Slotting Allowances and Optimal Product Variety*

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Abstract

Many commentators believe that slotting allowances enhance social welfare by providing retailers with an efficient way to allocate scarce retail-shelf space. The claim is that, by offering its space to the highest bidders, each retailer acts as an agent for consumers and ensures that only the most socially desirable products obtain distribution. I show that this claim does not hold in a model in which a dominant firm and competitive fringe compete for retailer patronage. By using slotting allowances to bid up the price of shelf space, the dominant firm can sometimes exclude its fringe rivals even when welfare would be higher if the fringe obtained distribution. The welfare loss due to the resulting higher retail prices and suboptimal variety can be substantial.

Key Words: Slotting allowances, Exclusive dealing, Vertical restraints

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I Introduction

The pace of new-product launches in recent years has contributed to making retail-shelf space scarce, especially in the grocery industry. According to one prominent industry analyst, “The typical supermarket has room for fewer than 25,000 products. Yet there are some 100,000 available, and between 10,000 and 25,000 items are introduced each year.”¹ Retailers must choose among more product categories and more products per category than at any time in the past. This proliferation of new products has intensified competition among manufacturers for the limited store space.

The scarcity of shelf space affects new and established products alike. In many instances, manufacturers are opting (or forced) to pay retailers for their patronage with upfront money. Manufacturers of new products typically pay ‘slotting fees’ to secure a spot on a retailer’s shelf and in its warehouse, while manufacturers of established products pay ‘facing allowances’ ostensibly to buy improved shelf positioning. End-aisle displays are paid for with ‘street money,’ and contributions to ‘market development funds’ help subsidize retailer advertising and promotional programs.

Many industry participants express concern that these payments to secure retailer patronage, known more generally as slotting allowances, may differentially affect large and small manufacturers and thus may be anticompetitive.² Small manufacturers (or makers of new products) often claim that having to pay for retail-shelf space puts them at a disadvantage relative to large manufacturers (or makers of established products) who can afford to pay more. They argue that, by bidding up the price of scarce shelf space, these larger firms can effectively foreclose them from the marketplace.

This concern has been echoed in congressional committees overseeing small business concerns, and in reports by the U.S. Federal Trade Commission and the Canadian Bureau of Competition on marketing practices in the grocery industry.³ The implication is that the products that obtain

¹Tim Hammonds, president of the U.S. Food Marketing Institute, Hammonds and Radtke (1990), p. 48. See also http://www.fmi.org/facts-figs/superfact.htm (last visited October 24, 2004). According to the Food Marketing Institute, a conventional supermarket carries approximately 15,000 items whereas a superstore (defined as a larger version of a conventional supermarket with at least 40,000 square feet in selling area) carries about 25,000 items.
²See Bloom, Gundlach, and Cannon (2000) for an overview of potential anticompetitive uses of slotting allowances.
distribution may not be socially optimal, and therefore slotting allowances may be anticompetitive.

An alternative view is that slotting allowances enhance social welfare by providing retailers with an efficient way to allocate scarce retail-shelf space. Because slotting allowances enable retailers to choose which products to carry on the basis of willingness-to-pay, many commentators allege that these payments serve as a screening device to weed out less socially desirable products. The typical story posits that each manufacturer possesses private information about whether its product will be a ‘success’ or ‘failure’ in the marketplace. Slotting allowances provide a credible way for manufacturers to convey this information to retailers. Those manufacturers who are willing to pay the most for shelf space signal that their products will be more profitable and hence will provide ‘better value’ to consumers than those products which, if sold, would fail.\(^4\) According to this view, if small manufacturers are excluded from distribution because they are willing to pay less than large manufacturers to secure shelf space, then it must be because they produce an inferior product.

This line of reasoning presumes that allocating scarce shelf space according to willingness-to-pay ensures socially optimal product variety. While this presumption may seem intuitive, it ignores two fundamental aspects of intermediate-goods markets. First, unlike in standard consumer theory where buyers’ valuations are independent, a manufacturer’s willingness-to-pay for shelf space will depend, among other things, on the degree of substitution among the competing products. The more substitutable are the products, the more a manufacturer will be willing to pay to acquire shelf space in order to avoid competing with its rivals. Second, unlike in standard consumer theory where individual buyers are too insignificant to affect price, the price of shelf space to any one manufacturer is endogenously determined by the amount a retailer can earn by selling its most profitable alternative. This allows manufacturers to be strategic in the sense that each can raise its rivals’ cost of obtaining shelf space simply by increasing its own offer of slotting allowances.

In this article, I consider a model in which a dominant firm and competitive fringe compete for retailer patronage and show that the dominant firm can sometimes use slotting allowances to exclude its rivals even when its product is less socially desirable (welfare would be higher if the

fringe obtained distribution). If the dominant firm opts to induce exclusion, it must pay slotting allowances to the retailers, but it can then choose the rest of its contract terms to capture the monopoly profit on its product. In contrast, if the dominant firm opts to accommodate the fringe, it can save on slotting allowances, but it must then suffer from more competitive retail pricing (which lowers the overall joint profit of the firms) because of the entry of a competitor. I find that the dominant firm is more likely to induce exclusion the more substitutable are the firms’ products.

The strategy of raising rivals’ costs was first advanced by Salop and Scheffman (1983) and elaborated on by Krattenmaker and Salop (1986). In this article, slotting allowances raise rivals’ costs because they are the means by which the dominant firm bids up the price of an essential input (the retailers’ shelf space). The dominant firm prefers to pay for scarce shelf space with slotting allowances rather than with wholesale price concessions because the former goes directly to the retailers’ bottom line, whereas the latter is mitigated by retail price competition. In other words, slotting allowances allow the dominant firm to compensate retailers for their scarce shelf space without having to distort its wholesale price, which in turn would reduce overall joint profit.

In related work, Chu (1992) finds that slotting allowances can effectively screen among manufacturers of high and low demand products. In his model, the retail sector is monopolized, the price of shelf space is exogenous, and a manufacturer’s willingness-to-pay is positively correlated with its product’s social desirability. The latter presumption, of course, is the focus of this paper. Shaffer (1991) considers why retailers with monopsony power prefer to use their bargaining strength to obtain slotting allowances rather than lower wholesale prices. In his model, retailers who receive slotting allowances not only benefit directly from an upfront payment, but they also benefit indirectly from reduced downstream price competition. By not seeking wholesale price concessions, a retailer essentially announces its intention to be less aggressive in its pricing. Other firms are induced to raise their retail prices, and the original firm gains through the feedback effects. Because the manufacturers’ products are homogeneous, however, product variety is a non-issue in his model.

The rest of the paper is organized as follows. Section II presents the model and notation. Section III examines the role of slotting allowances in raising rivals’ costs and characterizes when
II The Model

Manufacturers often compete to secure retailer patronage for the purpose of having their products distributed to final consumers. Obtaining access to retail-shelf space is imperative in many consumer-goods industries, especially when the technology of distribution is such that it is prohibitively costly for a manufacturer to enter the downstream market to sell only its product. Shelf space is typically limited, however, and thus some manufacturers’ products will be excluded. When this happens, two important questions are: will the ‘right’ products be excluded, and what effect will slotting allowances have on the retailers’ choices? That is, do slotting allowances enhance social welfare by providing retailers with an efficient means of allocating scarce retail-shelf space (as some theories imply), or are there circumstances in which slotting allowances facilitate the ‘wrong’ products being sold? If the latter, what factors contribute to making this more or less likely?

To answer these questions, and to focus on the environment that is of greatest interest to policy makers (small manufacturers of new products competing against an incumbent, dominant firm), I model the initial situation by assuming there is a local market in which two retailers operate (the model easily extends to \( n \geq 2 \) retailers). In addition to any other (unrelated) products they may sell, each retailer may carry either product A or B but not both. One can think of the retailer’s shelf space as being divided into slots of fixed width and depth, where adequate distribution requires that each product obtain at least one slot. The assumption that the retailer cannot carry both products thus implies that the number of available slots is less than the number of products.

