Slotting Allowances and Retail Product Variety under Oligopoly

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Abstract

Slotting fees are lump-sum charges paid by manufacturers to retailers for shelf space. In this letter we examine the strategic effect of slotting allowances on product variety. In a spatial model where consumers each have unit demand for their preferred product variant and retailers jointly select prices and product variety, we show that variety is (1)under-provided without slotting contracts and (2) efficiently supplied under equilibrium slotting fees.

Keywords: Slotting fees, vertical contracts, product variety, oligopoly
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1 Introduction

Slotting allowances are up-front tariffs paid by manufacturers to retailers for access to supermarket shelves. In grocery retailing, slotting fees are exchanged in a large number of product categories with magnitudes that range between \$75 and \$300 per item per store in the U.S. (FTC 2001). They are especially common in frozen and refrigerated foods, dry grocery, beverages, snacks, candy, and microwaveable shelf-stable foods.

Slotting allowances can have anti-competitive effects in the presence of market power either upstream (by manufacturers) or downstream (by retailers). With upstream market concentration, slotting contracts can foreclose markets to de novo entrants (Shaffer 2005), enable one retailer and a monopoly manufacturer either to foreclose a rival retailer (Marx and Shaffer 2007) or coordinate without retail exclusion (Rey, Thal and Verge 2011), and/or enable national brand manufacturers to control the retail prices of other (competitively supplied) goods (Innes and Hamilton 2006, 2009). [1] With downstream market power, slotting allowances enable retailers to commit to higher wholesale prices that result in higher retail price equilibria (Shaffer 1991).

In this letter we consider the case of downstream (retail) market power and study how slotting allowances affect product variety choices. [2] We develop a simple spatial model in which duopoly retailers compete for the patronage of consumers who have unit demands for their most preferred brand. The competition is over product variety and price in a multi-stage game where slotting contracts can be signed at the outset. [3]

Absent slotting allowances, retailers undersupply product variety relative to the social optimum. Expanding product lines intensifies price competition (Anderson and de Palma 1992, Hamilton and Richards 2009), deterring retailers from increasing variety.

[1]See also McAfee and Schwartz (1994), O'Brien and Shaffer (1997), and Rey and Verge (2004), with apologies for omissions of other superb papers on upstream market power. For literature on efficiency enhancing motives for slotting fees, see (for example) Klein and Wright (2007).

[2]The number of products sold at supermarkets has increased dramatically following the inception of slotting allowances as a grocery practice in 1984. For instance the median number of stock-keeping units (SKUs) among U.S. supermarkets increased 52 percent (from 16,500 to 25,153) over the period 1990-2004 (Progressive Grocer).

[3]We consider the simplest possible model that illustrates our result. Our expanded paper (available upon request) generalizes the result to multiple retailers with multiple outlets / stores and more general consumer preferences over product variety and retailers.

Our central finding is that slotting fees restore optimality. By elevating a retailer's post-contract wholesale price, slotting allowances lead to higher equilibrium retail prices (Shaffer 1991). As a result, customers are more valuable to retailers who therefore seek to attract them with larger numbers of product variants. Indeed, at the margin, slotting fees provide retailers with an instrument to control rival price responses, freeing them to capture all of the economic benefits of expanded product variety in creating better matches between consumers and brands.

2 The Model

We consider a single product category in which each of M consumers has unit demand. Without loss, we normalize M to equal one. Products within the category are distinguished by locations on the circumference of a unit circle (Salop 1979). Each consumer has a preference for one of the locations - their most-preferred product variant - and incurs a matching cost of δ per unit of distance between the product they purchase and their most-preferred variant. Each consumer's most-preferred-product location is drawn from a uniform distribution on the product circle and is revealed once the consumer shops at a retailer.

Consumers each shop at one of two retailers and have differential retailer preferences / transportation costs as in Hotelling (1929). The two retailers are located at the ends of a unit line segment, with consumers distributed uniformily between the two. A consumer's retail preference location is denoted by $\theta \in [0, 1]$. A consumer incurs transportation / preference costs equal to t per unit of distance between their preference location θ and the retailer where they shop, θt for Retailer 1 and $(1 - \theta)t$ for Retailer 2.

