is the well-known softening competition (SC) effect of horizontal mergers: mergers involve a reduction in the number of upstream competitors leading to higher wholesale prices (and, therefore, higher downstream prices). More interesting for our purposes, however, is the fact that $\underline{c}_A(\beta, \gamma, s)$ is strictly increasing in s. This implies that the more pervasive one-stop shopping is, the more demanding the efficiency gains that merging parties must document upstream. This extra efficiency requirement is the result of a new force that arises in the context of must-haves: the must-have horizontal-merger (MH-HM) effect.

The MH-HM effect arises because a horizontal merger of upstream suppliers increases the must-have potential of the products involved (in this case varieties A_1 and A_2). It does so by completely eliminating distributors' ability to overcome the removal of one variety by carrying the other, thereby allowing the merging entity to secure even higher wholesale prices.[39]

Despite the fact that we have illustrated the MH-MH effect under the assumption that A_1 and A_2 are perfect substitutes, it is not difficult to see that results extend also to the case of imperfect substitutes. Under perfect substitution, A_1 and A_2 do not qualify as must-haves pre-merger because distributors can perfectly substitute one variety for the other. As substitution weakens, this threat is less effective because a distributor that fails to carry one of the varieties, say A_n, may now lose some one-stop shoppers to her rival—those really interested in variety A_n. However, even though imperfect substitution may restore A_1 and A_2'a pre-merger must-have status, it remains true that the merger sharply increases A_1 and A_2's must-have potentials, as it completely eliminates distributors' ability to substitute between varieties.

The existence of the MH-HM effect implies that, in the presence of must-have items, horizontal mergers of upstream suppliers will be more anticompetitive than they otherwise would be. Accordingly, authorities should unambiguously lean less favorably toward these mergers when must-have items are thought to be present, or in settings conducive to the emergence of these items.

4 Application II: Downstream Consolidation

Although it has long been a controversial topic (see Galbraith, 1952; Stigler, 1954), the competitive effects of downstream consolidation and buyer power have received a surge in attention

[39] Note that the merger has not changed the patterns of substitution between A_1 and A_2 at the consumer level; both varieties continue to be perfect substitutes pre- and post-merger. The MH-HM effect arises because the merger affects the ability to substitute varieties at the distributor level.

lately.[40] This is explained by the increasing levels of concentration observed on the distribution side of many markets, from retail/grocery shopping to health insurance.

On the one hand, big distributors and buyer alliances could potentially extract more sizable price concessions from large upstream suppliers thanks to their enhanced bargaining leverage. On the other hand, it is not clear whether these better terms will be passed on to final consumers. This is particularly the case if an increase in buyer power is also accompanied by a reduction in downstream competition, whether directly, as in a merger, or indirectly, through a buyer alliance that may facilitate downstream collusion (Dobson and Waterson, 1997; Snyder, 2008).

In this application, we show how practices conducive to downstream consolidation weaken items' must-have potential, helping mitigate must-haves' anticompetitive effects. Consequently, in contrast to the case of upstream consolidation, our theory suggests that in the presence of must-haves a more lenient standard seems appropriate when evaluating these practices.

4.1 The Set-up

Downstream consolidation may take a range of different forms, from a "pure" buyer alliance—in which distributors negotiate jointly upstream but continue setting prices independently downstream—to a full merger—in which distributors act as one, both upstream and downstream. For ease of exposition, we will begin by analyzing the case of a pure buyer alliance and later discuss the possibility of cooperation downstream.

As shown in Figure 3, the setup is identical to that of Section 2, except that now M negotiates with D_{1+2}, the buyer alliance formed by D_1 and D_2, instead of bargaining with each distributor individually. M and D_{1+2} negotiate following a Nash Bargaining protocol with the same pre-alliance weights (β and $1-\beta$, respectively), anticipating that at $t=2$ distributors will continue setting downstream prices independently.

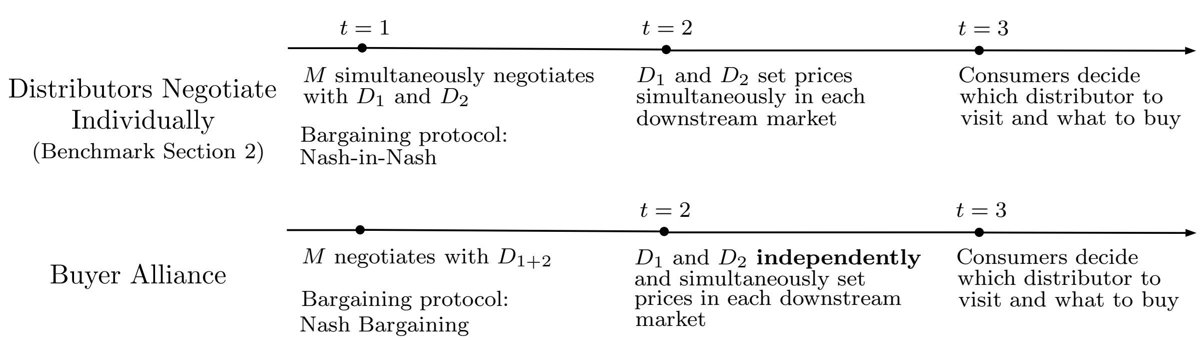


Figure 3: Timeline Application II

[40]See, for instance, the FTC Panel on "Monopsony and Buyer Power" from the *Hearings on Competition and Consumer Protection in the 21st Century* (September 21, 2018).

Finally, before heading into the analysis, let us recall the pre-alliance outcome (Section 2): wholesale prices are given by $w^*_{A1} = w^*_{A2} = w^*_A$, where $w^*_A \in (0, 1/2)$ is given by the smallest root of:

$$\frac{\beta\,(1-2w^*_A)}{w^*_A\left(2-2w^*_A-\gamma\right)} - \frac{1-\beta}{\gamma(2+s)} = 0, \tag{6}$$

and downstream prices are given, when $\epsilon \downarrow 0$, by:

$$\begin{array}{llll} p^{(1)*}_{A1} = w^*_A + \gamma & p^{(1)*}_{A2} = w^*_A & p^{(2)*}_{A1} = w^*_A & p^{(2)*}_{A2} = w^*_A + \gamma \\ p^{(1)*}_{B1} = \gamma & p^{(1)*}_{B2} = 0 & p^{(2)*}_{B1} = 0 & p^{(2)*}_{B2} = \gamma. \end{array}$$

4.2 The Must-Have Joint-Negotiation Effect

Let us denote by w^{**}_A the wholesale price that distributors are able to secure in a post-alliance equilibrium. Consider first the case in which M and D_{1+2} reach an agreement. Then, the downstream equilibrium (as $\epsilon \downarrow 0$) is similar to the one outlined above:

$$\begin{array}{llll} p^{(1)*}_{A1} = w^{**}_A + \gamma & p^{(1)*}_{A2} = w^{**}_A & p^{(2)*}_{A1} = w^{**}_A & p^{(2)*}_{A2} = w^{**}_A + \gamma \\ p^{(1)*}_{B1} = \gamma & p^{(1)*}_{B2} = 0 & p^{(2)*}_{B1} = 0 & p^{(2)*}_{B2} = \gamma \end{array}$$

so parties' payoffs in case of agreement are:

$$\hat{\pi}_M = w^{**}_A(1-w^{**}_A) \qquad\qquad \hat{\pi}_{D_{1+2}} = 2\hat{\pi}_i = \gamma + \gamma(1-w^{**}_A)$$

Comparing the prices in case of agreement pre- and post-alliance, it is evident that any decrease in the wholesale price of A obtained by the alliance will benefit consumers. Note, further, that because each distributor was obtaining $\gamma/2 + \gamma(1-w^*_A)/2$ on-path before the alliance, distributors have an incentive to form an alliance if and only if $w^{**}_A < w^*_A$. These two observations imply that in the case of a pure buyer alliance, distributors' and consumers' interests are perfectly aligned, i.e., distributors have incentives to form the alliance if and only if the alliance benefits final consumers.

Consider now the case of a negotiation breakdown between M and D_{1+2}. Parties' payoffs would then be $\bar{\pi}_M = 0$ and $\bar{\pi}_{D_{1+2}} = 2\bar{\pi}_i = \gamma$, as product A would no longer be available for either distributor and distributors would continue to compete Bertrand for product B in each location:

$$p^{(1)*}_{B1} = \gamma - \epsilon \qquad p^{(1)*}_{B2} = 0 \qquad p^{(2)*}_{B1} = 0 \qquad p^{(2)*}_{B2} = \gamma - \epsilon$$

Based on these expectations, we then have that M and D_{1+2} arrive at the following agreement in equilibrium:

Proposition 2. *The equilibrium wholesale price under a buyer alliance is given by:*

$$w_A^{**} = \frac{\beta}{1+\beta}. \tag{7}$$

Proof. The proof follows immediately from the above payoffs and the Nash Bargaining first-order condition. □

What is the effect of the buyer alliance on the negotiated terms? From (6) and (7) we get that:

$$w_A^{**} < w_A^* \Longleftrightarrow \beta > \frac{1}{\gamma(3+s)} - 1 \equiv \underline{\beta}(\gamma, s) \in [0, \infty) \tag{8}$$

That is, the buyer alliance secures better terms (and leads to lower downstream prices) only when M's bargaining power is sufficiently high to begin with. Interestingly, the cutoff $\underline{\beta}(\gamma, s)$ is strictly decreasing in s, implying that the higher A's must-have potential, the more likely it is that the alliance is competitively beneficial.

These results are the work of three forces: (i) the buyer power (BP) effect, (ii) the elimination of secret contracts (ESC) effect, and (iii) the must-have joint-negotiation (MH-JN) effect.

The BP effect comes from the fact that a buyer alliance reduces M's outside option in his negotiation with distributors. When distributors engage in separate negotiations, M always has the option to sell through a rival distributor if an individual negotiation breaks down. This option disappears, however, when distributors negotiate as a group, leading to a sharp decrease in M's outside option (which is now equal to zero). This allows distributors to obtain better terms, benefiting both distributors and final consumers.

