Bundled Discounts and Foreclosure in Wholesale Markets

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**** INCOMPLETE, COMMENTS WELCOME ****

Abstract

Can a multi-product firm offer bundled-discounts to foreclose a more efficient single-product supplier? We show that the degree of downstream competition is key. Bundled-discounts are successful in depriving single-product rivals of scale economies 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. These results are robust to alternative timing assumptions and different ways to model scale economies.

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


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In 2003, the Supreme Court had to decide whether to review the Third Circuit en banc 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’ claims against 3M’s bundled discounts program, a program under which 3M offered rebates to retailers conditioned on purchases in different product lines, reviewing the case would therefore set precedent in a particularly intricate issue: how should antitrust law treat 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 a further development of the economic analysis and case law, before determining a new guidance on the application of Section 2 to bundled rebates, a recommendation that was accepted by the Court. Motivated by the call for further analysis, this paper looks at the antitrust implications of these so-called bundled discounts in the context of wholesale markets, the relevant context of study of 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) 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 motive, for example as a price discrimination device in a monopoly setting (Stigler 1963, Adams and Yellen 1976, McAfee et al. 1989, Chen and Riordan 2013); be pro-competitive, for instance forcing suppliers to offer more advantageous terms to buyers (Gans and King 2006, Thanassoulis 2007, Armstrong and Vickers 2010, Armstrong 2013); and can 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, 1976), 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), who was the first to show that a company having market power

\[1\text{Later contributions include Nalebuff (2005), Peitz (2008) and Greenlee et al. (2008). Whinston (1990) model of tying could also be consider an early precursor. We return to these papers later on.}\]
in two goods, $A$ and $B$, can use bundled-discounts to make it harder for a potential rival with only one of the products to enter the market. However, while extremely insightful, his model only provides partial understanding of the anticompetitive potential of bundling.

First, it only consider the case of a more inefficient potential entrant. Second, by giving the incumbent a first-mover advantage, that paper is better suited to the analysis of entry deterrence rather than the eviction of an already present competitor, a fact at odds with all antitrust cases in the topic. And third and most importantly, it does not take into account the existence of wholesale markets, even though many antitrust cases involve exclusion at the upstream level of the supply chain, as all the cases listed previously can attest.

Inspired partly in Nalebuff’s (2004) work, in this paper we develop a model that, while keeping tractability, allow us to take into consideration all the aforementioned issues. 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 scale economies in production. However, we depart from Nalebuff’s model in some important directions. First, our model pays explicit attention to wholesale markets by assuming that suppliers serve consumers indirectly through one or more retail buyers, and allow arbitrary levels of competition at the downstream level. This not only allow us to analyze the implications of the degree of downstream competition on the possibility of upstream exclusion, but also to review and discuss the different wholesale contractual arrangements we have seen in practice, from the upstream bundles of *Cablevision v. Viacom* (2013) to the loyalty rebates of *3M v. LePage’s* (2003).

Second, since all antitrust cases ever raised involve anticompetitive eviction, we eliminate completely any first-mover advantage that may allow the multi-product supplier to commit to an action before a more efficient single-product rival shows up. We assume instead that both suppliers approach retailers simultaneously with wholesale offers. This timing/commitment assumption constitute a novel feature that is absent not only in Nalebuff’s (2004) model, but also in the closely-related literature of foreclosure through exclusive dealing contracts and single-product loyalty discounts, where it has been shown that ex-ante commitments are usually key (Whinston 2006, Ide et al. 2016).3

Finally, we aim to create a model (which we later relax) in which the only potential reason for bundled-discounts to emerge is the foreclosure of a rival manufacturer, as in many antitrust cases

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2This immediately rules out the opportunity for the multi-product supplier to irreversibly tie the production of goods $A$ and $B$ ex-ante, as in Whinston (1990).

3See Asker and Bar-Isaac (2014) for an exception.
dominant multi-product firms began offering bundled-discounts only after increasingly losing sales to single-product competitors.\footnote{For instance in \textit{3M v. LePage’s}, 3M started its bundled-discount program, which included its popular Scotch tape, only after LePage’s had captured 88\% of sales in private label tape market.} Moreover, by abstracting away any motive for bundling other than the exclusion of a rival manufacturer, we are able to more clearly characterize and highlight the anticompetitive potential of bundled-discounts.

The main result of the paper, is that the degree of downstream competition is key. Bundled-discounts are successful in depriving more efficient single-product rivals of scale economies, 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. Somehow surprising then, 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.

The intuition is as follows. By being gatekeepers to final consumers, monopoly retailers internalize in their own profits 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, just by being more efficient, 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 heterogeneity in valuations gets gradually restored. Competition for retailers’ preferences is no longer in terms of aggregate surplus, and the anticompetitive potential of bundled-discounts is reestablished. Indeed, as we approach the limit of downstream Bertrand competitors, retailers are forced to pass on to final consumers almost the same prices that they pay upstream, and we end-up as if suppliers were serving final consumers directly.

Our model predicts that when exclusion is feasible, bundled-discounts have a detrimental effect on both overall welfare and consumer surplus over the standalone equilibrium benchmark. Moreover, not only rival manufacturers but also retailers are made worse-off. This is consistent with the diverse range of parties usually initiating antitrust suits. For instance, 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 (2003), or one of the distributors, as in Cablevision v. Viacom (2013).

We are not the first to stress the importance of downstream competition in explaining upstream exclusion. Previous contributions however, have focused mainly in the somewhat different context of entry-deterrence in a single-product market composed by an incumbent supplier and a potential more efficient rival (Simpson and Wickelgren 2007a, Abito and Wright 2008, and Asker and Bar-Isaac 2014).

In Simpson and Wickelgren (2007a) and Abito and Wright (2008) for instance, exclusion relies on the incumbent’s ability to sign exclusive dealing arrangements ex-ante, that is, before a 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. No such ex-ante commitment is present in our model. 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 the retailers in the form of lump-sum rebates, in order to induce them not to facilitate entry. Their model however, is difficult to extend to the more realistic case of eviction, as it is precisely the more efficient supplier the one who has more surplus available to try to evict the more inefficient manufacturer out of the market.\footnote{Simpson and Wickelgren (2007b) also emphasize the importance of downstream competition. While their focus is also on bundled discounts, their paper is very different from ours in terms of assumptions and the exclusionary mechanism (in fact, they do not require scale economies and heterogeneity in consumers’ valuations). They restrict suppliers to offer linear prices, assume 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.}

All three models, moreover, predict that retailers are no-worse off by the incumbent’s anticompetitive scheme.

The exclusionary mechanism of 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 manufacturers only need one retailer to reach all final consumers. Interestingly, it is precisely this feature that allows the complete opposite outcome in this multi-product setting: 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 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. This represents our interpretation of the mechanism behind Nalebuff (2004). In section 3, we introduce wholesale markets. After a brief introduction of what constitute a bundled discount in a wholesale context, we explore the extreme cases of monopoly and perfect competition. These cases serve as the basis to study the more complex case of intermediate levels of competition, which comes thereafter. In section 4, we discuss the role of economies of scale, commitment, and sunk costs in explaining exclusion, and show that our results are robust. We conclude in section 5 with a discussion of our results while taking a closer look at some of the antitrust cases listed above, and by placing them into the broader theme of exclusion and foreclosure more generally.

