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Slotting Allowances and Optimal Product Variety*

Greg Shaffer

Abstract

Some 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 their shelf space to the highest bidders, retailers act as agents for consumers and ensure 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 the competitive fringe even when welfare would be higher if the fringe obtained distribution.

KEYWORDS: slotting allowances, exclusive dealing, raising rivals' costs

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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 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 to pay retailers for their patronage with lump-sum 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 lump-sum 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), for example, 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. The small manufacturers argue that, by bidding up the price of scarce shelf space, the large manufacturers can effectively foreclose them from the marketplace.

This concern has been echoed in U.S. congressional committees that oversee small business concerns, and it appears in reports by the U.S. Federal Trade Commission and the Canadian Bureau of Competition on marketing practices in the grocery industry.³ According to this view, slotting allowances bias product selection in favor of large manufacturers. The implication is that the retailers’ choices of which products to carry in their stores may not be socially optimal.

An alternative view is that slotting allowances enhance social welfare by pro-

¹Tim Hammonds, president of the U.S. Food Marketing Institute, Hammonds and Radtke (1990, p48). 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 the uses of slotting allowances.

³See “Slotting: Fair for Small Business and Consumers? Hearing Before the Senate Committee on Small Business,” 106th Congress, 1st Session 386 (1999), “Report on the Federal Trade Commission’s Workshop on Slotting Allowances and Other Marketing Practices in the Grocery Industry,” FTC (2001), “Slotting Allowances in the Retail Grocery Industry: Selected Case Studies in Five Product Categories,” FTC (2003), and “The Abuse of Dominance Provisions (Sections 78 and 79) as Applied to the Canadian Grocery Sector,” Canadian Bureau of Competition (2002).
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viding 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 manufacturer willingness-to-pay, some industry participants and 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. 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 retail shelf space, then it must be because they are producing inferior, or socially less desirable, products.

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 prices, the price of shelf space to any one manufacturer is endogenously determined by what the retailer could earn instead by selling its most profitable alternative. This allows manufacturers to be strategic in that each firm 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 will 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). The tradeoff for the dominant firm if it opts to exclude the competitive fringe is that it must balance the cost of paying slotting allowances to the retailers against the gain from being able to choose its other contract terms to capture the monopoly profit on its product. The tradeoff for the dominant firm if it opts to accommodate the competitive fringe is that it must balance the savings from not having to pay slotting allowances against the reduced ability to capture the surplus created by its product 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.

Slotting allowances work by raising rivals' costs, a strategy that was first ad-

⁴See the articles by Kelly (1991), Chu (1992), Sullivan (1997), and Lariviere and Padmanabhan (1997).

vanced by Salop and Scheffman (1983) and discussed in Krattenmaker and Salop (1986). 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 go directly to the retailers' bottom line, whereas the latter are mitigated by retail price competition. In other words, by paying retailers with lump-sum money, the dominant firm can compensate retailers for their scarce shelf space without having to lower its wholesale price, which would reduce the overall available profit to be split.

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 benefit in two ways. The lump-sum payments go directly to their bottom line and the higher wholesale prices reduce price competition. By not seeking a lower wholesale price, 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 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 the fringe is excluded. Section IV illustrates welfare effects with a linear demand example. Section V considers various extensions of the model. Section VI concludes with a discussion of the policy implications.

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 may 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 real-world 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 that there is a local market in which only two retailers operate (the model easily extends to $n > 2$ retailers). Due to limited shelf space, each retailer may sell either product A or product B but not both. One can think of the retailer's shelf space as being divided into slots of fixed width, where each product requires at least one slot for adequate display. Thus, the assumption that the retailer cannot carry both products implies that the number of slots is less than the number of products.

Product A is produced by a dominant firm at constant marginal cost c_A , and product B is produced by a competitive fringe of smaller rivals at constant marginal cost c_B . 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 V). Thus, the retailers only source of bargaining power is their limited shelf space. If both retailers sell the same product, consumers will buy from whichever retailer offers the lower price.

The assumption that product B is produced by a competitive fringe is made to capture the concerns of small manufacturers that slotting allowances are being 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 may differ in their bargaining power and thus in their ability to negotiate 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 in more detail below, there is an initial contracting stage, an accept-or-reject stage, a recontracting stage (if feasible), and a pricing stage. I assume that players at each stage of the game 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 with terms (w_A, F_A) , where w_A denotes the per-unit 'wholesale' price and F_A denotes the fixed fee. The fixed fee can be positive (the retailers pay the manufacturer) or negative (the manufacturer pays the retailers). With slotting allowances, the manufacturer pays the retailers to carry its product, and thus a slotting allowance corresponds 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 a retailer commits to carrying product A (instead of product B). Rejection implies that a retailer commits to carrying product B. In this case, the retailer purchases units

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 from the competitive fringe at marginal cost c_B . Thus, if both retailers accept the dominant firm's terms, then both carry product A and purchase from the dominant firm at the per-unit price w_A . 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 dominant firm's terms, then 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 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 only in the subgames where 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 in order to maximize their joint payoff given that they know 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 .⁶ 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 then ensues with each retailer purchasing according to the contract terms in effect for that retailer.