Product A is produced at constant marginal cost \( c_A \) by a dominant firm, and product B is produced at constant marginal cost \( c_B \) by a competitive fringe of smaller rivals. Products A and B are imperfect substitutes in the sense that an increase in the retail price of one leads to an increase in consumer demand for the other. However, for now, I assume that the retailers themselves do not add any differentiation (the effect of this assumption is discussed in section IV). This means that consumers will buy from whichever retailer offers the lower price if both retailers sell the same
product. Aside from their limited shelf space, retailers have no other source of bargaining power.

The assumption that product B is produced by a competitive fringe is made to capture the concerns of small manufacturers that slotting allowances can be used by dominant firms to exclude them from the marketplace. The assumption that retailers have no other source of bargaining power accords with claims made by retailers that slotting allowances are ‘cost-based’ and merely compensate them for the opportunity cost of their shelf space. More generally, one can imagine that retailers with more bargaining power may negotiate higher slotting allowances, but then Robinson-Patman Act concerns (the U.S. law that pertains to price discrimination in business-to-business selling), where one retailer claims that it is disadvantaged relative to another, may become an issue.

The game consists of four stages. As described below, there is an initial contracting stage, an accept-or-reject stage, a recontracting stage (if feasible), and a pricing stage. Players at each stage are assumed to choose their actions knowing the effects of such actions on all succeeding stages.

In the initial contracting stage, the dominant firm offers to both retailers a take-it-or-leave-it two-part tariff contract. Let $w_A$ denote the per-unit ‘wholesale’ price, and let $F_A$ denote the fixed fee. The fixed fee can be positive (the retailer pays the fee to the manufacturer) or negative (the manufacturer pays the fee to the retailer). With slotting allowances, the manufacturer pays the retailer to carry its product, and thus slotting allowances correspond to a negative fixed fee.

In the accept-or-reject stage, retailers simultaneously and independently choose whether to accept the dominant firm’s terms. Acceptance implies that the fixed fee exchanges hands and the retailer commits to carrying product A (instead of product B). Rejection implies that the retailer carries product B and purchases from the competitive fringe at marginal cost $c_B$. Thus, if both retailers accept the dominant firm’s terms, both retailers carry product A and purchase from the dominant firm at the per-unit price $w_A$. In this case, there is no scope for bilateral recontracting (recontracting with only one firm) and the game proceeds directly to the pricing stage.\(^5\) If both retailers reject the contract terms, the dominant firm exits the market, and both retailers carry product B. Once again the game proceeds directly to the pricing stage. If only one retailer accepts

\(^5\)The Robinson-Patman Act, which makes it unlawful for a seller “to discriminate in price between different purchasers of commodities of like grade and quality” where substantial injury to competition may result, requires that the dominant firm treat both retailers the same if both sell its product. See American Bar Association (1980).
the dominant firm’s terms, then that retailer carries product A and its rival carries product B. In this case, bilateral recontracting is feasible and so the game proceeds to the recontracting stage.

The recontracting stage occurs when only one retailer, say retailer $i$, accepts the dominant firm’s offer. In this case, the dominant firm and retailer $i$ may want to recontract to maximize their joint payoff given that the rival retailer is carrying product B. I model this by assuming that the dominant firm can offer a new take-it-or-leave-it two-part tariff contract to retailer $i$. Retailer $i$ either accepts the new contract offer and agrees to purchase under the new contract terms, or it rejects the new contract offer and purchases under the terms of its original contract. The pricing stage ensues with each player purchasing according to the contract terms in effect for that player.

The pricing stage is the last of the four stages. Here some additional notation is needed. Let $P_i$ denote the price set by retailer $i$, $i = 1, 2$, and let the market demand for product $k$, $k = A, B$, when both retailers carry it be given by $D_k(P_k)$, where $P_k \equiv \min \{P_1, P_2\}$. Because the retailers are homogeneous, if both retailers sell product B then equilibrium prices are $P_1 = P_2 = c_B$ and retail profits are zero. If both retailers sell product A then equilibrium prices are $P_1 = P_2 = w_A$ and retail profits are $-F_A$. Given that slotting allowances correspond to negative fixed fees, retailers earn positive profit in this latter subgame if and only if the dominant firm pays them slotting allowances.

Let retailer $i$’s demand when retailer 1 carries product B and retailer 2 carries product A be given by $D_{B,A}^i(P_1, P_2)$, and let $D_{A,B}^i(P_1, P_2)$ denote retailer $i$’s demand when retailer 1 carries product A and retailer 2 carries product B. For all positive values of $D_{B,A}^i$ and $D_{A,B}^i$, I assume that a firm’s demand is downward sloping in its own price and upward sloping in its rival’s price. In both cases, equilibrium retail prices and profits depend on the wholesale price and fixed fee, $(\omega_A, \mathcal{F}_A)$, that is in effect after the recontracting stage. For example, if retailer 1 carries product B and retailer 2 carries product A, then retailer 1’s profit is given by $\pi_{B,A}^1 \equiv (P_1 - c_B)D_{B,A}^1(P_1, P_2)$ and retailer 2’s profit is given by $\pi_{B,A}^2 \equiv (P_2 - \omega_A)D_{B,A}^2(P_1, P_2) - \mathcal{F}_A$. Assuming that $\pi_{B,A}^i$ is concave in $P_i$, and that $|\frac{\partial^2 \pi_{B,A}^i}{\partial P_i^2}| > |\frac{\partial^2 \pi_{B,A}^i}{\partial P_i \partial P_j}|$, there is a unique equilibrium retail price vector $(P_{B,A}^1(\omega_A, c_B), P_{B,A}^2(\omega_A, c_B))$.

Define analogous notation for when retailer 1 carries product A and retailer 2 carries product B.

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6 Allowing the dominant firm to offer new terms ensures that it can tailor its contract terms to the product market configuration, thereby ruling out situations in which it is stuck with a non-profit maximizing wholesale price in the event it is ‘surprised’ by a rejection. This assumption simplifies the algebra without affecting the qualitative results.
III Offering slotting allowances to exclude competitors

In solving the game, note that there are two product market configurations that are of interest, the configuration in which the competitive fringe is excluded, and the configuration in which both products are carried. Obviously, the dominant firm can influence which outcome will occur through its initial choice of contract, \((w_A, F_A)\). To induce exclusion of the competitive fringe, the dominant firm will have to pay slotting allowances to the retailers, but it will then be able to keep its wholesale price relatively high (to maximize its monopoly profit). In contrast, if it accommodates the fringe, the dominant firm can save on slotting allowances, but it will then have to keep its wholesale price relatively low (because of the competition from the fringe’s product in the downstream market).

To determine which of these outcomes the dominant firm prefers, consider first the continuation game in which both products are carried. Without loss of generality, let retailer 2 be the retailer carrying product A. Then, from the pricing stage, we have that retailer 2’s equilibrium profit is

\[
\Pi_{B,A}^2(w, F_A) \equiv (P_{B,A}^2(w_A, c_B) - w_A)D_{B,A}^2(P_{1,B,A}^2(w_A, c_B), P_{2,B,A}^2(w_A, c_B)) - F_A,
\]

where \((w_A, F_A)\) is the contract in place with the dominant firm after the recontracting stage.