2 The model

Our model builds upon Nalebuff’s (2004) seminal contribution, but we depart from it in important dimensions. First and most importantly, we introduce wholesale markets. Motivated by actual cases, our aim is to analyze the impact of downstream competition in the anticompetitive potential of bundled discounts at the wholesale level. Second, in order to highlight their anticompetitive potential, we assume away any motive for bundling other than the exclusion of a rival manufacturer. We therefore look for necessary conditions for exclusionary bundling to emerge. This is not, 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. Third, we dispense any first-mover advantage that may allow the multi-product supplier to commit to an action before a more efficient single-product rival shows up, and consider the more realistic setting in which manufacturers simultaneously compete in contracts. In that sense, our model is equally fit to analyze cases in which a multi-product supplier is trying to evict from the market an already existing competitor, or cases in which his aim is to discourage a potential rival from entering the market. We will therefore use both terms interchangeably.
2.1 Notation

Two goods, $A$ and $B$, are sold in a continuum of retail markets whose mass add up to 1. Each retail market can represent a distinct geographical area or a particular group of consumers that retailers can price discriminate (e.g., online shoppers, college students, etc). In each of these retail markets there is 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, $v_A = v_B = v \sim U[0, 1]$. This ensures that bundled discounts never emerge in the absence of a competitive threat.\footnote{As we already mentioned, this assumption plays no role in the main messages of the paper and is relaxed in the online Appendix, where we consider the case of valuations uniformly distributed over the entire unit square.}

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.\footnote{In the Online Appendix we let $c$ vary. This introduces some additional (and interesting) results but that do not affect the main message of the paper.} 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 $F$.\footnote{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.}

We restrict attention to values of $F$ that would give rise to market foreclosure. Following the literature on upstream exclusion in wholesale markets (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 $F \leq 3/16$, 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).\footnote{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.}
$R_1$ and $R_2$, that for the sake of simplicity, have no costs other than those of purchasing the goods from one or both manufacturers. Retail competition varies across markets. $R_1$ is assumed to be present in all retail markets while $R_2$ is only present in a fraction $\lambda \in [0, 1]$ of them. In retail markets where both $R_1$ and $R_2$ are present, they engage in intense Bertrand competition for final consumers. We assume that manufacturers and retailers agree on a single set of schedules that apply to all retail markets. Under this practice, $\lambda$ represents the average level of retail competition, which may go from none ($\lambda \to 0$) to virtually perfect ($\lambda \to 1$).

As a general rule, at the wholesale level quantities and prices are denoted following the convention $x_{ij}^{ki}$, where subindex $i \in \{A, B, AB\}$ denotes the type of product, either good $A$, $B$ or the bundle $AB$, while supra-indices $k \in \{M, S\}$ and $j \in \{1, 2\}$ denote a manufacturer and retailer $R_j$, respectively. For instance, $q_{MA}^{M2}$ would be the quantity of product $A$ purchased by retailer $R_2$ from manufacturer $M$. When possible, and if there is no ambiguity regarding who the retailer is, we will omit supra-index $j$ altogether to avoid cluttering notation.

The timing we begin considering is as follows: on date 1, there is contract competition in which $M$ and $S$ make simultaneous take-it-or-leave-it offers to retailers $R_1$ and $R_2$. Following the practice in many wholesale markets, a contract establishes a price schedule under which a manufacturer and a retailer agree to trade over the course of a period, typically a year. On date 2, and having observed the schedules announced on date 1, $S$ must decide whether to remain in business or not. If $S$ decides the latter, his contract offer is automatically canceled. Finally, on date 3, retailers buy according to the set of active contracts and compete for final consumers by simultaneously setting prices in the different retail locations. Our aim is to capture the following market situation: the current period is about to end, current wholesale contracts are about to expire, and manufacturers must decide whether to stay active or to leave the market.

Inherently in the above timing is the issue of commitment: $M$ may have incentives to change his contract offerings after observing whether $S$ paid $F$ or not. Section 4 is devoted in its entirety to this issue, where we perform an in depth study of the role of economies of scale, commitment, and different timing assumptions in explaining exclusion through bundled-discounts. For ease of exposition however, we assume for the remaining parts of Sections 2 and 3 that there is no such later stage in which parties can renegotiate its initial contract offerings.

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9 Results do not change if manufacturers can discriminate across retail markets as long as scale economies have a global nature. We also analyze the implications of market-specific fixed-cost at the end of Section 3, and how this give raise to the interesting possibility of partial foreclosure.
2.2 Bundling as a foreclosure tool

Before explicitly introducing the retail level, we analyze the scenario in which suppliers sell directly to final consumers. This represents our interpretation of the mechanism behind Nalebuff (2004). 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 thus, is exactly as the one described in the previous section, except that instead of simultaneously competing in contracts on date 1, manufacturers compete by simultaneously announcing prices.\footnote{Since in the absence of the retail level all markets are identical, there is no loss of generality in aggregating all of them into a single representative market.} Therefore, if $S$ decides to leave the market on date 2, all consumers are served by $M$ at the prices he previously announced at 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: stand-alone pricing, pure bundling, and mixed-bundling. Perfect correlation in valuations however, immediately implies that (i) independently on the competitive environment, mixed-bundling will always be equivalent to pure stand-alone pricing, and therefore $M$ decision is always whether to offer pure-bundling or standalone pricing; and (ii) in the absence of a competitive threat, bundling never emerges: $M$’s optimal pricing is to announce stand-alone monopoly prices $p^M_A = 1/2$ and $p^M_B = 3/4$. The latter of course changes, if $S$ is present.

Suppose first that for some reason $M$ is forced to use stand-alone pricing, then both manufacturers will be active in equilibrium. Indeed, the equilibrium announcements of each manufacturer will be $(p^M_A = 1/2, p^M_B = 1/2)$ and $p^S_B = 1/2 - \epsilon$ respectively, and $S$ will be willing to incur the fixed-cost $F$ anticipating profits of $1/4 - F > 0$. $M$’s profits would be equal to $1/4$ and all consumers with valuations above $1/2$ end up buying both products.

Can $M$ do better by selling $A$ and $B$ as a pure-bundle at price $p_{AB}^M$? We begin by showing the following result:

**Lemma 1.** $M$ will never sell goods $A$ and $B$ as a bundle if he is to accommodate $S$ in the market.

**Proof.** Consider a candidate equilibrium in which after announcements $p_{AB}^M$ and $p_B^S$, $S$ decides to be active and pay $F$. Then three conditions must hold: (i) $M$ and $S$ must be playing
their best-response conditional on both being active; (ii) $M$’s profit must be greater than or equal to $1/4$; and (iii) $S$ must make non-negative profits.

Now if $p_{AB}^M$ and $p_B^S$ are the announced prices and $S$ decides to pay $F$, consumers get divided in three groups (see Figure 1). Consumers with valuations $v_A = v_B = v \leq p_B^S$ buy nothing, those with $p_B^S < v \leq p_{AB}^M - p_B^S$ buy only from $E$, and those with $v > p_{AB}^M - p_B^S$ buy the bundle. Hence given these demands, condition (i) requires

$$p_B^S = \arg \max_y y (p_{AB}^M - 2y) \quad (1)$$

$$p_{AB}^M = \arg \max_x (x - 1/2)(1 - x + p_B^S) \quad (2)$$

which yields $p_B^S(p_{AB}^M) = p_{AB}^M/4$ and $p_{AB}^M(p_B^S) = 3/4 + p_B^S/2$. Solving the system of best responses gives an equilibrium bundling price of $6/7$ that plugged into $M$’s program leads to a payoff of $(5/14)^2 \approx 0.128 < 1/4$, contradicting condition (ii). Hence, $M$ will never use bundling if he is to accommodate $S$ in the market. ■

Figure 1: Demand under Bundling

In this simplified setting, bundling can only emerge in equilibrium if it is used as a foreclosure strategy (in Nalebuff (2004) bundling also emerges in the absence of an entry threat). We now show that this foreclosure strategy can be actually optimal.

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

**Proof.** Since $S$’s best response to $p_{AB}^M$ is $p_{AB}^M/4$, $S$ anticipates that he will not be able to cover its fixed cost if $M$ were to price the bundle slightly below $\sqrt{8F}$. Therefore, by charging a price of $p_{AB}^M = \sqrt{8F}$, $M$ anticipates a total demand of $1 - \sqrt{8F}/2$ for the bundle. Finally, it pays $M$ to do so whenever the profit involved, $(\sqrt{8F} - 1/2)(1 - \sqrt{8F}/2)$, is greater than the profit of sharing the market with $S$, which by Lemma 1 is equal to $1/4$, that is whenever $F \geq 1/8$. Hence bundling emerges in equilibrium as a market foreclosure strategy whenever $F \geq 1/8$. ■

Proposition 1 tells us that bundling allows $M$ to foreclose the market to efficient rivals provided that scale economies are important. Bundling hurts not only $S$ but also consumers, who now pay $\sqrt{8F} \geq 1$ for the bundle, as opposed to $1/2$ for each product. 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 either selling each good for $1/2$ or the bundle for $1$, which report to 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, $S$ requires a substantial undercut to attract some consumers, since they need to be compensated in order to give up product $A$.