Acting in the exact opposite direction, however, is the ESC effect. When M and the distributors negotiate individually, the implicit assumption underlying the Nash-in-Nash protocol is that they negotiate bilaterally and privately. That is, the Nash-in-Nash solution is a type of *contract equilibrium* (Cremer and Riordan, 1987; Collard-Wexler, Gowrisankaran and Lee, 2019) requiring contracts to be pairwise-proof: immune to bilateral deviations by M and any of the two distributors.[41] As a result, M suffers from a commitment problem preventing him from credibly solving the contracting externality that arises from dealing with competing distributors. The emergence of the buyer alliance, however, immediately solves this problem for M, allowing him to obtain better terms.

These two effects—the BP and the ESC—are always present, regardless of whether or not A is a must-have. When A is a must-have, however, an extra effect arises: the MH-JN effect. This effect emerges because A's must-have status further damages distributors' negotiating positions if they choose to negotiate individually: If the negotiation, say, between M and D_1 breaks down, D_1 fears that D_2 will carry A, so she will end up losing not only her profits on A, but also

[41] The concept of contract equilibrium is closely connected to the idea of secret contracts and passive beliefs of Hart and Tirole (1990). They show that under passive beliefs pairwise-proofness is a necessary condition for Perfect Bayesian Nash Equilibria.

a fraction of her profits on B. When distributors negotiate jointly, however, this must-have threat disappears because if the negotiation breaks down neither distributor will be carrying A, so the vertical-differentiation argument no longer applies.[42] This improves distributors' outside options vis-à-vis their pre-alliance levels, helping them to demand better terms from M.

Putting the three effects together, distributors will be able to obtain better terms (and will therefore have incentives to form the alliance) when the combination of the BP and MH-JN effects dominate the ESC effect. The latter occurs when (8) holds. Intuitively, when M enjoys a high bargaining power, M's commitment problem is not as acute as he has "more power over the distributors" to better internalize the contracting externality that arises from private negotiations. Hence, it is more likely that the BP and MH-JN effects dominate the ESC effect. The presence of the MH-JN effect, in turn, explains why $\underline{\beta}(\gamma, s)$ is strictly decreasing in s.

As we already argued, in the case of a pure buyer alliance, the interests of distributors are aligned with those of consumers. The latter implies that authorities should always welcome and approve their formation. A concern often voiced by antitrust authorities, however, is that buyer alliances may facilitate price coordination downstream.[43] Increased market power at the downstream level is also one of the reasons why authorities view downstream mergers with suspicion, even though the merging entity can, under some circumstances, secure better terms upstream, as we just saw.

When distributors cooperate downstream, whether as a result of an alliance or a merger deal, there is an additional effect that enters into the analysis: the softening downstream competition (SDC) effect. As we elaborate in the online Appendix, cooperation downstream not only has the direct impact of increasing downstream prices but also, indirectly, affects the terms negotiated upstream. While the direct channel always decreases consumer surplus, the indirect channel can go either way (i.e., w_A^{**} can increase or decrease as a result of the SDC effect).

It is important to stress, however, that the presence of the SDC effect does not alter the existence of any of the previous three effects (BP, ESC, and MH-JN), which arise from the fact that distributors negotiate jointly upstream. In particular, it should be clear that the MH-JN effect does not respond to changes in downstream competition, but to the fact that a joint negotiation eliminates the scope for asymmetric product portfolios.

The presence of the SDC effect has two important antitrust implications. The first is that any downstream consolidation practice, be it a buyer alliance or a merger, will face a competitive tradeoff. There will always be a need to balance pro-competitive against anticompetitive effects. The second implication, closely related to the first, is that the presence of must-haves alters this

[42] In richer settings with more distributors and more realistic patterns of substitutions, it is not necessary that all distributors belong to the alliance for the MH-JN effect to emerge. The magnitude of the effect, however, will be determined by the number of participants and, critically, by the patterns of substitutability among participants and non-participants.

[43] For example, on November 2019, the European Commission initiated an investigation into possible collusion by two French supermarket groups, Casino and Intermarché. It is argued that collusion would have been facilitated by their buying alliance formed in 2014.

tradeoff. The pro-competitive MH-JN effect should make authorities unambiguously lean more favorably towards any downstream consolidation practice when must-have items are present.

5 Application III: Vertical Mergers

Echoing the debate surrounding upstream and downstream consolidation, vertical mergers have also recently been subject to increasing antitrust scrutiny. The tradeoff involved, however, is quite different (Riordan, 2008). It involves weighting potential efficiencies, such as the elimination of double marginalization (Spengler, 1950), against the risk that the merging entity will have heightened incentives to foreclose rivals and raise their costs (Salop and Scheffman, 1983; Ordover, Saloner and Salop, 1990). Nowhere else in recent times has this tension been so vivid as in the multichannel television market (see Introduction), though it certainly extends to other markets as well.[44]

In this section, we show that a vertical merger involving a supplier of a must-have item strengthens the item's must-have potential, leading to more anticompetitive outcomes. Consequently, even though estimating the overall effect of a proposed vertical merger is ultimately an empirical matter, as with the other practices, our theory suggests that extra antitrust concern is warranted in the presence of such items.

5.1 The Set-up

Starting from the benchmark setting of Section 2, we consider a merger between M and D_2. We assume that after the merger: (i) M always delivers A to D_2 at a wholesale price of zero, M's actual cost of production, and (ii) M and D_2 completely internalize each other's profits when making decisions in the game.

With regards to the timing, the post-merger timing is identical to that in Section 2, except

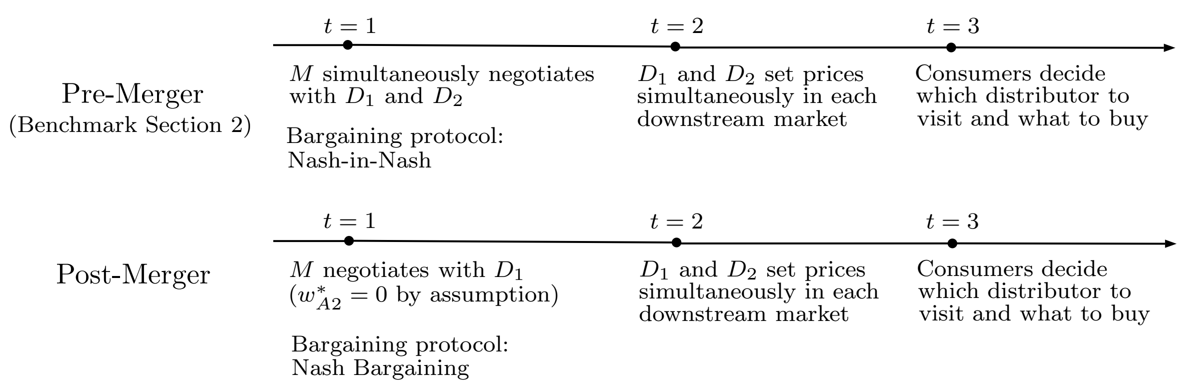


Figure 4: Timeline Application III

[44] Health care is another good example, as discussed by Glied and Altman (2017).

that, at $t = 1$, M only negotiates with D_1 under a Nash-Bargaining protocol with the same pre-merger weights (β and $1 - \beta$, respectively) while anticipating that $w^*_{A2} = 0$. It is important to highlight that the vertical merger introduces asymmetries across distributors, so the post-merger upstream equilibrium will clearly be asymmetric.

Finally, before heading into the analysis, recall the pre-merger outcome (Section 2): $w^*_{A1} = w^*_{A2} = w^*_A$, where $w^*_A \in (0, 1/2)$ is given by the smallest root of (4) (or (6)).

5.2 The Must-Have Vertical-Merger Effect

As in previous sections, denote by $(w^{**}_{A1}, w^{**}_{A2})$ the post-merger wholesale equilibrium prices. The merger's effect on w_{A2} is straightforward: D_2's wholesale price drops from $w^*_{A2} = w^*_A > 0$ to $w^{**}_{A2} = 0$ in what is known as the elimination of double marginalization (EDM) effect. Thus, the rest of this section focuses on characterizing how the merger affects the terms negotiated between M and D_1, and how these terms are altered by the presence of must-have items.

Consider the negotiation between M and D_1. Begin by noticing that, due to asymmetries created by the merger itself, it is no longer obvious that M and D_1 will always find a mutually profitable agreement. There may be instances in which M could refuse to deal with D_1. For the moment, however, let us entertain the idea that in equilibrium an agreement is reached. If that is the case, then it must be that $w^{**}_{A1} < 2\gamma$; otherwise, D_1 would not sell any units of A, neither in a standalone fashion nor in bundles, as D_2's cost advantage is sufficient to overcome D_1's home advantage. When $w^{**}_{A1} < 2\gamma$, we then have that the downstream markets clear according to the next lemma.

Lemma 3. *Suppose $w^{**}_{A2} = 0$ and that $w^{**}_{A1} < 2\gamma$. The Bertrand-Nash downstream equilibrium involves no downstream bundling and standalone prices are given by:*

$$
\begin{array}{llll}
p^{(1)*}_{A1} = \gamma - \epsilon & p^{(1)*}_{A2} = 0 & p^{(2)*}_{A1} = w^{**}_{A1} & p^{(2)*}_{A2} = \min\{w^{**}_{A1} + \gamma - \epsilon, (1+\gamma)/2\} \\
p^{(1)*}_{B1} = \gamma - \epsilon & p^{(1)*}_{B2} = 0 & p^{(2)*}_{B1} = 0 & p^{(2)*}_{B2} = \gamma - \epsilon
\end{array}
$$

with $\epsilon \downarrow 0$.