Let \((w^r_A, F^r_A)\) denote the new contract offered by the dominant firm in the recontracting stage, so that \((w_A, F_A) \in \{(w^r_A, F^r_A), (w_A, F_A)\}\). Then, since the dominant firm can always choose \((w^r_A, F^r_A) = (w_A, F_A)\), it follows that it is weakly profitable for the dominant firm to induce the retailer to accept the new contract, and thus it’s maximization problem in the recontracting stage is given by

\[
\max_{w^r_A, F^r_A} (w^r_A - c_A)D_{B,A}^2(P_{1,B,A}^2(w^r_A, c_B), F_{2,B,A}^r(w_A, c_B)) + F^r_A,
\]

such that the retailer carrying its product prefers contract \((w^r_A, F^r_A)\) to contract \((w_A, F_A)\),

\[
\Pi_{B,A}^2(w^r_A, F^r_A) \geq \Pi_{B,A}^r(w_A, F_A).
\]

Since the maximand in (1) is increasing in \(F^r_A\), it follows that the dominant firm will choose \(F^r_A\) such that the constraint (2) holds with equality, \(\Pi_{B,A}^2(w^r_A, F^r_A) = \Pi_{B,A}^r(w_A, F_A)\). Making this substitution into the maximand in (1), we have that the dominant firm will choose \(w^r_A\) to solve

\[
\max_{w^r_A} (P_{2,B,A}^r(w_A, c_B) - c_A)D_{B,A}^2(P_{1,B,A}^r(w^r_A, c_B), F_{2,B,A}^r(w_A, c_B)) - \Pi_{B,A}^2(w_A, F_A).
\]
Differentiating with respect to \( w_A^* \) and simplifying gives the first-order condition
\[
\left( P_{2}^{B,A} - c_A \right) \frac{\partial D_{2}^{B,A}}{\partial P_{2}} + D_{2}^{B,A} \frac{dP_{2}^{B,A}}{dw_{A}^*} + \left( P_{2}^{B,A} - c_A \right) \frac{\partial D_{2}^{B,A}}{\partial P_{1}} \frac{dP_{1}^{B,A}}{dw_{A}^*} = 0.
\]
Substituting in retailer 2’s first-order condition for \( P_{2} \),
\[
\left( P_{2}^{B,A} - w_{A}^* \right) \frac{\partial D_{2}^{B,A}}{\partial P_{2}} + D_{2}^{B,A} = 0,
\]
gives
\[
\left( w_{A}^* - c_A \right) \frac{\partial D_{2}^{B,A}}{\partial P_{2}} \frac{dP_{2}^{B,A}}{dw_{A}^*} + \left( P_{2}^{B,A} - c_A \right) \frac{\partial D_{2}^{B,A}}{\partial P_{1}} \frac{dP_{1}^{B,A}}{dw_{A}^*} = 0.
\]
(4) can be decomposed into a negative direct effect of an increase in \( w_{A}^* \) above \( c_A \) (the first term), and a positive indirect effect of an increase in \( w_{A}^* \) due to the induced increase in \( P_{1}^{B,A} \) (the second term).

Solving yields \( w_{A}^* = w_{A}^{rs} > c \). The equilibrium retail prices are \( P_{1}^{B,A}(w_{A}^{rs}, c_B) \) and \( P_{2}^{B,A}(w_{A}^{rs}, c_B) \).

By committing retailer 2 to a wholesale price that is above marginal cost, the dominant firm induces retailer 1 to increase its price, which then has a positive first-order feedback effect on the dominant firm’s profit via \( F_{l}^{r} \). In effect, the dominant firm exploits its first-mover advantage to soften the downstream competition between retailers 1 and 2. This dampering-of-competition is derived in similar contexts by Bonanno and Vickers (1988), Lin (1990), Shaffer (1991), and others.

It should not come as a surprise to readers familiar with vertical models that the equilibrium prices that arise from this arms-length contracting, \( P_{1}^{B,A}(w_{A}^{rs}, c_B) \), \( P_{2}^{B,A}(w_{A}^{rs}, c_B) \), are equivalent to the Stackelberg leader-follower prices in a game in which the retailers are vertically integrated and retailer 2 is the pricing leader. To see this, let \( P_{1}^{*}(P_{2}) \) be retailer 1’s best-response to any \( P_{2} \) set by retailer 2. Then the maximum profit a vertically-integrated retailer 2 can earn by leading is
\[
\Pi_{l}^{*} \equiv \max_{P_{2}} (P_{2} - c_A) D_{2}^{B,A}(P_{1}^{*}(P_{2}), P_{2}).
\]
(5)

Let \( P_{2}^{*} \equiv \arg \max_{P_{2}} (P_{2} - c_A) D_{2}^{B,A}(P_{1}^{*}(P_{2}), P_{2}) \). Then, because \( P_{2} = P_{2}^{B,A}(w_{A}^{rs}, c_B) \) is feasible, it follows that \( \Pi_{l}^{*} \geq (P_{2}^{B,A}(w_{A}^{rs}, c_B) - c_A) D_{2}^{B,A}(P_{1}^{*}(P_{2}^{B,A}(w_{A}^{rs}, c_B)), P_{2}^{B,A}(w_{A}^{rs}, c_B)) \equiv RHS \). On the other hand, because setting \( w_{A}^{rs} \) such that \( P_{2}^{B,A}(w_{A}^{rs}, c_B) = P_{2}^{*} \) is feasible, it follows from (3) and the definition of \( w_{A}^{rs} \) that \( RHS \geq (P_{2}^{*} - c_A) D_{2}^{B,A}(P_{1}^{*}(P_{2}^{*}), P_{2}^{*}) = \Pi_{l}^{*} \), where I have used the fact that Nash equilibrium implies \( P_{1}^{*}(P_{2}^{B,A}(w_{A}^{rs}, c_B)) = P_{1}^{B,A}(w_{A}^{rs}, c_B) \). This means that \( P_{2}^{B,A}(w_{A}^{rs}, c_B) = P_{2}^{*} \), \( P_{1}^{B,A}(w_{A}^{rs}, c_B) = P_{1}^{*} \), and the joint profit of the dominant firm and retailer 2 if only retailer 2
carries product A is $\Pi_l^*$. The follower’s profit goes to retailer 1. Its maximized profit is given by

$$\Pi_f^* \equiv (P_1^*(P_2^*) - c_B) D_1^{B,A}(P_1^*(P_2^*), P_2^*).$$

(6)

This proves the following lemma for the continuation game in which both products are carried.

**Lemma 1** In any equilibrium in which both products obtain distribution, the joint profit of the dominant firm and retailer carrying product A is $\Pi_l^*$, the profit of the retailer carrying product B is $\Pi_f^*$, and consumers face Stackelberg leader-follower prices on products A and B, respectively.

Using the results implied by Lemma 1 and (3), and given equilibrium profits in the pricing stage when only one product is carried, decision making in the accept-or-reject stage can now be addressed. If both retailers carry product A, each retailer earns $-F_A$. If both retailers carry product B, each retailer earns zero. If one retailer carries product A and the other carries product B, then the retailer carrying product B earns $\Pi_f^*$ and the retailer carrying product A earns $\Pi_2^{B,A}(w_A, F_A)$, which by symmetry is the same as $\Pi_1^{A,B}(w_A, F_A)$. These outcomes are illustrated in Table 1 below.

<table>
<thead>
<tr>
<th>RETAILER 1:</th>
<th>RETAILER 2:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product A</td>
<td>Product B</td>
</tr>
<tr>
<td>$-F_A, -F_A$</td>
<td>$\Pi_1^{A,B}(w_A, F_A), \Pi_f^*$</td>
</tr>
<tr>
<td>Product B</td>
<td>$\Pi_f^*, \Pi_2^{B,A}(w_A, F_A)$</td>
</tr>
</tbody>
</table>

Table 1: Accept-Or-Reject Stage

Given the dominant firm’s initial contract offer $(w_A, F_A)$, it is straightforward to characterize the best response of each retailer to the rival retailer’s choice of which product to carry. If retailer 1 carries product A, then retailer 2’s best response is also to carry product A if and only if $-F_A \geq \Pi_f^*$. And if retailer 1 carries product B, then retailer 2’s best response is to carry product A if and only if $\Pi_2^{B,A}(w_A, F_A) \geq 0$. Retailer 1’s best responses are symmetric. Combining these best responses, we have that, for any $(w_A, F_A)$, there exist one or more pure-strategy equilibria as follows. If
$-F_A \geq \Pi_f^*$, then the unique equilibrium calls for both retailers to carry product A. If $-F_A < \Pi_f^*$ and $\Pi_2^{B,A}(w_A, F_A) \geq 0$, then there is a pure-strategy equilibrium in which only retailer 1 carries product A, and a pure-strategy equilibrium in which only retailer 2 carries product A. If $-F_A < \Pi_f^*$ and $\Pi_2^{B,A}(w_A, F_A) < 0$, then the unique equilibrium calls for both retailers to carry product B.