Let P_1 and P_2 denote the prices set by retailers 1 and 2 in the pricing stage. If both retailers carry product k , $k = A, B$, then the market demand for product k is given by $D^k(P_k)$, where $P_k \equiv \min\{P_1, P_2\}$. It follows that, because the retailers are homogeneous, if both retailers sell product B then equilibrium prices are $P_1 = P_2 = c_B$ and each retailer earns zero profit. And if both retailers sell product A then equilibrium prices are $P_1 = P_2 = w_A$ and each retailer earns $-F_A$. Because slotting allowances correspond to negative fixed fees, retailers earn positive profit in this case 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 $D_i^{B,A}(P_1, P_2)$, and let $D_i^{A,B}(P_1, P_2)$ denote retailer i 's demand when retailer 1 carries product A and retailer 2 carries product B. For all positive values of $D_i^{B,A}$ and $D_i^{A,B}$, I assume that retailer i '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

⁵The 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) and O'Brien and Shaffer (1994).

⁶Allowing the dominant firm to offer a new two-part tariff contract ensures that it can tailor its contract terms to the actual 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.

B and retailer 2 carries product A, then retailer 1's profit is given by

$$\pi_1^{B,A} \equiv (P_1 - c_B)D_1^{B,A}(P_1, P_2), \quad (1)$$

and retailer 2's profit is given by

$$\pi_2^{B,A} \equiv (P_2 - \omega_A)D_2^{B,A}(P_1, P_2) - \mathcal{F}_A. \quad (2)$$

Assuming that $\pi_i^{B,A}$ is concave in P_i and $|\frac{\partial^2 \pi_i^{B,A}}{\partial P_i^2}| > |\frac{\partial^2 \pi_i^{B,A}}{\partial P_i \partial P_j}|$, there is a unique equilibrium retail price vector $(P_1^{B,A}(\omega_A, c_B), P_2^{B,A}(\omega_A, c_B))$. Define analogous notation for when retailer 1 carries product A and retailer 2 carries product B.

III Offering slotting allowances to exclude competitors

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, 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 is more profitable for the dominant firm, consider first the continuation game in which both products are carried in the downstream market. Without loss of generality, let retailer 2 be the lone retailer carrying product A. Then, from the pricing stage, we have that retailer 2's equilibrium profit is

$$\Pi_2^{B,A}(\omega_A, \mathcal{F}_A) \equiv (P_2^{B,A}(\omega_A, c_B) - \omega_A)D_2^{B,A}(P_1^{B,A}(\omega_A, c_B), P_2^{B,A}(\omega_A, c_B)) - \mathcal{F}_A,$$

where $(\omega_A, \mathcal{F}_A)$ is the contract in place between retailer 2 and the dominant firm after the recontracting stage.

Let (w_A^r, F_A^r) denote the contract offered by the dominant firm in the recontracting stage. Thus, it follows that $(\omega_A, \mathcal{F}_A) \in \{(w_A^r, F_A^r), (w_A, F_A)\}$ (if the new contract is accepted, then $(\omega_A, \mathcal{F}_A) = (w_A^r, F_A^r)$, otherwise, $(\omega_A, \mathcal{F}_A) = (w_A, F_A)$). Since the dominant firm can always choose $(w_A^r, F_A^r) = (w_A, F_A)$, it follows that it is weakly profitable for the dominant firm to induce the retailer to accept the new contract, and thus its maximization problem in the recontracting stage is given by

$$\max_{w_A^r, F_A^r} (w_A^r - c_A)D_2^{B,A}(P_1^{B,A}(w_A^r, c_B), P_2^{B,A}(w_A^r, c_B)) + F_A^r, \quad (3)$$

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such that retailer 2 prefers contract (w_A^r, F_A^r) to contract (w_A, F_A) ,

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$$\Pi_2^{B,A}(w_A^r, F_A^r) \geq \Pi_2^{B,A}(w_A, F_A). \quad (4)$$

Since the maximand in (3) is increasing in F_A^r , the dominant firm will choose F_A^r such that (4) holds with equality. Making this substitution into the maximand in (3), we have that the dominant firm will choose w_A^r to solve

$$\max_{w_A^r} (P_2^{B,A}(w_A^r, c_B) - c_A) D_2^{B,A}(P_1^{B,A}(w_A^r, c_B), P_2^{B,A}(w_A^r, c_B)) - \Pi_2^{B,A}(w_A, F_A). \quad (5)$$

Differentiating with respect to w_A^r and simplifying gives the first-order condition

$$\left((P_2^{B,A} - c_A) \frac{\partial D_2^{B,A}}{\partial P_2} + D_2^{B,A} \right) \frac{dP_2^{B,A}}{dw_A^r} + (P_2^{B,A} - c_A) \frac{\partial D_2^{B,A}}{\partial P_1} \frac{dP_1^{B,A}}{dw_A^r} = 0.$$

Substituting in retailer 2's first-order condition for P_2 , $(P_2^{B,A} - w_A^r) \frac{\partial D_2^{B,A}}{\partial P_2} + D_2^{B,A} = 0$, gives

$$(w_A^r - c_A) \frac{\partial D_2^{B,A}}{\partial P_2} \frac{dP_2^{B,A}}{dw_A^r} + (P_2^{B,A} - c_A) \frac{\partial D_2^{B,A}}{\partial P_1} \frac{dP_1^{B,A}}{dw_A^r} = 0. \quad (6)$$

Assuming retail prices are increasing in w_A^r , as is the case if reaction functions are upward sloping, (6) can be decomposed into a negative direct effect of an increase in w_A^r above c_A (the first term), and a positive indirect effect of an increase in w_A^r due to the induced increase in $P_1^{B,A}$ (the second term). Solving yields $w_A^r = w_A^{r*} > c_A$. The equilibrium retail prices are then $P_1^{B,A}(w_A^{r*}, c_B)$ and $P_2^{B,A}(w_A^{r*}, c_B)$.

