Bundled Discounts and Monopolization in Wholesale Markets

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Abstract

Can a multi-product firm use bundled discounts to extend its market power into an adjacent market? The degree of downstream competition is key. Bundled discounts can be used for anticompetitive purposes only when buyers are disorganized and their valuations heterogeneous, which holds when suppliers sell directly to final consumers or indirectly through competing retailers. Under intense downstream competition, bundled discounts force retailers to carry the full range of products to make a sale, even though there are no shopping costs and final consumers' demands are independent. Bundled discounts can then be used either as foreclose device, or alternatively, as an exploitative device that allows the multi-product firm to obtain monopoly profits in all markets.

1 Introduction

While bundled rebates may be a common business practice, it is not clear that monopolists commonly bundle rebates for products over which they have monopolies with products over which they do not. The United States submits that, at this juncture, it would be preferable to allow the case law and economic analysis to develop further

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and to await a case with a record better adapted to development of an appropriate standard."

– Solicitor General of the United States, *Amicus Curiae - 3M v. LePage's (2003)*

In 2003, the Supreme Court had to decide whether to review the Third Circuit unanimous decision that found 3M guilty of exclusionary conduct in violation of Section 2 of the Sherman Act. Because the crux of the case was LePage's Inc.'s claim against 3M's bundled discounts program, a program under which 3M offered rebates to retailers conditioned on purchases for different product lines, reviewing the case would therefore set precedent in a particularly intricate issue: how should antitrust law treat these complex discount schemes involving multiple product lines?

To decide whether to embark upon such an endeavor, the Supreme Court asked the Solicitor General to express the views of the United States. As the quote above indicates, the United States argued that it would be preferable to wait and allow for further development of the economic analysis and case law before setting a new guidance on the application of Section 2 to bundled rebates, a recommendation that was accepted by the Court.[1] Motivated by the call for further analysis, and the fact that the debate is still far from being settled (Jaeckel 2010),[2] this paper looks at the antitrust implications of these so-called bundled discounts in the context of wholesale markets, i.e., explicitly taking into account the different levels in the supply chain. This turns out to be the relevant context in many of the cases that have raised so much concern among antitrust authorities, for example, *EU Commission v. Hoffman-La Roche* (1976), *Ortho Diagnostic Systems v. Abbott Laboratories* (1996), *3M v. LePage's* (2003), *Cascade Health Solutions v. PeaceHealth* (2007), and *Cablevision v. Viacom* (2013), to name a few.

Offering discounts to buyers that purchase two or more products from the same supplier is a common business practice, but as the above quote suggest its implications for antitrust policy are still unclear. Part of the reason is that these practices can arise without an exclusionary

[1]This view was later shared by the Antitrust Modernization Commission (AMC), a bipartisan effort created by the U.S. Congress to examine the need for antitrust laws and enforcement to be adjusted to modern times. Their recommendations are contained in their 2007 Report: `http://govinfo.library.unt.edu/amc/report_recommendation/toc.htm`. We come back to their recommendations in section 3.5.

[2]For instance, in 2008 the U.S. Department of Justice unilaterally issued a report on the topic only to retract and withdraw it seven months later. For more see `https://www.justice.gov/opa/pr/justice-department-withdraws-report-antitrust-monopoly-law`

motive, for example, as a price discrimination device in monopoly settings (Stigler 1963, Adams and Yellen 1976, McAfee et al. 1989, Chen and Riordan 2013), or be pro-competitive in oligopoly settings by forcing firms to compete more intensely (Gans and King 2006, Thanassoulis 2007, Armstrong and Vickers 2010, Armstrong 2013). They can also help achieve cost-savings through economies of scope, and increase the efficiency of vertical structures, expanding both industry profits and consumer surplus (Salinger 1995, Vergé 2001, Jeon and Menicucci 2012).

Moreover, and although the use of multi-product discounts to foreclose single-product rivals may seem intuitive to some, because of the ubiquitous presence of the single-monopoly profit argument (Bork, 1978), it took time for economic theory to formalize models in which these sort of discounts could be used for anticompetitive purposes. The seminal contribution in the area is due to Nalebuff (2004),[3] who was the first to show that a company with market power in two goods, A and B, and that enjoys a first-mover advantage, could use bundled discounts to price discriminate buyers while simultaneously making it harder for a more inefficient single-product rival to enter the market. This exclusionary mechanism turns out to be surprisingly general, as further studied in Ide and Montero (2016), who show that it extends to situations in which (i) the single-product rival is more efficient, (ii) the multi-product firm does not enjoy any first-mover advantage, and (iii) price discrimination among buyers is impossible.

However, while extremely insightful these models only provide partial understanding of the anticompetitive potential of bundling, since they do not take into account the existence of wholesale markets despite many antitrust cases actually involve exclusion at the upstream level of the supply chain. In this paper we develop a model that, while keeping tractability, allow us to address this issue. The model maintains the basic structure of a multi-product supplier of two goods, A and B, and a single-product supplier of just one good, B, both of which face economies of scale in production. We depart from the previous literature, however, by paying explicit attention to wholesale markets. In particular, we assume that suppliers serve consumers indirectly through one or more retail buyers. Only in such setting we can analyze the anticompetitive potential of the different wholesale contractual arrangements we have seen in practice, from the "downstream" bundles of *Cablevision v. Viacom* to the multi-product loyalty rebates of *3M v. LePage's*.

The paper's main contribution is establishing the importance of downstream competition

[3]Later contributions include, among others, Nalebuff (2005), Peitz (2008) and Greenlee et al. (2008). Whinston's (1990) model of tying could also be considered an early precursor.

to explain anticompetitive conduct upstream. The key observation is that bundled discounts can be used for anticompetitive purposes only to the extent that buyers are disorganized and their valuations heterogeneous. This holds when suppliers deal directly with final consumers, or when they sell to retailers that compete intensely in downstream markets, but it is lost in the case of retail monopolies.

The intuition is as follows. By being the gatekeepers to final consumers, monopoly retailers internalize to their own benefit the individual heterogeneity present in the pool of final consumers they serve. This eliminates individual heterogeneity in valuations, which is the key that allows bundled discounts to deprive single-product rivals of scale economies, and forces manufacturers to compete for retailers' preference over which products to carry in terms of created market surplus. This is a competition in which a more efficient single-product supplier can always win. However, as downstream competition strengthens and the multi-product manufacturer has more options in reaching final consumers, retailers' margins get squeezed, such internalization weakens, and the heterogeneity in valuations gets restored. The multi-product firm then only needs one of the retailers to accept his bundled discount offer to foreclose the smaller rival. As competition for retailers' preferences is therein no longer in terms of created market surplus, the multi-product supplier can use bundle discounts to obtain a competitive advantage without the need to compensate intermediaries at all.

This result implies that, once we take into account the existence of wholesale markets, it is possible to foreclose a more efficient rival, but only when downstream competition is sufficiently intense. Moreover, our mechanism not only leaves the rival supplier worse off but also retailers. This is consistent with the diverse range of parties initiating antitrust suits in a bundling context. In fact, it helps explain why we may see either a small rival initiating an accusation of an antitrust violation, as in *3M v. LePage's* and *Cascade Health Solutions v. PeaceHealth*, or one of the distributors, as in *Cablevision v. Viacom*.

The introduction of wholesale markets, however, produces some new and interesting results beyond those obtained when manufacturers sell directly to final consumers. Provided that downstream competition is sufficiently intense, we show that the multi-product firm can suitably design his bundled discount offers to force retailers to carry both products in order to make a sale, thus *endogenously* giving his monopoly product A the status of a must-stock item from a retailer's perspective. In other words, the multi-product firm can use bundled discounts to create complementarities between good A and B at the wholesale level, despite final consumers having independent demands for the two goods and no shopping costs. Used this way, bundled discounts allow the multi-product firm to accommodate entry and maximize industry profits, while obtaining for himself monopoly profits in both markets, effectively extending his monopoly power from market A to B.

Since this exploitative practice accommodates entry, and given that its welfare implications are in general ambiguous, it might be argued that it should not be considered an antitrust violation. This is problematic, however, as it may lead to higher retail prices to the detriment of final consumers. Moreover, it is not competition on its merits, but rather the possibility of offering discounts spanning multiple product lines, what allows the multi-product firm to obtain monopoly profits in both markets, despite offering a wider portfolio of products does not have a direct impact on the utility of final consumers, nor does it follow an efficiency logic whatsoever.

We are not the first to stress the importance of downstream competition in explaining anticompetitive conduct at the upstream level. Previous contributions though, have mainly focused on the somewhat different context of a single-product market composed of an incumbent supplier and a more efficient potential rival. In Simpson and Wickelgren (2007b) and Abito and Wright (2008), for instance, exclusion relies on the incumbent's ability to sign exclusive dealing arrangements *ex-ante*, that is, before the rival supplier shows up. The authors explain that paying retailers to accept these exclusive-dealing commitments is virtually costless ex-ante for the incumbent, as intense downstream competition prevents retailers from appropriating any of the benefits that a more efficient manufacturer brings. Discounts contracts, however, are unable to replicate the same outcome, even if one allows the incumbent to offer them first. The reason, as explained by Ide et al. (2016) for different environments, is because these discounts lack any ex-ante commitment, that is, they do not require a retail buyer to take any action before hearing from the rival supplier. In Asker and Bar-Isaac (2014), on the other hand, exclusion relies on the incumbent's ability to induce retailers not to accept the rival's offer ex-post. Since entry reduces industry profits, the incumbent is willing to transfer almost all of his profit reduction back to retailers in the form of lump-sum payments in order to induce them not to facilitate entry. In their model, however, retailers benefit from the incumbent's anticompetitive scheme and, therefore, would never initiate an antitrust suit in the first place, a fact at odds with many recent antitrust cases.[4]

[4]Simpson and Wickelgren (2007a) also emphasize the importance of downstream competition. Although their focus is also on bundled discounts, their paper is very different from ours in terms of assumptions and the

The exclusionary mechanism in our model is completely different. Indeed, as Fumagalli and Motta (2006) first noted, in single-product models scale economies are irrelevant if downstream competition is intense, as a small rival only needs one retailer to reach all final consumers and achieve his minimum viable scale of operation. In contrast, in this multi-product setting it is precisely this feature that allows exclusion: it is *because* the multi-product firm only needs one retailer to reach final consumers when competition is intense, that he is *able* to deprive the single-product rival of scale economies by exploiting consumers' individual heterogeneity.

The rest of the paper is organized as follows. In the next section we present the model and establish the conditions under which bundling arises as a foreclosure strategy when suppliers sell directly to final consumers. In section 3, we introduce wholesale markets. After a brief introduction of what constitute a bundled discount in a wholesale context, we show that sufficiently intense downstream competition is key to replicate the aforementioned exclusionary outcome. In section 4, we explore the optimal bundled discount scheme, and show how a multi-product firm can accommodate entry while being able to appropriate maximum industry profits in both markets, effectively extending his monopoly power from market A to B. We conclude in section 5 with a discussion of our results while taking a closer look at some of the antitrust cases listed above.

2 The Model

2.1 Notation

There are two goods, A and B, and a unit mass of final consumers with heterogeneous valuations v_A and v_B for the two goods. Consumers purchase one unit of each, at most. In order to rule out any price discrimination motive for bundling, we assume that valuations are positively and perfectly correlated, and for tractability, that they are uniformly distributed in the unit interval, $v_A = v_B = v \sim U[0, 1]$.[5] This ensures that bundled discounts never emerge in the

exclusionary mechanism (in fact, they do not require scale economies and heterogeneity in consumers' valuations). They restrict suppliers to offer linear prices, *exogenously* impose that a retailer that does not carry both goods cannot sell anything at all, and allow contracts to be contingent on what others retailers do. As explained above, none of these (restrictive) assumptions is needed in our model. Our paper also separates from theirs in that we show how bundled discounts can alternatively be used as an exploitative device.

[5]This assumption plays no role in the main message of the paper and is relaxed in the online Appendix, where we consider, as Nalebuff (2004) does, the case of valuations uniformly and independently distributed over the unit square.

absence of a competitive threat, highlighting therefore their potential anticompetitive effects. This should not be considered, however, a mere expositional device. In many antitrust cases dominant multi-product firms began offering bundled discounts only after increasingly losing sales to single-product competitors.[6]

Goods are supplied by two manufacturers under scale economies in production. Manufacturer M is a multi-product supplier that can produce good A at zero cost and good B at a positive and constant marginal cost c. For ease of exposition we set $c = 1/2$ in what follows, but at the cost of cumbersome notation the analysis can be easily extended to the case of an arbitrary c. Manufacturer S, on the other hand, is a single-product supplier that can only produce good B at zero cost. To introduce scale economies in the simplest possible way, we assume that in addition to these variable costs, both manufacturers must incur a fixed cost per period. We normalize M's fixed cost to zero, assuming that per-period profits made selling product A alone suffice to pay for it, and denote S's fixed cost by F.