In the initial contracting stage, the dominant firm chooses $(w_A, F_A)$ to induce the product market configuration that maximizes its profit. Since it will never induce both retailers to carry product B, there are only two possibilities to consider. It will either induce both retailers to carry product A, or it will induce one retailer to carry product A and the other to carry product B.

The dominant firm’s maximization problem if it induces both retailers to carry product A is

$$\max_{w_A, F_A} (w_A - c_A)D^A(w_A) + 2F_A \text{ such that } -F_A \geq \Pi_f^*. \quad (7)$$

where (7) uses the result from the pricing stage that $P_A = w_A$, and the result from the accept-or-reject stage that $-F_A \geq \Pi_f^*$ is necessary and sufficient for both retailers to accept the dominant firm’s contract. Let $\Pi_m^* \equiv \max_{P_A} (P_A - c_A)D^A(P_A)$ denote the monopoly profit on product A. Then, because $\Pi_f^*$ does not depend on $w_A$, it follows that the dominant firm’s maximized profit is

$$\Pi_m^* - 2\Pi_f^*, \quad (8)$$

This proves the following lemma for the continuation game in which only product A is carried.

**Lemma 2** In any equilibrium in which only product A obtains distribution, the profit of the dominant firm is $\Pi_m^* - 2\Pi_f^*$, the profit of each retailer is $\Pi_f^*$, and consumers face monopoly prices.

The overall joint profit in this case is $\Pi_m^*$, of which each retailer gets $\Pi_f^*$. Notice that slotting allowances are instrumental in achieving this outcome. The dominant firm must ensure that each retailer earns $\Pi_f^*$ to exclude the competitive fringe. With slotting allowances, the dominant firm simply pays each retailer this amount. Absent slotting allowances, however, it is not possible to exclude the fringe because each retailer would earn zero profit if both retailers carried product A.

The dominant firm’s maximization problem if it induces one retailer to carry product A and the other retailer to carry product B (i.e., if it decides to accommodate the competitive fringe) is

$$\max_{w_A, F_A} \Pi_i^* - \Pi_2^{B,A}(w_A, F_A) \quad (9)$$
such that

\[-F_A < \Pi^*_f \quad \text{and} \quad \Pi_2^{B,A}(w_A, F_A) \geq 0, \quad (10)\]

where (9) and (10) use the result from Lemma 1 that the joint profit of the dominant firm and retailer carrying product A is \(\Pi^*_l\), the result from (3) that the retailer’s share of this profit is \(\Pi_2^{B,A}(w_A, F_A)\), and the result from the accept-or-reject stage that \(-F_A < \Pi^*_f\) and \(\Pi_2^{B,A}(w_A, F_A) \geq 0\) are necessary and sufficient to induce only one retailer to accept the dominant firm’s contract. Since the maximand in (9) is decreasing in \(\Pi_2^{B,A}(w_A, F_A)\), and since \(\Pi_2^{B,A}(w_A, F_A)\) must be at least zero, it follows that the dominant firm will choose \((w_A, F_A)\) such that \(\Pi_2^{B,A}(w_A, F_A) = 0\) and \(-F_A < \Pi^*_f\).

Such contracts exist because, for any \(w_A\), the retailer’s payoff gross of \(F_A\), \(\Pi_2^{B,A}(w_A, 0)\), is non-negative, which implies that, for any \(w_A\), there exists \(F_A\) such that \(F_A \geq 0\) and \(\Pi_2^{B,A}(w_A, F_A) = 0\).

Thus, the dominant firm’s maximized profit if it does not exclude the competitive fringe is \(\Pi^*_l\).

The dominant firm’s profit-maximizing strategy is determined by comparing its maximized profit if it induces both retailers to carry product A, \(\Pi^*_m - 2\Pi^*_f\), to its maximized profit if it induces only one retailer to carry product A, \(\Pi^*_l\). The results are summarized in the following proposition.

**Proposition 1** Equilibria exist in which the dominant firm excludes the competitive fringe if and only if \(\Pi^*_m - 2\Pi^*_f \geq \Pi^*_l\). In these equilibria, the dominant firm pays slotting allowances to the retailers, consumers face monopoly prices on product A, and product B does not obtain distribution.

Equilibria exist in which the dominant firm accommodates the competitive fringe if and only if \(\Pi^*_m - 2\Pi^*_f \leq \Pi^*_l\). In these equilibria, the dominant firm does not pay slotting allowances to the retailers, and consumers face Stackelberg leader-follower prices on products A and B, respectively.

A comparison of the dominant firm’s profit in the two cases suggests there is both a gain and a cost of inducing exclusion. The gain from excluding product B is \(\Pi^*_m - \Pi^*_l\), which is the increase in the overall profit from selling product A when product B is excluded. The cost of excluding product B is \(2\Pi^*_f\), which is the amount of slotting allowances that must be paid to retailers to compensate them for not selling product B. Product B is excluded if and only if the gain exceeds the cost.

To get a sense of when exclusion might arise, note that if \(c_A = c_B\) then the gain to the dominant firm from inducing exclusion approaches \(\Pi^*_m\) in the limit as products A and B become perfect
substitutes, while the cost of inducing exclusion in this case approaches zero. This follows because a Stackelberg leader’s ability to induce supracompetitive prices becomes increasingly difficult the more price sensitive consumers become. In the limit, the Stackelberg profits approach the Bertrand profits; retailers engage in marginal-cost pricing and no firm earns positive profit when both products obtain distribution \( \Pi_i^* = \Pi_f^* = 0 \). It follows that the dominant firm’s gain from inducing exclusion will exceed its cost of inducing exclusion when the products are sufficiently close substitutes. In contrast, the gain to the dominant firm from inducing exclusion approaches zero in the limit as products \( A \) and \( B \) become independent in demand, while the cost of inducing exclusion in this case approaches \( 2 \left( \max_{P_B} (P_B - c_B) D^B(P_B) \right) > 0 \). This follows because when products \( A \) and \( B \) are independent in demand and one retailer carries product \( A \) and the other retailer carries product \( B \), each will be able to obtain the monopoly profit on its product. Because the dominant firm can capture this monopoly profit, it follows that the dominant firm’s cost of inducing exclusion will exceed its gain from inducing exclusion when the products are sufficiently weak substitutes.

Slotting allowances for the purpose of inducing exclusion are not likely to arise when products \( A \) and \( B \) are poor substitutes because, from the dominant firm’s perspective, there is little additional profit to be had by excluding the competitive fringe, and moreover, the out-of-pocket cost of acquiring the extra shelf space approaches twice the monopoly profit on product \( B \). On the other hand, slotting allowances for the purpose of inducing exclusion are likely to arise when products \( A \) and \( B \) are sufficiently close substitutes because, by excluding the competitive fringe, the dominant firm can avoid the dissipative effects on profits that would occur from the downstream price competition if both products were sold. And, moreover, the out-of-pocket cost of acquiring the extra shelf space approaches zero as the products become sufficiently close substitutes. For intermediate levels of demand substitution, intuition suggests that there will be a critical level of demand substitution above (below) which slotting allowances for the purpose of inducing exclusion will (not) arise.

Turning to welfare considerations, note that a policy of no slotting allowances could be implemented by constraining the dominant firm to choose \( F_A \geq 0 \). This constraint would have no effect on equilibria in the pricing stage, the recontracting stage, or the accept-or-reject stage, but
it would have an effect the dominant firm’s choice of initial contract. In particular, recall that the
dominant firm’s maximization problem if it is to induce both retailers to carry product A requires
that each retailer receive \(-F_A \geq \Pi_f^r\), which cannot be satisfied when \(\Pi_f^r > 0\) if slotting allowances
are prohibited. Thus, absent slotting allowances, it will not in general be possible for the dominant
firm to exclude the competitive fringe. Since the dominant earns zero if it induces both retailers
to carry product B, and since it earns \(\Pi_f^r \geq 0\) if it induces one retailer to carry product B and the
other retailer to carry product A (its maximization problem in this case is unaffected by the new
constraint), it follows that when \(\Pi_f^r > 0\) both products will obtain distribution in all equilibria.