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_A^r . In effect, the dominant firm exploits its first-mover advantage to soften the downstream competition between retailers 1 and 2. This dampening-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, $P_1^{B,A}(w_A^{r*}, c_B)$, $P_2^{B,A}(w_A^{r*}, c_B)$, 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

$$\Pi_l^* \equiv \max_{P_2} (P_2 - c_A) D_2^{B,A}(P_1^*(P_2), P_2). \quad (7)$$

Let $P_2^* \equiv \arg \max_{P_2} (P_2 - c_A) D_2^{B,A}(P_1^*(P_2), P_2)$. Then, because $P_2 = P_2^{B,A}(w_A^{r*}, c_B)$ is feasible, it follows that

$$\Pi_l^* \geq (P_2^{B,A}(w_A^{r*}, c_B) - c_A) D_2^{B,A}(P_1^{B,A}(w_A^{r*}, c_B), P_2^{B,A}(w_A^{r*}, c_B)) \equiv RHS. \quad (8)$$

On the other hand, because setting w_A^r such that $P_2^{B,A}(w_A^r, c_B) = P_2^*$ is feasible, it follows from (5) and the definition of w_A^{r*} that

$$RHS \geq (P_2^* - c_A)D_2^{B,A}(P_1^*(P_2^*), P_2^*) = \Pi_l^*, \quad (9)$$

where I have used the fact that Nash equilibrium implies $P_1^*(P_2^{B,A}(w_A^r, c_B)) = P_1^{B,A}(w_A^r, c_B)$. This means that $P_2^{B,A}(w_A^{r*}, c_B) = P_2^*$, $P_1^{B,A}(w_A^{r*}, c_B) = P_1^*(P_2^*)$, and the joint profit of the dominant firm and retailer 2 if only retailer 2 carries product A is Π_l^* . The follower's profit goes to retailer 1. Its maximized profit is given by

$$\Pi_f^* \equiv (P_1^*(P_2^*) - c_B)D_1^{B,A}(P_1^*(P_2^*), P_2^*). \quad (10)$$

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

Lemma 1 *In any equilibrium in which both products obtain retail distribution, the joint profit of the dominant firm and the retailer carrying product A is Π_l^* , and the profit of the retailer carrying product B is Π_f^* . Consumers face the Stackelberg-leader price on product A and the Stackelberg-follower price on product B.*

Using Lemma 1 and (3)-(5), and given equilibrium profits in the pricing stage when both retailers sell the same product, 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 Π_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.

Table 1: Accept-Or-Reject Stage

		RETAILER 2	
		Product A	Product B
RETAILER 1	Product A	$-F_A, -F_A$	$\Pi_1^{A,B}(w_A, F_A), \Pi_f^*$
	Product B	$\Pi_f^*, \Pi_2^{B,A}(w_A, F_A)$	0, 0

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

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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 there is 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 pure-strategy equilibrium calls for both retailers to carry product B.

In the initial contracting stage, the dominant firm chooses contract (w_A, F_A) to induce the product market configuration that maximizes its profit. Since it will never want to 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 its product is

$$\max_{w_A, F_A} (w_A - c_A)D^A(w_A) + 2F_A \quad \text{such that} \quad -F_A \geq \Pi_f^*, \quad (11)$$

where (11) uses the result from the pricing stage that, in equilibrium, $P_A = w_A$, and the result from the accept-or-reject stage that $-F_A \geq \Pi_f^*$ is a necessary and sufficient condition 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 the dominant firm's profit is increasing in F_A , and Π_f^* does not depend on w_A , it follows from (11) that the dominant firm's maximized profit is

$$\Pi_m^* - 2\Pi_f^*. \quad (12)$$

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

Lemma 2 *In any equilibrium in which only the dominant firm's product obtains retail distribution, the profit of the dominant firm is $\Pi_m^* - 2\Pi_f^*$, and the profit of each retailer is Π_f^* . Consumers face the monopoly price on product A.*

The overall joint profit in this case is Π_m^* , of which each retailer gets Π_f^* . Notice that slotting allowances are instrumental in achieving this outcome. To exclude the competitive fringe, the dominant firm must ensure that each retailer earns at least Π_f^* . With slotting allowances, the dominant firm simply pays each retailer this amount. Without slotting allowances, however, excluding the fringe is not possible 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 its product and the other retailer to carry its rivals' product (that is, if it decides

to accommodate the competitive fringe) is

$$\max_{w_A, F_A} \Pi_l^* - \Pi_2^{B,A}(w_A, F_A) \quad (13)$$

such that

$$-F_A < \Pi_f^* \quad \text{and} \quad \Pi_2^{B,A}(w_A, F_A) \geq 0, \quad (14)$$

where (13) and (14) use the result from Lemma 1 that the joint profit of the dominant firm and the retailer carrying product A is Π_l^* , the result from (5) 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 conditions to induce only one retailer to accept the dominant firm's contract.