Proof. See the online Appendix. □

The outcome of Lemma 3 turns out to be very similar to that of Lemma 1 in Section 2. In both cases, it is still true that D_i is the only distributor selling units in market $m = i$. At first, this may seem surprising given that w^{**}_{A1} could potentially be between γ and 2γ, implying that D_2's cost advantage could be sufficient to overcome D_1's home advantage for the standalone units of A. However, from Lemma 1, we know that due to Bertrand competition and the fact that the fringe has zero costs, all consumers buy either B or the bundle, so all that matters is whether D_2's cost advantage is sufficient to overcome D_1's home advantage for the bundle; that is, whether $w^{**}_{A1} \gtreqless 2\gamma$.

The only difference between Lemmas 1 and 3, is that the latter accepts two cases depending on the value of γ and w_{A1}. When $w_{A1}^{**} \leq (1-\gamma)/2$, distributors compete Bertrand for good A in D_2's home market; otherwise D_2 charges monopoly prices for A in that market.

According to Lemma 3, and taking into account that M completely internalizes D_2's profits in the downstream market, parties' payoffs in case of agreement when $\epsilon \downarrow 0$ are:

$$\hat{\pi}_1 = \frac{\gamma}{2} + \frac{\gamma - w_{A1}^{**}}{2} \qquad \hat{\pi}_M = \frac{w_{A1}^{**}}{2} + \frac{\Phi}{2} \tag{9}$$

where

$$\Phi \equiv \begin{cases} \gamma + (w_{A1}^{**} + \gamma)(1 - w_{A1}^{**}) & \text{if } \ w_{A1}^{**} \leq (1-\gamma)/2 \\ \gamma + (1+\gamma)^2/4 & \text{otherwise} \end{cases} .$$

Consider now the case in which M and D_1 fail to reach an agreement. The corresponding downstream equilibrium is characterized as follows:

Lemma 4. *If M and D_1 fail to reach and agreement and $w_{A2}^{**} = 0$, then the Bertrand-Nash downstream equilibrium involves no downstream bundling and standalone prices are given by:*

$$\begin{array}{llll} p_{A1}^{(1)*} = \infty & p_{A2}^{(1)*} = (1-\epsilon)/2 & p_{A1}^{(2)*} = \infty & p_{A2}^{(2)*} = (1+\gamma)/2 \\ p_{B1}^{(1)*} = \gamma - \epsilon & p_{B2}^{(1)*} = 0 & p_{B1}^{(2)*} = 0 & p_{B2}^{(2)*} = \gamma - \epsilon \end{array}$$

with $\epsilon \downarrow 0$.

Proof. The proof follows closely that of Lemma 2 and is, therefore omitted. □

Accordingly, parties' outside options when $\epsilon \downarrow 0$ are:

$$\bar{\pi}_1 = \frac{\gamma}{2}\left(1 - \frac{s}{2}\right) \qquad \bar{\pi}_{M1} = \frac{1}{8} + \frac{1}{2}\left[\gamma + \frac{(1+\gamma)^2}{4}\right] \tag{10}$$

Based on these payoffs, the wholesale (post-merger) equilibrium accepts different outcomes as the next proposition shows.

Proposition 3. *Define*

$$\underline{\gamma}(s) \equiv \frac{5 + 2s - \sqrt{7 + 8s + 2s^2}}{(3+s)^2} \qquad \bar{\gamma}(s,\beta) \equiv \frac{1+\beta}{2(1+\beta+\beta s)}$$

where $\underline{\gamma}(s) < \bar{\gamma}(s,\beta) \leq 1/2$. Then,

(i) (Refusal-to-Deal) If $\gamma \leq \underline{\gamma}(s)$, then M refuses to deal with D_1 (i.e., $w_{A1}^{**} \to \infty$)

(ii) (Bertrand/Bertrand) If $\underline{\gamma}(s) < \gamma \leq \bar{\gamma}(s,\beta)$, then w_{A1}^{**} is given by the smallest root of the quadratic equation:

$$\frac{\beta\,(1 - w_{A1}^{**} - \gamma/2)}{\Delta\pi_M(w_{A1}^{**})} - \frac{1-\beta}{\Delta\pi_1(w_{A1}^{**})} = 0$$

where:

$$\Delta\pi_M(w_{A1}^{**}) \equiv \hat{\pi}_M - \bar{\pi}_{M1} = w_{A1}^{**}(1 - w_{A1}^{**}/2) + \gamma(1 - w_{A1}^{**})/2 - [1 + (1+\gamma)^2]/8$$
$$\Delta\pi_1(w_{A1}^{**}) \equiv \hat{\pi}_1 - \bar{\pi}_1 = \gamma(1 + s/2) - w_{A1}^{**}$$

(iii) (Bertrand/Monopoly) Finally, if $\bar{\gamma}(s,\beta) < \gamma \leq 1/2$, then w_{A1}^{**} is given by:

$$w_{A1}^{**} = \frac{1-\beta}{4} + \gamma\beta\left(1 + \frac{s}{2}\right)$$

Proof. See the online Appendix. □

The three regions of Proposition 3 are intuitive. When downstream distributors are barely differentiated (i.e., $\gamma < \underline{\gamma}(s)$), M is better-off using his distributor to serve all consumers, as dealing with D_1 would only intensify competition and destroy profits in both downstream markets (explaining the *Refusal-to-Deal* region). As γ increases, however, M finds it optimal to deal with D_1 even though this unleashes competition downstream because D_1 becomes increasingly more efficient at serving her home market. For moderate levels of differentiation, i.e., $\gamma < \bar{\gamma}(s)$, this competition remains Bertrand in both locations (explaining the *Bertrand/Bertrand* region); otherwise D_2 enjoys sufficient cost and home advantages to charge monopoly prices for A in her home market despite D_1 also offering that product (explaining the *Bertrand/Monopoly* region).

We can now analyze the impact of the merger on w_{A1}. Leaving aside the less interesting/relevant case of no deal, $\gamma < \underline{\gamma}(s)$,[45] we have that D_1's wholesale price can either increase or decrease as a result of the merger.[46] Three forces explain this ambiguity: (i) the raising rivals' costs (RRC) effect, (ii) the increased downstream competition (IDC) effect, and (iii) the must-have vertical-merger (MH-VM) effect. The first two of these effects exist independently of whether or not A is a must-have, while the third is a novel force that arises exclusively due to A's must-have status.

To understand each of these effects, recall that in order to maximize the generalized Nash Product of M and D_1, w_{A1}^{**} must satisfy the following first-order condition:

$$\frac{\beta}{\hat{\pi}_M - \bar{\pi}_{M1}}\frac{\partial\hat{\pi}_M}{\partial w_{A1}} + \frac{1-\beta}{\hat{\pi}_1 - \bar{\pi}_1}\frac{\partial\hat{\pi}_1}{\partial w_{A1}} = 0 \tag{11}$$

where $\partial\hat{\pi}_M/\partial w_{A1} > 0$, $\partial\hat{\pi}_1/\partial w_{A1} < 0$, $\hat{\pi}_M - \bar{\pi}_{M1} > 0$ and $\hat{\pi}_1 - \bar{\pi}_1 > 0$.

[45] Although it emerges in our simple setting, refusal-to-deal is unappealing for two reasons. First, a vertically integrated firm refusing to deal with downstream competitors will raise antitrust scrutiny. For ease of exposition, we have omitted this possibility in our model, though incorporating it is straightforward. Second, the most controversial vertical mergers are usually the ones in which the expectation is that the merging firm will continue providing access to rivals. That was the case, for instance, in the AT&T and Time Warner merger.

[46] For instance, take $s = 1$ and $\beta \to 1$. When $\gamma = 1/2$ then $(w_{A1}^{*}, w_{A1}^{**}) \to (1/2, 3/4)$, while when $\gamma = 1/4$ then $(w_{A1}^{*}, w_{A1}^{**}) \to (1/2, 3/8)$. For another example, take $s = 0$ and $\gamma = 1/3$. When $\beta = 2/5$ then $(w_{A1}^{*}, w_{A1}^{**}) = (0.21, 0.29)$, while when $\beta = 3/5$ then $(w_{A1}^{*}, w_{A1}^{**}) = (0.33, 0.30)$.

With the aid of (11), let us first explain the RRC and IDC effects. Because neither effect relies on A being a must-have, we momentarily set $s = 0$ to deactivate A's must-have potential.

The RRC effect arises because post-merger M internalizes the totality of the profits made by D_2, incentivizing M to demand (and successfully secure) higher wholesale prices from D_1. The latter occurs through two channels. First, M's profits in case of agreement, $\hat{\pi}_M$, become more sensitive to w_{A1} after the merger (i.e., $\partial\hat{\pi}_M/\partial w_{A1}$ increases with the merger) since M internalizes that an agreement with D_1 will intensify competition in D_2's home market, eroding his distributor profits. Second, the surplus M expects to obtain in case of agreement, $\hat{\pi}_M - \bar{\pi}_M$, decreases with the merger, as now M internalizes the totality of the profits that D_2 will obtain in D_1's home market if the negotiation with D_1 breaks down.[47,48] Both channels lead to a higher w_{A1}, as we can see from (11).

Acting in the opposite direction, however, is the IDC effect, which is a consequence of w_{A2} dropping to M's marginal cost after the merger. The IDC also affects the negotiation through two channels. First, D_1's profit in case of agreement, $\hat{\pi}_1$, becomes more sensitive to w_{A1} after the merger (i.e., $|\partial\hat{\pi}_1/\partial w_{A1}|$ increases with the merger). Second, the surplus D_1 expects to obtain in case of agreement, $\hat{\pi}_1 - \bar{\pi}_1$, decreases with the merger, since D_1's outside option is constant and equal to $\gamma/2$ pre- and post-merger when $s = 0$, and $\hat{\pi}_1$ decreases with the merger, as D_1 now expects tougher competition for A in her home market. As seen from (11), both channels lead to a lower w_{A1}.