A policy that prohibits slotting allowances clearly has a beneficial effect on consumers when
\(\Pi_m^*-2\Pi_f^r > \Pi_f^r\) and \(\Pi_f^r > 0\). In this case, in the absence of slotting allowances, consumers can choose
between products A and B and face Stackelberg leader-follower prices. But, if slotting allowances are
permitted, the dominant firm will use them to exclude product B from the market, and consumers
will face monopoly prices on product A. These results are summarized in the following proposition.

**Proposition 2** If \(\Pi_m^*-2\Pi_f^r \leq \Pi_f^r\) or \(\Pi_f^r = 0\), then a prohibition of slotting allowances has no
effect on consumer welfare. If \(\Pi_m^*-2\Pi_f^r > \Pi_f^r\) and \(\Pi_f^r > 0\), then a prohibition of slotting allowances
increases consumer welfare. Consumers gain from lower prices and an increase in product variety.

When slotting allowances are used by a dominant firm to exclude the competitive fringe, the
gains from a prohibition of slotting allowances can be decomposed as follows. Some consumers who
would not pay the monopoly price for product A, when product B was unavailable, may buy when
products A and B are available at Stackelberg leader-follower prices, respectively. These consumers
are clearly better off. Consumers who would pay the monopoly price for product A, but who would
switch to product B when it becomes available are also better off. Consumers who would continue
to buy product A in the absence of slotting allowances are better off because they pay lower prices.
Consumers who would not buy either product with or without slotting allowances are no worse off.
Hence, a prohibition on slotting allowances is a weak Pareto improvement for all consumers.

It is likely that a prohibition of slotting allowances will also lead to an increase in social welfare
(consumer surplus plus profits), but this depends in part on whether product B is more costly
to produce than product A, and on the willingness-to-pay of consumers for product B relative to product A. This issue is explored in more depth in the next section, where a linear-demand example is solved to gain a sense of the potential magnitude of the welfare losses from slotting allowances.

IV Illustrative example

To calculate the potential welfare losses from slotting allowances, suppose aggregate utility is

$$U = V \sum_{i=A,B} q_i - \frac{1}{2(1 + 2\gamma)} \left[ \frac{q_A^2}{s} + \frac{q_B^2}{(1-s)} + 2\gamma \left( \sum_{i=A,B} q_i \right)^2 \right] + M,$$

where $M$ is aggregate income, $\gamma > 0$ is a demand-substitution parameter, $s > 0$ is a measure of product asymmetry, and $q_i$ is the quantity consumed of the $i$th product, $i = A, B$. If both retailers carry product A, $q_B = 0$, and the aggregate demand facing the dominant firm is given by

$$D^A(P_A) = \frac{(1 + 2\gamma)s}{1 + 2\gamma s} (V - P_A).$$

If retailer 2 carries product A and retailer 1 carries product B, then each retailer’s demand is found by differentiating $U$ with respect to $q_A, q_B$ and then inverting to give

$$D_1^{B,A}(P_1, P_2) = (1 - s) (V - (1 + 2\gamma s)P_1 + 2\gamma s P_2),$$

$$D_2^{B,A}(P_1, P_2) = s (V - (1 + 2\gamma(1 - s))P_2 + 2\gamma(1 - s) P_1).$$

The parameter $\gamma \geq 0$ is a measure of the degree of demand-side substitution. As $\gamma \to 0$, products A and B become independent in demand. As $\gamma \to \infty$, products A and B become perfect substitutes. The parameter $s$ is a measure of the degree of product asymmetry in the sense that equal prices give rise to a market share of $s$ for product A and $1 - s$ for product B. In what follows, I assume that the dominant firm’s product has the higher baseline market share in the sense that $s \geq 1/2$.

To simplify the computations when solving for the equilibrium profits and retail prices in the two product-market continuation games of interest, let $c_A = c_B = c$. Let $P^*_A \equiv \arg\max_{P_A} (P_A - c_A)D^A(P_A)$ be the monopoly price of product A when both retailers carry product A. Then

$$P^*_A = \frac{V + c}{2}; \quad \Pi^*_m = \frac{(V - c)^2(1 + 2\gamma)s}{4(1 + 2\gamma s)}.$$
Now consider the case in which the dominant firm does not induce exclusion. Without loss of
generality, let retailer 2 be the one carrying product A. Then the Stackelberg prices and profits are:

\[
P_B^A(\omega_A^{rs}, c) = \frac{(1 + 2\gamma + \gamma s + 3\gamma^2 s - \gamma^2 s^2)V + (1 + 2\gamma + 3\gamma s + 9\gamma^2 s - 3\gamma^2 s^2 + 8\gamma^3 s^2 - 8\gamma^3 s^3)c}{2(1 + 2\gamma s)(1 + 2\gamma + 2\gamma^2 s - 2\gamma^2 s^2)},
\]

\[
P_B^A(\omega_A^{rs}, c) = \frac{(1 + \gamma + \gamma s)V + (1 + 3\gamma - \gamma s + 4\gamma^2 s - 4\gamma^2 s^2)c}{2(1 + 2\gamma + 2\gamma^2 s - 2\gamma^2 s^2)},
\]

\[
\Pi_f = \frac{(V - c)^2(1 - s)(1 + 2\gamma + \gamma s + 3\gamma^2 s - \gamma^2 s^2)^2}{4(1 + 2\gamma s)(1 + 2\gamma + 2\gamma^2 s - 2\gamma^2 s^2)^2},
\]

\[
\Pi_f = \frac{(V - c)^2(1 + \gamma + \gamma s)^2}{4(1 + 2\gamma s)(1 + 2\gamma + 2\gamma^2 s - 2\gamma^2 s^2)^2}.
\]

Proposition 1 implies that the dominant firm will offer slotting allowances to exclude the com-
petitive fringe if and only if \(\Pi_m^* - 2\Pi_f^* \geq \Pi_f^*\), or in other words, if and only if \(\Delta \Pi \geq 0\), where \(\Delta \Pi \equiv \Pi_m^* - 2\Pi_f^* - \Pi_f^*\). Using Mathematica, and after considerable simplification, one obtains

\[
\Delta \Pi = -((1 - s)(V - c)^2(2 + 8\gamma + 8\gamma^2 + 2\gamma s + 13\gamma^2 s + 18\gamma^2 s -
\frac{5\gamma^2 s^2 - 10\gamma^3 s^2 + 4\gamma^4 s^2 - 12\gamma^4 s^2 - 8\gamma^5 s^3 + 8\gamma^4 s^3 + 8\gamma^5 s^4)}{(4(1 + 2\gamma s)(1 + 2\gamma + 2\gamma^2 s - 2\gamma^2 s^2)^2)}.
\]

From this messy expression, it is tedious but straightforward to show that \(\Delta \Pi\) is increasing in \(\gamma\) and
that, for any \(s \in [\frac{1}{2}, 1]\), there exists \(\gamma > 0\) such that \(\Delta \Pi \geq 0\). This proves the following proposition.

**Proposition 3** In the linear-demand example with \(c_A = c_B = c\), there exists \(\gamma(s) > 0\) such that,
for all \(\gamma \geq \gamma(s)\), the dominant firm will offer slotting allowances to exclude the competitive fringe.