We restrict attention to values of F that would give rise to market foreclosure. Following the literature on upstream exclusion in wholesale markets in single-product settings (O'Brien and Shaffer [1997], Bernheim and Whinston [1998], Rey and Whinston [2013], among others), market foreclosure is defined as the situation in which S is excluded from the market even though a fully integrated (horizontally and vertically) firm would sell goods from both manufacturers. This reduces the relevant range to $F < 3/16$, which is the difference in industry (monopoly) profits between selling good A from M and good B from S (equal to $1/2$) and selling both goods from M (equal to $5/16$).[7]

Manufacturers do not supply directly to final consumers but indirectly through (risk-neutral) retail buyers, whom, for the sake of simplicity, have no costs other than those of purchasing the good from one or both manufacturers. We will study the polar cases of one monopoly retailer, R, serving final consumers, and of two Bertrand retailers, $R1$ and $R2$, competing intensely for serving them.

For simplicity we adopt the following sequential timing.[8] On date 1, M makes a take-it-or-

[6]In *3M v. LePage's*, for instance, 3M started its bundled discount program, which included its popular *Scotch* tape, only after LePage's had captured 88% of sales in the private-label tape market.

[7]We adopt this definition because the cap it creates over F is invariant to market structure. Alternatively, we could adopt the convention of defining the exclusionary potential of bundling, as the exclusion of a rival that would be otherwise active if bundling was forbidden. Results are independent of which definition is adopted.

[8]In Section 4, however, we show that the equilibrium under this sequential timing is also an equilibrium if manufacturers were to make their offers simultaneously (see Lemma 4).

leave-it offer to R, or to $R1$ and $R2$. Following the practice in many wholesale markets, an offer is a price schedule under which a manufacturer is ready to supply a retailer over the course of a period, typically a year. The exact form of the offer will be specified shortly, as it will depend on whether M includes bundled discounts or not. On date 2, and having observed M's offers, it is S's turn to make take-it-or-leave-it offers to retailers in case she decides to remain in business and incur the fixed cost F.[9] Finally, on date 3, retailers buy according to the offers received and compete for final consumers by simultaneously setting prices.

2.2 Bundling as a Foreclosure Tool

Before explicitly introducing the wholesale level, we analyze the scenario in which suppliers sell directly to final consumers. This benchmark is important, since it will help understand the implications of varying degrees of downstream competition on the possibility of exclusion later on. The setting is exactly as the one described in the previous section, except that instead of making offers on dates 1 and 2, manufacturers announce prices on those same dates. Therefore, if S decides to leave the market on date 2, all consumers are served by M at the prices he announced on date 1. We denote by p_i^k the price charged by manufacturer k for product i.

Notice that since final consumers buy at most one unit of each product, the only possible non-linearity in the price schedule is bundling. M has then three different pricing options for selling the two goods: stand-alone pricing, pure bundling and mixed bundling. So begin by considering the case where M is the only manufacturer present in both markets. It is then straightforward to prove that perfect correlation in valuations immediately rules out any form of bundling. In this case, M's optimal pricing strategy is to announce stand-alone (monopoly) prices $p_A^M = 1/2$ and $p_B^M = 3/4$.

The latter of course changes if S is present. If for some reason M is forced to charge stand-alone prices, both manufacturers will be active in equilibrium with the Bertrand announcements $p_A^M = p_B^M = 1/2$ and $p_B^S = 1/2 - \epsilon$.[10] S will be willing to incur the fixed cost F anticipating profits of $1/4 - F > 0$, M will obtain $1/4$, and all consumers with valuations above $1/2$ will

[9] To simplify notation, we will assume that S finds it optimal to pay F only if he expects strictly positive profits (net of fixed costs). Results are, of course, insensitive to alternative tie-breaking rules.

[10] Notice that the game accepts multiple equilibria, though most of them can be discarded by the usual refinements. Moreover, all equilibria are outcome equivalent in that M always accommodates S's entry and obtains the same profit. We will therefore not refer again to this kind of multiplicity unless it has outcome implications.

end up buying both products.

Can M do better by selling A and B in a bundle, whether in its pure form at price p_{AB}^M, or together with stand-alone prices p_A^M and p_B^M, where $p_{AB}^M < p_A^M + p_B^M$?

Proposition 1. *Suppose that M and S supply directly to final consumers. Pure bundling emerges in equilibrium as a market foreclosure strategy if and only if $F \geq 1/8$.*

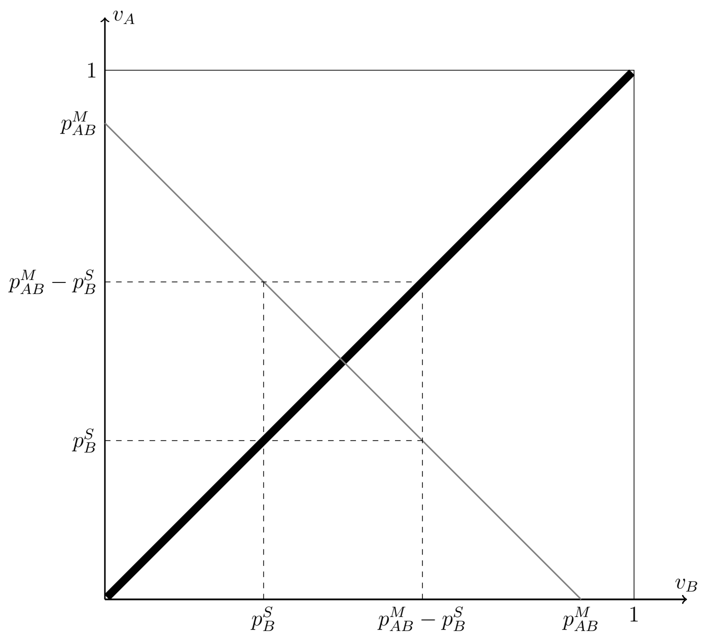
Proof. Notice first that the perfect-correlation assumption allows us to disregard mixed bundling and only concentrate on stand-alone pricing and pure bundling (the formal proof can be found in the online Appendix). So consider pure bundling, and suppose that p_{AB}^M and p_B^S are the prices announced by M and S for the bundle and good B, respectively. Consumers then get divided into three groups. As depicted in Figure 1, consumers with valuations $v_A = v_B = v < p_B^S$ buy nothing, those with $p_B^S \leq v < p_{AB}^M - p_B^S$ buy only from S, and those with $v \geq p_{AB}^M - p_B^S$ buy the bundle. Given these demands, S's best response is given by

$$p_B^S(p_{AB}^M) \in \arg\max_p \; p \; (p_{AB}^M - 2p) \tag{1}$$

which yields $p_B^S(p_{AB}^M) = p_{AB}^M/4$. If we plug this back into (1), it is easy to see that S cannot cover his fixed cost if M were to price the bundle at $\sqrt{8F}$. Since by charging a price of $p_{AB}^M = \sqrt{8F}$ M anticipates a total demand of $1 - p_{AB}^M/2 = 1 - \sqrt{8F}/2$ for the bundle, M will find it optimal to do so whenever the resulting profit, $(\sqrt{8F} - 1/2)(1 - \sqrt{8F}/2)$, is greater than the profit from charging stand-alone prices $p_A^M = 1/2$ and $p_B^M = 1/2$ and sharing the market with S, which is equal to $1/4$; that is, whenever $F \geq 1/8$. Hence, bundling emerges in equilibrium as a market foreclosure strategy if and only if $F \geq 1/8$. ■

Proposition 1 tells us that bundling allows M to foreclose the market to efficient rivals provided that scale economies are important. The mechanism behind this anticompetitive outcome was first detected by Nalebuff (2004). By exploiting the heterogeneity in consumers valuations, bundling is a very effective tool to prevent a single-product rival from reaching a minimum scale of operation. The intuition can be more easily grasp by the means of a simple example. Suppose M is alone in the market selling either each good for $1/2$ or the bundle for 1, which leaves him a payoff of $1/4$ in either case. These two pricing options also leave final consumers indifferent. However, from S's perspective they are radically different: under stand-alone pricing, a slight undercut in the price of good B is all that S needs to capture the entire demand for this good, making entry more likely. Under bundling, on the other hand, S

Figure 1: Demand under Pure Bundling



requires a substantial undercut to attract some consumers, since they need to be compensated in order to give up product A.[11]

Another way to appreciate why bundling can be so effective is by contrasting single and multi-product competition. If M and S were to compete for market B alone, M could not expel S from the market because any effort to do so by lowering the price of B would require M to suffer a profit loss equal to his rival's. However, if M were to compete with bundles, his profit loss from reducing the price of the bundle in one dollar, $p^S_B + 3/2 - 2p^M_{AB} < p^S_B$, would be much lower than his rival's, p^S_B.[12] The reason is that by bundling goods A and B, M makes it very hard for S to attract higher-valuation consumers with a single-product offer. In the absence of consumer's heterogeneity, i.e., where all consumers value A in $\bar{v}_A$ and B in $\bar{v}_B$, bundling provides no competition advantage to the multi-product firm, even if $\bar{v}_A \gg \bar{v}_B$ (see Appendix A).

[11] Notice that this foreclosure mechanism does not rely on M's having a first-mover advantage at all (Ide and Montero 2016). In fact, in the online Appendix we show that if we merge dates 1 and 2, so manufacturers announce their prices simultaneously, there exists a mixed-strategy equilibrium in which foreclosure happens with positive probability.

[12] Recall from Figure 1 that $\pi^M(p^M_{AB}, p^S_B) = (p^M_{AB} - 1/2)(1 - p^M_{AB} + p^S_B)$ and $\pi^S(p^M_{AB}, p^S_B) = p^S_B(p^M_{AB} - 2p^S_B)$. Note also that $p^S_B + 3/2 - 2p^M_{AB} < p^S_B$ requires $p^M_{AB} > 3/4$, which always hold since M will never price the bundle below the unity.

3 Foreclosure in Wholesale Markets

While extremely insightful, this foreclosure theory of bundling has been applied face-value to many antitrust cases in which manufacturers do not actually sell directly to final consumers, but rather operate through retailers. In this section we analyze the effects of explicitly accounting for this, in particular, the extent to which the multi-product firm can replicate the foreclosure outcome of Proposition 1 for different levels of retail competition. We will first pay attention to the case where R is the only retailer in the market and then to the case where retailers $R1$ and $R2$ compete intensely for final consumers.

But before we delve into the analysis, there are a couple of definitions that need attention. The first is with regard to notation. As a general rule we will denote wholesale variables by x_i^{kj}, where j denotes a retailer, k a manufacturer, and i a product, whether an individual good or a bundle. For example, q_A^{M2} would be the number of units of good A purchased by retailer $R2$ from manufacturer M. When possible, and if there is no ambiguity regarding the retailer's identity, we will omit supra-index j altogether to avoid cluttering the notation. The second definition involves explaining what exactly constitutes a bundled discount offer in a wholesale context. We turn to this next.

3.1 Bundled Discounts in Wholesale Markets

Since a retailer's demand is a derived demand that results from the aggregation of unit demands from many different final consumers, this opens up the possibility for manufacturers to write richer price schedules than those offered to final consumers. In a context where manufacturers compete for each good separately, the natural extension of the competition in stand-alone prices of the previous section is a competition in (stand-alone) two-part tariffs, that is, a competition in which manufacturers offer retailers price schedules of the form (w, T), where w is the wholesale price for each unit of the good and T is the fixed-fee that is paid conditional on buying some positive amount of the good.[13]

In this wholesale competition, M has also the option to improve upon stand-alone schedules by offering an additional discount to retailers that agree to buy multiple products from him. But unlike when serving final consumers, M has now many different options to present these bundle discounts to retailers. Here there are two that we have seen in recent antitrust cases:

[13] Nocke and White (2007) is a good example where we also see these (wholesale) two-part tariffs. Notice that these nonlinear schedules can be also written as (single-product) volume discounts.

Selling bundles downstream (e.g., *Cablevision v. Viacom*)

> In the cable television industry, content providers offer schedules ("master agreements") specifying how much a particular cable-operator system has to pay per subscriber per channel each month. Discounts are pervasive, and apply depending on the set of channels the system carries, the latter being directly monitored by the content provider. In simple words, discounts are conditional on how the channels are sold downstream. In *Cablevision v. Viacom*,[14] Viacom, a major producer of media content and entertainment, was accused of bundling together his highly popular "core" networks (e.g., Nickelodeon, Comedy Central, BET, MTV) with much less valuable "suite" networks (e.g., Centric, CMT Pure Country). If Cablevision would decline to distribute Viacom's suite networks and replaced them with alternative networks from other content producers, it would have to pay more per subscriber for the core networks than for the core and suite networks combined. Viacom was, in essence, forcing Cablevision to sell *bundles downstream*.