## 3 Bundled discounts in wholesale markets

While extremely insightful, this theory has been applied face-value to many antitrust cases in which manufacturers do not actually sell directly to final consumers, but rather operate through local distributors. In this section we analyze the effects of explicitly accounting for this.

We are specially interested in characterizing how different levels of retail competition affect $M$’s ability to foreclose the market to a more efficient rival. Our goal therefore is to solve the market equilibrium for any arbitrary level of $\lambda$. But in doing so, we begin by analyzing the extreme cases of monopoly ($\lambda = 0$) and perfect competition ($\lambda = 1$). These two cases not only prove useful for communicating the intuition, but also serve as the basis for constructing...
the equilibrium for the more difficult case of intermediate levels of competition, \( \lambda \in (0, 1) \). But before delving into the analysis, there are some definitions that need attention.

### 3.1 Preliminaries

What exactly constitutes a bundled discount in a wholesale context? Since a retailer’s demand is a derived demand that results from aggregating unit demands of lots of different consumers, this opens up the possibility for writing richer price schedules than those offered to final consumers.

The most general wholesale schedules manufacturers \( M \) and \( S \) can offer \( R_j \) are: \( W^{Mj}(q^{Mj}) \) and \( W^{Sj}(q^{Sj}) \), where \( q^{Mj} = (q^{Mj}_A, q^{Mj}_B) \). We now define bundled-discounts as follows:

**Definition 1.** We say that \( M \) is using a “bundled-discount” if the function \( W^{Mj}(q^{Mj}) \) is not additively separable:

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W^{Mj}(q^{Mj}) \neq W^{Mj}_A(q^{Mj}_A) + W^{Mj}_B(q^{Mj}_B)
\]

and that he is using “standalone” schedules otherwise.

Since our setting does not involve uncertainty nor asymmetric information, and moreover we are assuming that manufacturers have constant marginal costs, we can further simplify our analysis by noting that it is without loss of generality to write \( W^{Sj}(\cdot) \) as a two-part tariff \((w^{Sj}_B, T^{Sj}_B)\), whether \( w \) is the wholesale unit price and \( T \) is the fixed-fee that is paid conditional on buying some positive amount. The same can be said when \( M \) is using stand-alone prices, as the functions \( W^{Mj}_A(\cdot) \) and \( W^{Mj}_B(\cdot) \) can be translated into \((w^{Mj}_A, T^{Mj}_A)\) and \((w^{Mj}_B, T^{Mj}_B)\).

Hence, in the absence of bundled-discounts, schedule competition between manufacturers can be represented as competition in (market-specific) two-part tariffs.

There are however many ways to write bundled-discounts. Two have been particularly prominent in recent antitrust cases:

**Selling bundles upstream (e.g., *Cablevision v. Viacom, 2013*)**

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, being the latter directly monitored by the content provider. In *Cablevision v. Viacom* (2013),\(^{11}\) Viacom, a major producer of media content and entertainment, was accused of bundling together his

\(^{11}\)See Civil Action No. 13 CIV 1278 (LTS) (JLC), filed on March 7, 2013 in the Southern District Court of New York.
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 for the core networks than for the core and suite networks combined. This can be interpreted as Viacom selling directly bundles of channels upstream and monitoring the distributing process downstream.

**Bundled-loyalty rebates (e.g., 3M v. LePage’s, 2003)**

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 (2003), 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.

Both types of contracts differ in the extent of control the multi-product manufacturer has over the retailers. Bundling directly upstream and monitoring the distributing process provides $M$ with tighter control, and therefore makes a priori exclusion more likely. We will show however, that bundled-loyalty rebates can always be designed to mimic the first type of contract, and therefore in our setting both turn out to be equivalent. Since results are more easily grasped when $M$ can directly sell bundles upstream, as the wholesale schedule $W^M_j(q^M_j)$ can then be collapsed, without loss of generality, into a menu of two-part tariffs $\{(w^M_A, T^M_A), (w^M_{AB}, T^M_{AB})\}$, one for purchasing only $A$, and one for purchasing the bundle, we develop that analysis that follows under that assumption.

### 3.2 Monopoly retailer

Consider first the case in which $R1$ is the only retailer in all markets ($\lambda = 0$). If $M$ were the only manufacturer supplying goods to $R1$, he would offer the set of two-part tariffs that maximizes industry profits: $\{w^M_A = 0, w^M_{AB} = 1/2, T^M = T^M_A + T^M_B = 5/16\}$, where $T^M$ is the fixed-fee that extracts the entire profit that $R1$ makes in the retail markets, $1/4$ in good $A$ and

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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 \{$(w_M^A, T_M^A)$, $(w_M^B, T_M^B)$\}. Given these offers and the perfect-correlation assumption, there is no reason for $R_1$ to offer bundles in the retail market, so the competition for goods $B$ and $A$ can be treated separately. This implies that for good $A$, $M$ will offer the industry-optimal schedule \{$(w_M^A = 0, T_M^A = 1/4)$\}, appropriating the full surplus.

Regarding product $B$, in turn, competition will drive $M$ to offer \{$(w_M^B = 1/2, T_M^B = 0)$\}, while $S$ will choose the industry maximizing wholesale price $w_S^B = 0$, and a fixed fee of $T_S^B = 3/16$ that leaves $R_1$ just indifferent between purchasing product $B$ from him at the lower marginal cost of zero but conditional on paying a fixed fee (i.e., $1/4 - T_S^B$), and purchasing it from $M$ at wholesale price of $1/2$ and no fixed fee ($1/16$).\(^{13}\) Therefore, $S$ will always be willing to incur the fixed-cost $F$ anticipating profits of $3/16 - F \geq 0$, implying that stand-alone schedules cannot be used by $M$ to evict $S$ from the market. It remains to be seen if this is also the case when $M$ starts offering bundled discounts:

**Proposition 2.** Suppose that $M$ and $S$ supply indirectly to final consumers through a single (monopoly) retailer, $R_1$. Bundling never emerges as a foreclosure strategy.

**Proof.** Suppose $M$ offers the bundled discount \{$(w_M^M, T_M^M)$, $(w_M^{AB}, T_M^{AB})$\}, while $B$ offers \{$(w_B^S, T_B^S)$\}, and denote $\pi(w_M^A, w_B^S, w_M^{AB})$ as the optimal (monopoly) profits $R_1$ makes in the retail market gross of fixed payments. First, it is easy to see that for a sufficiently attractive offer from $S$, $R_1$ will buy either product $A$ or the bundle from $M$, but never both, as this latter would entail having zero demand for at least one of these latter two.

Now, for $R_1$ not to take product $B$ from $S$ it must hold that

$$\pi(\infty, \infty, w_{AB}^M) - T_{AB}^M \geq \max\{\pi(w_A^M, w_B^S, \infty) - T_A^M - T_B^S, \pi(\infty, w_B^S, \infty) - T_B^S\}$$

i.e., that the payoff to $R_1$ of buying exclusively the bundle must be greater than (i) buying both goods separately and (ii) buying only good $B$ from $S$. It is immediately clear that to foreclose $S$ it is optimal for $M$ to set $w_A^M \to \infty$ or $T_A^M \to \infty$, that is, to offer pure-bundling, so as to

\(^{13}\) This is an asymmetric version of the Nash (non-collusive) equilibrium of Nocke and White (2007).

\[1/16\] in good $B$.  