Figure 1 plots the locus of points for which \(\Delta \Pi = 0\). Intuitively, one can think of \(\Delta \Pi\) as
increasing in \(\gamma\) for two reasons. First, the consumer demand foregone if product B is not sold by
either retailer is less the closer are products A and B as substitutes. This means that \(D_A^A(P_A)\) is
increasing in \(\gamma\), and hence that the monopoly profit on product A, \(\Pi_m^*\), is increasing in \(\gamma\). Second,
an increase in the demand substitution between products A and B translates into more vigorous
price competition between retailers when both products are sold. This implies that the dominant
firm will be less able to exploit its first-mover advantage by inducing a high price on its product, and
therefore that its Stackelberg-leader profit will be less. It also implies that the Stackelberg-follower
profit will be less. It follows that the difference $\Pi_m^* - (2\Pi_f^* + \Pi_l^*)$ is increasing in $\gamma$ and thus that slotting allowances and exclusion are more likely to occur the more substitutable are the products.

It remains to consider the effect of slotting allowances on equilibrium retail prices and social welfare, where social welfare is defined as consumer surplus plus profits. Consider first the effect on equilibrium retail prices. When the dominant firm pays slotting allowances to induce both retailers to carry its product, the competitive fringe is necessarily excluded. This means that the dominant firm can to choose its wholesale price without regard to its upstream rivals, and thus, it will choose its wholesale price to induce the monopoly price on product A (product B’s price is infinite). On the other hand, in the absence of slotting allowances, the best the dominant firm can do is to choose its wholesale price to induce the Stackelberg-leader price on product A and the Stackelberg-follower price on product B. Since the monopoly price on product A is higher than the Stackelberg leader price on product A, it follows that slotting allowances will be associated with higher equilibrium retail prices. It is straightforward to verify this in the linear-demand example with $c_A = c_B = c$. Moreover, comparative statics imply that the increase in the price of product A is larger the larger
is the degree of product substitution $\gamma$ and the smaller is the degree of product asymmetry $s$.

In addition to paying higher retail prices, consumers also have less choice when slotting allowances are used to exclude the competitive fringe. The joint effect of higher retailer prices and less choice can be seen in Figure 2, which depicts the percentage decrease in social welfare with slotting allowances over the region of parameter space bounded by $0.5 \leq s \leq 0.9$ and $4.5 \leq \gamma \leq 10$.\(^8\)

**Proposition 4** A dominant firm will sometimes find it profitable to offer slotting allowances to exclude the competitive fringe even when social welfare would be higher if both products were sold. In the linear-demand example with $c_A = c_B = c$, $0.5 \leq s \leq 0.9$, and $4.5 \leq \gamma \leq 10$, the welfare loss from higher retail prices and reduced product variety ranges from a low of $14.7\%$ to a high of $29.4\%$.

As $s$ increases, the welfare loss associated with slotting allowances decreases. There are two reasons for this. First, the foregone consumer demand if product B is not sold by either retailer is less the more skewed preferences are towards product A. In other words, the welfare loss from a

\(^8\)It is easily seen from Figure 1 that the dominant firm will opt to induce exclusion over this entire region.
reduction in product variety is decreasing in $s$. Second, the reduced sensitivity of $D_{2}^{B,A}$ to increases in $P_2$ as $s$ increases enables the dominant firm to sustain profitably a higher price on its product in any subgame in which exclusion does not occur. Thus, the welfare loss from higher retail prices is also decreasing in $s$. Whether the welfare loss associated with slotting allowances is increasing or decreasing in $\gamma$ depends on the level of product asymmetry. When $s = .5$, the welfare loss from slotting allowances ranges from $-29.4\%$ to $-27.7\%$. When $s = .9$, the welfare loss from slotting allowances ranges from $-14.7\%$ to $-18.2\%$. Intuitively, an increase in $\gamma$ affects the welfare loss due to a reduction in product variety and the welfare loss due to higher retail prices differently. The consumer demand foregone if product $B$ is not sold by either retailer is less the closer are products $A$ and $B$ as substitutes. Hence, the loss in welfare due to a reduction in product variety is decreasing in $\gamma$. On the other hand, an increase in demand substitution between products $A$ and $B$ translates into lower retail prices when both products are sold. Hence, the loss in welfare due to higher retail prices is increasing in $\gamma$. On balance, the first (second) effect dominates for low (high) levels of $s$.

V Extensions

In this section, I consider several extensions to the basic model. The various extensions explore in greater depth the role of observable contracts, the role of the recontracting stage, the role of retail competition in dissipating profits, and the assumption that a retailer cannot carry both products.

The role of observable contracts

The Robinson-Patman Act requires that the dominant firm treat both retailers the same if both carry the dominant firm’s product.\footnote{See O’Brien and Shaffer (1994) for a discussion of the role of the Robinson-Patman Act in vertical contracting.} Hence, it is reasonable to assume that the initial contract offer, $(w_A, F_A)$, is observable to both firms. However, the Robinson-Patman Act does not constrain the dominant firm if only one retailer carries product $A$, and so it may be that in the recontracting stage the dominant firm’s offer of $(w^r_A, F^r_A)$ to the retailer carrying its product is not observable to the retailer carrying product $B$. If this is the case, then it is well known from Katz (1991) that the dominant firm’s ability to soften downstream competition will be limited. In the environment
considered here, with no uncertainty and no risk aversion, the best the dominant firm can do is to offer \( w_A^* = c_A \), which in equilibrium will be anticipated by the retailer carrying product B.\(^{10}\)

This implies that the equilibrium retail prices when one retailer carries product A and the other retailer carries product B are \( P_{1,A}^{B,A}(c_A, c_B) \) and \( P_{2,A}^{B,A}(c_A, c_B) \), respectively (by symmetry it does not matter whether retailer 1 or 2 carries product A). It follows that when the dominant firm’s contract is unobservable, the equilibrium joint profit of the dominant firm and retailer carrying product A is \( \Pi_{1,2,A}^{B,A} \equiv (P_{2,B}^{B,A}(c_A, c_B) - c_A)D_{2,B}^{B,A}(P_{2,B}^{B,A}(c_A, c_B), P_{2,B}^{B,A}(c_A, c_B)) \), and the equilibrium profit of the retailer carrying product B is \( \Pi_{1,2,A}^{B,A} \equiv (P_{1,B}^{B,A}(c_A, c_B) - c_B)D_{1,B}^{B,A}(P_{1,B}^{B,A}(c_A, c_B), P_{2,B}^{B,A}(c_A, c_B)) \).

Replacing all occurrences of \( \Pi_f^* \) with \( \Pi_{1,2,A}^{B,A} \), and all occurrences of \( \Pi_f^* \) with \( \Pi_{1,2,A}^{B,A} \), but otherwise following the analysis of the previous section, it follows that when contracts in the recontracting stage are unobservable, equilibria exist in which the dominant firm excludes the competitive fringe if and only if \( \Pi_m^* - 2\Pi_{1,2,A}^{B,A} \geq \Pi_{1,2,A}^{B,A} \). Comparing this condition to the condition for exclusion when contracts are observable in the recontracting stage, \( \Pi_m^* - 2\Pi_f^* \geq \Pi_f^* \), and noting that \( \Pi_{1,2,A}^{B,A} \leq \Pi_f^* \) and \( \Pi_{1,2,A}^{B,A} \leq \Pi_f^* \), with equality only when the products are perfect substitutes, we have that the left-hand side is larger and the right-hand side is smaller when contracts are unobservable. This means that the net gain to the dominant firm from excluding the competitive fringe is larger and thus exclusion of the competitive fringe is more likely to occur when contracts are unobservable.