Figure 1 depicts the layout of the model. Each retailer carries an endogenous number of differentiated variants $(v_1, v_2, v_3, ...v_n)$ within a single product category. The variants are (optimally) symmetrically distributed on the product circle. In choosing between retailers, consumers consider their distance to each retailer (on the Hotelling line), the expected quality of the available matches in each retailers product assortment, and the respective retailer prices. Consumers who are closest to a given retailer shop at that retailer, producing a critical consumer, $\theta = \theta^*$, who is indifferent between the two retail options.

Let $\overline{u}$ denote the gross value each consumer receives from consuming her most preferred product variant. Expected consumer utility from shopping at retailer i is (before subtracting transportation costs):

$$u(p_i, n_i) = \overline{u} - \delta/4n_i - p_i \tag{1}$$

where p_i is the (symmetric) price charged by retailer i for each variant in the product category; n_i is the number of product variants; and the second term captures the consumers' expected cost of matching to a product variant,

$$2n \int_0^{1/2n} \delta x dx = \frac{\delta}{4n} \tag{2}$$

Notice that net consumer utility u is increasing in n. A greater range of products improves the match between consumer preferences and products; hence, more product variety and lower prices work jointly to attract customers to a store.

The critical consumer θ^* has equal net utility at the two retailers:

$$\theta^* : u(p_1, n_1) - t\theta = u(p_2, n_2) - t(1-\theta) \rightarrow \theta^*(p_1, n_1; p_2, n_2) = \frac{t + u(p_1, n_1) - u(p_2, n_2)}{2t} \tag{3}$$

On the supply / cost side, we assume that competitive wholesalers have constant unit costs of supply $c \geq 0$ and retailers face a constant unit cost f of stocking / marketing each of n variants.

3 Social Optimum

The socially optimal allocation maximizes consumption value net of production costs,

$$W = \overline{u} - [\delta/4n] - c - 2fn \tag{4}$$

Maximizing with respect to n yields $n^* = \sqrt{\delta/8f}$.

4 Market Equilibrium

The Game. Strategic interaction between retailers is modeled as a four-stage game. First, in the contract stage, each retailer i simultaneously chooses the number of variant suppliers n_i and contract terms with the suppliers. Contracts stipulate a two-part tariff comprised of a fixed slotting allowance (s_i) and per-unit wholesale price (w_i). Second, the manufacturers simultaneously accept or reject the retailer's contract offer. Third, retailers compete in prices to attract consumers to their stores. Finally, consumers each choose a retailer and buy products.

Stage 3 Pricing. Proceeding by backward induction, retailers select prices in stage 3 to maximize profit. For Retailer 1 (R1), profit is:

$$\pi_1 = \theta^*(p_1, n_1; p_2, n_2)(p_1 - w_1) - fn_1 + s_1 n_1 \tag{5}$$

Substituting (1) and (3) into (5), the first-order necessary condition for a maximum is

$$p_1 - w_1 = 2t\theta^*(p_1, n_1; p_2, n_2) \tag{6}$$

for R1, and similarly for Retailer 2 (R2),

$$p_2 - w_2 = 2t(1 - \theta^*(p_1, n_1; p_2, n_2)) \tag{7}$$

Let $p_1^e(n_1, w_1, n_2, w_2)$ and $p_2^e(n_1, w_1, n_2, w_2)$ denote the solutions to equations (6) and (7):

$$p_1^e(n_1, w_1, n_2, w_2) = (2k_1 + k_2)/3 \ \ , \ \ p_2^e(n_1, w_1, n_2, w_2) = (k_1 + 2k_2)/3 \tag{8}$$

where $k_1 = w_1 + t + \frac{\delta(n_1 - n_2)}{4n_1 n_2}$ and $k_2 = w_2 + t - \frac{\delta(n_1 - n_2)}{4n_1 n_2}$. Notice that each retailer's equilibrium price is increasing in his own provision of product variety and decreasing in his rival's provision of product variety. In contrast, a rise in wholesale prices by one retailer raises the retail prices of both retailers.

Substitution of (1) and (8) into (3) defines the location of the critical consumer:

$$\theta^e(w_1, n_1, w_2, n_2) = \frac{3t + w_2 - w_1 + \delta(n_1 - n_2)/4n_1n_2}{6t} \tag{9}$$

Ceteris paribus, consumers favor the retailer with relatively greater product variety.