Bundled-loyalty rebates (e.g., *3M v. LePage's*)

> While still conditioning total outlay on different product categories, either in terms of physical quantities, market share requirements, or growth targets, *bundled-loyalty rebates* do not impose any selling obligation upon retailers. For instance in *3M v. LePage's*,[15] LePage's Inc. accused 3M of monopolizing the transparent tape market, by offering retailers discounts conditioned on purchases spanning multiple product lines. The size of the rebate depended on the number of product lines in which the retailer met pre-specified growth targets. If a retailer failed to meet the targets in multiple categories, no rebate was granted, while if it failed in only one product line, the rebate was reduced substantially.

Extending the stand-alone schedules that M may offer to retailers to include bundled discounts a la *Cablevision v. Viacom* will result in a wholesale offer of the form

$$\{(w_A^{Mj}, T_A^{Mj}), (w_B^{Mj}, T_B^{Mj}), (w_{AB}^{Mj}, T_{AB}^{Mj})\} \tag{2}$$

where (w_A^{Mj}, T_A^{Mj}) and (w_B^{Mj}, T_B^{Mj}) are the purchasing terms that prevail when retailer Rj decides to purchase and sell both goods A and B separately and $(w_{AB}^{Mj}, T_{AB}^{Mj})$ when she decides to purchase and sell them in a bundle. Obviously, under this bundle-discount schedule Rj has also the option to buy and sell some bundle units together with some extra units of either good.

[14]See Civil Action No. 13 CIV 1278 (LTS) (JLC), filed on March 7, 2013 in the Southern District Court of New York.

[15]3M v. LePage's Inc., 324 F.3d 141 (3d Cir. 2003), cert. denied, 124 S. Ct. 2932 (2004).

Schedule (2) provides M with tighter control over what is sold downstream since the retailer cannot just buy the bundle, discard M's good B and have it replaced with S's. In principle, this should make exclusion easier than under the bundled-loyalty rebates of *3M v. LePage's*, which, following the description above, can be written as

$$\{(w_A^{Mj}, r_A^{Mj}, T_A^{Mj}), (w_B^{Mj}, r_B^{Mj}, T_B^{Mj})\} \quad (3)$$

where r_A and r_B are the retroactive per-unit rebates that retailer Rj gets if she decides to buy goods A and B in a way to comply with some pre-specified target or condition. For instance, M could agree to grant the rebates if Rj buys as many units of good B as of A from him. Notice that, in contrast to the bundled discounts offered by Viacom, in this case there is no explicit restriction imposed upon Rj on how to sell A and B to final consumers.

One reason why M may be unable to propose a schedule that grants rebates or discounts conditional on the sale of bundles downstream is because of imperfect monitoring. Part of our contribution in this paper, however, is to show that the two types of schedules, (2) and (3), are essentially no different from an anticompetitive perspective. Since results are more easily grasped under schedule (2), i.e., when M can control the selling of bundles downstream, we develop the analysis that follows under that assumption, and only then explain how it goes through under the alternative bundling design (3). Finally, it might be argued that our results are an artifact of restricting attention to only these two types of bundled discounts. We will show, however, that this assertion is incorrect. As it will become clear in sections 3.2 and 4, restricting attention to theses bundled discounts entails minimum loss of generality whatsoever.

3.2 Monopoly Retailer

Consider the case in which final consumers are served through one monopoly retailer R. If M were the sole manufacturer supplying both goods, the wholesale schedule (2) would reduce to the set of stand-alone schedules that maximizes industry profits: $\{(w_A^M = 0, T_A^M = 1/4), (w_B^M = 1/2, T_B^M = 1/16)\}$. As before, there is no reason for M to offer bundled discounts in the absence of an entry threat.

This may change if S is ready to compete with M in the wholesale market. To check for this possibility, we need first to study the benchmark case in which M cannot offer bundled discounts, so the wholesale competition reduces to offers (w_B^S, T_B^S) and $\{(w_A^M, T_A^M), (w_B^M, T_B^M)\}$. Given these offers and the perfect-correlation assumption, there is no reason for R to offer bundles in the retail market, so the competition for goods A and B can be treated separately. This implies that for good A, M will offer the industry-optimal schedule ($w_A^M = 0, T_A^M = 1/4$), appropriating the full surplus.

Regarding product B, competition will drive M's offer to ($w_B^M = 1/2, T_B^M = 0$), while S will choose the industry profit-maximizing wholesale price $w_B^S = 0$, and the fixed fee $T_B^S = 3/16 - \epsilon$ that leaves R slightly better purchasing product B from him at the lower marginal cost of zero but paying the fixed fee T_B^S (i.e., $1/4 - T_B^S$), than purchasing the same product from M at wholesale price of 1/2 and no fixed fee (1/16). Therefore, S will always be willing to incur the fixed cost F anticipating profits of $3/16 - F > 0$, implying that stand-alone schedules cannot be used by M to evict S from the market. It turns out that this result does not change even if we allow M to offer bundled discounts:

Proposition 2. *Suppose that M and S supply indirectly to final consumers through a single (monopoly) retailer R. Bundling never emerges as a foreclosure strategy.*

Proof. Following (2), suppose that R gets the offer $\{(w_A^M, T_A^M), (w_{AB}^M, T_{AB}^M)\}$ from M and (w_B^S, T_B^S) from B. Notice that we can omit the second term in (2), since M always prefers selling one unit of A rather than one unit of B, and we are assuming that bundled discount has bite (otherwise we would collapse to the standalone benchmark).

Let $q_i^*(w_A^M, w_B^S, w_{AB}^M)$ be R's optimal quantity of product i to be purchased and sold when facing wholesale prices (w_A^M, w_B^S, w_{AB}^M) and $\gamma^R(w_A^M, w_B^S, w_{AB}^M)$ the corresponding retail profit gross of fixed payments. Then a necessary condition for exclusion is

$$\gamma^R(w_A^M, \infty, w_{AB}^M) - \mathbb{1}_{\{q_A^*(w_A^M, \infty, w_{AB}^M) > 0\}} T_A^M - \mathbb{1}_{\{q_{AB}^*(w_A^M, \infty, w_{AB}^M) > 0\}} T_{AB}^M \geq \gamma^R(\infty, 0, \infty) - F \quad (4)$$

that is, that R's profits when choosing M as her exclusive supplier must be greater than her profits from selling only good B from S under the schedule ($w_B^S = 0, T_B^S = F + \epsilon$) with $\epsilon \to 0$, which is the most attractive schedule S can offer, as it maximizes the profits of S and R combined while allowing S to break even. Otherwise, S could deviate by slightly undercutting M's offer, getting access to the market while making strictly positive profits. Rearranging (4), and using $\gamma^R(\infty, 0, \infty) = 1/4$, implies that

$$\mathbb{1}_{\{q_A^*(w_A^M, \infty, w_{AB}^M) > 0\}} T_A^M + \mathbb{1}_{\{q_{AB}^*(w_A^M, \infty, w_{AB}^M) > 0\}} T_{AB}^M \leq \gamma^R(w_A^M, \infty, w_{AB}^M) - 1/4 + F \quad (5)$$

M's profit from implementing (4), on the other hand, is given by

$$\pi^M = w_A^M q_A^*(w_A^M, \infty, w_{AB}^M) + (w_{AB}^M - 1/2) q_{AB}^*(w_A^M, \infty, w_{AB}^M) \\ + \mathbb{1}_{\{q_A^*(w_A^M, \infty, w_{AB}^M)>0\}} T_A^M + \mathbb{1}_{\{q_{AB}^*(w_A^M, \infty, w_{AB}^M)>0\}} T_{AB}^M$$

that using the bound (5) yields

$$\pi^M \leq [\gamma^R(w_A^M, \infty, w_{AB}^M) + w_A^M q_A^*(w_A^M, \infty, w_{AB}^M) + (w_{AB}^M - 1/2) q_{AB}^*(w_A^M, \infty, w_{AB}^M)] - 1/4 + F$$

But the term in brackets is the profit that M and R combined can get when selling $q_A^*(w_A^M, \infty, w_{AB}^M)$ and $q_{AB}^*(w_A^M, \infty, w_{AB}^M)$ units of good A and of the bundle, respectively, which we know must be less than or equal to 5/16, the maximum profit that M and R combined can get. Hence $\pi^M \leq 1/16 + F$, which is less than or equal to 1/4 —M's payoff when accommodating entry with stand-alone prices— for all $F < 3/16$. Therefore, bundling can never emerge as a foreclosure strategy. ■

The intuition is as follows. By being the gatekeeper of final consumers, a monopoly retailer internalizes for her own benefit the individual heterogeneity present in the pool of final consumers. She therefore acts as an agent, a representative purchaser, of a grand coalition of final consumers; thus, eliminating the heterogeneity in valuations, which we saw was crucial for bundling to deprive single-product rivals from market share. This forces manufacturers to compete for the retailer's preference over which products to carry in terms of created market surplus. This is a competition in which a more efficient single-product supplier can always win, not only under the set of offers considered in Proposition 2, but under any conceivable set of offers, including (3)—see Appendix B for a more general proof of Proposition 2. This is another instance in which Bork's (1976) single-monopoly-profit argument applies.

A final remark is in order. It is tempting to interpret Proposition 2 as saying that observing a bundled discount is an indication of the absence of retail market power and, hence, the exclusion of a more efficient rival. Although this conclusion is factually correct in our model, this is almost by construction, as we have omitted any motive for bundling other than the exclusion of a rival manufacturer. In fact, all the pro-competitive and efficiency-enhancing motives for bundled discounts that make this issue so controversial have been purposely assumed away in our model, only to highlight the necessary conditions that makes these schemes potentially anticompetitive.

3.3 Competing Retailers

We now move to the opposite environment of two retailers, $R1$ and $R2$, competing intensely for final consumers. Consumers see no difference between the two retailers, other than the prices they charge, and do not incur in any extra cost if they purchase the two goods from different retailers (i.e., there are no shopping costs).

The effect of downstream competition on M's ability to expel S is not immediately obvious. As pointed out by Fumagalli and Motta (2006) for single-product settings, for instance, if retailers are Bertrand competitors a small supplier only needs one retailer to reach the entire pool of final consumers, implying therefore that the dominant manufacturer is forced to persuade both to exclude the smaller rival from the market. This intuition in fact explains why foreclosure becomes more difficult, ultimately disappearing, as the number of retailers increases in the single-product setting of Asker and Bar-Isaac (2014). As we will see shortly, none of these considerations matter in our model, because our exclusionary mechanism does not rely on compensating retailers at all. In fact, they end up worse off. Furthermore, this also implies that it makes no difference to consider $N \geq 2$ competing Bertrand retailers in our multi-product context.

As before we begin our analysis with the standalone-pricing benchmark. Again, markets A and B can be treated separately given the perfect-correlation assumption. Regarding the monopoly product A, M will offer retailers the symmetric schedules $(w_A^{M1} = 1/2, T_A^{M1} = 0)$ and $(w_A^{M2} = 1/2, T_A^{M2} = 0)$ to obtain the monopoly profit 1/4, since he anticipates that downstream competition will drive retail prices to $p_{A1} = p_{A2} = 1/2$. Notice the extra notation p_{ij} to denote the retail price of product i charged by retailer Rj.

Regarding product B, the perfect substitutability between manufacturers' products will produce the following Bertrand outcome at the wholesale level: M will offer the symmetric schedules $(w_B^{M1} = 1/2, T_B^{M1} = 0)$ and $(w_B^{M2} = 1/2, T_B^{M2} = 0)$, and S will slightly undercut them with offers $(w_B^{M1} = 1/2 - \epsilon, T_B^{M1} = 0)$ and $(w_B^{M2} = 1/2 - \epsilon, T_B^{M2} = 0)$. Retailers will then only sell S's product at downstream prices $p_{B1} = p_{B2} = 1/2 - \epsilon$, which will allow S to pay for his fixed cost F and get a profit equal to $1/4 - F$.

Consider now the possibility for M to offer bundled discounts. Suppose that M approaches both retailers on date 1 with the following schedule (2) a la *Cablevision v. Viacom*: A and B can be purchased at prices $w_{AB}^M = \sqrt{8F}$ and $T_{AB}^M = 0$ as long as they are purchased and sold as a bundle to final consumers; otherwise they can be independently purchased at prices

$w_A^M \geq \sqrt{8F}$, $w_B^M \geq \sqrt{8F}$ and $T_A^M = T_B^M = 0$.