Since the maximand in (13) is decreasing in $\Pi_2^{B,A}(w_A, F_A)$, and since this 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 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, we have that the dominant firm's maximized profit if it accommodates the competitive fringe is Π_l^* .

The dominant firm's profit-maximizing strategy is determined by comparing its maximized profit if it induces both retailers to carry its product, $\Pi_m^* - 2\Pi_f^*$, to its maximized profit if it induces only one retailer to carry its product, Π_l^* .

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 equals the 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 Π_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 ($\Pi_l^* = \Pi_f^* = 0$). 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 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 are not likely to arise when products A and B are weak substitutes because, from the dominant firm's perspective, there is little additional profit to be had by excluding the competitive fringe, and the out-of-pocket cost of acquiring both retailers' shelf space approaches twice the monopoly profit on product B . On the other hand, slotting allowances are more 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 both retailers' 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 will (not) arise.

Turning to welfare considerations, note that the effects of a policy of no slotting allowances can be analyzed by constraining the dominant firm to choose $F_A \geq 0$. This constraint would have no effect on the characterization of equilibria in the pricing stage, the recontracting stage, and the accept-or-reject stage, but it would have an effect on 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 $-F_A \geq \Pi_f^*$, which cannot be satisfied when $\Pi_f^* > 0$ if slotting allowances are prohibited. Thus, absent slotting allowances, it will not be possible for the dominant firm to exclude the competitive fringe. Since the dominant firm earns zero if it induces both retailers to carry product B , and since it earns $\Pi_l^* \geq 0$ if it induces only one retailer to carry product B (its maximization problem in this case is unaffected by the constraint $F_A \geq 0$), it follows that, when $\Pi_f^* > 0$, both products will obtain distribution in all equilibria.

A policy that prohibits slotting allowances benefits consumers when the dominant firm would otherwise have an incentive to exclude the competitive fringe, $\Pi_m^* - 2\Pi_f^* > \Pi_l^*$, and when slotting allowances would be necessary to induce this exclusion, $\Pi_f^* > 0$. In this case, in the absence of slotting allowances, consumers can choose between products A and B and face Stackelberg leader-follower prices in

equilibrium. But, if slotting allowances are permitted, the dominant firm will use them to exclude product B, and consumers will face monopoly prices on product A in equilibrium. These results are summarized in the following proposition.

Proposition 2 *If $\Pi_m^* - 2\Pi_f^* < \Pi_l^*$ or $\Pi_f^* = 0$, then a prohibition of slotting allowances has no effect on consumer welfare. If $\Pi_m^* - 2\Pi_f^* \geq \Pi_l^*$ and $\Pi_f^* > 0$, then a prohibition of slotting allowances increases consumer welfare. Consumers gain from an increase in product variety and from lower prices on products A and B.*

When slotting allowances would otherwise be used by a dominant firm to exclude the competitive fringe, the gains from prohibiting 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 both products 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 regardless of the legality of slotting allowances are no worse off. Hence, a prohibition on slotting allowances is a Pareto improvement for all consumers.

In addition to benefiting 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 below using a linear example.

IV Illustrative example

To get a sense of the potential gain in social welfare that may result from a policy of no slotting allowances, suppose consumers' aggregate utility is given by

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

where M is consumers' aggregate income, $\gamma \in (0, \infty)$ is a measure of demand substitution (higher γ means the products are closer substitutes), $s \in (0, 1]$ is a measure of market-share asymmetry at equal prices ($s = 1/2$ means the market is equally divided), and q_i is the quantity consumed of the i th product.

If both retailers carry product A, then $q_B = 0$. In this case, the market demand for product A is found by differentiating $U(q_A, 0) - P_A q_A$ with respect to q_A and

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

If one retailer carries product A and the other carries product B, then $q_A, q_B > 0$. In this case, the demand for each product is found by differentiating $U(q_A, q_B) - P_A q_A - P_B q_B$ with respect to (q_A, q_B) and then inverting the first-order conditions.⁷ When retailer 2 carries product A and retailer 1 carries product B, this yields

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

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

Recall that a higher γ implies that products A and B are closer substitutes. In the limit, as $\gamma \rightarrow 0$, products A and B become independent in demand, and as $\gamma \rightarrow \infty$, products A and B become perfect substitutes. Recall also that s measures market-share asymmetry. Define a product's baseline market share to be the market share that product would receive if the prices for products A and B were equal. Then, from the demands above, it follows that product A has a baseline market share of s and product B has a baseline market share of $1 - s$. Since one would expect the dominant firm's product to have a higher baseline market share than the fringe's product, in what follows, I restrict attention to environments in which $s \geq 1/2$.