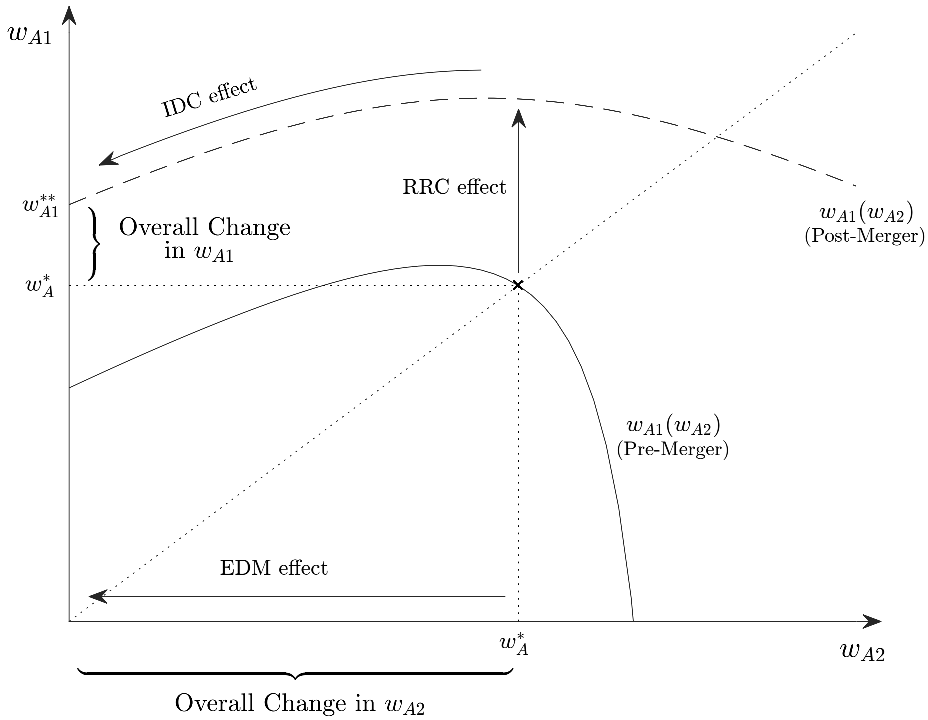
Figure 5 depicts the overall impact of the vertical merger on equilibrium wholesale prices in the absence of must-haves, and provides a graphical explanation for how this impact can be broken down into the RRC, IDC, and EDM effects. The solid and dashed curves depict $w_{A1}(w_{A2})$, the Nash solution to the negotiation between M and D_1 as a function of w_{A2}, before and after the merger, respectively. The pre-merger situation is given by (w_A^*, w_A^*), the intersection of $w_{A1}(w_{A2})$ (Pre-Merger) with the 45° line (marked with an $\times$). The RRC effect then corresponds to the upward shift of $w_{A1}(w_{A2})$ curve, so for any w_{A2}, M can extract a higher w_{A1}. The EDM effect is simply the drop of w_{A2} from $w_{A2}^* = w_A^* > 0$ to $w_{A2}^{**} = 0$, and the IDC effect is the movement along the curve $w_{A1}(w_{A2})$ (Post-Merger) occasioned by the drop in w_{A2}.

We are now in position to explain the must-have vertical-merger (MH-VM) effect, the new (anticompetitive) force that arises exclusively due to the presence of must-haves. To this end, we reactivate A's must-have potential by setting $s > 0$. In a nutshell, the MH-VM effect arises because D_1's outside option is no longer invariant to the merger in the presence of must-haves;

[47] More precisely, $\bar{\pi}_{M1}$ jumps by an amount equal to D_2's monopoly profits on good A in both downstream markets, while $\hat{\pi}_M$ jumps only by an amount equal to D_2's equilibrium profit on good A in her home market (as D_1 will serve market $m = 1$ in case of agreement).

[48] This second channel is also sometimes referred to as the "Increased Bargaining Leverage" effect.

Figure 5: Effects of a Vertical Merger (No Must-Haves)[a]



[a]Note that the figure depicts a situation in which $w^{**}_{A1} > w^*_{A1} = w^*_A$. This need not always be the case.

rather, it is decreasing in the merger:

$$\bar{\pi}_1 = \frac{\gamma}{2}\left[1 - \frac{s(1-w^*_{A2})}{2}\right] = \frac{\gamma}{2}\left[1 - \frac{s(1-w^*_A)}{2}\right] \qquad \text{(Pre-Merger)}$$

$$\bar{\pi}_1 = \frac{\gamma}{2}\left[1 - \frac{s(1-w^{**}_{A2})}{2}\right] = \frac{\gamma}{2}\left[1 - \frac{s}{2}\right] \qquad \text{(Post-Merger)}$$

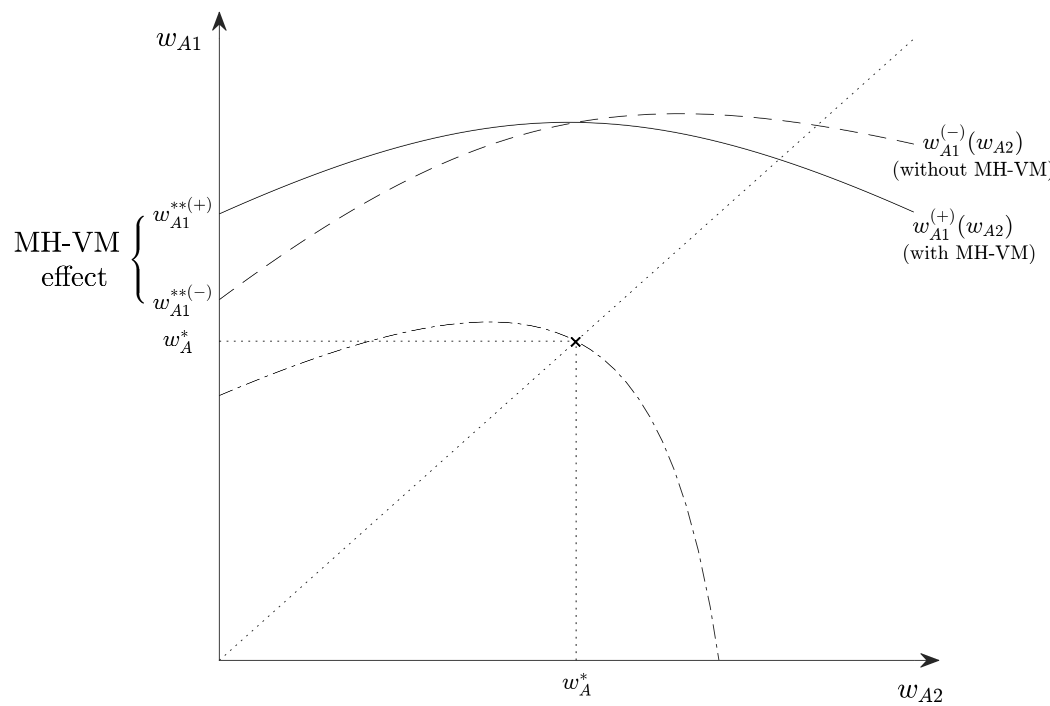
Intuitively, when A is a must-have, the mass of one-stop shoppers (and therefore the units of B) that D_1 loses in the event that her negotiation with M breaks down is not exogenous but depends on downstream equilibrium prices. Since, in equilibrium, the lower w_{A2}, the lower the price that D_2 charges for A in D_1's home market when D_1 does not carry A (see, for instance, Lemmas 2 or 4), a decrease in w_{A2} leads to an increase in the fraction of one-stop shoppers that switch to D_2 when D_1 fails to secure A.

Simply put, by eliminating double marginalization in the M-D_2 relationship, the vertical merger allows D_2 to be more aggressive downstream in the event that M and D_1 do not reach an agreement, increasing A's must-have potential and decreasing D_1's outside option relative to the pre-merger scenario. Thus, the integrated firm M-D_2 obtains more bargaining leverage from A's must-have status than M was securing before the merger. This extra boost in bargaining leverage is the MH-VM effect.

The MH-VM effect is depicted in Figure 6. The figure captures the post-merger negotiation between M and D_1 under two different assumptions. The solid curve represents the terms that M and D_1 negotiate as a function of w_{A2} under the correct assumption that D_1's outside option varies with w_{A2}, i.e., $\bar{\pi}_1 = \gamma[1 - s(1 - w_{A2})/2]/2$. The dashed curve, on the other hand, represents the terms negotiated under the "naive" assumption that D_1's outside option remains constant at its pre-merger level, i.e., $\bar{\pi}_1 = \gamma[1 - s(1 - w_A^*)/2]/2$. The solid curve is, therefore, a clockwise rotation of the dashed curve around w_A^*. The naive assumption predicts that w_{A1} would increase from w_A^* to $w_{A1}^{**(-)}$, when in reality it will increase by more to $w_{A2}^{**(+)}$. The extent of this underestimation, the difference between $w_{A1}^{**(+)}$ and $w_{A1}^{**(-)}$, is precisely the MH-VM effect.[49]

The MH-VM effect has two critical implications for the evaluation of vertical mergers. First, extra antitrust concern is warranted when evaluating a vertical merger involving a supplier of must-haves. Second, there is the need to recognize that in the presence of must-have items, the number of consumers that a distributor will lose in the event of a negotiation breakdown—a critical input for estimating the distributor's outside option—is not invariant to the merger. A naive estimation using pre-merger data without making any adjustments to take their post-

Figure 6: The MH-VM Effect



[49]Although calculating the extent of the underestimation in practice would certainly require a richer model than ours, we can still use our model to illustrate that the MH-VM effect can, in principle, be substantial. Letting $s = 1$, $\beta = 1/2$ and $\gamma = 1/3$, we obtain that the combined IBL and EDM effects take w_{A1} from its pre-merger level of 0.333 to 0.347, a 4.2% increase. Adding the MH-VM effect, w_{A1} jumps to 0.375, a 12.5% increase from its pre-merger level.

merger variation into account will always underestimate the anticompetitive potential of the merger at hand.

6 Conclusions

Many important markets (e.g., pay-TV, healthcare, retail) can be characterized as a group of competing distributors serving one-stop shoppers interested in multiple products, which distributors procure from upstream suppliers through bilateral negotiations. We have developed a theory that shows that, under certain conditions, these market features support the emergence of must-haves: products that, when they are not carried, impair distributors' ability to compete effectively for other products in their lineups. These must-have items are a strict subset of all the products over which suppliers have market power, but a strict superset of products deemed essential inputs—inputs without which a distributor cannot stay in business.