What is S's optimal response to M's bundle offer on date 2? If S decides not to discriminate across retailers, Bertrand competition precludes the use of any fixed fees, reducing S's offers to the symmetric linear schedules $w_B^{S1} = w_B^{S2} = w_B^S$. Given these wholesale marginal costs, there is an equilibrium in the retail market in which, on date 3, $R1$ and $R2$ charge $p_{B1} = p_{B2} = w_B^S$ for good B and $p_{AB1} = p_{AB2} = \sqrt{8F}$ for the bundle AB. Anticipating this retail equilibrium, we know from Proposition 1 that even if S sets the wholesale price at the profit-maximizing level $w_B^S = \sqrt{8F}/4$, this will not be enough to cover the fixed cost F. If, on the other hand, S decides to discriminate across retailers, it will do so by approaching just one retailer, say $R1$, with an offer $(w_B^{S1} = 0, T_B^{S1})$; failing to do so will result in either double marginalization or inefficient cannibalization of profits. But again, there is an equilibrium in the retail market in which both retailers offer the bundle for $p_{AB1} = p_{AB2} = \sqrt{8F}$, so the best price $R1$ can charge for product B in that case is $p_{B1} = \sqrt{8F}/4$.[16] Anticipating this retail equilibrium, even if S extracts all of $R1$'s profit, this will not be enough to pay for the fixed cost F and obtain strictly positive profits. Whether S discriminates across retailers or not, M knows that such bundled discount offers will persuade S not to incur the fixed cost F, and therefore he anticipates a payoff of $(\sqrt{8F} - 1/2)(1 - \sqrt{8F}/2)$, which is the exact same payoff he gets when selling bundles directly to final consumers for $\sqrt{8F}$.

We have just shown that by taking advantage of the intense retail competition, M has no problem in replicating the exclusionary result of Proposition 1. While it is true that this exclusionary outcome builds upon manufacturers' expectation of retailers playing one particular equilibrium in the retail market, the next proposition shows that this results extends to any possible pure-strategy equilibrium in the retail market that may be played.

Proposition 3. *Suppose that M and S supply indirectly to final consumers through Bertrand retailers $R1$ and $R2$. Then, M is able to replicate the exclusionary outcome of Proposition 1 using bundled discounts a la Cablevision v. Viacom.*

Proof. See Appendix C. ■

Intuitively, as downstream competition strengthens and the multi-product manufacturer has two perfectly substitutable ways to reach final consumers, margins get squeezed and retailers no

[16] Notice that because $w_A^M \geq \sqrt{8F}$, $R1$ cannot offer a bundle for slightly less than $\sqrt{8F}$ by combining good A from M and B from S

longer internalize the individual heterogeneity of the pool of consumers they serve. Competition for retailers' preferences is therein no longer in terms of created market surplus. In the extreme case of perfectly Bertrand competitors, retailers are forced to pass on to final consumers the same prices that they pay upstream, so the multi-product firm only needs one of the retailers to carry his offer to foreclose the smaller rival. Intense downstream competition has thus recovered bundling exclusionary potential, as we end-up in a situation akin as if suppliers were serving final consumers directly.

While Proposition 3 was established for bundles that resemble the "downstream bundles" of *Cablevision v. Viacom*. It is not difficult to show that M can also replicate the same exclusionary outcome with the bundled-loyalty rebates of *3M v. LePage's* as defined in schedule (3). In particular, consider the following bundling offer: goods A and B can always be purchased separately at wholesale prices $w_A^M \geq \sqrt{8F}$ and $w_B^M \geq \sqrt{8F}/2$ (and $T_A^M = T_B^M = 0$), but any retailer that purchases as many units of B as of A is entitled to the per-unit rebates r_A and r_B, so that per-unit prices reduce to $\tilde{w}_A^M = w_A^M - r_A$ and $\tilde{w}_B^M = w_B^M - r_B \geq \sqrt{8F}/2$, where $\tilde{w}_A^M + \tilde{w}_B^M = \sqrt{8F}$. As the next lemma establishes, this bundling offer also results in foreclosure.

Lemma 1. *Suppose that M and S supply indirectly to final consumers through Bertrand retailers $R1$ and $R2$. Then, M is able to replicate the exclusionary outcome of Proposition 1 using bundled discounts a la 3M v. LePage's.*

Proof. See Appendix D. ■

It turns out that to exclude S from the market, M does not need to closely monitor retailers' way of selling products downstream. All that is required, in addition to intense retail competition, are wholesale bundling schemes that induce retailers to sell bundles downstream, which is what ultimately deprives S from acquiring enough market share to cover his fixed cost of production.

Whether we look at Proposition 3 or Lemma 2, it is evident that foreclosure hurts not only S but also final consumers, who now pay $\sqrt{8F} \geq 1$ for the bundle, as opposed to 1/2 for each product when bundling is not allowed. This latter does not always need be the case, however, if M's cost of producing B is lower than 1/2. In those cases consumer surplus may raise or fall depending on the extent of scale economies: for very low values of F there is no foreclosure; for intermediate values, foreclosure ensues but consumer surplus might increase as M is willing to offer the bundle for relatively low prices in an effort to exclude S; finally in the upper range of

F foreclosure does not require of such low prices, so it decreases consumer surplus.[17]

3.4 The Importance of Downstream Competition

How can we understand the importance of downstream competition under the light of Propositions 1, 2 and 3? The key is that it determines the *degree of access* the multi-product firm has in reaching final consumers.

To see it more crisply, consider the following extension of our baseline setting. Suppose that the two goods A and B are not longer sold in one "large" retail market, but in a continuum of mass one of identical retail markets, each endowed with a unit mass of consumers with valuations $v_A = v_B = v \sim U[0,1]$ for the two goods. As in the previous section there are two retailers $R1$ and $R2$, but now $R1$ is assumed to be present in all retail markets while $R2$ is only present in a fraction $\lambda \in [0,1]$ of them. In retail markets where both $R1$ and $R2$ are present, they still engage in intense Bertrand competition. Retailers are allowed to charge different prices in different retail locations, so one can think of each retail market as a distinct geographical area or a particular group of consumers that retailers can price discriminate (e.g., online shoppers, college students, etc). Hence, the parameter λ captures the average level of competition at the downstream level.

With the help of this extension we can highlight the interplay that exists between access to final consumers and downstream competition. To fix ideas assume for a moment that $R2$ is not a free retailer but rather that she is vertically integrated with M. Under this new scenario λ accepts an alternative interpretation: M's degree of *direct* access to final consumers, which goes from none ($\lambda = 0$) to perfect ($\lambda = 1$). When $\lambda = 0$, M has no direct access to final consumers, so he must necessarily deal with the monopoly retailer $R1$ to reach them. Proposition 2 then applies and bundled discounts cannot be used to foreclose S. In the case of $\lambda = 1$, in contrast, M has immediate access to the entire pool of consumers through $R2$, so he can easily replicate the outcome of Proposition 3 by instructing $R2$ to charge $p_{AB}^{M2} = \sqrt{8F}$ while completely neglecting $R1$. S is therefore foreclosed as there is no conceivable offer he can make to $R1$ that allows him to recover the fixed cost F. Following a similar logic, it is then easy to see that M will still be able to exclude S if access is less than perfect $\lambda < 1$, provided it is sufficiently high $\lambda \to 1$. This shows that what determines the feasibility of exclusion is how much of a direct access in

[17] Take the case of $c = 2/5$, for instance. Foreclosure benefits consumers if $0.0825 \leq F < 0.10025$ but hurts them if $0.10025 \leq F < 0.16$.

reaching final consumers M has.

The previous intuition can be easily extended to the case in which both retailers are free, connecting the results of our three main propositions: when downstream competition is sufficiently intense, the multi-product firm can reach almost the entire pool of final consumers with a single retailer, implying that he needs to persuade just one of the retailers to accept his offer in order to foreclose S. This generates a negative externality among retailers, allowing M to achieve exclusion without the need to compensate retailers at all.

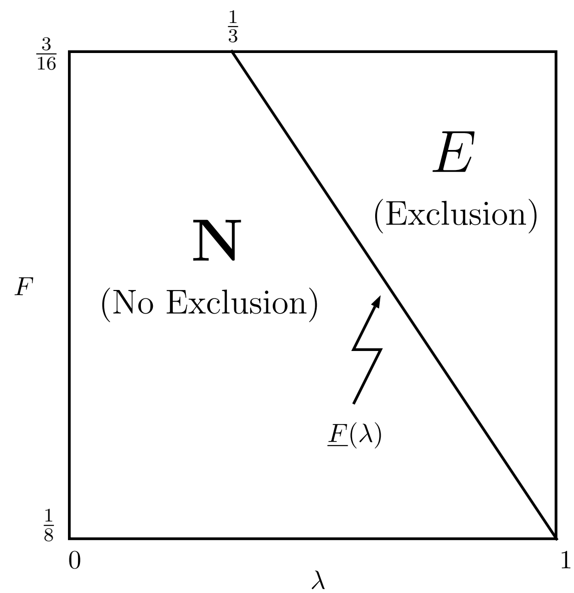
The underlying foreclosure mechanism in our model is therefore completely different than the ones in the one-product exclusive-dealing literature (Rasmusen et. al. 1991, Segal and Whinston 2000, Simpson and Wickelgren 2007b, Abito and Wright 2008, and Asker and Bar-Isaac 2014). Indeed, as Fumagalli and Motta (2006) first noted, in single-product models scale economies are irrelevant if downstream competition is intense, as a small rival only needs one retailer to reach all final consumers and achieve his minimum viable scale of operation. In contrast, in this multi-product setting it is precisely this feature that allows exclusion: it is *because* the multi-product firm only needs one retailer to reach final consumers when competition is sufficiently intense, that he is *able* to deprive the single-product rival of scale economies by exploiting final consumers' individual heterogeneity. The following lemma provides a formalization of the previous discussion:

Lemma 2. *Consider the case of free retailers $R1$ and $R2$ in the imperfect-competition extension of the baseline model captured by the competition parameter $\lambda \in [0, 1]$. It is possible for M to use bundled discounts to foreclose S as long as $\lambda \in [\frac{1}{3}, 1]$ and $F \geq \underline{F}(\lambda)$, where $\underline{F}(\lambda) = (7 - 3\lambda)/32$ and satisfies $\underline{F}(1/3) = 3/16$ and $\underline{F}(1) = 1/8$.*

Proof. See the online Appendix. ■

In the proof of the lemma we provide details of the schedules that are offered by M and S as a function of the level of access λ (i.e., average level of downstream competition) and the extent of scale economies F. There are, however, a couple of results that are worth emphasizing. The first is how the feasibility of exclusion, captured by the boundary $\underline{F}(\lambda) = (7 - 3\lambda)/32$, is jointly determined by λ and F in a monotonic (see Figure 2), yet intuitive, way, i.e., the greater λ and F are, the more likely exclusion is. There is a limit however, as to how much one can offset a drop in λ with an increase in F so as to keep the exclusionary possibilities intact. Exclusion becomes impossible, no matter how large $F < 3/16$ is, once average downstream competition has reached a relatively low level ($\lambda \leq 1/3$).

Figure 2: Foreclosure and Downstream Competition



The second result is how retailers are strictly worse off when the multi-product firm engage in foreclosure. This result is fairly intuitive: in the standalone benchmark, retailers obtain strictly positive profits due to the existence of imperfect competition. In the foreclosure outcome of Lemma 2, in contrast, retailers' outside options drop substantially, sometimes to zero, as soon as S is expected to exit the market, which allows M to leave retailers with very little, if not zero. This latter will depend on the extend of imperfect competition. When competition is nearly perfect, i.e., when λ is close to 1, M is able to divide and conquer the two retailers and leave them with nothing. As competition relaxes, this divide-and-conquer strategy becomes costly for M because the two retailers are not longer equally effective for reaching final consumers. Since now $R1$ is alone in many of the retail markets, it is easier for S to approach her with an offer (recall Proposition 2), which forces M to leave her with some rents, but still less than the rents $R1$ would otherwise get under the standalone benchmark.

3.5 Implications for Antitrust Practice

We can now use our model to shed some light on the current antitrust practice regarding the treatment of bundled discounts. A good point to start is the Third Circuit's decision on *3M v. LePage's*, a decision that was highly controversial and that was received with heavy criticism by scholars and practitioners alike (Waldman and Weiner 2003, Davis 2004, Warren 2004, Zanfagna 2004). The Court's position, that is was not necessary to show *any* form of below-cost pricing for bundled discounts to be considered unlawful, dismissed previous precedent on the topic, e.g. *SmithKline Corp. v. Eli Lilly & Co* (1976) and *Ortho Diagnostic Systems v. Abbott Laboratories* (1996), while failing to provide any new guidance on how to evaluate the legality of these schemes. This sparked fears that multi-product firms would be discouraged from adopting this type of contracts even for legitimate or pro-competitive reasons.