Stage 2 Contract Acceptance. Each competitive manufacturer is willing to accept a retailer's proposed contract provided the contract delivers non-negative profit:

$$(w_i - c)(\theta_i^e/n_i) - s_i \geq 0 \tag{10}$$

where $\theta_1^e = \theta^e$ and $\theta_2^e = (1 - \theta^e)$. A retailer's optimal contract offer will meet the manufacturer's participation constraint in (10) with equality.

Product Variety and Contract Terms. In stage 1, each retailer chooses the contract terms so as to maximize profits in (5) subject to the (binding) participation constraint (10) and the pricing stage solutions above. Substituting from (8) and (10) into (5), the contracting / variety choice problem for R1 becomes

$$\text{Max}_{w_1,n_1} = \theta^e(w_1, n_1, w_2, n_2)(p_1^e(n_1, w_1, n_2, w_2) - c) - fn_1 \tag{11}$$

Corresponding first-order necessary conditions for a profit maximum are

$$n_1 : (p_1 - c)\frac{\partial\theta^e(w_1, n_1, w_2, n_2)}{\partial n_1} + \theta^e(w_1, n_1, w_2, n_2)\frac{\partial p_1^e(w_1, n_1, w_2, n_2)}{\partial n_1} - f = 0 \tag{12}$$

$$w_1 : (p_1 - c)\frac{\partial\theta^e(w_1, n_1, w_2, n_2)}{\partial w_1} + \theta^e(w_1, n_1, w_2, n_2)\frac{\partial p_1^e(w_1, n_1, w_2, n_2)}{\partial w_1} = 0 \tag{13}$$

Product Variety with No Slotting Contracts. With no contracts, perhaps due to antitrust regulation banning their use, symmetric equilibrium product variety per retailer solves (12) with $w_1 = w_2 = c$ and $n_1 = n_2 = n$. Substituting from (8) and (9), (12) produces

$$n_{NC}^e = \sqrt{\delta/12f} \ \ (< \sqrt{\delta/8f} = n^*) \tag{14}$$

Result 1. With no slotting contracts, equilibrium product variety is under-provided, $n^e_{NC} < n^*$.

Widening the product range imposes a negative externality on the rival retailer, who responds by reducing retail prices (equation (8)). Each retailer is deterred from widening her own product range by her rival's price response.

Product Variety with Slotting Contracts. Solving (12) and (13) for symmetric equilibrium variety and wholesale price, $n_1 = n_2 = n$ and $w_1 = w_2 = w$, we have (using (8) and (9)):

$$w^e = c + t \ , \ \ n^e = \sqrt{\delta/8f} \ , \ \ p^e = c + 2t \tag{15}$$

Result 2. In equilibrium, slotting allowances lead to the optimal provision of product variety, $n^e = n^*$.

Without slotting fees, product variety is an indirect - and costly - mechanism to alter rival price incentives (Result 1); the benefit of lower variety is an attenuation of rival price competition, but the cost is a lower consumer willingness to pay for products. Slotting contracts give retailers another mechanism to alter rival price incentives, the slotting fee. As a result, there is no longer any reason to distort product variety because any beneficial effect on rival price incentives can be achieved at lower cost using the slotting fee (per equation (13)). Each retailer is therefore able to fully extract the rents from her own variety provision, producing a socially efficient choice (Result 2).

5 Conclusion

This letter considers a model of downstream (retail) market power and shows that slotting fee contracts (1) increase retail product variety and, by doing so, (2) increase social welfare. We thus find an efficiency-enhancing role for slotting contracts, despite their use by imperfectly competitive retailers to increase market prices (Shaffer 1991).

Although the model we study is as simple as possible to identify these effects, they are quite general. For example, if consumers who have a stronger preference for variety are more likely to have a stronger preference for a given retailer, and/or if the retail entry game produces a less-than-optimal number of outlets, and/or if retailers choose their capacity for variety before slotting contracts are negotiated, then slotting contracts will continue to enhance social welfare by increasing variety provision in the market. [4] With elastic demands (vs. the perfectly inelastic case we consider here), there is a welfare cost to slotting contracts due to the higher consumer prices they produce. However, the variety-increasing effect of slotting fees persists, reduces the cost of the price distortion, and can lead to welfare improvement if demand is sufficiently price inelastic. This trade-off between price and variety effects suggests the need for empirical analysis to examine the relative importance of each effect.

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[4] See our expanded paper for details.

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Figure 1. The "Barbell model"