1/16 in good $B$.  

eliminate the option that R1 could just carry A from M and B from S. Therefore, to evict S it must be true that M’s offer satisfies

$$\pi(\infty, \infty, w_{AB}^M) - T_{AB}^M \geq \pi(\infty, w_B^S, \infty) - T_B^S$$

(3)

for all possible offers S can profitably make. Since $$\pi(\infty, w_B^S, \infty)$$ is maximized at $$w_B^S = 0$$ with a value of 1/4, the most defensive offer S can make is $$\{w_B^S = 0, T_B^S = F\}$$.

Hence exclusion requires $$\pi(\infty, \infty, w_{AB}^M) - T_{AB}^M \geq 1/4 - F$$. It is easy to see then, that M’s profits conditional on exclusion are maximized by selling the bundle at marginal cost of $$w_{AB}^M = 1/2$$, and charging a fixed fee that makes the exclusion restriction bind with equality: $$T_{AB}^M = \pi(\infty, \infty, 1/2) - (1/4 - F)$$. This fixed fee is also equal to M’s maximum profits conditional on excluding S. But $$\pi(\infty, \infty, 1/2) = 9/32$$, so $$\pi(\infty, \infty, 1/2) - (1/4 - F) = 1/32 + F$$. However, since $$F \leq 3/16$$, this implies that $$1/32 + F \leq 7/32$$, which is always less than 1/4, the profits M could otherwise make using stand-alone schedules. Hence, foreclosure through bundling is never profitable, and therefore never emerges in equilibrium. ■

The intuition is as follows. By being the gatekeeper to final consumers, a monopoly retailer internalizes in its own profits the individual heterogeneity present in the pool of final consumers. He therefore acts basically as an agent, a representative purchaser, of a grand coalition of final consumers, eliminating thus individual heterogeneity in valuations, which we saw was the key that allowed bundling to deprive single-product rivals of scale economies. This forces manufacturers to compete for retailers’ preference over which products to carry, in terms of created surplus. This is a competition in which a more efficient single-product supplier, just by being more efficient, can always win.

Two important remarks are in order. First, while Proposition 2 is developed under the assumption that M can sell bundles upstream and monitor its distribution a la Cablevision v. Viacom (2013), it is intuitive that M cannot do any better by offering bundled-loyalty rebates instead, as they lessen the extent of control the multi-product manufacturer has over the retailer. Second, despite the fact that this proposition only states that bundling never emerges as a foreclosure strategy, it should also be immediately clear that M will not use them either to accommodate entry instead. This is formally proved in the Appendix, and is artifact of our perfect correlation in valuations assumption. Remember that our goal is to derive necessary conditions for anticompetitive bundling to emerge, so our model is set-up so that the only potential reason for offering bundled discount is foreclosure. This result is extensively used
later on, when characterizing the possibility of foreclosure for arbitrary levels of $\lambda \in (0, 1)$.

### 3.3 Competing retailers

We now move to other extreme situations in which the two retailers, $R_1$ and $R_2$, compete intensely for final consumers in all retail markets ($\lambda = 1$). Consumers see no difference between the two retailers, other than their prices, and do not incur in any extra cost if they purchase the two goods from different retailers. We denote $p_{ij}$ the retail price of product $i$ charged by retailer $R_j$. The next proposition shows that $M$ has no problem in replicating the anticompetitive outcome of Proposition 1.

**Proposition 3.** Suppose that $M$ and $S$ supply indirectly to final consumers through Bertrand retailers $R_1$ and $R_2$. Anticompetitive bundling emerges in equilibrium if $F \geq 1/8$.

**Proof.** We need to show that if $F \geq 1/8$ it is an equilibrium (foreclosure) strategy for $M$ to offer each retailer the bundle schedule $\{ w_{AB}^{Mj} = \sqrt{8F}, T_{AB}^{Mj} = 0 \}$, where $w_{AB}^{Mj}$ is the wholesale price that retailer $j = 1, 2$ pays for the bundle. Suppose then $w_{AB}^{M1} = w_{AB}^{M2} = w_{AB}$, there are two cases to consider depending on whether $S$ makes offers to both retailers or just one. If $S$ decides to make offers to both retailers, Bertrand competition in the retail market forces $S$ to make symmetric linear offers $w_{B}^{S1} = w_{B}^{S2} = w_{B}$. Given these marginal costs, the retail prices that $R_1$ and $R_2$ will charge in equilibrium will be the Bertrand prices $p_{B1} = p_{B2} = w_{B}$ and $p_{AB1} = p_{AB2} = w_{AB}$, for good $B$ and the bundle $AB$, respectively. So, if $S$ anticipates that $M$ will offer $w_{AB}^{M1} = w_{AB}^{M2} = \sqrt{8F}$, according to Proposition 1 the best schedules that $S$ can respond with are $w_{B}^{S1} = w_{B}^{S2} = \sqrt{8F}/4$, which are not enough to cover the fixed cost $F$. In an effort to soften downstream competition, it remains to see whether $S$ can do better by just approaching one retailer, say $R_2$, with the offer $w_{B}^{S2}$. Because now retailers are not identical, one is carrying two products while the other one is just carrying one, this may open up the possibility for a specialization equilibrium in which $R_1$ sells the bundle for $p_{AB1} > w_{AB}^{M1}$ and $R_2$ just sells good $B$ for $p_{B2} > w_{B}^{S2}$. This cannot be an equilibrium, however, since $R_2$ has incentives to slightly undercut $p_{AB1}$ and end up selling both the bundle and good $B$. It is easy to check that the equilibrium prices in the retail market are $p_{AB1} = p_{AB2} = w_{AB}$ and $p_{B2} > w_{B}^{S2}$, where $p_{B2}$ is the best response to a price $w_{AB}$ given a marginal cost of $w_{B}$. But according to Proposition 1, even if $S$ sets $w_{B}$ at zero and extract all $R_2$’s retail rents with a fixed-fee $T_B$, there will

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14Strictly speaking $S$ could achieve the same by offering the schedules $\{ w_{B}^{S1}, T_{B}^{S1} = 0 \}$ and $\{ w_{B}^{S2} < w_{B}^{S1}, T_{B}^{S2} > 0 \}$ with $T_{B}^{S2}$ just enough to extract the rents $R_2$ gets from pricing $B$ slightly below $w_{B}^{S1}$. 
not be enough to pay for the fixed cost $F$ if $M$ sets $w^M_{AB1} = w^M_{AB2} = \sqrt{SF}$. Therefore, when $F \geq 1/8$, $M$ will find it optimal to use these bundle schedules to deter entry; otherwise, he will accommodate to $S$’s entry and just sell good $A$ for $w^M_A = 1/2$. ■

Intuitively, since now the multi-product manufacturer has two perfectly substitutable ways to reach final consumers, margins get squeezed and retailers no longer internalize the individual heterogeneity of the pool of consumers they serve. In the extreme case of perfectly Bertrand competitors, retailers are forced to pass on to final consumers the same prices that they pay upstream, and we end-up as if suppliers were serving final consumers directly. Intense downstream competition hence, recovers Nalebuff’s (2004) exclusionary mechanism.

This underlying mechanism is completely different than the ones developed in the one-product exclusive dealing literature (Simpson and Wickelgren 2007a, 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 manufacturers only need one retailer to reach all final consumers. Interestingly, it is precisely this feature that allows exclusion in this multi-product setting: 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.

In the proof of Proposition 3 the bundled-offers used by $M$ resembled those in Cablevision v. Viacom (2013). However, it is not difficult to show that $M$ can implement the same exclusionary outcome with the bundled-loyalty discounts that we see in 3M v. LePage’s (2003).

**Lemma 2.** If $F > 1/8$, $M$ can induce the exclusionary outcome of Proposition 3 by offering retailer bundled-rebates.