**The role of the recontracting stage**

The purpose of the recontracting stage is to allow the dominant firm to tailor its contract terms to the product market configuration, thereby ruling out situations in which it is stuck with a non-profit maximizing wholesale price in the event it is surprised by a rejection. If there is no recontracting stage, then any retailer who carries product A must compete in the product market with contract \((w_A, F_A)\), and any retailer who carries product B knows this. This implies that when retailer 1 carries product B and retailer 2 carries product A, retailer 1 earns profit \( \Pi_{1,2,A}^{B,A}(w_A, F_A) \), where \( \Pi_{1,2,A}^{B,A}(w_A, F_A) \equiv (P_{1,B}^{B,A}(w_A, c_B) - c_B)D_{1,B}^{B,A}(P_{1,B}^{B,A}(w_A, c_B), P_{2,B}^{B,A}(w_A, c_B)) \), and retailer 2 earns

\(^{10}\)To see this, note that, with unobservable contracts, the second set of terms in (4) is zero because \( \frac{dP_{B,A}^{B,A}}{dw_A} = 0 \). Put simply, the retailer carrying product B cannot be induced to react to a wholesale price change it cannot observe.
profit $\Pi^{B,A}_2(w_A, F_A)$, which was defined previously. Define analogous notation for the case in which retailer 1 carries product A and retailer 2 carries product B. Then the payoffs to each retailer in the accept-or-reject stage for each product market configuration is given by Table 2 below:

Table 2: Accept-Or-Reject Stage

<table>
<thead>
<tr>
<th>RETAILER 1: ↙</th>
<th>Product A</th>
<th>Product B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product A</td>
<td>$-F_A, -F_A$</td>
<td>$\Pi^{A,B}_1(w_A, F_A), \Pi^{A,B}_2(w_A)$</td>
</tr>
<tr>
<td>Product B</td>
<td>$\Pi^{B,A}_1(w_A), \Pi^{B,A}_2(w_A, F_A)$</td>
<td>0, 0</td>
</tr>
</tbody>
</table>

Given the dominant firm’s initial contract offer $(w_A, F_A)$, it is straightforward to characterize the best-response of each retailer to the rival retailer’s choice of which product to carry. The intersection of these best responses yields one or more pure-strategy equilibria as follows. If $-F_A \geq \Pi^{B,A}_1(w_A)$, then the unique equilibrium calls for both retailers to carry product A. If $-F_A < \Pi^{B,A}_1(w_A)$ and $\Pi^{B,A}_2(w_A, F_A) \geq 0$, then there is a pure-strategy equilibrium in which only retailer 1 carries product A, and a pure-strategy equilibrium in which only retailer 2 carries product A. If $-F_A < \Pi^{B,A}_1(w_A)$ and $\Pi^{B,A}_2(w_A, F_A) < 0$, then the unique equilibrium calls for both retailers to carry product B.

In the initial contracting stage, the dominant firm chooses $(w_A, F_A)$ to induce the product market configuration that maximizes its profit. It can induce one or both retailers to carry its product. If it induces both retailers to carry its product, its maximization problem is given by

$$\max_{w_A, F_A} (w_A - c_A)D^A(w_A) + 2F_A \quad \text{such that} \quad -F_A \geq \Pi^{B,A}_1(w_A). \quad (11)$$

where (11) uses the result from the pricing stage that $P_A = w_A$, and the result from the accept-or-reject stage that $-F_A \geq \Pi^{B,A}_1(w_A)$ is necessary and sufficient for both retailers to accept the dominant firm’s contract. Let $\tilde{w}_A \equiv \arg \max_{w_A} \left((w_A - c_A)D^A(w_A) - 2\Pi^{B,A}_1(w_A)\right)$ denote the dominant firm’s profit-maximizing wholesale price when $F_A$ satisfies the constraint in (11) with equality.
Then, the dominant firm’s maximized profit when it induces both retailers to carry its product is

\[(\tilde{w}_A - c_A)D^A(\tilde{w}_A) - 2\Pi^{B,A}_1(\tilde{w}_A).\] (12)

The dominant firm’s maximization problem if it induces one retailer to carry product A and the other retailer to carry product B (i.e., if it decides to accommodate the competitive fringe) is

\[
\max_{w_A, F_A} (w_A - c_A)D^{B,A}_2(P^{B,A}_1(w_A, c_B), F^{B,A}_2(w_A, c_B)) + F_A,
\] (13)

such that

\[-F_A < \Pi^{B,A}_1(w_A) \quad \text{and} \quad \Pi^{B,A}_2(w_A, F_A) \geq 0,
\] (14)

where (13) and (14) use the result from the accept-or-reject stage that \(-F_A < \Pi^{B,A}_1(w_A)\) and \(\Pi^{B,A}_2(w_A, F_A) \geq 0\) are necessary and sufficient to induce only one retailer to carry product A. Since the maximand in (13) is increasing in \(F_A\), and since \(\Pi^{B,A}_2(w_A, F_A)\) must be at least zero, it follows that the dominant firm will choose \(F_A \geq 0\) to solve \(\Pi^{B,A}_2(w_A, F_A) = 0\) and \(w_A \geq 0\) to solve

\[
\max_{w_A} (P^{B,A}_2(w_A, c_B) - c_A)D^{B,A}_2(P^{B,A}_1(w_A, c_B), P^{B,A}_2(w_A, c_B)).
\] (15)

Since the argmax of (15) is the same as the argmax of (3), it follows that the dominant firm’s maximized profit if it excludes the competitive fringe is \(\Pi^*_f\), with or without a recontracting stage.

The dominant firm’s profit-maximizing strategy in the absence of the recontracting stage depends on the relation between its maximized profit if it induces both retailers to carry product A, \((\tilde{w}_A - c_A)D^A(\tilde{w}_A) - 2\Pi^{B,A}_1(\tilde{w}_A))\), and its maximized profit if it induces only one retailer to carry product A, \(\Pi^*_f\). It follows that, in the absence of the recontracting stage, equilibria exist in which the dominant firm excludes the competitive fringe if and only if \((\tilde{w}_A - c_A)D^A(\tilde{w}_A) - 2\Pi^{B,A}_1(\tilde{w}_A) \geq \Pi^*_f\).

Comparing this condition to the condition for exclusion when there is a recontracting stage, \(\Pi^*_m - 2\Pi^*_f \geq \Pi^*_f\), we have that the left-hand side may differ but the right-hand side of both conditions is the same, and thus we have that the net gain to the dominant firm from excluding the competitive fringe is larger when there is a recontracting stage if and only if \(\Pi^*_m - 2\Pi^*_f \geq (\tilde{w}_A - c_A)D^A(\tilde{w}_A) - 2\Pi^{B,A}_1(\tilde{w}_A)\). It can be shown that this inequality is always satisfied in the linear demand example in section IV. Intuitively, having the ability to recontract allows the dominant
firm to induce monopoly pricing when both retailers carry its product. Otherwise, the dominant firm will be constrained in raising its wholesale price in case one of the retailers rejects its offer.

**The role of retail competition**

The dissipation of the dominant firm’s profit due to the competitive fringe and retail price competition provides the motive for the dominant firm to use slotting allowances. Either one alone is not sufficient. Dissipation of the dominant firm’s profit due to retail price competition alone is not sufficient because in the absence of the competitive fringe the dominant firm would find it optimal to set its wholesale price to internalize fully the retail price competition on its product and charge a fixed fee to extract each retailer’s surplus. Dissipation of the dominant firm’s profit due to the competitive fringe alone is also not sufficient because if there were only one retailer, with limited shelf space, the dominant firm would find it optimal to set its wholesale price at cost and charge a fixed fee equal to the maximum of zero and the difference between what the retailer could earn from selling the dominant firm’s product and what it could earn by selling the product of the competitive fringe. If the competitive fringe’s product happened to be more profitable for the retailer to carry, the dominant firm would be excluded from the market. Otherwise, the competitive fringe would be excluded. But in neither case would offering slotting allowances benefit the dominant firm.

Retail price competition increases when the demand substitution between products A and B increases or when the number of retailers in the marketplace increases. In fixing the number of retailers at two, I have focused on identifying demand substitution as a key factor in determining when a dominant firm will find it profitable to offer slotting allowances to induce exclusion. However, it is easy to see that the number of retailers is also an important determinant. Suppose there are \( n > 2 \) retailers. Then, if the dominant firm is to induce exclusion, the dominant firm must give each retailer a profit at least equal to the profit that retailer would get if it were the only retailer to deviate and carry the product of the competitive fringe. Assuming there is a recontracting stage, it is straightforward to show that the dominant firm’s maximized profit if it induces exclusion is \( \Pi_m^* - n\Pi_f^* \), while its maximized payoff if it accommodates the fringe and allows one retailer to sell product B continues to be \( \Pi_f^* \). Hence, the dominant firm will induce exclusion if and only if
\[ \Pi_m^* - n \Pi_f^* \geq \Pi_l^* \]. Because the left-hand side of this inequality is decreasing in \( n \), it follows that the dominant firm's use of slotting allowances to induce exclusion is less likely the larger is \( n \).