Our notion of must-haves is novel. It rests on two fundamental properties. One is that a product's must-have status has a degree of intensity inherent to it: the product's must-have potential. This corresponds to the loss of sales in unrelated products due to its removal. The higher this potential, the more adversely affected are distributors' outside options, translating into higher wholesale and downstream prices. Second, our notion of must-haves is not an intrinsic product characteristic; it is rather the result of a multi-dimensional interaction involving product characteristics, upstream market conditions, downstream market conditions, and distributors' product portfolio decisions.

These two properties carry profound antitrust implications. To start, what matters is not whether or not a product is classified as a must-have but rather its must-have potential, something that depends on the status quo and may well vary across distributors. Consequently, one must be careful with extrapolating an item's must-have potential from a particular situation or distributor to another. Furthermore, a structural approach seems necessary to estimate items' must-have potential. Fortunately, it is possible to identify this potential from wholesale price data, since wholesale terms agreed in equilibrium depend on a distributor's outside option, the very experiment that determines a product's must-have potential for that distributor.

Moreover, the fact that must-haves are the result of such rich multi-dimensional interaction implies that there will be an interaction—a "cross-derivative," if you will—between items' must-have potential and transactions that change the overall structure of the market. Indeed, as we showed in Sections 3–5, transactions conducive to upstream and vertical consolidation strengthen items' must-have status, leading to more anticompetitive outcomes. Meanwhile, practices conducive to downstream consolidation weaken items' must-have status, helping to mitigate must-haves' anticompetitive effects. Thus, in the context of must-haves, antitrust authorities should unambiguously lean less favorably towards both horizontal mergers of upstream suppliers and vertical mergers. In contrast, they should lean more favorably towards buyer alliances and horizontal mergers of distributors.

While very relevant for antitrust, the practices and transactions covered in these sections are by no means the only ones with the potential to interact with must-have items. In that regard, our theory should provide a useful framework to study any transaction with the potential to affect the multi-dimensional interaction that gives rise to such items. Some such transactions that come to mind include conglomerate and cross-market mergers (e.g. Dafny, Ho and Lee, 2019), and wholesale bundling and monopolization upstream.[50] We leave their analysis for future work.

Appendix A Downstream Demands

Consider market $m = 1$ (the other market is symmetric) and suppose that D_1 and D_2 set prices $(p^{(1)}_{A1}, p^{(1)}_{B1}, p^{(1)}_{AB1})$ and $(p^{(1)}_{A2}, p^{(1)}_{B2}, p^{(1)}_{AB2})$, respectively. Furthermore, without loss of generality, assume $\max\{p^{(1)}_{Ai}, p^{(1)}_{Bi}\} \leq p^{(1)}_{ABi} \leq p^{(1)}_{Ai} + p^{(1)}_{Bi}$ for $i = 1, 2$. Define

$$\underline{p}^{(1)}_{AB} \equiv \min\{p^{(1)}_{AB1} - 2\gamma, p^{(1)}_{AB2}\} \quad \text{and} \quad \underline{p}^{(1)}_{k} \equiv \min\{p^{(1)}_{k1} - \gamma, p^{(1)}_{k2}\} \text{ for } k = A, B$$

as the lowest "quality-adjusted" prices for the bundle and a stand-alone unit of product k, respectively. Finally, denote by $\underline{\mathbf{D}}_{AB}$ and $\underline{\mathbf{D}}_k$ the sets of distributors offering the lowest quality-adjusted prices for the bundle and product $k = A, B$.

Instead of characterizing demands in a general fashion, for ease of exposition we will use the following shortcut: in any equilibrium $\underline{p}^{(1)}_B \leq 0$. The reason follows a standard Bertrand logic. Since distributors can acquire good B from the fringe at zero cost, if $\underline{p}^{(1)}_B > 0$, then at least one distributor would have strict incentives to undercut $\underline{p}^{(1)}_B$.

A.1 The Consumer's Problem

Consider a consumer with intrinsic valuations $(v_A, v_B) \in [0, 1]^2$. Her problem depends on whether she is a one-stop or a two-stop shopper.

One-Stop Shopper. A one-stop shopper must decide which distributor to visit and what to buy from that distributor.

Since $\underline{p}^{(1)}_B \leq 0$, then a one-stop shopper will visit a distributor to purchase some item with probability one. Note further that this consumer will never purchase a standalone unit of A plus a standalone unit of B: for this to be the case there must exists a distributor $D_i \in \underline{\mathbf{D}}_A \cap \underline{\mathbf{D}}_B$, but if so then the consumer weakly prefers buying the bundle from D_i given that $p^{(1)}_{ABi} \leq p^{(1)}_{Ai} + p^{(1)}_{Bi}$. Consequently, her problem can be thought as either buying only A from $D \in \underline{\mathbf{D}}_A$, buying only B from $D' \in \underline{\mathbf{D}}_B$, or buying the bundle from $D'' \in \underline{\mathbf{D}}_{AB}$. Her purchasing behavior then depends on whether $\underline{p}^{(1)}_A \geq \underline{p}^{(1)}_{AB}$ or $\underline{p}^{(1)}_A < \underline{p}^{(1)}_{AB}$.

[50] See, for instance, *Cablevision Systems Corp. v. Viacom International Inc.* (Civil Action No. 13 CIV 1278 (LTS) (JLC), S.D.N.Y. 2013)

When $\underline{p}_A^{(1)} \geq \underline{p}_{AB}^{(1)}$, it is clear that no consumer will be purchasing only A since the bundle is a superior alternative to all consumers. Her problem then is to buy either only B from $D' \in \underline{\mathbf{D}}_B$ or the bundle from $D'' \in \underline{\mathbf{D}}_{AB}$. The consumer will choose the former whenever $v_A < \underline{p}_{AB}^{(1)} - \underline{p}_B^{(1)}$, as shown in Figure A.1a.

Alternatively, when $\underline{p}_A^{(1)} < \underline{p}_{AB}^{(1)}$ (which implies that $\underline{\mathbf{D}}_A \cap \underline{\mathbf{D}}_B = \emptyset$) her problem is whether to purchase only A from $D \in \underline{\mathbf{D}}_A$, only B from $D' \in \underline{\mathbf{D}}_B$, or the bundle from $D'' \in \underline{\mathbf{D}}_{AB}$. As seen from Figure A.1b, in this case the consumer will buy only product k from $D \in \underline{\mathbf{D}}_k$ whenever: (i) $v_k - \underline{p}_k^{(1)} \geq v_{-k} - \underline{p}_{-k}^{(1)}$, and (ii) $v_{-k} \leq \underline{p}_{AB}^{(1)} - \underline{p}_k^{(1)}$. In contrast, she will purchase the bundle from $D' \in \underline{\mathbf{D}}_{AB}$ whenever $v_k \geq \underline{p}_{AB}^{(1)} - \underline{p}_k^{(1)}$ for both $k = A, B$.

Two-Stop Shopper. If the consumer is a two-stop shopper, her problem is slightly different. Since this consumer can visit multiple distributors, her problem is to decide whether to buy only A from a distributor $D \in \underline{\mathbf{D}}_A$, only B from $D' \in \underline{\mathbf{D}}_B$, A from $D \in \underline{\mathbf{D}}_A$ and B from $D' \in \underline{\mathbf{D}}_B$, or the bundle from $D'' \in \underline{\mathbf{D}}_{AB}$ (not purchasing anything is never optimal given that $\underline{p}_B^{(1)} \leq 0$).

Her purchasing behavior then depends on whether $\underline{p}_{AB}^{(1)} \gtrless \underline{p}_A^{(1)} + \underline{p}_B^{(1)}$, as shown in Figure A.2. When $\underline{p}_{AB}^{(1)} \leq \underline{p}_A^{(1)} + \underline{p}_B^{(1)}$, the consumer purchases only B from $D \in \underline{\mathbf{D}}_B$ whenever $v_A < \underline{p}_{AB}^{(1)} - \underline{p}_B^{(1)}$; otherwise she will purchase the bundle from $D'' \in \underline{\mathbf{D}}_{AB}$. In contrast, when $\underline{p}_{AB}^{(1)} > \underline{p}_A^{(1)} + \underline{p}_B^{(1)}$, she will always purchase B from $D \in \underline{\mathbf{D}}_B$, and she will additionally purchase A from $D' \in \underline{\mathbf{D}}_A$ whenever $v_A \geq \underline{p}_A^{(1)}$.