This controversy forced the Antitrust Modernization Commission (AMC), a bipartisan effort created by the U.S. Congress to examine the need for antitrust laws and enforcement to be adjusted to modern times, to emit an opinion on the matter and ultimately come up with a new standard, known as the AMC-3 test, to evaluate the anticompetitive implications of these bundling programs. As indicated in its 2007 report, the AMC suggested that for a bundled discount scheme to be in violation with Section 2 of the Sherman Act, the following three criteria ought to be satisfied: (a) the competitive product is sold below its incremental cost once all discounts and rebates attributable to the entire bundle of products are subtracted from its stand-alone price (this is called the "Discount Attribution Test"); (b) these short-term losses are likely to be recouped in the near future; and (c) the bundled discount or rebate program has had or is likely to have an adverse effect on competition.

Although the AMC-3 test is still far from being the benchmark standard to evaluate multi-product discounts (Jaeckel 2010), it has already been applied in 2009 when the Ninth Circuit Court of Appeals endorsed points (a) and (c), to reverse a district court decision in *Cascade Health Solutions v. PeaceHealth.* Since a consensus appears to be building around this approach, it is important to understand how effective is in identifying foreclosure according to our theory.

To keep things simple consider the case of perfectly competing retailers of section 3.3. We begin by evaluating points (b) and (c) since they hold almost by construction. It is clear that there is no need for recoupment, since the foreclosure outcome leaves M with higher profit than the standalone benchmark. Equally evident is that M's bundled discount scheme produces an adverse effect on competition, since S is expelled from a market that would have been active otherwise.

Evaluating point (a) is more involved. Recall that M's symmetric offers in Proposition 3 are given by

$$\left\{(w_A^{Mj} \geq \sqrt{8F}, T_A^{Mj} = 0), (w_B^{Mj} \geq \sqrt{8F}, T_B^{Mj} = 0), (w_{AB}^{Mj} = \sqrt{8F}, T_{AB}^{Mj} = 0)\right\}$$

so the total amount of the discount implied by this schedule is

$$\Delta = w_A^{Mj} + w_B^{Mj} - w_{AB}^{Mj}$$

Subtracting this discount from the price of product purchasing product B alone yields $w_B^{Mj} - \Delta = w_{AB}^{Mj} - w_A^{Mj} = \sqrt{8F} - w_A^{Mj} \leq 0$, which is clearly less than 1/2, M's incremental cost of producing good B. Thus point (a) also holds, implying that the AMC-3 test correctly deems M's offers to be anticompetitive. Notice though that point (a) will also hold when $0 < w_B^{Mj} - \Delta < 1/2$, a case in which according to Proposition 3, bundled discounts could have not been used for foreclosure purposes.

Crucial in evaluating condition (a) was the fact that $w_A^{Mj} \geq \sqrt{8F}$. Could M have chosen a different set of wholesale schedules, so as to still replicate Proposition 3 (or Lemma 1) while passing the Discount Attribution Test? The answer is no. The reason is that if M offers good A alone for $w_A^{Mj} < \sqrt{8F}$ to any retailer, then S can guarantee himself access to the market by offering that retailer a wholesale price of zero with a fixed fee of $F + \epsilon$. That retailer can then start offering her own bundle by combining products from both manufacturers.

More generally, we have that in any anticompetitive scheme the difference $w_B^{Mj} - \Delta$ is always bounded above by S's marginal cost, which is always less than M's marginal cost, since S is assumed to be more efficient. This implies that the foreclosure scheme always fails to pass the Discount Attribution Test. Furthermore it also provides three additional implications. The first is that the more efficient the single-product supplier is, the more likely the Discount Attribution Test will identify foreclosure. Second, holding constant the level of production efficiency in the production of good B by S relative to M, the Discount Attribution Test is more likely to identify anticompetitive behavior the more important S's scale economies are. Indeed, larger scale economies, conditional on a certain level of production efficiency for S, implies a lower marginal cost, which we saw was the upper bound of $w_B^{Mj} - \Delta$. And third, in our model the Discount Attribution Test is still subject to Type I errors, identifying foreclosure when in reality there would be none, when $0 < w_B^{Mj} - \Delta < 1/2$. Our model however, is not suited to say much else about these cases, as we have purposely omitted any of the efficiency rationales usually attributed to bundled discounts.

Our model can also help us rationalize which parties are more likely to initiate an accusation of an antitrust violation. While the impact of bundled discounts on the single-product supplier is straightforward, its effects on retailers' profits are far less evident, especially as perfect competition (Proposition 3) always imply zero profits at the downstream level. However, using the imperfect-competition extension developed in the previous section (see Lemma 2), it is easy to see that retailers are also worse off when the multi-product firm engage in foreclosure. The fact that not only rival manufacturers end up worse off but also retailers is consistent with the diverse range of parties initiating antitrust suits. In fact, it helps explain why in a bundling context we may see either a small rival initiating an accusation of an antitrust violation, as in *3M v. LePage's* and *Cascade Health Solutions v. PeaceHealth*, or one of the distributors, as in *Cablevision v. Viacom*.

These distributional considerations are also useful to separate our exclusionary mechanism from the downstream competition models in the exclusive-dealing literature. In all of these, retailers are strictly better off as the incumbent supplier needs to proceed with lump-sum payments, whether ex-ante (Simpson and Wickelgren 2007a, Abito and Wright 2008) or ex-post (Asker and Bar-Isaac 2014), to compensate them not to deal with the rival supplier.

4 Bundled Discounts as an Exploitative Device

When final consumers are directly served by manufacturers, M's strategy comes down to two options (Proposition 1), either to accommodate with stand-alone prices, when $F < 1/8$, or to foreclose with bundling, when $F \geq 1/8$. Letting consumers be served by competitive retailers does not eliminate any of these two options (Proposition 3), but it does open a new one for M: to accommodate to S's presence while simultaneously extracting all of his profit. As we explain below, this exploitative practice is possible as bundled discounts endogenously create complementarities between products A and B at the wholesale level: both goods must be sold in conjunction in order to generate enough sales to cover the fixed cost F.

A helpful way to communicate this idea is using the structure developed in section 3.4 for the case of $\lambda = 1$, where $R2$ was assumed to be vertically integrated with M. Consider the case when $F \geq 1/8$, and suppose that in an effort to replicate Proposition 3, the integrated firm M-$R2$ sets a retail price of $\sqrt{8F}$ for the bundle, while making no offer to $R1$. We know from that section that there is nothing S can do to recover the fixed cost F. But suppose now, that right after M instructs $R2$ to sell the bundle at that price, $R1$ receives a most favorable offer from S for good B, $(w_B^{S1} = 0, T_B^{S1} = F + \epsilon)$, together with an unexpected opportunity to acquire good A: by paying an amount of $\tilde{F}_A = 1/2 - F - \epsilon$ she can start producing good A herself at zero marginal cost. Will $R1$ take this opportunity?

If she does not, she gets zero anyway. Instead, if she does, she can now compete with

M-$R2$'s bundle by solving

$$\max_{p_{A1}, p_{B1}} \pi^{R1} = p_{A1}(1 - p_{A1}) + p_{B1}(1 - p_{B1}) - \tilde{F}_A - T_B^{S1}$$

subject to $p_{A1} + p_{B1} \leq \sqrt{8F}$. The solution is $p_{A1} = p_{B1} = 1/2$, since $\sqrt{8F} \geq 1$, yielding a profit of zero to $R1$ and of ϵ to S. Notice that despite $\tilde{F}_A$ is larger than the monopoly profit to be made in market A alone (i.e. $1/2 - F - \epsilon > 1/4$), $R1$ is still willing to pay for it, as carrying good A makes her a potentially effective competitor to M-$R2$'s bundle.

By offering the bundle for $\sqrt{8F}$, M-$R2$ has transformed good A in a must-stock item, an indispensable input at the wholesale level: good B must be sold in conjunction with good A in order to generate enough sales so as to cover the fixed cost F. In other words, goods A and B have now become perfect complements. Notice that since final consumers have independent demands for the two goods and do not incur in any shopping costs when purchasing from different retailers, this complementarity is purely due to pricing and the competition conditions in the downstream market.

Of course, since by assumption M is the sole supplier of good A, M-$R2$'s optimal strategy is to sell the bundle for $\sqrt{8F}$, creating the complementarity, and offer $R1$ the possibility of purchasing good A under the schedule $(w_A^{M1} = 0, T_A^{M1} = 1/2 - F - \epsilon)$. This will force S to offer $R1$ the schedule $(w_B^{S1} = 0, T_B^{S1} = F + \epsilon)$, which will leave S with a payoff of ϵ. In the downstream market then, $R1$ ends up selling both goods A and B for $1/2$ each. The integrated firm M-$R2$ has thus been capable of obtaining for itself $1/2 - F - \epsilon$, the totality of the maximum industry profit as $\epsilon \to 0$.

The fact that M-$R2$ can appropriate the maximum industry surplus is not entirely surprising. From Whinston (1990) (see also Carlton and Waldman 2014), we know that if (i) the primary product A is essential for all uses of the complementary product B, (ii) a multi-product firm is the sole supplier of good A, but can also produce B, and (iii) there is a single-product rival who produces a better quality, or cheaper, version of the complementary product B, then firm M can appropriate all of the surplus available. However, all previous models assume exogenous "technological" complementarities. Our model is different, in the sense that the multi-product firm is endogenously generating the complementarity by suitably designing his contract offers. There lies the novelty of our result.

The following lemma shows that M can dispense the vertical-integration assumption, and still replicate the exploitative outcome just described using free retailers as a conduit of transfers and rents:

Lemma 3. *Consider the case of Bertrand retailers. If $F \geq 1/8$, then, by suitably designing his bundled discount offers, M can accommodate entry while obtaining for himself maximum industry profits in markets A and B, which total to $1/2 - F$.*

Proof. Take the offers in Proposition 3, and consider the following modification to $R1$'s offer (we could have instead considered $R2$'s offer since the two retailers are symmetric):

$$(w_A^{M1} \geq \sqrt{8F}, T_A^{M1} = 0) \rightarrow (w_A^{M1} = 0, T_A^{M1} = 1/2 - F - \epsilon)$$

so that M's offers end up being

$$\left\{(w_A^{M1} = 0, T_A^{M1} = 1/2 - F - \epsilon), (w_B^{M1} \geq \sqrt{8F}, T_B^{M1} = 0), (w_{AB}^{M1} = \sqrt{8F}, T_{AB}^{M1} = 0)\right\} \quad (6)$$

$$\left\{(w_A^{M2} \geq \sqrt{8F}, T_A^{M2} = 0), (w_B^{M2} \geq \sqrt{8F}, T_B^{M2} = 0), (w_{AB}^{M2} = \sqrt{8F}, T_{AB}^{M2} = 0)\right\} \quad (7)$$

to $R1$ and $R2$, respectively. Following Proposition 3, it is easy to see that if S make symmetric offers, or if he only approaches $R2$ with an offer, then in all possible downstream equilibria S cannot recover his fixed cost F, as in all of them $R1$ sells M's bundle for $\sqrt{8F}$. However, if S offers the alternative schedule $(w_B^{S1} = 0, T_B^{S1} = F + \epsilon)$ to $R1$, he anticipates a payoff of ϵ given that the downstream outcome involves $R2$ offering M's bundle for $p_{AB2} = \sqrt{8F} \geq 1$, but making no sales, and $R1$ selling $1/2$ units of M's good A for $p_{A1} = 1/2$ and $1/2$ units of S's good B for $p_{B1} = 1/2$ for a total profit of

$$\pi^{R1} = p_{A1}(1 - p_{A1}) + p_{B1}(1 - p_{B1}) - T_A^{M1} - F - \epsilon = 0$$

Anticipating that S's best response is to approach $R1$ with this schedule to get at least $\epsilon > 0$, offers (6) and (7) report M a payoff of $T_A^{M1} = 1/2 - F - \epsilon$, the maximum industry profit as $\epsilon \rightarrow 0$. ■

A few remarks are in order. First, from a welfare and consumer surplus perspective, Lemma 3 implies that consumers are indifferent between this exploitative outcome and the standalone-pricing benchmark: in either case they face retail prices of $1/2$ for each good. This result should be taken with caution, however, since it is an artifact of our assumption that M's cost of producing B was equal to $c = 1/2$, which we have used throughout the text to simplify calculations. If c were instead strictly less than $1/2$, the exploitative outcome of Lemma 3 will have a negative impact on both measures.[18]

[18] For instance, consider $c = 2/5$ and continue assuming $F \geq 1/8$. Following section 3.4, retail prices in the

Second, although the proof of Lemma 3 is built around bundled discounts a la *Cablevision v. Viacom*, we show in the online Appendix that this exploitative outcome can also be implemented using bundled loyalty rebates instead. More importantly, notice also that because M captures for himself the maximum industry profits there is no loss of generality in focusing on the two types of bundled discount introduced in Section 3.1; no alternative offer can do better, at least when scale economies are important, i.e., when $F \geq 1/8$.