**Proof.** Suppose that $M$ offers the two retailers the possibility to buy goods $A$ and $B$ at wholesale prices $3/4$ each. Retailers are free to buy as many units of each good as they want, but if they buy as many units of good $B$ as of good $A$ they are entitled to a rebate of $3/4 - \sqrt{SF}/2$ per unit bought of each good. To see that this is indeed an (equilibrium) exclusionary offer, notice that if both retailers aim for the rebate, they will charge final consumers $p_{AB1} = p_{AB2} = \sqrt{SF}$ for the bundle (selling $M$’s products this way is the only option for a retailer to comply with $M$’s rebate threshold since the perfect correlation makes mixed-bundling irrelevant; notice, however, that a retailer may still sell some additional units of good $B$ acquired from $S$). What
is $S$’s optimal response to this bundled-discount offer? One option is for $S$ to try to induce one retailer to drop both of $M$’s product. But we know from Proposition 1 that the surplus created by such relationship is unable to cover $S$’s fixed costs, if it has to compete with a “bundle” that is priced in the retail market at $\sqrt{8F}$. An alternative, is for $S$ to try to induce one retailer to multi-source, offering a price for good $B$ to one of the retailers, say $R_2$, so that this retailer decides to combine good $A$ at marginal cost $w_{MA} = 3/4$ with good $B$ from $S$ at marginal cost $w_{SB}$. $R_2$ therefore could offer a bundle to final consumers for slightly less than $R_1$’s price of $\sqrt{8F}$. This would be possible only if by setting $w_{SB} = \sqrt{8F} - w_{MA}$ there is enough demand and margin to cover $S$’s fixed cost $F$, that is, only if

$$\left(1 - \frac{\sqrt{8F}}{2}\right)\left(\sqrt{8F} - w_{MA}\right) \geq F \quad (4)$$

But this is not possible when $w_{MA} = 3/4$. ■

Notice that while Proposition 3 and Lemma 2 are developed around symmetric offerings, $M$ could also achieve the exact same outcome with asymmetric contracts in which one of the retailers ends up being $M$’s exclusive distributor.15 Suppose for instance, that $M$ offers retailers the two-part tariffs \{w_{M1AB} = 1/2, T_{M1AB}^M > 0\} and \{w_{M2AB} = \sqrt{8F}, T_{M2AB}^M = 0\}, respectively, where $T_{M1AB}^M$ is enough to extract all $R_1$’s profit from pricing the bundle $AB$ slightly below $\sqrt{8F}$. It can be checked that $S$ cannot respond to these offers, whether approaching $R_1$ or $R_2$, with a deal that allows him to cover his fixed cost $F$.16

Finally, and following the literature on vertical differentiation and price competition (e.g., Shaked and Sutton 1990, Chen 1997), there is the possibility that $R_1$ and $R_2$ may relax price competition by each choosing to carry a different product, say, $R_1$ the bundle $AB$ and $R_2$ just product $B$, or the other way around. This possibility was rule out in the proof of Proposition 3 because it was implicitly assumed that manufacturers offers, once made, were readily available to the retailers regardless of how much they actually buy from each manufacturer. Some readers may argue that if $R_1$ and $R_2$ must explicitly decide whether to accept or reject these offers, which seems reasonable, this sole action may provide them with enough commitment to soften price competition by just accepting one offer. This possibility is only an artifact of our simplifying assumption of two Bertrand retailers. The moment we add one or more retailers

\textsuperscript{15}This will change if we introduce a bit of product differentiation at the retail level. In this case $M$ will have both retailers carrying his products. This case is covered in the online Appendix.

\textsuperscript{16}For this reason the same applies for the bundled-loyalty discounts. $M$ can approach one of the two retailers with a rebate offer slightly better (i.e., $3/4 - \sqrt{8F}/2 + \varepsilon$) to make her the exclusive distributor.
in the competitive markets the possibility of softening competition is gone since at least two
retailers would be ready, in equilibrium, to accept the exclusionary schedules of Proposition 3.

3.4 Intermediate Levels of Competition

Using the monopoly and Bertrand solutions we now solve the more general case of \( \lambda \in (0, 1) \).

**Proposition 4.** For any \( \lambda \in \left[ \frac{1}{3}, 1 \right] \), there exists a unique function \( F(\lambda) = \frac{7 - 3\lambda}{32} \), which is strictly decreasing in \( \lambda \) and satisfies \( F(1/3) = 3/16 \) and \( F(1) = 1/8 \). If \( F \geq F(\lambda) \), bundling emerges as an equilibrium foreclosure strategy.

**Proof.** See Appendix B. ■

As depicted in Figure 2, \( M \) finds optimal to use bundled discounts to foreclose \( S \) whenever
\( F \geq F(\lambda) \), that is, whenever \( F \) and \( \lambda \) fall in regions II and III. The feasibility of exclusion is jointly determined by the degree of downstream competition and the extent of scale economies, and is moreover “monotonic” in those parameters, implying that exclusion is in some sense more likely the greater \( \lambda \) and \( F \).\(^{17}\)

Figure 2: Exclusionary Equilibrium with Intermediate Levels Competition

Interestingly, when feasible, the optimal foreclosure strategy followed by \( M \) varies in shape
with \( (\lambda, F) \), which explains the presence of Areas II and III in Figure 2. Indeed, as shown in
the proof of Proposition 4, \( M \)’s optimal foreclosure strategy takes the form:

\(^{17}\)Formally, the correspondence \( \varphi : \lambda \mapsto E \), where \( E = \{ F \in [0, \frac{3}{16}] : F \geq F(\lambda) \} \) is ascending in \( \lambda \).
Area II \( \left( \frac{7}{32} - \frac{3\lambda}{32} \leq F < \frac{1}{4} - \frac{\lambda}{8} \right) \):

\[
R1 : \{ w_{AB}^{M1} = 1/2, T_{AB}^{M1} = (1 + 3\lambda) / 32 + F \}
\]
\[
R2 : \{ w_{AB}^{M2} = 1, T_{AB}^{M2} = 0 \}
\]

Area III \( \left( \frac{1}{4} - \frac{\lambda}{8} \leq F \leq \frac{3}{16} \right) \):

\[
R1 : \{ w_{AB}^{M1} = 1/2, T_{AB}^{M1} = (41 - 57\lambda) / 32 - 4F + (5/4)\lambda w_{AB}^{M2} \}
\]
\[
R2 : \{ w_{AB}^{M2} = (1/\lambda) \sqrt{8\lambda F - 2\lambda(1 - \lambda)}, T_{AB}^{M2} = 0 \}
\]

To understand this results it is instructive to begin by characterizing the standalone schedule equilibrium that would prevail in the absence of bundled-discounts. In this case, \( M \) and \( S \) equilibrium offers are:

\[
R1 : \{w_{A}^{M1} = 0, T_{A}^{M1} = 1/4\}, \{w_{B}^{M1} = 1/2, T_{B}^{M1} = 0\} \text{ and } \{w_{B}^{S1} = 0, T_{B}^{S1} = (3/16) + (\lambda/16)\}
\]
\[
R2 : \{w_{A}^{M2} = 1/2, T_{A}^{M2} = 0\}, \{w_{B}^{M2} = 1/2, T_{B}^{M2} = 0\} \text{ and } \{w_{B}^{S2} = 1/2, T_{B}^{S2} = 0\}
\]

Only products \( A \) from \( M \), and \( B \) from \( S \) are then put available by retailers to final consumers, and at equilibrium retail prices \( p_{A}^{R1} = p_{A}^{R2} = 1/2 \) and \( p_{B}^{R1} = p_{B}^{R2} = 1/2 \). Pricing is therefore independent on whether we are considering a monopoly or a Bertrand market. Profits finally, are given by \( \pi^{M} = 1/4, \pi^{S} = (3 + \lambda)/16 - F \geq 0 \) (so \( S \) always pays \( F \)), \( \pi^{R1} = (1 - \lambda)/16 \) and \( \pi^{R2} = 0 \).