A.2 Demands

We can now aggregate consumers' decisions to obtain distributors' demands. Recall that each market is of size 1/2. D_i's demands from one-stop shoppers in market $m = 1$ for product $k = A, B$ and the bundle AB are, respectively:

$$\hat{q}_{Ai}^{(1)} = \frac{s}{2}\left[(1 - \underline{p}_{AB}^{(1)} + \underline{p}_B^{(1)})(\underline{p}_{AB}^{(1)} - \underline{p}_A^{(1)}) + \frac{1}{2}(\underline{p}_{AB}^{(1)} - \underline{p}_A^{(1)})^2\right]\mathbb{1}_{\underline{p}_A^{(1)} \leq \underline{p}_{AB}^{(1)}}\left(\frac{\mathbb{1}_{D_i \in \underline{\mathbf{D}}_A}}{\#\underline{\mathbf{D}}_A}\right)$$
$$\hat{q}_{Bi}^{(1)} = \frac{s}{2}\left[(\underline{p}_{AB}^{(1)} - \underline{p}_B^{(1)}) - \frac{1}{2}(\underline{p}_{AB}^{(1)} - \underline{p}_A^{(1)})^2\mathbb{1}_{\underline{p}_A^{(1)} \leq \underline{p}_{AB}^{(1)}}\right]\left(\frac{\mathbb{1}_{D_i \in \underline{\mathbf{D}}_B}}{\#\underline{\mathbf{D}}_B}\right)$$
$$\hat{q}_{ABi}^{(1)} = \frac{s}{2}\left[(1 - \underline{p}_{AB}^{(1)} + \underline{p}_B^{(1)})\big(1 - (\underline{p}_{AB}^{(1)} - \underline{p}_A^{(1)})\mathbb{1}_{\underline{p}_A^{(1)} \leq \underline{p}_{AB}^{(1)}}\big)\right]\left(\frac{\mathbb{1}_{D_i \in \underline{\mathbf{D}}_{AB}}}{\#\underline{\mathbf{D}}_{AB}}\right)$$

where $\#\boldsymbol{S}$ denotes the cardinality of set $\boldsymbol{S}$. Meanwhile her demands from two-stop shoppers are, respectively:

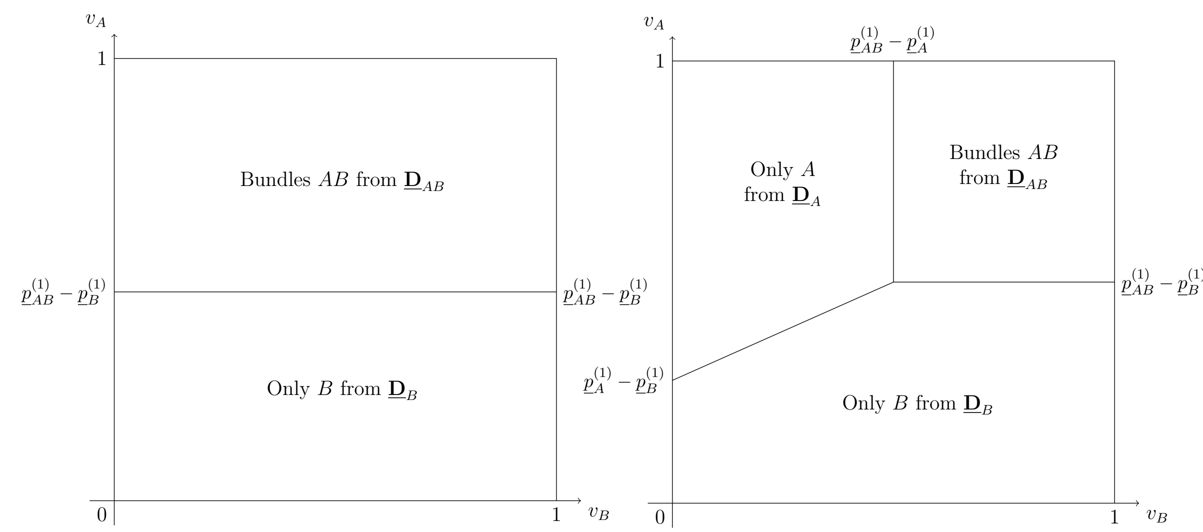
$$\tilde{q}_{Ai}^{(1)} = \frac{1-s}{2}\big(1 - \underline{p}_A^{(1)}\big)\mathbb{1}_{\underline{p}_A^{(1)} + \underline{p}_B^{(1)} < \underline{p}_{AB}^{(1)}}\left(\frac{\mathbb{1}_{D_i \in \underline{\mathbf{D}}_A}}{\#\underline{\mathbf{D}}_A}\right)$$
$$\tilde{q}_{Bi}^{(1)} = \frac{1-s}{2}\left[\big(\underline{p}_{AB}^{(1)} - \underline{p}_B^{(1)}\big) + \big(1 - (\underline{p}_{AB}^{(1)} - \underline{p}_B^{(1)})\big)\mathbb{1}_{\underline{p}_A^{(1)} + \underline{p}_B^{(1)} < \underline{p}_{AB}^{(1)}}\right]\left(\frac{\mathbb{1}_{D_i \in \underline{\mathbf{D}}_B}}{\#\underline{\mathbf{D}}_B}\right)$$
$$\tilde{q}_{ABi}^{(1)} = \frac{1-s}{2}\big(1 - \underline{p}_{AB}^{(1)} + \underline{p}_B^{(1)}\big)\mathbb{1}_{\underline{p}_A^{(1)} + \underline{p}_B^{(1)} \geq \underline{p}_{AB}^{(1)}}\left(\frac{\mathbb{1}_{D_i \in \underline{\mathbf{D}}_{AB}}}{\#\underline{\mathbf{D}}_{AB}}\right)$$

Given these demands D_i's profit in market $m = 1$ can be written as

$$\pi_i^{(1)} = (p_{ABi}^{(1)} - w_{Ai})[\hat{q}_{ABi}^{(1)} + \tilde{q}_{ABi}^{(1)}] + (p_{Ai}^{(1)} - w_{Ai})[\hat{q}_{Ai}^{(1)} + \tilde{q}_{Ai}^{(1)}] + p_{Bi}^{(1)}[\hat{q}_{Bi}^{(1)} + \tilde{q}_{Bi}^{(1)}] \tag{12}$$

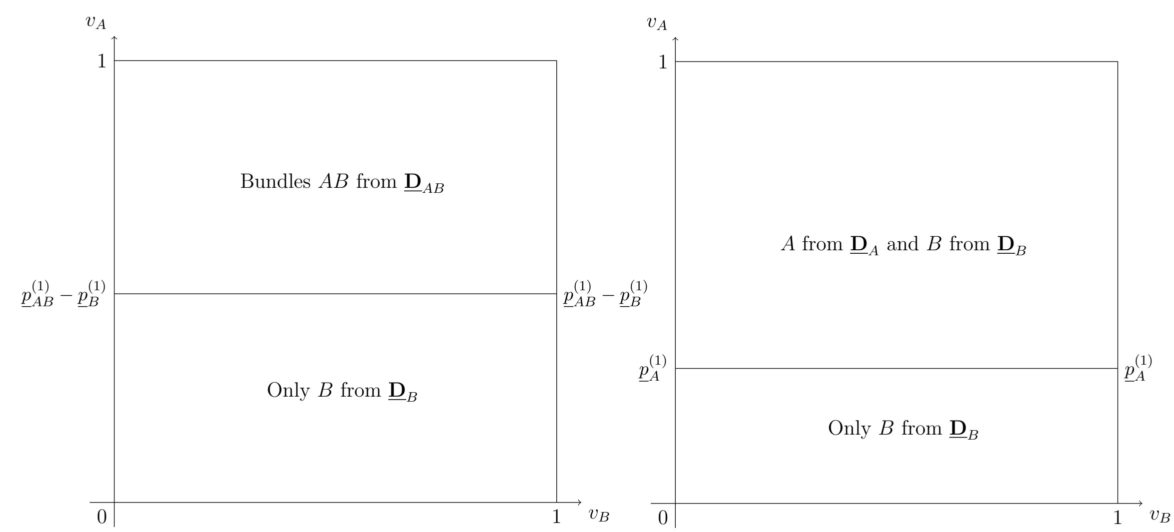
so her total profits considering both markets are $\pi_i = \pi_i^{(1)} + \pi_i^{(2)}$.

Figure A.1: Purchasing Decisions of One-Stop Shoppers



(a) $\underline{p}_A^{(1)} \geq \underline{p}_{AB}^{(1)}$ (b) $\underline{p}_A^{(1)} < \underline{p}_{AB}^{(1)}$

Figure A.2: Purchasing Decisions of Two-Stop Shoppers



(a) $\underline{p}_{AB}^{(1)} \leq \underline{p}_A^{(1)} + \underline{p}_B^{(1)}$ (b) $\underline{p}_{AB}^{(1)} > \underline{p}_A^{(1)} + \underline{p}_B^{(1)}$

Appendix B Proofs of Lemmas 1 and 2

B.1 Proof of Lemma 1

Consider market $m = 1$ (the proof for $m = 2$ is basically symmetric). The proof is structured as follows. First, we establish necessary conditions that any equilibrium must satisfy and show that these conditions take us to a unique equilibrium candidate. Then, we verify that this candidate is indeed an equilibrium.

Define $\mathbf{p}_i^{(1)} \equiv (p_{Ai}^{(1)}, p_{Bi}^{(1)}, p_{ABi}^{(1)})$, where without loss of generality $\max\{p_{Ai}^{(1)}, p_{Bi}^{(1)}\} \leq p_{ABi}^{(1)} \leq p_{Ai}^{(1)} + p_{Bi}^{(1)}$, and suppose that $(\mathbf{p}_1^{(1)*}, \mathbf{p}_2^{(1)*})$ is an equilibrium in market $m = 1$.

Claim B.1. *In any equilibrium D_1 is the only distributor selling units in market $m = 1$. Hence, (i) $p_{A1}^{(1)*} \leq p_{A2}^{(1)*} + \gamma - \epsilon$, (ii) $p_{B1}^{(1)*} \leq p_{B2}^{(1)*} + \gamma - \epsilon$, and (iii) $p_{AB1}^{(1)*} \leq p_{AB2}^{(1)*} + 2\gamma - \epsilon$ with $\epsilon \downarrow 0$.*

Proof. By contradiction. If D_2 is selling some units in equilibrium, then she must be pricing those units at or above marginal cost. But if so, then D_1 will always find it profitable to slightly undercut the price of such units given her home advantage and the fact that $w_A^* - \gamma < w_{A1} < w_A^* + \gamma$ (as $w_{A1} \approx w_A^*$) and $w_{B1} = w_{B2} = 0$. □

Claim B.2. *In any equilibrium the following conditions must hold: (iv) $p_{A1}^{(1)*} \leq w_A^* + \gamma - \epsilon$, (v) $p_{B1}^{(1)*} \leq \gamma - \epsilon$, and (vi) $p_{AB1}^{(1)*} \leq w_A^* + 2\gamma - \epsilon$ with $\epsilon \downarrow 0$.*