And third, the exploitative outcome does not require valuations to be positively correlated at all, as we have assumed so far. For instance, if we let valuations to be independently and uniformly distributed over the unit square, M can still appropriate the maximum industry surplus for himself following the same exploitative logic of Lemma 3: using one retailer, say $R2$, to cap the bundle at a price that S cannot profitably operate using only $R1$ as his exclusive distributor, and the other retailer, $R1$, to transfer rents from S to himself after pricing the two goods at the monopoly level. The only difference with Lemma 3 is that now the monopoly solution involves mixed bundling (see McAfee et al 1989), so the level of scale economies above which M can appropriate the maximum industry surplus is even lower, $F \geq 0.118$.[19]

Since the maximum industry surplus is larger than M's outside option, $1/2 - F > 1/4$, this raises the question as to whether M finds it optimal to extend the exploitative use of bundled discounts beyond the foreclosure area. This is indeed the case as the next proposition establishes.

Proposition 4. *Consider the case of Bertrand retailers. The equilibrium of the wholesale offer game entails M using bundled discounts to exploit S if and only if $F \geq (11-4\sqrt{6})/100 \approx 0.012$; otherwise, accommodation with standalone schedules ensue.*

Proof. The proof follows closely that of Lemma 3, so we can be brief. Take the same offers (6) and (7) with the only exception that now

$$T_A^{M1} = \begin{cases} 1/2 - F - \epsilon & \text{if } F \geq \frac{1}{8} \\ \sqrt{8F}\left(1 - \sqrt{8F}/2\right) - F - \epsilon & \text{if } F < \frac{1}{8} \end{cases} \tag{8}$$

As before, S's best choice is to approach $R1$ with the offer $(w_B^{S1} = 0, T_B^{S1} = F + \epsilon)$ to obtain at least ϵ. This is because the downstream equilibrium outcome entails $R2$ offering M's bundle for

standalone benchmark will then be $p_{A1} = p_{A2} = 1/2$, and $p_{B1} = p_{B2} = 2/5$. But since S's cost parameters have not changed, Lemma 3 follows through without any modification. Consumers surplus and social welfare now decline, as the price of product B increases from $2/5$ to $1/2$.

[19] For more see the online Appendix.

$p_{AB2} = \sqrt{8F}$ (and making no sales), while $R1$ pricing goods A and B at $p_{A1} = \min\{1, \sqrt{8F}\}/2$ and $p_{B1} = \min\{1, \sqrt{8F}\}/2$, and selling $1 - p_{A1}$ units of good A, and $1 - p_{B1}$ units of good B from S. Given T_A^{M1} and T_B^{S1}, this leaves $R1$ with zero profit. Any other potential offer made by S, forces him out of the market as he would be unable to recover the fixed cost F.

While it is clear that S's best response to M's offers is to approach $R1$ with the above offer, we still need to check if this exploitative strategy is always in M's best interest. It obviously is when $F \geq 1/8$ since he appropriates the maximized industry profit (Lemma 3). As for the case when $F < 1/8$, we need to compare the exploitative payoff T_A^{M1} with what M gets in his outside option, 1/4 from standalone pricing. Therefore, M will accommodate and exploit entry with the above bundle discounts, whenever

$$\sqrt{8F}\left(1 - \sqrt{8F}/2\right) - F - \epsilon \geq 1/4 \tag{9}$$

that is, whenever $F \geq (11 - 4\sqrt{6})/100 \approx 0.012$ as $\epsilon \to 0$; otherwise he will accommodate entry with stand-alone prices. ■

Proposition 4 indicates that when scale economies are not that important, i.e., when $F < 1/8$, M still finds it optimal to fully exploit S but now must share part of S's profit with final consumers. At some point sharing S's profit with final consumers becomes too costly, because it forces M to lower the price of the bundle too much; at that moment M rather offers stand alone schedules. It is important to emphasize that the result in Proposition 4 does not rely on the sequential nature of the timing in which manufacturers approach retailers. This implies that observability of (and therefore commitment power in) M's offer is not necessary at all to implement the exploitative outcome, as shown in the next lemma.[20]

Lemma 5. *The exploitative outcome of Proposition 4 is also an equilibrium outcome of the game where M and S make simultaneous offers to retailers.*

Proof. If S conjectures that M will make offers (6) and (7), where T_A^{M1} is given by (8), then his best response is to offer $(w_B^{S1} = 0, T_B^{S1} = F + \epsilon)$ to $R1$; and if M conjectures that S will play $(w_B^{S1} = 0, T_B^{S1} = F + \epsilon)$, his best response is to approach retailers with offers (6) and (7), where T_A^{M1} is given by (8). Hence, the outcome of Proposition 4 is also Nash-equilibrium outcome of the game where M and S make their offers to retailers simultaneously rather than sequentially. ■

[20] The simultaneous timing admits other equilibria. In contrast, the (subgame perfect) equilibrium under the sequential timing of Lemma 3 and Proposition 4 is unique.

Proposition 4, and Lemma 4 for that matter, are important since they show, contrary to the current wisdom that is illustrated in the Introduction's quote, that multi-product firms do have *huge* incentives to bundle rebates together, and for purely *exploitative reasons*. Unfortunately, since the effect of this practice over welfare and consumer surplus is ambiguous once we consider the whole range of values for F, final consumers usually end up worse off when scale economies are important but enjoy lower prices when they are not, clear-cut policy recommendations become elusive.

It should be noted however, that it is not competition for consumers' preferences what generates lower prices, but rather M's desire to appropriate S's profits: if scale economies are not sufficiently important, M must share part of those profits with final consumers in his effort to exploit S. This also explains why when F increases beyond certain point, the effects over consumer surplus and overall welfare reverse. It is not far-fetched then, that some antitrust scholars might eventually judge this novel exploitative conduct as unfair competition, to be condemned regardless of its effect on final consumers, since what should drive lower prices in the market is the competition for market share, not the use of lower prices as a vehicle to exploit a rival supplier. It is evident that this new exploitative conduct introduces a tension to the antitrust practice that it is not obvious yet how to solve.

Where there is no tension is in the novelty of the mechanism of Proposition 4 through which bundling can result in either lower or higher prices. In the oligopoly models of Thanassoulis (2007) and Armstrong and Vickers (2010), for example, bundling creates a prisoner's dilemma to symmetric firms by forcing them to sell bundles in equilibrium despite they are better off without them. As shown by Chen (1997), however, this mechanism is not only lost but reversed in cases of asymmetric firms, where bundling is used instead as a product differentiation device to relax competition. In all these cases suppliers sell directly to final consumers; in our model in contrast, suppliers sell through retailers. With their help, and provided they compete intensely, a multi-product firm can now use bundling as an exploitation device which can lead to either outcome.[21]

[21] Notice that our exploitative mechanism is also different from the price-discrimination mechanism in Chen and Rey (2012). They focus on retail markets, and analyze how a multi-product retailer can use loss-leading practices to price discriminate among final consumers with different shopping costs.

5 Final remarks

We have studied the anticompetitive implications of bundled discounts in the specific context of wholesale markets, the relevant context for many antitrust cases, including the well known *3M v. LePage's* and the most recent *Cablevision v. Viacom*. Contrary to the current wisdom, well illustrated in the Introduction's quote, our analysis suggests that multi-product firms may have great incentives to offer bundled discounts for purely anticompetitive reasons. Indeed, a multi-product supplier with monopoly power in one market, can use these bundled discounts to foreclose a more efficient single-product supplier from a second market, but only to the extent that final consumers are served by highly competitive retailers. Then, and only then, the multi-product firm can exploit the existing heterogeneity in consumers' valuations for the different goods, and deprive the single-product supplier of sales revenue enough to pay for fixed costs. This is a novel exclusionary mechanism that departs from existing ones in that the multi-product firm does not need to commit any party ex-ante nor to compensate retail buyers; on the contrary, retailers, as well as the rival supplier, end up worse off.

When retail competition is intense, the multi-product firm can put bundled discounts to an even better use: to exploit the rival supplier. Bundled discounts are designed in a way that no retailer can make a sale without carrying the monopoly good, endogenously creating a perfect complementarity at the wholesale level between monopoly and competitive goods, despite final consumers having independent demands for the two goods and no shopping costs. Used this way, bundled discounts allow the multi-product firm to accommodate (efficient) entry and maximize industry profits, effectively extending his monopoly power from one market to the next.

There are reasons outside our model, however, that might explain why the multi-product firm may still prefer to follow a foreclosure strategy over an exploitative one. Agency reasons, for example, may force managers to be rewarded based on market shares and not so much on profits. Moreover, and building on our analogy with the literature on tying, foreclosure would also be the preferred strategy if the multi-product firm is looking to protect or enhance his monopoly position in the monopoly market, either from an existing, more inefficient alternative supplier (Ordover et al. 1985, Whinston 1990), or from future, more efficient potential entrants (Choi and Stefanadis 2001, Carlton and Waldman 2002). This would fit with the allegations in *3M v. LePage's*, for instance, where it has been argued that 3M initiated its bundled discount scheme in part to protect its highly popular, and profitable, *Scotch* tape. In Appendix E we provide a simple extension of our model to include some of these additional considerations and show that foreclosure can be indeed an equilibrium.

Whether is foreclosure or exploitation, our theory's main policy implication is that to sustain an anticompetitive outcome at the upstream (i.e., wholesale) level, it is key to observe an intense competition at the downstream (i.e., retail) level. Although some of the actual cases do spare a few words on downstream competition, they do it in a very descriptive manner without adverting the implications it may have for making (or not making) the case. In *3M v. LePage's*, for instance, it is explained that suppliers reach final consumers through different distributors, including Wal-Mart, Kmart, Staples, Office Max, Walgreens and CVS, but it is never mentioned, much less estimated, the intensity of this retail competition and its connection to foreclosure. The same is true in *Cablevision v. Viacom*, where it is briefly mentioned that Cablevision faces competition from different video distributors, including direct-broadcast satellite providers such as DISH Network and DIRECTV, overbuilders such as RCN, and telecommunications companies that offer video and other services over fiber optic networks such as Verizon and AT&T. Future cases should start by establishing if the necessary condition we advance in this paper—that intense downstream competition is essential for either foreclosure or exploitation—is likely to hold in practice or not.

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APPENDIX

A. Bundling with homogeneous consumers

Suppose all consumers value good A in $\bar{v}_A$ and good B in $\bar{v}_B$. Since S is still more efficient in the production of good B, i.e., $F < 1/2 < \bar{v}_B$, it is evident that foreclosure is unprofitable under standalone pricing. If, on the other hand, M announces a price of $p_{AB} \leq \bar{v}_A + \bar{v}_B$ for the bundle, S's optimal response, provided he can cover the fixed cost F, is to announce

$$p_B^*(p_{AB}) = p_{AB} - \bar{v}_A - \epsilon$$

where $\epsilon \to 0$; otherwise he would sell nothing. Therefore, to keep S out of the market, M would need to set the price of the bundle at $F + \bar{v}_A$, so for S to not have enough to pay for the fixed cost F. But if M sets the bundle price at that level, his payoff, $F + \bar{v}_A - 1/2$, would be strictly less than his standalone payoff, $\bar{v}_A$; unless $F \geq 1/2$, a contradiction.

B. General proof of Proposition 2

Let

$$(p_A^*, p_B^*, p_{AB}^*) \in \arg\max \left\{ \zeta^R(p_A, p_B, p_{AB}) - W^M(\mathbf{q}^M(p_A, p_B, p_{AB})) \right\}$$

where $\zeta^R(\cdot)$ is R's total revenue in the downstream market when he charges prices (p_A, p_B, p_{AB}) to final consumers and $W^M(\cdot)$ is his wholesale cost of purchasing a total of $\mathbf{q}^M = (q_A^M, q_B^M)$ units from M. Then a necessary condition for exclusion is

$$\zeta^R(p_A^*, p_B^*, p_{AB}^*) - W^M(\mathbf{q}^M(p_A^*, p_B^*, p_{AB}^*)) \geq \max_{p_B} \left\{ \zeta^R(\infty, p_B, \infty) - W_B^S(q_B^S(p_B)) \right\} \tag{10}$$

for any offer $W_B^S(\cdot)$ that is profitable for S to make. But since S's most aggressive offer that still allows him to break-even is $W_B^S(q_B^S) = F + \epsilon$ with $\epsilon \downarrow 0$, as this maximizes the surplus of the S-R vertical structure while allowing S to recover his fixed cost, condition (10) can be written as

$$\zeta^R(p_A^*, p_B^*, p_{AB}^*) - W^M(\mathbf{q}^M(p_A^*, p_B^*, p_{AB}^*)) \geq 1/4 - F \tag{11}$$

Since, on the other hand, M's exclusionary profits are given by

$$\pi^M = W^M(\mathbf{q}^M(p_A^*, p_B^*, p_{AB}^*)) - q_B^M(p_A^*, p_B^*, p_{AB}^*)/2$$

condition (11) implies that $\pi^M \leq \zeta^R(p_A^*, p_B^*, p_{AB}^*) - q_B^M(p_A^*, p_B^*, p_{AB}^*)/2 - 1/4 + F$. But we know that $\zeta^R(p_A^*, p_B^*, p_{AB}^*) - q_B^M(p_A^*, p_B^*, p_{AB}^*)/2$ must be less than or equal to $5/16$, which is the maximum surplus that the M-R vertical structure can generate. Hence $\pi^M \leq 1/16+F$, which is less than or equal to $1/4$, the profits M can get by accommodating entry with standalone prices, for all $F < 3/16$. Therefore, since using bundled discount to foreclose is always dominated by accommodating entry using standalone prices, bundling never emerges as a foreclosure strategy.