Returning to the characterization of the optimal foreclosure scheme, notice that \( M \)'s optimal contract always take the form \( \{w_{AB}^{M1} = 1/2, T_{AB}^{M1}\} \), and \( \{w_{AB}^{M2} \geq w_{AB}^{M1}, T_{AB}^{M2} = 0\} \), that is \( R1 \) ends up being the exclusive distributor of \( M \)'s product. Otherwise, the contract would produce an inefficient amount of double-marginalization in the monopoly markets and/or too much rent dissipation in the competitive ones.\(^{18}\)

Now, in Area II downstream competition is not that intense and \( S \) is relatively more efficient. Hence, faced with the decision on whether to carry both of \( M \)'s product or only \( S \)'s product \( B \), \( R1 \) has a more attractive outside option, since a potential relationship with \( S \) is able to generate more surplus. This induces \( M \) to lower the wholesale price \( w_{AB}^{M2} \) to 1 in an attempt to lower \( R1 \)'s outside option, as \( w_{AB}^{M2} \) determines the retail price in the \( \lambda \)-Bertrand markets. Although

\(^{18}\)This result, which also holds for the standalone equilibrium benchmark, greatly simplifies the analysis and is due to the fact that \( R2 \) is only present in the \( \lambda \)-Bertrand markets, while \( R1 \) is present in all. An \( \epsilon \)-degree of differentiation would suffice to arrive to the more realistic case in which, on equilibrium, both retailers end up selling strictly positive quantities of \( M \)'s product.
$M$ is then obtaining zero from selling good $B$ in this $\lambda$ competitive markets when compared to the standalone equilibrium benchmark, if $F \geq \frac{7}{32} - \frac{3\lambda}{32}$, this is more than compensated with the profits $M$ is able to extract from $R1$, who is now selling both of $M$’s product in the $1 - \lambda$ markets at a joint (monopoly) price of $5/4$. Finally, as we approach Area III, $R1$’s outside option decreases, and $M$ can start increasing $w_{AB}^M$ without losing his grip over $R1$. This produces an increase in the price of the bundle in the competitive markets also, to $p_{AB} = (1/\lambda)\sqrt{8\lambda F - 2\lambda(1 - \lambda)}$ (which approaches $\sqrt{8F}$ as $\lambda \to 1$), allowing $M$ to start reaping additional benefits from selling its product $B$ at a profit in the $\lambda$ Bertrand markets.

**Welfare Analysis and Consumer Surplus:** when compared to the standalone equilibrium benchmark, foreclosure has a detrimental effect not only on overall welfare, as a more efficient supplier of product $B$ is excluded from the market, but also in consumer surplus. In Area II, while consumers in the competitive markets are exactly as before, consumers in the monopoly markets now face a higher price of $5/4$, instead of $1$, for one unit of both goods. The impact of bundling on consumer surplus is even higher in Area III, as now consumers in the $\lambda$ competitive markets now also face a price of $(1/\lambda)\sqrt{8\lambda F - 2\lambda(1 - \lambda)} > 1$ for the bundle.

Moreover, not only rival manufacturers and consumers are affected, but also retailers are made worse-off.\footnote{R1 obtains $\pi^{R1} = (1/4) - (\lambda/8) - F$ and $\pi^{R1} = 0$ in Areas II and III respectively, both of which are less than $(1 - \lambda)/16$, his payoff in the standalone equilibrium benchmark. On the other hand, $R2$, by construction, always get 0, independently on whether there is foreclosure or not.} This fact is consistent with the diverse range of parties usually initiating antitrust suits. For instance, 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 (2003), or one of the distributors, as in Cablevision v. Viacom (2013). Furthermore, it provides an interesting contrast with the models of exclusion and downstream competition developed in the one-product setting of the exclusive dealing literature, which predict that retailers are no-worse, and sometimes even strictly better-off, by the incumbent’s anticompetitive scheme (Simpson and Wickelgren 2007a, Abito and Wright 2008, and Asker and Bar-Isaac 2014).

### 3.5 Extensions

We extend our model to discuss the following:

- what if we add more monopoly products, say $C$,...we extend the range of exclusion...this was important in 3M. But how important? Does it matter the correlation in valuations
between C and A?

• Price discrimination at the wholesale level. One can imagine, for example, a situation in which $M$ tells a retailer that bundles are only available in some retail markets but not in others where products must be sold in a stand-alone fashion. Similarly, one can imagine $S$ making different discount offers depending on the level of retail competition. This won’t affect the extreme cases of monopoly and Bertrand competition but it likely does the cases of imperfect competition by changing the “foreclosure” cutoff $F(\lambda)$. It is not obvious to us in which way. On the one hand, allowing for price discrimination at gives $M$ more flexibility to design a foreclosure strategy. But it also gives $S$ more flexibility to respond. Our question is whether price discrimination makes foreclosure more or less likely.

• what if fixed costs are at the retail market level... it is obvious that this generates partial foreclosure when there is wholesale price discrimination (back to our results), but the more interesting case is that it also may generate partial foreclosure when there is no price discrimination

• what if $M$ also wants to use bundling in the absence of an entry threat? Consider the square city...

4 Exploiting scale economies

We have seen that scale economies is one of the key ingredients for exclusion. In our model it is has been captured by the cost $F$ that $S$ must incur to stay in business, but one can think of alternative ways of capturing them, from learning-by-doing, demand-side externalities, volume discounts paid by manufacturers to input suppliers, etc. The question is whether alternative ways of capturing these scale economies can have any implications for our results. As we will see next, the answer is yes and no.

4.1 Fixed vs sunk costs

In many economic models it does not make much of a difference whether $F$ is treated as a one-time (sunk) cost or as fixed cost that is paid overtime.\footnote{A notable exception is Baumol and Willing (1981) which explain that the distinction between sunk and fixed is crucial for their contestable theory, and actually, the implications are exactly the opposite that we get.} So far it has been $M$ who has
exploited this cost $F$ to his advantage. There is the question, however, as to whether $S$ could instead exploit it to his advantage. Suppose $F$ is better interpreted as a one-time cost that $S$ must pay to enter the market. If $S$ can find a way to commit ex-ante that he will pay $F$ no matter what, then exclusion is not possible in our baseline model. Having the ability to do that, for example by letting $S$ to pay $F$ before suppliers make their offers on date 1, transforms $S$ in a very strong competitor ex-post with a marginal cost of zero.

This non-exclusionary result remains even if $M$ does not observe $S$’s investment decision before making his offer on date 1. To see why suppose a slight change on the game leading to Proposition 1 so on date 1 suppliers not only simultaneously announce their prices to consumers but also $S$ decides whether to pay $F$ or not. It is easy to see that the equilibrium outcome of the game is one in which $S$ pays $F$ and announces $p^S_B = 1/2 - \varepsilon$ and $M$ announces $p^M_A = p^M_B = 1/2$.

Why is this result radically different from the one in Proposition 1? It is because the distinction between sunk and fixed is crucial in this context. So far we have assumed that $F$ is a fixed cost, that could be paid quite rapidly overtime but not instantaneously as it would be if it were a sunk entry cost. To be more precise, suppose that as a result of learning-by-doing the cost of production of $S$ can be captured by the non-increasing marginal cost function

\[ C'_S(q^S_B) = -2F \ln(2q^S_B) \]

for $q^S_B < 1/2$ and $C'_S(q^S_B) = 0$ for $q^S_B \geq 1/2$, so that $C_S(q^S_B) = F$ for $q^S_B \geq 1/2$. This functional form ensures that the equilibrium in the absence of bundling is the same as when $F$ is sunk.

Given this cost function, what are the equilibrium prices that $M$ and $S$ will announce on date 1? The answer is in the following lemma.

**Lemma 3.** Given the non-increasing marginal cost function above, there is an exclusionary (bundling) equilibrium where $p^M_{AB} = \sqrt{8F}$ and $p^S_B = 2\sqrt{8F} - 3/2$.