Another important determinant of the use of slotting allowances to induce exclusion is the degree of substitution among retailers. The model assumes an extreme case in which the retailers are perfectly homogeneous. This assumption simplifies the math because it implies a zero flow payoff to both retailers if both carry the same product. However, it also biases the results towards finding a role for slotting allowances. To see this, note that, at the other extreme, if each retailer is a local monopolist, then the dominant firm has no use for slotting allowances because its profit-maximizing wholesale price in this case is marginal cost and any fixed payment necessarily flows from the retailer to the dominant firm. More generally, one can imagine intermediate cases in which there is some differentiation between retailers. In these intermediate cases, there is a new tradeoff for the dominant firm to consider. On the one hand, the constraint placed by a retailer carrying product B on the price of product A is increasing in the degree of substitution between retailers. This makes it more likely that the dominant firm will want to induce exclusion. On the other hand, in the absence of product B, the gain to the dominant firm from having its product sold at both retail outlets as opposed to only one is decreasing in the degree of substitution between retailers. This makes it less likely that the dominant firm will want to induce exclusion. It seems reasonable to conjecture that the former effect will dominate, implying that the use of slotting allowances to induce exclusion will be increasing in the degree of substitution between retailers. The more substitutable are the retailers, the more likely the dominant firm will want to induce exclusion.

**The role of scarce shelf space**

I have assumed that each retailer can carry either product A or B, but not both. This assumption, which captures in an extreme way the scarcity of shelf space facing a typical retailer, may be more or less realistic depending on, among other things, whether the retailer can make substitutions to its product lines not only within product categories but also across product categories. This may be difficult for products that require refrigeration or need to be kept frozen (because refrigeration and freezer space tends to be especially tight) but not so difficult for other types of consumer goods.
More generally, one can imagine that a retailer may be constrained in the overall number of products it can carry in its store but not be unduly constrained in the number of products it can carry in any given product category. For example, suppose there are two product categories, laundry detergent and potato chips, and suppose the retailer can carry at most three products. Then, instead of carrying two brands of potato chips and one brand of laundry detergent, it is conceivable that the retailer might prefer to carry two brands of laundry detergent and only one brand of potato chips (or three brands of one category and nothing of the other category). In these cases, a dominant firm that produces product A will naturally be wary of offering slotting allowances to the retailer for the purpose of excluding product B unless it can be assured that the competitive fringe’s product will not be carried. One way for the dominant firm to achieve this is to accompany its offer of slotting allowances with a contract that includes ancillary provisions that expressly prohibit the retailer from carrying product B (or otherwise severely restrict the retailer’s sales of product B). Such ancillary provisions are not uncommon, although they do make the dominant firm’s intentions more transparent and thus more susceptible to challenge in antitrust.\footnote{For example, a manufacturer may offer to pay a slotting allowance to the retailer if the retailer agrees to purchase a certain percentage of its requirements from the manufacturer, e.g., 80%. Such a contract combines a slotting allowance with a market-share discount. In their respective reports on slotting allowances, the Federal Trade Commission (2001) and the Canadian Bureau of Competition (2002) expressed concern that these types of contracts might lead to inefficient exclusion and higher consumer prices than otherwise because of the concomitant decrease in competition.}

Allowing each retailer to carry one or more products changes surprisingly little in the model, provided the dominant firm augments its strategy of offering slotting allowances with an exclusivity provision. To see this, note that to exclude the competitive fringe when $\Pi_m^* - 2\Pi_f^* \geq \Pi_l^*$, the dominant firm will combine an offer of slotting allowances with an exclusivity provision in which the retailer is explicitly prohibited from carrying product B. In this case, the dominant firm earns $\Pi_m^* - 2\Pi_f^*$, and each retailer receives a slotting payment of $\Pi_f^*$, which is what it could earn by unilaterally rejecting the dominant firm’s contract and carrying product B. If $\Pi_m^* - 2\Pi_f^* < \Pi_l^*$, then the dominant firm prefers not to induce exclusion and slotting allowances are not used. The dominant firm earns $\Pi_f^*$ in this case because by setting a wholesale price to induce the Stackelberg-leader price and charging a positive fixed fee to extract the Stackelberg-leader profit surplus, the dominant firm ensures that only one retailer will carry its product and that this retailer will not
also carry product B (it cannot be an equilibrium for one retailer to carry both products and the other retailer to carry only product B because this would lead to marginal cost pricing on product B, which would depress the price of price of product A and decrease the former retailer’s profit.)

**VI Conclusion**

The central issue addressed in this article is whether allocating scarce shelf space according to manufacturer willingness-to-pay using slotting allowances will ensure socially optimal product variety. The claim made by many commentators is that, by offering their space to the highest bidders, retailers act as agents for consumers and ensure that only the most socially desirable products obtain distribution. However, in this article, I find that a dominant firm can sometimes use slotting allowances to exclude a competitive fringe from distribution even when welfare would be higher if the fringe obtained distribution. Moreover, slotting allowances are the *sine qua non* of this exclusion. If the dominant firm had to pay for exclusion by offering retailers lower wholesale prices, it would not be profitable for it to induce exclusion. Since the socially optimal product variety in the model is for both products A and B to be sold, it follows that slotting allowances are always undesirable.

Intuitively, the tradeoff facing the dominant firm in deciding whether to exclude its upstream rivals is the loss of retail-pricing control, and hence potential profit, if it does not exclude its rivals versus the out-of-pocket cost in slotting allowances needed to compensate retailers for their opportunity cost of not selling its rivals’ products. For a given degree of product asymmetry, the dominant firm is more likely to opt for exclusion the more substitutable are the two products.

It is well known that contract observability is often central to the results in vertical models such as this.\(^{12}\) In this paper, I have assumed that the dominant firm’s contract terms are observable to both retailers but that the individual retailer/competitive fringe contract terms are not. If, instead, the dominant firm’s contract terms were not observable to a retailer selling product B, it would not be possible for the dominant firm to induce the Stackelberg leader-follower prices. In this case, relaxing the observability assumption increases the likelihood of exclusion since otherwise the dominant firm would have to settle for Bertrand-Nash profits. By contrast, if the individual

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\(^{12}\)In addition to Katz (1991), see O’Brien and Shaffer (1992), and McAfee and Schwartz (1994).
retailer/competitive fringe contract terms were observable, the equilibrium in the subgame in which both products are sold would resemble the slotting-allowances equilibrium in Shaffer (1991). In this case, the Stackelberg profits are improved upon, and the likelihood of exclusion decreases.

The likelihood of anti-competitive exclusion in practice is also affected by the number of retail outlets available to the competitive fringe. It can be shown that in the case of more than two retailers, each retailer’s opportunity cost of shelf space is zero when rival retailers are selling products A and B. Hence, buying up scarce shelf space slots is costless for the dominant firm unless it seeks to exclude product B altogether. In this case, however, it would have to pay Stackelberg follower profits to all \( n > 2 \) retailers, since any one of them could unilaterally deviate and earn this amount. Thus, adding retailers to the model reduces the likelihood that slotting allowances are observed.

While recognizing that small manufacturers can indeed be the victims of anti-competitive exclusion in some circumstances, more research needs to be done to determine the extent to which this is so in practice. One avenue for future work is to allow retailers to be differentiated. One can then imagine circumstances in which, given limited shelf space, both retailers selling product A would be socially optimal. In these circumstances, slotting allowances could well be procompetitive if they make it easier for this product configuration to occur. Because of this, and because of the paucity of related work on slotting allowances, policy conclusions at this time are premature.
BIBLIOGRAPHY