C. Proof of Proposition 3

For the proof we need to establish the following two claims first.

Claim 1. *Suppose M offers the following schedules to both retailers*

$$\left\{(w_A^{Mj} \geq w_{AB}^M, T_A^{Mj} = 0), (w_B^{Mj} \geq w_{AB}^M, T_B^{Mj} = 0), (w_{AB}^{Mj} = w_{AB}^M, T_{AB}^{Mj} = 0)\right\}$$

where $w_{AB}^M \in [\frac{1}{2}, \frac{5}{4}]$. Suppose also that S decides to incur the fixed cost F and to offer the pair of symmetric schedules $(w_B^{Sj} = w_B^S, T_B^{Sj} = 0)$ to both retailers, where $w_B^S \in (0,1)$. Given these offers, these are the possible equilibria in the downstream market:

1. *It is always an equilibrium for both retailers to carry S's product and M's bundle at retail prices $p_{B1} = p_{B2} = w_B^S$ and $p_{AB1} = p_{AB2} = w_{AB}^M$, respectively.*
2. *If $w_B^S > w_{AB}^M/2$, it is also an equilibrium for both retailers to only carry M's bundle at retail prices $p_{AB1} = p_{AB2} = w_{AB}^M$.*
3. *If, alternatively, $w_B^S < w_{AB}^M - 1$, it is also an equilibrium for both retailers to only carry S's product at retail prices $p_{B1} = p_{B2} = w_B^S$.*

Proof. We restrict attention to pure strategy equilibria. First, it is clear that there is no equilibrium in which retailers multi-source products, A from M and B from S, as this would require S to charge $w_B^S \leq 0$. Second, consider the possibility of $R1$ and $R2$ carrying both S's product and M's bundle in equilibrium. Since Bertrand competition dissipates profits, retail prices go down to $p_{AB1} = p_{AB2} = w_{AB}^M$ and $p_{B1} = p_{B2} = w_B^S$. This is indeed an equilibrium for any values of w_{AB}^M and w_B^S. Third, consider then the possibility of both retailers carrying only M's bundle in equilibrium. Bertrand competition requires $p_{AB1} = p_{AB2} = w_{AB}^M$, so the only possible deviation includes one of the retailers, say $R1$, to unilaterally decide to also carry S's product, together with M's bundle or not, whichever is more profitable. It is easy to see that either way pays the same since Bertrand competition forces retailers to sell M's bundle at cost. Since the demand for product B drops to zero if $p_B > p_{AB}/2$, this deviation is not profitable whenever $w_B^S > w_{AB}^M/2$, which confirms the possibility of an equilibrium with both retailers carrying only M's bundle. Fourth, consider now the possibility that both retailers only carry S's product in equilibrium. Bertrand competition requires $p_{B1} = p_{B2} = w_B^S$, so again the only possible deviation is to carry instead M's bundle, whether in addition to S's product or not. Suppose a retailer, say $R1$, deviates and decides to carry the bundle for $p_{AB1} = w_{AB}^M + \epsilon$. Her deviation payoff would be

$$\pi_d^{R1} = \epsilon\left(1 - w_{AB}^M - \epsilon + w_B^S\right)$$

which is negative if and only if $w_B^S < w_{AB}^M - 1$. So, if this latter holds, there exists an equilibrium with both retailers carrying S's product only. Finally, and following Shaked and Sutton (1990) and Chen (1997), consider the possibility of specialization as a way to relax (retail) price competition: $R1$ carrying S's product and $R2$ carrying M's bundle. In equilibrium, retailers must be playing according to their local best-responses

$$\begin{aligned} p_{B1} &\in \arg\max_p \, (p - w_B^S)(p_{AB2} - 2p) \\ p_{AB2} &\in \arg\max_x \, (x - w_{AB}^M)(1 - x + p_{B1}) \end{aligned}$$

which gives $p_{B1} = (1 + w_B^S + w_{AB}^M)/7$ and $p_{AB2} = (4 + 2w_B^S + 4w_{AB}^M)/7$, and have no incentives to undertake a global deviation. For this latter, it must be true that $R1$, for example, prefers to play according to her local best response, rather than to undercut $R2$'s bundle price and continue selling product B, possibly, at a price different than p_{B1}. Without computing $R1$'s optimal deviation, it is evident that it pays $R1$ to deviate since she can always slightly undercut $R2$'s price and continue selling B for p_{B1}, obtaining a payoff arbitrarily close to

$$(p_{AB2} - w_{AB}^M)(1 - p_{AB2} + p_{B1}) + (p_{B1} - w_B^S)(p_{AB2} - 2p_{B1}) > (p_{B1} - w_B^S)(p_{AB2} - 2p_{B1})$$

For the same reason, it also pays $R2$ to deviate by undercutting $R1$'s standalone price for product B and continue selling M's bundle. Hence, specialization cannot be an equilibrium. ■

Claim 2. *Suppose M offers the following schedule to both retailers*

$$\left\{(w_A^{Mj} \geq w_{AB}^M, T_A^{Mj} = 0), (w_B^{Mj} \geq w_{AB}^M, T_B^{Mj} = 0), (w_{AB}^{Mj} = w_{AB}^M, T_{AB}^{Mj} = 0)\right\}$$

Suppose also that S decides to incur the fixed cost F and to offer the schedule $(w_B^S = w_B^S, T_B^S = 0)$ to only one of the retailers, say $R1$. If $T_B^S \leq (w_{AB}^M)^2/8$, there exists an equilibrium in which $R1$ carries both S's product and M's bundle, while $R2$ carries only M's bundle. Retail prices are $p_{AB1} = p_{AB2} = w_{AB}^M$ and $p_{B1} = w_{AB}^M/4$.

Proof. If $R1$ carries both S's product and M's bundle and $R2$ carries only M's bundle, Bertrand competition forces $p_{AB1} = p_{AB2} = w_{AB}^M$. Therefore, $R1$'s optimal price for S's product is $p_{B1} = w_{AB}^M/4$. Since $R1$ will be making a profit, before fixed fees, of $(w_{AB}^M)^2/8$ by selling product B at that price, she will indeed carry that product in equilibrium if $T_B^S \leq (w_{AB}^M)^2/8$. As in Claim 1, we must also rule out the possibility of specialization: $R1$ carrying S's product and $R2$ carrying M's bundle. If this were indeed an equilibrium, retailers should be playing according to their local best-responses

$$\begin{aligned} p_{B1} &\in \arg\max_p \; p(p_{AB2} - 2p) \\ p_{AB2} &\in \arg\max_x \; (x - w_{AB}^M)(1 - x + p_{B1}) \end{aligned}$$

which gives $p_{B1} = (1 + w_{AB}^M)/7$ and $p_{AB2} = 4(1 + w_{AB}^M)/7$, and should have no incentives to undertake a global deviation. For this latter, it must be true that $R1$ prefers to play according to her local best response, rather than to undercut $R2$'s bundle price and continue selling product B, possibly, at a price different than p_{B1}. Without computing $R1$'s optimal deviation, it is evident that it pays $R1$ to deviate since she can always slightly undercut $R2$'s price and continue selling B for p_{B1}, obtaining a payoff arbitrarily close to

$$(p_{AB2} - w_{AB}^M)(1 - p_{AB2} + p_{B1}) + p_{B1}(p_{AB2} - 2p_{B1}) - T_B^{S1} > p_{B1}(p_{AB2} - 2p_{B1}) - T_B^{S1}$$

Hence, specialization cannot be an equilibrium. ■

With these two claims, we now proceed with the rest of the proof of the Proposition *3*. Suppose M approaches both retailers with the following offers

$$\left\{(w_A^{Mj} \geq \sqrt{8F}, T_A^{Mj} = 0), (w_B^{Mj} \geq \sqrt{8F}, T_B^{Mj} = 0), (w_{AB}^{Mj} = \sqrt{8F}, T_{AB}^{Mj} = 0)\right\} \tag{12}$$

If S responds with symmetric offers $(w_B^{Sj} = w_B^S, T_B^{Sj} = 0)$, where $w_B^S \in (0, 1)$, then by Claim 1 his equilibrium profits would be either (i) $\pi^S = w_B^S(\sqrt{8F} - 2w_B^S)$, (ii) $\pi^S = 0$, or (iii) $(\sqrt{8F} - 1)(2 - \sqrt{8F})$; all of which are less than or equal to F. Hence irrespective of which downstream equilibrium is played, S cannot recover his fixed costs with symmetric offers. If instead S responds with asymmetric offers, it is easy to see then, that the optimum for S is to approach only one retailer, say Rj, with an offer $(w_B^{Sj} = 0, T_B^{Sj} = F)$. Indeed let (w_B^{S1}, T_B^{S1}) and (w_B^{S2}, T_B^{S2}) be S's offers. If $w_B^{S1} < w_B^{S2}$, then in the event of entry only $R1$ sells S's good. Hence, the optimum is to set w_B^{S2} high enough so that there is no cannibalization of profits in markets in which $R1$ and $R2$ compete. Otherwise, S could increase the profits of the "vertical structure", and it would be easier to recover his fixed cost. This is equivalent as making no offer to $R2$ at all. The case $w_B^{S1} > w_B^{S2}$ follows a similar logic. Now, since S only approaches one retailer with the offer $(w_B^{Sj} = 0, T_B^{Sj} = F)$, by Claim 2 S's equilibrium profits are equal to $\pi^S = F$. Again, S cannot recover his fixed costs with asymmetric offers. Therefore, if M offers (12), S will refrain from entering, the downstream equilibrium will be $p_{AB1} = \sqrt{8F} = p_{AB2}$, and M's profit will be

$$\pi^M = \left(\sqrt{8F} - 1/2\right)\left(1 - \sqrt{8F}/2\right)$$

the exact same profit in Proposition 1, which is greater than or equal to 1/4 whenever $F \geq 1/8$. Thus, M can replicate the exclusionary outcome of Proposition 1 using bundled discounts *a la Cablevision v. Viacom*. ■

D. Proof of Lemma 1

Considered the bundled-loyalty-rebate offers described in the text. We need to demonstrate that there is no profitable deviation from an equilibrium in which S exits the market on date 2 and both retailers end up selling M's products either as bundle for $\sqrt{8F}$ or independently for $\sqrt{8F}/2$ each on date 3.

The deviation in which S stays in the market with symmetric offers to both retailers can be immediately discarded for the same reason it was discarded under the *Cablevision v. Viacom* schedule of Proposition 3. Another possible deviation is for S to stay and make an offer to just one retailer, say $R1$. Since the most S can offer $R1$ is $(0, F + \epsilon)$, we need to check whether it pays $R1$ to give up rebates r_A and r_B. Again from Proposition 3, we know that if $R1$ sells only product B, she makes at most a profit of F, and therefore she would not be willing to pay a fixed fee of $F + \epsilon$ to S. Another alternative, is for $R1$ to buy good A from M, and B from S, and slightly undercut $R2$'s most competitive offer on date 3, which is to offer the bundle for $p_{AB2} = \sqrt{8F}$ (as opposed to individual offers $p_{A2} = p_{B2} = \sqrt{8F}/2$ which are easier for $R1$ to undercut, at least for good B, which would make $R2$ lose all rebates by failing to comply with the rebate target). Since by undercutting $R2$'s bundle offer, $R1$ gets the entire market, her problem is to choose p_{A1} and p_{B1} so as to maximize

$$(p_{A1} - w_A^M)(1 - p_{A1}) + p_{B1}(1 - p_{B1})$$

subject to $p_{A1} + p_{B1} = \sqrt{8F}$. Using $p_{A1} = \sqrt{8F} - p_{B1}$, her problem reduces to choosing p_{B1} so as to maximize

$$(\sqrt{8F} - w_A^M)(1 - \sqrt{8F} + p_{B1}) + p_{B1}(\sqrt{8F} - 2p_{B1})$$

whose solution leads, at best, to a payoff of F when $w_A^M \geq \sqrt{8F}$, as established in the offer (notice that $\max_p p(\sqrt{8F}-2p) = F$). Therefore, irrespective of whether S's offers are symmetric or asymmetric, he cannot recover the fixed cost F given the rebate schedules offered by M, and therefore it is forced to leave the market.