Proof. First, it is clear that $p_{A1}^{(1)*} \leq w_A^* + \gamma$, (v) $p_{B1}^{(1)*} \leq \gamma$, and (vi) $p_{AB1}^{(1)*} \leq w_A^* + 2\gamma$; otherwise D_2 could profitably undercut D_1's price for at least one of the products and start selling units in market $m = 1$ contradicting Claim B.1. Now, suppose that $p_{A1}^{(1)*} = w_A^* + \gamma$, then it must be that $p_{A2}^{(1)} > w_A^*$; otherwise, condition (i) from Claim B.1 would be violated. But if so, then D_1 could slightly increase $p_{A1}^{(1)*}$ and strictly increase her profits. Thus $p_{A1}^{(1)*} < w_A^* + \gamma$, or equivalently, $p_{A1}^{(1)*} \leq w_A^* + \gamma - \epsilon$ with $\epsilon \downarrow 0$. Repeating this argument for $p_{B1}^{(1)*}$ and $p_{AB1}^{(1)*}$ we arrive at (v) and (vi). □

Claim B.3. *In any equilibrium $p_{ABi}^{(1)*} = p_{Ai}^{(1)*} + p_{Bi}^{(1)*}$ for $i = 1, 2$, and:*

$$p_{A1}^{(1)*} = \begin{cases} w_A^* + \gamma - \epsilon & \text{if } \gamma \leq 1 - w_A^* + (w_{A1} - w_A^*) + 2\epsilon \\ (1 + w_{A1} + \gamma)/2 & \text{otherwise} \end{cases} \qquad p_{B1}^{(1)*} = \gamma - \epsilon$$
$$p_{A2}^{(1)*} = w_A^* \qquad\qquad p_{B2}^{(1)*} = 0$$

Proof. By Claim B.1 we have that $\underline{\mathbf{D}}_A = \underline{\mathbf{D}}_B = \underline{\mathbf{D}}_{AB} = D_1$, so $\underline{p}_k^{(1)*} = p_{k1}^{(1)*} - \gamma$ for $k = A, B$, $\underline{p}_{AB}^{(1)*} = p_{AB1}^{(1)*} - 2\gamma$. This implies that $\underline{p}_A^{(1)*} \leq \underline{p}_{AB}^{(1)*}$ and that $\underline{p}_{AB}^{(1)*} \leq \underline{p}_A^{(1)*} + \underline{p}_B^{(1)*}$, since $p_{A1}^{(1)} \leq p_{AB1}^{(1)} \leq p_{A1}^{(1)} + p_{B1}^{(1)}$. Consequently, D_1's equilibrium profits in this market are $\pi_1^{(1)*} = f(\mathbf{p}_1^{(1)*})$, where

$$f(\mathbf{p}_1^{(1)}) = (p_{B1}^{(1)} - \gamma)(p_{AB1}^{(1)} - p_{B1}^{(1)} - \gamma) + (p_{AB1}^{(1)} - 2\gamma - w_{A1})(1 - p_{AB1}^{(1)} + p_{B1}^{(1)} + \gamma)$$

Now, since in any equilibrium D_1 must be maximizing his profits given D_2's equilibrium prices, then $\pi_1^{(1)*} = \max_{\mathbf{p}_i^{(1)}} f(\mathbf{p}_1^{(1)})$ subject to conditions (i)-(iii) of Claim B.1. Moreover, because we know that in any equilibrium conditions (iv)-(vi) of Claim B.2 must hold, then it must be that $\pi_1^{(1)*} \leq \breve{\pi}_1^{(1)}$, where $\breve{\pi}_1^{(1)} = \max_{\mathbf{p}_i^{(1)}} f(\mathbf{p}_1^{(1)})$ subject to (iv)-(vi). But since D_2 cannot be pricing below cost, as she is not selling any units,[51] then conditions (iv)-(vi) are weakly more stringent than conditions (i)-(iii), implying that $\pi_1^{(1)*} \geq \breve{\pi}_1^{(1)}$. Thus, $\pi_1^{(1)*} = \breve{\pi}_1^{(1)}$ necessarily.

Because $\pi_1^{(1)*} = \breve{\pi}_1^{(1)}$, and given that the problem $\max_{\mathbf{p}_i^{(1)}} f(\mathbf{p}_1^{(1)})$ subject to (iv)-(vi) has a unique solution, then in any equilibrium D_1's prices must necessarily come from this maximization. Solving, yields $p_{A1}^{(1)*} \geq p_{AB1}^{(1)*} - p_{B1}^{(1)*}$, $p_{B1}^{(1)*} = \gamma - \epsilon$, and

$$p_{AB1}^{(1)*} = \begin{cases} w_A^* + 2\gamma - \epsilon & \text{if } \gamma \leq 1 - w_A^* + (w_{A1} - w_A^*) + 2\epsilon \\ (1 + w_{A1} + \gamma)/2 + \gamma & \text{otherwise} \end{cases}$$

The latter implies that bundling does not emerge, as we can rewrite D_1's equilibrium prices as $p_{AB1}^{(1)*} = p_{A1}^{(1)*} + p_{B1}^{(1)*}$, $p_{B1}^* = \gamma - \epsilon$, and

$$p_{A1}^{(1)*} = \begin{cases} w_A^* + \gamma - \epsilon & \text{if } \gamma \leq 1 - w_A^* + (w_{A1} - w_A^*) + 2\epsilon \\ (1 + w_{A1} + \gamma)/2 & \text{otherwise} \end{cases}$$

Intuitively, D_1's problem reduces to finding just two prices, one for serving consumers who buy only B and another for consumers who buy A and B.

Finally, to find D_2's equilibrium prices, note that whenever a restriction from the set (iv)-(vi) binds, then D_2 must be pricing at cost; otherwise D_1 would have incentives to increase prices, violating the binding restriction. Consequently, since the restriction (v) always binds (i.e., $p_{B1}^{(1)*} = \gamma - \epsilon$), we have that $p_{B2}^{(1)*} = 0$, so $p_{B1}^{(1)*} = p_{B2}^{(1)*} + \gamma - \epsilon = \gamma - \epsilon$. In contrast, conditions (iv) and (vi) only bind when $\gamma \leq 1 - w_A^* + (w_{A1} - w_A^*) + 2\epsilon$, in which case $p_{A2}^{(1)*} = w_A^*$ and $p_{AB2}^{(1)*} = w_A^* = p_{A2}^{(1)*} + p_{B2}^{(1)*}$; otherwise any $p_{A2}^{(1)*} = p_{AB2}^{(1)*} \geq w_A^*$ will do it. So, for ease of exposition we can set them at $p_{A2}^{(1)*} = p_{AB2}^{(1)*} = w_A^*$ also in that case. □

Claim B.4. *The unique equilibrium in market $m = 1$ is as stated in the lemma.*

Proof. The previous three claims imply that there is a unique equilibrium candidate. Thus, we only need to verify that this candidate is indeed an equilibrium. It is clear that D_2 is playing a best response in that no profitable deviation exists. D_1's response is also optimal, both locally (as shown in Claim B.3) and globally. The only feasible global deviation would be to drop one or more products, which is clearly unprofitable since the loss from doing so cannot be made up by increasing the price of any of the remaining products given $\mathbf{p}_2^{(1)}$. □

B.2 Proof of Lemma 2

Consider market $m = 1$ (the proof for $m = 2$ follows closely that of Lemma 1, so it is omitted). Define $\mathbf{p}_i^{(1)} \equiv (p_{Ai}^{(1)}, p_{Bi}^{(1)}, p_{ABi}^{(1)})$, where without loss of generality $\max\{p_{Ai}^{(1)}, p_{Bi}^{(1)}\} \leq p_{ABi}^{(1)} \leq p_{Ai}^{(1)} +$

[51] As standard in Bertrand games with asymmetric costs, we rule out equilibria in which D_2 is pricing one or more items below her cost while expecting to sell no units of them.

$p_{Bi}^{(1)}$, and suppose that $(\mathbf{p}_1^{(1)*}, \mathbf{p}_2^{(1)*})$ is an equilibrium in market $m = 1$. Because D_1 does not carry A, then $p_{A1}^{(1)*} = p_{AB1}^{(1)*} \to \infty$ necessarily. Hence we only need to find $p_{Bi}^{(1)*}$ and $\mathbf{p}_2^{(1)*}$. Furthermore, this implies that $\underline{\mathbf{D}}_A = \underline{\mathbf{D}}_{AB} = D_2$, so $\underline{p}_A^{(1)*} = p_{A2}^{(1)*}$ and $\underline{p}_{AB}^{(1)*} = p_{AB2}^{(1)*}$. Hence $\underline{p}_A^{(1)*} \leq \underline{p}_{AB}^{(1)*}$, as $p_{A2}^{(1)*} \leq p_{AB2}^{(1)*}$.

The structure of the proof is similar to that of Lemma 1. First, we establish necessary conditions that any equilibrium must satisfy and show that these conditions take us to a unique equilibrium candidate. Then, we verify that this candidate is indeed an equilibrium.