**Proof.** See the Appendix. ■

The outcome is the same as in Proposition 1. It is a limit pricing equilibrium.\(^{21}\)

We have established that if $F$ is a (one-time) entry cost, then it provides $S$ with commitment and foreclosure is not possible. However, if $F$ is something to be paid gradually over time, as most examples would suggest, then exclusion arise as established in Proposition 1, no matter

\(^{21}\)There are other equilibria, all exclusionary, that are less profitable for $M$. The least profitable is $p^M_{AB} = 1$ and $p^S_B = 1/2$, which can be ruled out with a trembling hand refinement. See Appendix.
how rapid is paid. It is now M how can commit to low enough prices because he correctly
anticipates that S will stay away of the market the minute production starts.

4.2 Ex-post commitment

Even if F is sunk, and S has the oppotunity to invest first, we want to show now that exclusion
is still posible in a setting where consumers’ valuations exhibit no correlation, which is the case
covered by Nalebuff (2004). To simplify the exposition consider the case in which suppliers serve
final consumers directly. Consumers’ valuations are uniformly distributed over the unit square
(see picture in Nalebuff, for example). Unlike in our perfect-correlation setting, zer-correlation
implies that M will bundle even in the absence of an entry threat.

As before M produces good A at no cost and B at cost c per unit. S, on the other hand,
produces good B at no cost, but before competing for final consumers must incur a fixed entry
cost of F. Again, this latter is such that it is industry optimal to pay F to produce both goods
at zero cost. The only change in the timing is that S decides first, say, on date 0, whether to
enter and pay F or not. If S decides to do so, S and M set prices simultaneously.

There are two cases to consider in the post-entry game. The first is when M is restricted to
uniform pricing (p_A^M and p_B^M), which is trivial. There is always entry because S is more efficient
in the production of B. In this case M’s payoff is 1/4, as before, because the correlation plays no
role for stand-alone pricing. The second case is when M is free to offer a bundle. For simplicity
we will restrict attention to pure bundling (p_{AB}^M), but it is obvious that in this zero-correlation
setting mixed-bundling will emerge in equilibrium and will make foreclosure cheaper for M
(these calculations are in the online Appendix).

If M offers the bundle AB for p_{AB}^M, S’s best response is

\[ p_{AB}^S(p_{AB}^M) = \left( 1 + p_{AB}^M - \sqrt{1 - p_{AB}^M + (p_{AB}^M)^2} \right) / 3 \]

If, on the other hand, S offers B for p_B^M, M’s optimal response is (better than just p_A^M)

\[ p_{AB}^M(p_B^S) = \left( 2 + 2c + 2p_B^S - (p_B^S)^2 \right) / 4 \]

For example, if we take c = 0.2 the equilibrium outcome is p_{AB}^M = 0.719 and p_B^S = 0.275. This
leads to payoffs \( \pi_M = 0.269 > 0.25 \) (this latter is M’s payoff from stand-alone pricing, i.e., his
outside option) and \( \pi_S = 0.088 \). There will be foreclosure if 0.088 < F ≤ 0.128, where this
latter is the industry-optimal threshold. Why is bundling so effective to foreclose (efficient)
entry even in this setting where $S$ can move first and pay $F$? This heterogeneity in consumers' valuations provides $M$ with the necessary ex-post commitment that he will bundle even if $S$ decides to enter. We can now consider the wholesale market and the results of Propositions 2, 3 and 4 carry through. That is, exclusion is possible only if there is enough downstream competition.

5 Discussion and final remarks

To be written....

- conectar single-product and multi-product discounts.....
- are we talking about Greenlee?
- mechanism
- retailers worse off....

References


APPENDIX

A. Accommodating entry with bundled discounts: Monopoly retailer case

We show that $M$ accommodates to $S$’s entry with offers that may or may not include bundled discounts. The reason for the indifference is that bundles are not sold in equilibrium; their inclusion only affect $S$ and $R_1$’s payoffs.

Lemma A - 1. Comparing to the case where $M$ uses stand-alone schedules, the entry equilibrium with bundled discounts leaves $M$ no better-off (both with a payoff of 1/4), $S$ strictly better off (with a payoff of $7/32 - F$ against $3/16 - F$), and $R_1$ strictly worst-off (with a payoff of $1/32$ against $1/16$).

Proof. Suppose that $S$ offers the schedule $\{w^S_B = 0, T^S_B \geq F\}$ such that $\pi(\infty, 0, \infty) > T^S_B$, otherwise $R_1$ will never buy from $S$, and $M$ offers the mixed-bundling schedule $\{(w^M_A = 0, T^M_A), (w^M_{AB} = 1/2, T^M_{AB})\}$ that secures himself to sell good $A$, whether alone or as part of a bundle. We start by asking what is $M$’s best response to $S$’s offer. Since $R_1$ will buy from $M$ according to either $\{w^M_A = 0, T^M_A\}$ or $\{w^M_{AB} = 1/2, T^M_{AB}\}$, $M$’s optimal response is to induce $S$ to take whichever generates the largest fixed-fee, $T^M_A$ or $T^M_{AB}$. If $T^M_A$ is the largest of the two for a given $T^S_B$, it must be true that $R_1$ prefers to buy $A$ from $M$ and $B$ from $S$ than to just buy good $B$ from $S$.

\[
\pi(0, 0, \infty) - T^M_A - T^S_B \geq \pi(\infty, 0, \infty) - T^S_B
\]

where $\pi(0, 0, \infty) = 1/2$ is $R_1$’s retail profit when buying $A$ from $M$ and $B$ from $S$ at no cost. From (5) we have that $T^M_A \leq \pi(0, 0, \infty) - \pi(\infty, 0, \infty)$, so if selling just $A$ is $M$’s optimal response, then $T^M_A = \pi(0, 0, \infty) - \pi(\infty, 0, \infty)$. Notice that to complete $M$’s optimal response, $T^M_{AB}$ is set large enough that $R_1$ does not take the bundling option, that is, $\pi(0, 0, \infty) - T^M_A - T^S_B \geq \pi(\infty, \infty, 1/2) - T^M_{AB}$, where $\pi(\infty, \infty, 1/2) = 9/32$ is $R_1$’s retail profit when buying the bundle for 1/2 and selling it for 5/4.

If instead $T^M_{AB}$ is the largest of the two fixed-fees for a given $T^S_B$, so that selling the bundle $AB$ is $M$’s optimal response, it must be true that $R_1$ prefers to buy the bundle $AB$ than to just buy $B$ from $S$.

\[
\pi(\infty, \infty, 1/2) - T^M_{AB} \geq \pi(\infty, 0, \infty) - T^S_B
\]

Thus, if $M$’s best response is to sell the bundle, then $T^M_{AB} = \pi(\infty, \infty, 1/2) - \pi(\infty, 0, \infty) + T^S_B$. As shown in Figure A1, when $T^S_B \leq \pi(0, 0, \infty) - \pi(\infty, \infty, 1/2)$, $M$’s best response is to sell only
A by charging $T_M^A = \pi(0, 0, \infty) - \pi(\infty, 0, \infty)$, whereas when $T_S^B > \pi(0, 0, \infty) - \pi(\infty, \infty, 1/2)$, $M$’s best response is to sell the bundle by charging $T_{AB}^M = \pi(\infty, \infty, 1/2) - \pi(\infty, 0, \infty) + T_B^S$.

We can now use these best responses to complete the characterization of the equilibrium offers. Since $S$ optimal response to $M$’s play is to charge the largest possible fee that guarantees $R_1$ will carry his product in equilibrium, an obvious equilibrium candidate is for $S$ to charge $T_S^B = \pi(0, 0, \infty) - \pi(\infty, \infty, 1/2) - \epsilon$ (see Figure A1) and for $M$ to sell good $A$ for a fixed-fee of $T_A^M = \pi(0, 0, \infty) - \pi(\infty, 0, \infty) = 1/4$. But for this to be the equilibrium outcome, $M$’s equilibrium strategy must also include an offer for the bundle, even if it is not actually taken by $R_1$, otherwise $S$ could increase $T_B^S$ without losing the sale (and if so, $M$ will rather sell the bundle and so on). Thus, an schedule for the bundle of $\{w_{AB}^M = 1/2, T_A^M = T_{AB}^M = \pi(0, 0) - \pi(\infty, 0)\}$ completes $M$’s equilibrium offer.