We still need to check, however, that M's profit when S does not enter are no less than $(\sqrt{8F} - 1/2)(1 - \sqrt{8F}/2)$. If one retailer, say $R1$, anticipates that $R2$ will be selling the two goods in a bundle for $\sqrt{8F}$ (notice that if $R1$ anticipates that the goods will be sold separately for $\sqrt{8F}/2$ each, this deviation is ruled out immediately), $R1$ may decide to sell, in addition to bundles for $\sqrt{8F}$, extra units of good B, which would harm M since B is more expensive to produce. But even if these extra units are priced as low as $\sqrt{8F}/2$, which is the lowest marginal cost for $R1$ regardless of whether rebates apply or not, $R1$ attracts no demand given a bundle price of $\sqrt{8F}$. This eliminates this last possible deviation and finishes the proof. ■

E. Foreclosure equilibrium

This section contains an extension to the baseline model of section 2.1. After presenting the additions to the model, we derive M's best offers under alternative options: (i) when he disregards the use of bundled discounts to follow a standalone-pricing strategy, (ii) when he follows a foreclosure strategy like the one in Proposition 3, and (iii) when he follows an exploitation strategy like the one in Proposition 4. The section ends with a characterization of the strategy that will prevail in equilibrium, the most profitable of the three, which will vary depending on parameter values.

The new game. Consider the following extension to the baseline model for the case of two identical retailers, $R1$ and $R2$, competing intensely for final consumers. After M and S have approached the two retailers on dates 1 and 2, respectively, there is a possibility for a third manufacturer E to come to market on date 3 to rival M in the supply of good A. E can produce good A at zero marginal cost, but like S, must also incur a fixed cost, which makes him more inefficient in the production of good A. For simplicity, we let E's fixed cost be equal to S's, that is, equal to $F \in [0, 3/16]$. If E is presented with the possibility to enter the market on date 3, which happens with probability $\alpha \in (0, 1)$, he must decide then whether to approach the retailers and be willing to incur in the fixed cost F.[22] Finally, on date 4, retailers make their pricing decisions based on the offers received.

Standalone benchmark. If M disregards the use of bundled discounts, his offers in market B reduce to the (Bertrand) schedules $(w_B^{Mj} = 1/2, T_B^{Mj} = 0)$ for both $R1$ and $R2$, which are to be responded by S with the symmetric offers $(w_B^{Sj} = 1/2 - \epsilon, T_B^{Sj} = 0)$. Downstream equilibrium prices will then be $p_{B1} = p_{B2} = 1/2 - \epsilon$, which report S a payoff of $\pi^S = 1/4 - F > 0$. M's offers in market A, on the other hand, are not that simple, since he has two options. One option is to completely disregard E and approach the two retailers with the monopoly offers $(w_A^{Mj} = 1/2, T_B^{Mj} = 0)$. Since there is a probability α that E may enter the market by slightly undercutting these offers, M's expected payoff under this first option is $(1 - \alpha)/4$. A second option is to approach the two retailers with the limit-pricing offers $(w_A^{Mj} = \underline{w}_A, T_B^{Mj} = 0)$, where $\underline{w}_A$ solves the zero-profit condition $\underline{w}_A(1 - \underline{w}_A) - F = 0$ needed to discourage E from entering the market. In this case M sells good A with probability 1, but for a payoff of only F, so M will follow whatever option is expected to be more profitable, resulting in a (standalone) payoff of

$$\pi_{St.Al}^M = \max\{(1 - \alpha)/4, F\} \tag{13}$$

Foreclosure. This alternative strategy is more involved because there are numerous possibilities to consider. The analysis, however, can be simplified with a bit of hindsight. In particular, we will show that if a bundle offer of $\bar{w}_{AB}$ blocks S's entry it also does E's. More formally, let us conjecture that E enters on date 3 —provided he is presented with the opportunity to do so— if only if S has done so on date 2. Anticipating this, suppose that M approaches the two retailers with the same offer

$$\{(w_A^{Mj} \geq \bar{w}_{AB}, T_A^{Mj} = 0), (w_B^{Mj} \geq \bar{w}_{AB}, T_B^{Mj} = 0), (w_{AB}^{Mj} = \bar{w}_{AB}, T_{AB}^{Mj} = 0)\}$$

Since retailers are Bertrand competitors S is indifferent between responding to M's offers with symmetric offers $(w_B^{Sj} = w_B^S, T_B^{Sj} = 0)$ or with the asymmetric ones $(w_B^{S1} = w_B^S, T_B^{S1} = 0)$ and $(w_B^{S2} = 0, T_B^{S2} > 0)$, where T_B^{S2} is large enough to leave $R2$ with zero profits. In either case retailers will be selling good B for w_B^S. But to simplify notation, let us focus on symmetric offers. Given our conjecture, S expected payoff would be

$$\alpha w_B^S(1 - w_B^S) + (1 - \alpha)w_B^S(\bar{w}_{AB} - 2w_B^S) - F \tag{14}$$

[22]As in footnote 10, we assume that E finds it optimal to pay F only if he expects strictly positive profits (net of fixed costs).

If S decides to remain in the market with the above offers, he will get a variable profit of $w_B^S(1-w_B^S)$ if E enters, which happens with probability α, because in this case E will price his product A such that no retailer will offer M's bundle in equilibrium. On the other hand, if E does not enter, which happens with probability $1-\alpha$, S will get a profit of $w_B^S(\bar{w}_{AB}-2w_B^S)$, because in that case retailers will be selling the bundle, along with product B, for $\bar{w}_{AB}$.

The first thing to note is that for foreclosure, as well as for exploitation, to be feasible we require $F \geq \alpha/4$, otherwise S could always enter with the symmetric offers ($w_B^{Sj}=1/2, T_B^{Sj}=0$) and make a profit of $\alpha/4-F>0$.

Now, maximizing (14) with respect to w_B^S gives

$$w_B^{S*}(\bar{w}_{AB}) = \frac{\alpha+\bar{w}_{AB}(1-\alpha)}{2(2-\alpha)}$$

that plugged into (14) yields

$$\pi^S = \frac{[\alpha+\bar{w}_{AB}(1-\alpha)]^2}{4(2-\alpha)} - F$$

Hence, M needs to set $\bar{w}_{AB}$ at

$$\bar{w}_{AB} = \frac{2\sqrt{F(2-\alpha)}-\alpha}{1-\alpha} \tag{15}$$

in order to induce S to exit the market.

It is time now to corroborate that our conjecture was correct. Consider first the subgame in which S did not enter. What is E's optimal strategy? As before, we can focus without loss of generality on the symmetric offers ($w_A^{Ej}=w_A^E, T_A^{Ej}=0$), which would report E a profit of

$$w_A^E(\bar{w}^{AB}-2w_A^E) - F$$

Since E's profit-maximizing wholesale price is $w_A^{E*}=\bar{w}^{AB}/4$, the most he can get is $(\bar{w}^{AB})^2/8-F$. But it can be shown that $(\bar{w}^{AB})^2/8-F<0$ since $\bar{w}^{AB}<\sqrt{8F}$ for all $\alpha\in[0,4F]$ and $F\in[0,3/16]$. Therefore, E will not enter if S has decided to exit the market.

Consider now the subgame in which S did enter. In this case, E's optimal offers are the symmetric schedules ($w_A^{Ej}=\tilde{w}_A^E, T_A^{Ej}=0$), where

$$\tilde{w}_A^E = \min\{1/2, \bar{w}_{AB}-w_B^{S*}(\bar{w}_{AB})\} = \min\left\{\frac{1}{2}, \left(\frac{-\alpha}{1-\alpha}\right) + \frac{(3-\alpha)}{(1-\alpha)(2-\alpha)}\sqrt{F(2-\alpha)}\right\}$$

It is easy to see that these offers report E a payoff of $\tilde{w}_A^E(1-\tilde{w}_A^E)-F>0$ for all $\alpha\in[0,4F]$ and $F\in[0,3/16]$, which implies that E will always enter having been observed S doing so. The results from these two subgames confirm that our conjecture was indeed correct, so in case M decides to follow a foreclosure strategy his payoff would be

$$\pi^M_{For} = \left(\bar{w}^{AB} - \frac{1}{2}\right)\left(1 - \frac{\bar{w}^{AB}}{2}\right) \tag{16}$$

where $\bar{w}_{AB}$ is given by (15).

Exploitation. If instead M decides to follow an exploitation strategy, the logic to find M's best offers is similar to that in the standalone benchmark. One option is for M to completely disregard E and offer

$$\left\{(w_A^{M1} = 0, T_A^{M1} = K), (w_B^{M1} \geq \bar{w}_{AB}, T_B^{M1} = 0), (w_{AB}^{M1} = \bar{w}_{AB}, T_{AB}^{M1} = 0)\right\}$$
$$\left\{(w_A^{M2} \geq \bar{w}_{AB}, T_A^{M2} = 0), (w_B^{M2} \geq \bar{w}_{AB}, T_B^{M2} = 0), (w_{AB}^{M2} = \bar{w}_{AB}, T_{AB}^{M2} = 0)\right\}$$

to $R1$ and $R2$, respectively, where (recall Proposition 4)

$$K = \begin{cases} 1/2 - F - \epsilon & \text{if } \bar{w}_{AB} \geq 1 \\ \bar{w}_{AB}\left(1 - \bar{w}_{AB}/2\right) - F - \epsilon & \text{if } \bar{w}_{AB} < 1 \end{cases}$$

But if E is presented with the opportunity to enter the market with a fixed cost of $F < K$, he will do so with offers that slightly undercut M's: $(w_A^{E1} = 0, T_A^{E1} = K - \epsilon)$ to $R1$ and nothing to $R2$. Therefore, under this first option M's profit would be $(1-\alpha)K$ if $F < K$ and K otherwise.

An alternative option is for M to shelter against E's potential appearance with the (limit-pricing) offers

$$\left\{(w_A^{M1} = 0, T_A^{M1} = \min\{F, K\}), (w_B^{M1} \geq \bar{w}_{AB}, T_B^{M1} = 0), (w_{AB}^{M1} = \bar{w}_{AB}, T_{AB}^{M1} = 0)\right\}$$
$$\left\{(w_A^{M2} \geq \bar{w}_{AB}, T_A^{M2} = 0), (w_B^{M2} \geq \bar{w}_{AB}, T_B^{M2} = 0), (w_{AB}^{M2} = \bar{w}_{AB}, T_{AB}^{M2} = 0)\right\}$$

that ensure that E will not be able to undercut them. Doing this reports M a payoff of $\min\{F, K\}$ that combined with the above implies that in case M decides to follow an exploitation strategy his payoff would be

$$\pi^M_{Exp} = \max\{(1-\alpha)K, \min\{F, K\}\} \tag{17}$$

Equilibrium strategy. M's equilibrium strategy is the most profitable strategy that results of comparing (13), (16) and (17). The resulting equilibrium is summarized in Figure 3 below for the different values of α and F (functions $F_1(\alpha)$ and $F_2(\alpha)$ can be found in the online Appendix, whereas $F_3(\alpha) = \alpha/4$ and $F_4(\alpha) = (1-\alpha)/4$). Unlike in Proposition 4, now foreclosure is part of the equilibrium landscape. The multi-product firm will find it optimal to follow a foreclosure strategy whenever scale economies are important and there is some possibility of an inefficient manufacturer rivaling his monopoly market later on (i.e., α is neither too small not too large). The best way to understand this is by keeping F constant at a relatively high level and let α to vary. When E's presence is very unlikely ($\alpha \to 0$), we already know from Proposition 4 that exploitation is M's best course of action. Conversely, when E is almost certain to be ready to enter the market ($\alpha \to 1$), exploitation turns out to be a bad idea precisely because letting S to remain in the market opens the door for E to enter the market as well. In this case the best for M is to just focus on protecting his monopoly market A, with a standalone limit-pricing strategy, and let S serve market B. For intermediate values of α, however, there is a better way for M to protect his monopoly market A: to eliminate S from the market altogether. It pays M to do so not only because exploitation is too risky but also because there is not so much to extract from S given his relatively large F. As S becomes more efficient (i.e., smaller F), foreclosure becomes too costly an option to shelter against E's potential entry, given the low price of the bundle that is required. It is better for M to either handle that shelter directly with stand-alone pricing or extract as much as possible from S hoping that E is not presented with an opportunity to enter the market, whichever is more profitable.

It is important to conclude this analysis with the observation that, like in our baseline model, the underlying mechanism behind the foreclosure equilibrium in Figure 3 does not rely on M's having a first-mover advantage at all. In fact, in the online Appendix we show that if M and S approach the two retailers simultaneously, there still exists a mixed-strategy equilibrium in which foreclosure happens with positive probability. If we take $F = 0.18$, for example, the range in which the foreclosure equilibrium is valid goes from $\alpha = 0$ to $\alpha = 0.4723$.

Figure 3: M's Equilibrium Strategy