To simplify the computations when solving for the equilibrium profits and retail prices, let $c_A = c_B = c$. In addition, 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 exclude the competitive fringe. Without loss of generality, let retailer 2 be the retailer carrying product A. Then the Stackelberg leader-follower prices and profits are:

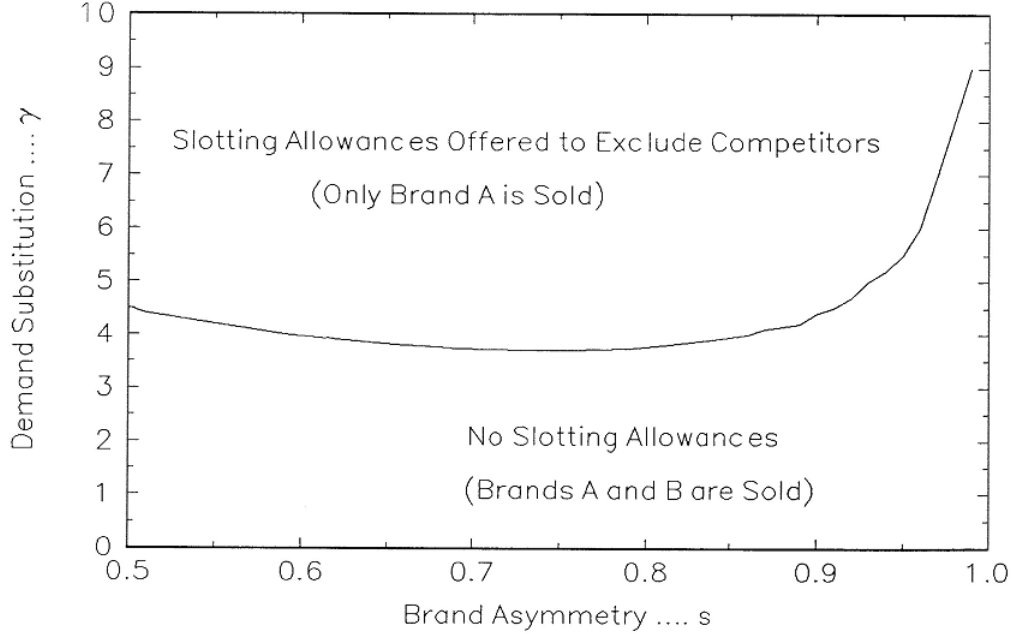
$$P_1^{B,A}(\omega_A^{r*}, c) = (1 + 2\gamma + \gamma s + 3\gamma^2 s - \gamma^2 s^2)V + (1 + 2\gamma + 3\gamma s + 9\gamma^2 s - \frac{3\gamma^2 s^2 + 8\gamma^3 s^2 - 8\gamma^3 s^3}{2(1 + 2\gamma s)(1 + 2\gamma + 2\gamma^2 s - 2\gamma^2 s^2)})c,$$

$$P_2^{B,A}(\omega_A^{r*}, c) = \frac{(1 + \gamma + \gamma s)V + (1 + 3\gamma - \gamma s + 4\gamma^2 s - 4\gamma^2 s^2)c}{2(1 + 2\gamma + 2\gamma^2 s - 2\gamma^2 s^2)},$$

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

⁷The properties of this demand system are explored in more depth in Shubik (1980; p. 132).

Figure 1: Determining When Slotting Allowances Are Used



$$\Pi_l^* = \frac{(V - c)^2 s (1 + \gamma + \gamma s)^2}{4(1 + 2\gamma s)(1 + 2\gamma + 2\gamma^2 s - 2\gamma^2 s^2)}.$$

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

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

It is straightforward to show that $\Delta\Pi$ is increasing in γ and, for any $s \in [\frac{1}{2}, 1]$, there exists $\bar{\gamma} > 0$ 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 $\bar{\gamma}(s) > 0$ such that, for all $\gamma \geq \bar{\gamma}(s)$, the competitive fringe is excluded in equilibrium. The dominant firm induces exclusion by offering slotting allowances to the retailers.*

The locus of points for which $\Delta\Pi = 0$ is plotted in Figure 1. Above the curve, $\Delta\Pi > 0$ and the dominant firm will offer slotting allowances to exclude its competi-

tors. Below the curve, $\Delta\Pi < 0$ and slotting allowances will not be offered. Only product A is sold in the former case. Both products are sold in the latter case.

For a given degree of brand asymmetry s , we see from Figure 1 that $\Delta\Pi$ starts out negative for low γ and then turns positive as γ increases. Intuitively, $\Delta\Pi$ is increasing in γ for two reasons. First, the more substitutable are products A and B, the less aggregate demand is foregone if product B is not sold by either retailer. This means that $D^A(P_A)$ is increasing in γ , and hence the monopoly profit on product A, Π_m^* , is increasing in γ . Second, the more substitutable are products A and B, the more vigorous price competition is between retailers when both products are sold. This means that the dominant firm's ability to induce a relatively high Stackelberg-leader price on its product is decreasing in γ , and hence both the Stackelberg-leader profit and the Stackelberg-follower profit are decreasing in γ . It follows that $\Pi_m^* - (2\Pi_f^* + \Pi_l^*)$ is increasing in γ , and thus slotting allowances and exclusion are more likely to occur the more substitutable are the products.⁸

It remains to consider the effect of slotting allowances on equilibrium retail prices and social welfare, where social welfare is defined as the sum of consumer surplus and profits. Consider first the effect on equilibrium retail prices. When the dominant firm pays slotting allowances to induce both retailers to carry its product, it will choose its wholesale price to induce the monopoly price on product A (product B's price is infinite). On the other hand, when both products are sold, 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. It follows that slotting allowances lead to higher equilibrium retail prices.⁹