Figure A1: $M$’s Best Response

Note: $\pi_0 \equiv \pi(0, 0, \infty)$, $\pi_1 \equiv \pi(\infty, 0, \infty)$ and $\pi_2 \equiv \pi(\infty, \infty, 1/2)$, where $\pi(w_M^A, w_S^B, w_{AB}^M)$ are the optimal (monopoly) profits $R_1$ makes in the retail market gross of fixed payments.

B. Proof of Proposition 4

Following Propositions 2 and 3, $M$’s optimal foreclosure strategy necessarily involves offering pure-bundling to both retailers, as mixed-bundling makes multi-sourcing more attractive and exclusion more costly. $M$’s problem then, is to choose the set of two-part tariffs $\{w_{AB}^{M1}, T_{AB}^{M1}\}$
and \(\{w_{AB}^{M2}, T_{AB}^{M2}\}\) that maximize the profits of the \(M - R1 - R2\) vertical structure, conditional on foreclosing \(S\). From here, it is easy to see that the set of optimal contracts for \(M\) must take the form \(\{w_{AB}^{M1} = 1/2, T_{AB}^{M1}\}\), and \(\{w_{AB}^{M2} \geq w_{AB}^{M1}, T_{AB}^{M2} = 0\}\), where \(T_{AB}^{M1}\) and \(w_{AB}^{M2}\) are chosen to satisfy the exclusion of \(S\) and the participation constraints of each retailer. Otherwise, the contract would produce an inefficient amount of double-marginalization in the monopoly markets and/or too much rent dissipation in the competitive ones, and therefore the contract could be improved upon while still sustaining foreclosure.

We now show that for similar reasons, manufacturer \(S\) best defense strategy always involves approaching only one retailer, say \(Rj\), with an offer \((w_{Bj}^{S1}, T_{Bj}^{S1})\) and \((w_{Bj}^{S2}, T_{Bj}^{S2})\) be \(S\)’s offers. If \(w_{Bj}^{S1} < w_{Bj}^{S2}\), then in the event of entry only \(R1\) sells \(S\)’s good. Hence, the optimum is to set \(w_{Bj}^{S2}\) 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 have more surplus to fight-off exclusion. This is equivalent as making no offer to \(R2\) at all. The case \(w_{Bj}^{S1} > w_{Bj}^{S2}\) follows a similar logic. Finally, consider \(w_{Bj}^{S1} = w_{Bj}^{S2}\). This necessarily implies that \(T_{Bj}^{S2} = 0\) since \(R2\) would be making zero profits. But then \(w_{Bj}^{S1} = w_{Bj}^{S2}\) cannot be optimal, as \(S\) could improve the profits of the vertical structure by setting \(w_{Bj}^{S1} < w_{Bj}^{S2}\), and reducing the amount of double-marginalization in the monopoly \(1 - \lambda\) markets and/or the rent dissipation in the \(\lambda\) competitive ones. Hence, \(S\) optimal defensive strategy is to always approach only one retailer, say \(Rj\). But if so, his contract must maximize the profits of the vertical structure \(S - Rj\), so \(w_{Bj}^{S1} = 0\), and therefore the most defensive contract \(S\) could offer would be \((w_{Bj}^{Sj} = 0, T_{Bj}^{Sj} = F)\).

We know therefore that in our candidate exclusionary equilibria \(M\) is offering \(\{w_{AB}^{M1} = 1/2, T_{AB}^{M1}\}\), and \(\{w_{AB}^{M2}, T_{AB}^{M2} = 0\}\). His profits then are equal to \(T_{AB}^{M1}\) and \(w_{AB}^{M2}\) must be chosen such that both \(R1\) and \(R2\) individually prefer to sell the bundle, when only one of them faces the offer \((w_{Bj}^{S1} = 0, T_{Bj}^{Sj} = F)\) and the other does not have an standing offer from \(S\) at all. \(R1\) will choose to do that, whenever

\[
\frac{9}{32}(1 - \lambda) + \lambda(w_{AB}^{M2} - 1/2) - T_{AB}^{M1} = \max \left\{ 0, \frac{1 - \lambda}{4} + \frac{\lambda(w_{AB}^{M2})^2}{8} - F \right\}
\]

(7)

that is, whenever the profits he gets by selling the bundle in the monopoly markets \((9/32)(1 - \lambda)\) at the monopoly price of 5/4, plus the profits obtained in the competitive markets minus the fixed fee, are greater than (i) the profits of doing nothing, and (ii) the profits \((1/4)(1 - \lambda)\) of selling good \(B\) at a price of 1/2 in the \(1 - \lambda\) monopoly markets, plus the profits of selling \(S\)’s product in the competitive market when \(R2\) has a wholesale marginal cost of \(w_{AB}^{M2}\) for the
bundle, \((\lambda/8)(w_{AB}^{M2})^2\), minus the fixed fee \(T_B^{M1} = F\). Similarly for \(R2\), he will sell the bundle whenever \((\lambda/8)(w_{AB}^{M1})^2 - F \leq 0\), that is, whenever the profit of selling only \(S\)'s product is non-positive, which is what he is getting with \(M\)'s contract. But \(w_{AB}^{M1} = 1/2\), so this translates in to \((\lambda/32) - F \leq 0\). Hence a necessary condition for exclusion is \((\lambda/32) \leq F\).

\(M\)'s optimal exclusionary contract, and therefore our candidate foreclosure equilibrium, maximizes \(T_B^{M1}\) subject to conditions (7), provided that \((\lambda/32) \leq F\). The solution considers two cases. The first is when the value of curly bracket is strictly positive and the second case when the value curly bracket is zero.

1. If \(F < \frac{1}{4} - \frac{\lambda}{8}\), \(M\)'s optimal foreclosure strategy is given by \(T_B^{M1} = (1/32) + (3/32)\lambda + F\) and \(w_{AB}^{M2} = 1\).

2. If \(F \geq \frac{1}{4} - \frac{\lambda}{8}\), \(M\)'s optimal foreclosure strategy is given by \((41 - 57\lambda)/32 - 4F + (5/4)\sqrt{8\lambda F - 2\lambda(1 - \lambda)}\) and \(w_{AB}^{M2} = (1/\lambda)\sqrt{8\lambda F - 2\lambda(1 - \lambda)}\)

We still need to verify whether this optimal contract leaves \(M\) better off than just offering standalone schedules, which reports a payoff of \(1/4\). So, consider first the case where \(F < \frac{1}{4} - \frac{\lambda}{8}\). Then \(M\)'s profits, which are equal to \(T_B^{M1}\), are greater than or equal to \(1/4\) if

\[F \geq E_1(\lambda) = \frac{7 - 3\lambda}{32}\]

which implies that exclusion is profitable only when \(E_1(\lambda) \leq F \leq \frac{1}{4} - \frac{\lambda}{8}\). Consider now the case where \(F \geq \frac{1}{4} - \frac{\lambda}{8}\), then \(M\)'s profits, which are again equal to \(T_B^{M1}\), are greater than or equal to \(1/4\) whenever

\[F \geq E_2(\lambda) = \frac{33 - 7\lambda}{128} - \frac{5\sqrt{\lambda}}{64}\]

But if \(F \geq \frac{1}{4} - \frac{\lambda}{8}\), we have that \(F \geq E_2(\lambda)\) always. Therefore, exclusion is always profitable when \(F \geq \frac{1}{4} - \frac{\lambda}{8}\). Hence \(E(\lambda) = E_1(\lambda)\). It is clear then that \(E(\lambda)\) is strictly decreasing in \(\lambda\), and satisfies \(E\left(\frac{3}{4}\right) = \frac{3}{16}\) and \(E(1) = \frac{1}{8}\). Hence, exclusionary equilibria exists for some \(F \leq 3/16\), whenever \(\lambda \geq 1/3\).