Claim B.5. *In any equilibrium D_1 is the only distributor selling stand-alone units of B in market $m = 1$ so $p_{B1}^{(1)*} \leq p_{B2}^{(1)*} + \gamma - \epsilon$. Furthermore, in any equilibrium $p_{B1}^{(1)*} \leq \gamma - \epsilon$.*

Proof. The proof is analogous to the one of Claim B.1 and Claim B.2. □

Claim B.6. *In any equilibrium $p_{B1}^{(1)*} = \gamma - \epsilon$, $p_{A2}^{(1)*} = p_{AB2}^{(1)*} = (1 + w_A^* - \epsilon)/2$, and $p_{B2}^{(1)*} = 0$.*

Proof. By Claim B.5, we know that $\underline{\mathbf{D}}_B = D_1$ and, therefore, that $\underline{p}_B^{(1)*} = p_{B1}^{(1)*} - \gamma$, so $\underline{p}_{AB}^{(1)*} - \underline{p}_A^{(1)*} - \underline{p}_B^{(1)*} > p_{AB2}^{(1)*} - p_{A2}^{(1)*} - (p_{B1}^{(1)*} - \gamma) > 0$, since $p_{AB2}^{(1)*} \geq p_{A2}^{(1)*}$ and $p_{B1}^{(1)*} < \gamma$. The latter result, combined with the fact that $\underline{p}_A^{(1)*} = p_{A2}^{(1)*} \leq \underline{p}_{AB}^{(1)*} = p_{AB2}^{(1)*}$ (as we already saw), imply that D_1's and D_2's equilibrium profits in this market are, respectively, $\pi_1^{(1)*} = g(\mathbf{p}_1^{(1)*}, \mathbf{p}_2^{(1)*})$ and $\pi_2^{(1)*} = h(\mathbf{p}_1^{(1)*}, \mathbf{p}_2^{(1)*})$, where

$$
\begin{aligned}
g(\mathbf{p}_1^{(1)}, \mathbf{p}_2^{(1)}) &= \frac{p_{B1}}{2}\left[s(p_{AB2}^{(1)} - p_{B1}^{(1)} + \gamma) - \frac{s}{2}(p_{AB2}^{(1)} - p_{A2}^{(1)})^2 + (1-s)\right] \\
h(\mathbf{p}_1^{(1)}, \mathbf{p}_2^{(1)}) &= \frac{1}{2}\Big\{s(p_{AB2}^{(1)} - w_{A2})(1 - p_{AB2}^{(1)} + p_{B1}^{(1)} - \gamma)(1 - p_{AB2}^{(1)} + p_{A2}^{(1)}) \\
&\quad (p_{A2}^{(1)} - w_{A2})\left[(1-s)(1 - p_{A2}^{(1)}) + s(1 - p_{AB2}^{(1)} + p_{B1}^{(1)} - \gamma)(p_{AB2}^{(1)} - p_{A2}^{(1)}) + \frac{s}{2}(p_{AB2}^{(1)} - p_{A2}^{(1)})^2\right]\Big\}
\end{aligned}
$$

Now, since in any equilibrium D_1 must be maximizing his profits locally given D_2's equilibrium prices, then $\pi_1^{(1)*} = \max_{\mathbf{p}_1^{(1)}} g(\mathbf{p}_1^{(1)}, \mathbf{p}_2^{(1)*})$ subject to $p_{B1}^{(1)} \leq p_{B2}^{(1)*} + \gamma - \epsilon$. This yields,

$$
p_{B1}^{(1)*} = \min\left\{p_{B2}^{(1)*} + \gamma - \epsilon, \frac{p_{AB2}^{(1)*} + \gamma}{2} + \left(\frac{1-s}{2s}\right) - \frac{1}{4}(p_{AB2} - p_{A2})^2\right\} \tag{13}
$$

Similarly, in any equilibrium D_2 must be maximizing his profits locally given D_1's equilibrium prices $\pi_2^{(1)*} = \max_{\mathbf{p}_2^{(1)}} h(\mathbf{p}_1^{(1)*}, \mathbf{p}_2^{(1)})$. This yields:

$$
p_{A2}^{(1)*} = p_{AB2}^{(1)*} = \frac{1}{2}(1 + w_{A2} + p_{B1}^{(1)} - \gamma) \tag{14}
$$

where we are using the fact that $p_{AB2}^{(1)*} \geq p_{A2}^{(*)}$ (otherwise, consumers interested in only A, buy the bundle and discard B).

But when $\gamma \leq 1/2$, the only way for (13) and (14) to hold, provided that $p_{B1}^{(1)*} \geq \gamma - \epsilon$, is when $p_{B1}^{(1)*} = \gamma - \epsilon$, $p_{A2}^{(1)*} = p_{AB2}^{(1)*} = (1 + w_A^* - \epsilon)/2$, and $p_{B2}^{(1)*} = 0$. □

Claim B.7. *The unique equilibrium in market $m = 1$ is as stated in the lemma.*

Proof. The previous three claims imply that there is a unique equilibrium candidate. Thus, we only need to verify that this candidate is indeed an equilibrium. It is clear that D_1 is playing a best response in that no profitable deviation exists. D_2's response is also optimal, both locally (as shown in Claim B.6) and globally (dropping either A or B is clearly unprofitable, the former because of Claim B.5 and the latter because A is already at its monopoly level). □

References

Bernheim, B. Douglas, and Erik Madsen. 2017. "Price Cutting and Business Stealing in Imperfect Cartels." *American Economic Review*, 107(2): 387–424.

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

Bliss, Christopher. 1988. "A Theory of Retail Pricing." *Journal of Industrial Economics*, 36(4): 375–391.

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

Calzolari, Giacomo, Vincenzo Denicolo, and Piercarlo Zanchettin. forthcoming. "Exclusive dealing with distortionary pricing." *RAND Journal of Economics*.

Chen, Zhijun, and Patrick Rey. 2012. "Loss Leading as an Exploitative Practice." *American Economic Review*, 102(7): 3462–3482.

Chipty, Tasneem, and Christopher M. Snyder. 1999. "The Role of Firm Size in Bilateral Bargaining: A Study of the Cable Television Industry." *The Review of Economics and Statistics*, 81(2): 326–340.

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

Crawford, Gregory S., and Ali Yurukoglu. 2012. "The Welfare Effects of Bundling in Multichannel Television Markets." *American Economic Review*, 102(2): 643–85.

Crawford, Gregory S., Robin S. Lee, Michael D. Whinston, and Ali Yurukoglu. 2018. "The Welfare Effects of Vertical Integration in Multichannel Television Markets." *Econometrica*, 86(3): 891–954.

Cremer, Jacques, and Michael H. Riordan. 1987. "On Governing Multilateral Transactions with Bilateral Contracts." *RAND Journal of Economics*, 18(3): 436–451.

Cuesta, Jose Ignacio, Carlos Noton, and Benjamín Vatter. 2019. "Vertical Integration between Hospitals and Insurers." Working Paper.

Dafny, Leemore, Kate Ho, and Robin S. Lee. 2019. "The price effects of cross-market mergers: theory and evidence from the hospital industry." *RAND Journal of Economics*, 50(2): 286–325.

Dobson, Paul W., and Michael Waterson. 1997. "Countervailing Power and Consumer Prices." *The Economic Journal*, 107(441): 418–430.

Farrell, Joseph, and Carl Shapiro. 1990. "Horizontal Mergers: An Equilibrium Analysis." *American Economic Review*, 80(1): 107–126.

Farrell, Joseph, and Carl Shapiro. 2010. "Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition." *The B.E. Journal of Theoretical Economics*, 10(1).

Galbraith, John Kenneth. 1952. *American capitalism: The concept of countervailing power.* Boston:Houghton Mifflin.

Glied, Sherry A., and Stuart H. Altman. 2017. “Beyond Antitrust: Health Care And Health Insurance Market Trends And The Future Of Competition.” *Health Affairs*, 36(9): 1572–1577.

Gowrisankaran, Gautam, Aviv Nevo, and Robert Town. 2015. “Mergers When Prices Are Negotiated: Evidence from the Hospital Industry.” *American Economic Review*, 105(1): 172–203.

Hart, Oliver, and Jean Tirole. 1990. “Brooking Papers on Economic Activity – Microeconomics.” , ed. M. N. Baily and C. Winston, Chapter Vertical integration and market foreclosure. Washington:The Brookings Institution.

Ho, Kate, and Robin S. Lee. 2017. “Insurer Competition in Health Care Markets.” *Econometrica*, 85(2): 379–417.

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

Klemperer, Paul. 1992. “Equilibrium Product Lines: Competing Head-to-Head May be Less Competitive.” *American Economic Review*, 82(4): 740–755.

Lee, Robin S. 2013. “Vertical Integration and Exclusivity in Platform and Two-Sided Markets.” *American Economic Review*, 103(7): 2960–3000.

Noton, Carlos, and Andrés Elberg. 2018. “Are Supermarkets Squeezing Small Suppliers? Evidence from Negotiated Wholesale Prices.” *The Economic Journal*, 128(610): 1304–1330.

Ordover, Janusz A., Garth Saloner, and Steven C. Salop. 1990. “Equilibrium Vertical Foreclosure.” *American Economic Review*, 80(1): 127–142.

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

Rhodes, Andrew, and Jidong Zhou. 2019. “Consumer Search and Retail Market Structure.” *Management Science*, 65(6): 2607–2623.

Riordan, Michael H. 2008. “Handbook of Antitrust Economics.” , ed. Paolo Buccirossi, Chapter Competitive Effects of Vertical Integration. Cambridge:The MIT Press.

Rubinstein, Ariel. 1982. “Perfect Equilibrium in a Bargaining Model.” *Econometrica*, 50(1): 97–109.

Salop, Steven C., and David T. Scheffman. 1983. “Raising Rivals’ Costs.” *American Economic Review*, 73(2): 267–271.

Snyder, Christopher. 2008. “he New Palgrave Dictionary of Economics, 2nd edition.” , ed. Steven. N. Durlauf and Lawrence E. Blume, Chapter Countervailing Power. Palgrave Macmillan.

Spengler, Joseph J. 1950. “Vertical Integration and Antitrust Policy.” *Journal of Political Economy*, 58(4): 347–352.

Stigler, George J. 1954. “The Economist Plays with Blocs.” *American Economic Review*, 44(2): 7–14.

Stole, Lars A., and Jeffrey Zwiebel. 1996. “Intra-Firm Bargaining under Non-Binding Contracts.” *The Review of Economic Studies*, 63(3): 375–410.

U.K. Office of Fair Trading. 2000. “Supermarkets: A Report on the Supply of Groceries from Multiple Stores in the United Kingdom.” Report Cm-4842.

Villas-Boas, J. Miguel, and Ying Zhao. 2005. “Retailer, Manufacturers, and Individual Consumers: Modeling the Supply Side in the Ketchup Marketplace.” *Journal of Marketing Research*, 42(1): 83–95.

Williamson, Oliver E. 1968. “Economies as an Antitrust Defense: The Welfare Tradeoffs.” *American Economic Review*, 58(1): 18–36.

Zhou, Jidong. 2014. “Multiproduct Search and the Joint Search Effect.” *American Economic Review*, 104(9): 2918–39.