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 product variety can be seen in Figure 2 below, which depicts the percentage decrease in social welfare associated with slotting allowances over the region of parameter space bounded by $.5 \leq s \leq .9$ and $4.5 \leq \gamma \leq 10$.¹⁰

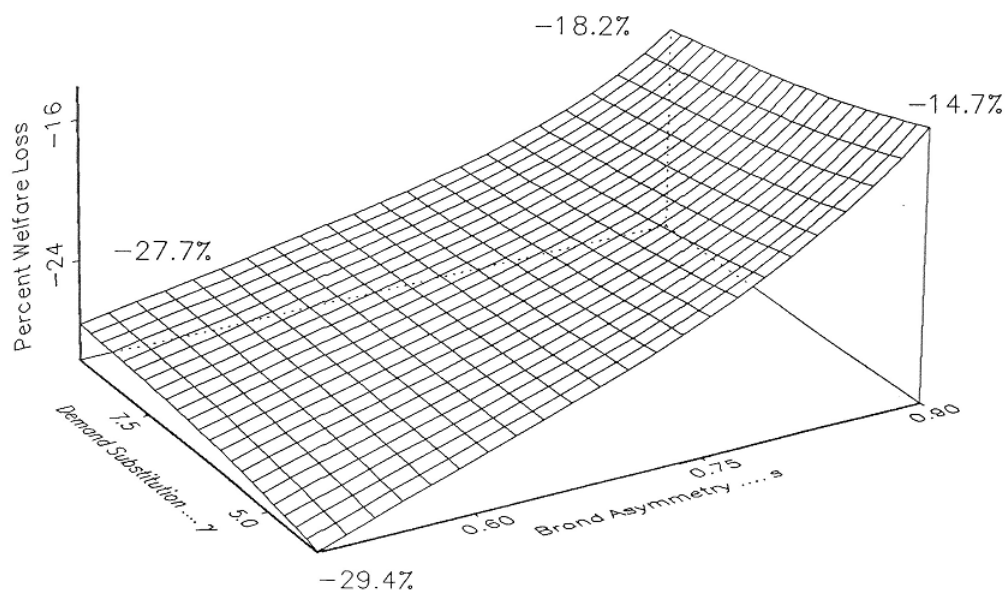
Proposition 4 *The dominant firm may use slotting allowances to exclude the competitive fringe in equilibrium even when social welfare would be higher if both products were sold. In the linear-demand example with $c_A = c_B = c$, $.5 \leq s \leq .9$, and $4.5 \leq \gamma \leq 10$, Figure 2 implies that the welfare loss from the higher retail prices and the reduced product variety ranges from a low of 14.7% to a high of 29.4%.*

⁸It can be shown that the derivative of $\Delta\Pi$ is increasing in s for all $s \leq .75$ and decreasing in s thereafter. This non-monotonicity is due to several factors. On the one hand, the monopoly profit on product A is increasing in s for the same reason that it is increasing in γ —because $D^A(P_A)$ is increasing. By itself, this effect makes exclusion *more* likely. On the other hand, the Stackelberg leader profit on product A when both products are sold is also increasing in s . By itself, this effect makes exclusion *less* likely. The first (second) effect dominates for low (high) levels of s .

⁹Comparative statics in the linear example imply that the increase in retail prices is increasing in the degree of product substitution γ and decreasing in the degree of product asymmetry s .

¹⁰Note from Figure 1 that the dominant firm will opt to induce exclusion over this entire region.

Figure 2: Percentage Change in Social Welfare
With Slotting Allowances



As s increases, the welfare loss associated with slotting allowances decreases. There are two reasons for this. First, the foregone consumer demand from product B if product B is not sold by either retailer is less the more skewed preferences are towards product A. This implies that the welfare loss due to a reduction in product variety is decreasing in s . Second, the reduced sensitivity of $D_2^{B,A}(P_1, P_2)$ to an increase in P_2 as s increases enables the dominant firm to sustain profitably a higher price on its product in any continuation game in which exclusion does not occur. Thus, the welfare loss due to higher retail prices is also decreasing in s .

Whether the welfare loss associated with slotting allowances is increasing or decreasing in γ 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 γ affects the welfare loss from a reduction in product variety and the welfare loss from higher retail prices differently. The consumer demand foregone from product B if product B is not sold by either retailer is less the more substitutable are products A and B. Hence, the loss in welfare from a reduction in product variety is decreasing in γ . 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 γ .

The former effect (reduction in product variety) dominates for relatively low levels of s ; the latter effect (higher retail prices) dominates for relatively high levels of s .

V Extensions

In this section, I explore in greater depth several extensions: 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 they both carry its product.¹¹ Hence, it is not unreasonable to assume that its initial contract offer, (w_A, F_A) , is the same for both firms and thus observable. However, since the Robinson-Patman Act does not constrain the dominant firm if only one retailer carries product A, it is interesting to consider the case in which, in the recontracting stage, the dominant firm's offer of (w_A^r, F_A^r) to the retailer carrying its product is not observable to the retailer carrying product B. In this case, it is well known from Katz (1991) and others that the dominant firm's ability to soften downstream competition will be severely limited. In the environment considered here, for instance, the best the dominant firm can do is to offer its retailer $w_A^r = c_A$, which in equilibrium will be anticipated by the retailer carrying product B.¹²

This implies that the new equilibrium retail prices when one retailer carries product B and the other retailer carries product A are $P_1^{B,A}(c_A, c_B)$ and $P_2^{B,A}(c_A, c_B)$, 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

$$\tilde{\Pi}_2^{B,A} \equiv (P_2^{B,A}(c_A, c_B) - c_A)D_2^{B,A}(P_1^{B,A}(c_A, c_B), P_2^{B,A}(c_A, c_B)), \quad (15)$$

and the equilibrium profit of the retailer carrying product B is

$$\tilde{\Pi}_1^{B,A} \equiv (P_1^{B,A}(c_A, c_B) - c_B)D_1^{B,A}(P_1^{B,A}(c_A, c_B), P_2^{B,A}(c_A, c_B)). \quad (16)$$

Replacing all occurrences of Π_f^* with $\tilde{\Pi}_2^{B,A}$ and all occurrences of Π_f^* with $\tilde{\Pi}_1^{B,A}$, 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

¹¹See O'Brien and Shaffer (1994) for a discussion of the role of the Robinson-Patman Act in vertical models with a dominant firm and its implications for contract observability.

¹²To see this why this is so, note that, with unobservable contracts, the second set of terms in (6) is zero because the derivative of $dP_1^{B,A}$ with respect to dw_A^r is zero. Put simply, the retailer carrying product B cannot be induced to react to a wholesale price change it cannot observe.

dominant firm excludes the competitive fringe if and only if $\Pi_m^* - 2\tilde{\Pi}_1^{B,A} \geq \tilde{\Pi}_2^{B,A}$. Comparing this condition to the condition for exclusion when contracts are observable in the recontracting stage, $\Pi_m^* - 2\Pi_f^* \geq \Pi_l^*$, and noting that $\tilde{\Pi}_2^{B,A} \leq \Pi_l^*$ and $\tilde{\Pi}_1^{B,A} \leq \Pi_f^*$, with equality only when the products are perfect substitutes, we have that the left-hand side is smaller and the right-hand side is larger when contracts are observable than when they are not. This means that the net gain to the dominant firm from excluding the competitive fringe is smaller when contracts are observable. Thus, exclusion is more likely 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 actual 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) regardless of what its rival may carry, 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 $\Pi_1^{B,A}(w_A, F_A)$, where $\Pi_1^{B,A}(w_A, F_A) \equiv (P_1^{B,A}(w_A, c_B) - c_B)D_1^{B,A}(P_1^{B,A}(w_A, c_B), P_2^{B,A}(w_A, c_B))$, and retailer 2 earns profit $\Pi_2^{B,A}(w_A, F_A)$, 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 is given by Table 2 below:

Table 2: Accept-Or-Reject Stage

		RETAILER 2	
		Product A	Product B
RETAILER 1	Product A	$-F_A, -F_A$	$\Pi_1^{A,B}(w_A, F_A), \Pi_2^{A,B}(w_A)$
	Product B	$\Pi_1^{B,A}(w_A), \Pi_2^{B,A}(w_A, F_A)$	0, 0

Given the dominant firm's initial contract offer (w_A, F_A) in stage one, 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 $-F_A \geq \Pi_1^{B,A}(w_A)$, then the unique equilibrium of the game calls for both retailers to carry product A. If

$-F_A < \Pi_1^{B,A}(w_A)$ 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 $-F_A < \Pi_1^{B,A}(w_A)$ and $\Pi_2^{B,A}(w_A, F_A) < 0$, then the unique equilibrium of the game calls for both retailers to carry product B.

In the initial contracting stage, the dominant firm chooses contract (w_A, F_A) to induce the product market configuration that maximizes its profit. It can induce zero (which is never optimal), one or both retailers to carry its product. If it induces both retailers to carry its product, its maximization problem is given by

$$\max_{w_A, F_A} (w_A - c_A)D^A(w_A) + 2F_A \quad \text{such that} \quad -F_A \geq \Pi_1^{B,A}(w_A), \quad (17)$$

where (17) uses the result from the pricing stage that, in equilibrium, $P_A = w_A$, and the result from the accept-or-reject stage that $-F_A \geq \Pi_1^{B,A}(w_A)$ is a necessary and sufficient condition for both retailers to accept the dominant firm's contract.

Let $\tilde{w}_A \equiv \arg \max_{w_A} ((w_A - c_A)D^A(w_A) - 2\Pi_1^{B,A}(w_A))$ denote the dominant firm's profit-maximizing wholesale price when F_A satisfies the constraint in (17) with equality. Then, substituting this into the maximand in (17), the dominant firm's maximized profit if it induces both retailers to carry its product is

$$(\tilde{w}_A - c_A)D^A(\tilde{w}_A) - 2\Pi_1^{B,A}(\tilde{w}_A). \quad (18)$$

The dominant firm's maximization problem if it induces one retailer to carry its product and the other retailer to carry its rivals' product (that is, if it decides to accommodate the competitive fringe) is

$$\max_{w_A, F_A} (w_A - c_A)D_2^{B,A}(P_1^{B,A}(w_A, c_B), P_2^{B,A}(w_A, c_B)) + F_A, \quad (19)$$

such that

$$-F_A < \Pi_1^{B,A}(w_A) \quad \text{and} \quad \Pi_2^{B,A}(w_A, F_A) \geq 0, \quad (20)$$

where (19) and (20) use the result from the accept-or-reject stage that $-F_A < \Pi_1^{B,A}(w_A)$ and $\Pi_2^{B,A}(w_A, F_A) \geq 0$ are necessary and sufficient conditions to induce only one retailer to accept the dominant firm's contract. Since the maximand in (19) is increasing in 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 F_A to solve $\Pi_2^{B,A}(w_A, F_A) = 0$ and w_A to solve

$$\max_{w_A} (P_2^{B,A}(w_A, c_B) - c_A)D_2^{B,A}(P_1^{B,A}(w_A, c_B), P_2^{B,A}(w_A, c_B)). \quad (21)$$

Since the argmax of (21) is the same as the argmax of (5), it follows that the dominant firm's maximized profit if it excludes the competitive fringe is Π_i^* .

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, $(\tilde{w}_A - c_A)D^A(\tilde{w}_A) - 2\Pi_1^{B,A}(\tilde{w}_A)$, and its maximized profit if it induces only one retailer to carry product A, Π_i^* . 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 $(\tilde{w}_A - c_A)D^A(\tilde{w}_A) - 2\Pi_1^{B,A}(\tilde{w}_A) \geq \Pi_l^*$.

Comparing the condition for exclusion when there is no recontracting stage, $(\tilde{w}_A - c_A)D^A(\tilde{w}_A) - 2\Pi_1^{B,A}(\tilde{w}_A) \geq \Pi_l^*$, to the condition for exclusion when there is a recontracting stage, $\Pi_m^* - 2\Pi_f^* \geq \Pi_l^*$, 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 $\Pi_m^* - 2\Pi_f^* \geq (\tilde{w}_A - c_A)D^A(\tilde{w}_A) - 2\Pi_1^{B,A}(\tilde{w}_A)$. This inequality is satisfied in the linear-demand example above. Intuitively, recontracting allows the dominant firm to choose its initial wholesale price to induce monopoly pricing at the retail level when both retailers carry its product, whereas, without recontracting, the dominant firm will be constrained in choosing its wholesale price so as not to be too disadvantaged in the event that one of the retailers were to reject its offer.

The role of retail competition

The motive to use slotting allowances comes from the dissipation of the dominant firm's profit due to the competitive fringe *and* retail price competition. Either one alone is not sufficient. Dissipation of the 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 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, then 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 increases or when the number of retailers in the market 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, each retailer must earn a profit which is at least equal to what that retailer would earn 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

Π_i^* . Hence, the dominant firm will induce exclusion if and only if $\Pi_m^* - n\Pi_f^* \geq \Pi_i^*$. Because the left-hand side of the inequality is decreasing in n , it follows that the dominant firm's use of slotting allowances to induce exclusion is decreasing in 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 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. It may be more realistic for products that require refrigeration or that need to be kept frozen (because refrigeration and freezer space tends to be especially tight) because then substitutions may be difficult, but it may be less realistic 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 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.¹³

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 must combine an offer of slotting allowances with a provision that expressly prohibits the retailer from carrying product B (if it accepts the dominant firm's terms). In this case, the dominant firm earns $\Pi_m^* - 2\Pi_f^*$ and each retailer receives a slotting payment of Π_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 Π_l^* 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 product A and decrease the former retailer's profit).

VI Conclusion

The central issue addressed in this article is whether slotting allowances enhance social welfare by providing retailers with an efficient way to allocate scarce shelf-space. The claim made by some commentators is that, by offering their shelf space to the highest bidders, retailers act as agents for consumers and ensure 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,

¹³For 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 contracts might lead to inefficient exclusion and higher consumer prices than otherwise because of the concomitant decrease in competition.

the dominant firm can sometimes exclude the competitive fringe 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, exclusion would not be profitable. 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 (weakly) 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 on the one hand, if it does not exclude its rivals, versus the out-of-pocket cost in slotting allowances that it would incur (necessary to compensate retailers for their opportunity cost of not selling the rivals' products) if it does induce exclusion. For a given degree of product asymmetry, the dominant firm is more likely to find it profitable to induce 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 the one in this article.¹⁴ I have assumed that the dominant firm's contract terms are observable to both retailers but 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 retailer/competitive fringe contract terms were observable, then the equilibrium in the subgame in which both products are sold would resemble the slotting-allowances equilibrium in Shaffer (1991). In this case, profits exceed the Stackelberg profits, and the likelihood of exclusion decreases.

The likelihood of 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 both products have obtained distribution. 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 of slotting allowances.

This model finds that small manufacturers can indeed be the victims of anti-competitive exclusion in some circumstances. However, more research needs to be done to determine the extent to which these circumstances prevail in practice.

¹⁴For example, O'Brien and Shaffer (1992) find that if the downstream firms can observe each other's contract, an upstream monopolist can maximize overall joint profit by elevating its wholesale price to internalize retailer competition and using the fixed component of its contract to extract surplus. But if the downstream firms cannot observe each other's contract, then the fear of opportunism may imply that the upstream monopolist can do no better than to set its wholesale price equal to its marginal cost, even if this reduces the overall surplus that can be extracted.

One avenue for future work is to allow retailers to be differentiated in the eyes of consumers. 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.

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