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Slotting Allowances and Retail Product Variety under Oligopoly

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Abstract: Slotting fees are fixed charges paid by food manufacturers to retailers for access to the retail market. The role of the practice and its effects on market efficiency are highly controversial. To date, the literature has focused on the effect of the practice on retail prices; however, slotting allowances also have the potential to alter the range of products available to consumers. Our analysis reveals that the strategic use of slotting allowances by oligopoly firms leads to a superior allocation of product variety among retailers. Indeed, absent price effects, we show that slotting allowances lead to the socially optimal provision of product variety.

Keywords: Slotting fees, vertical contracts, monopolization.

JEL Classifications: L13, L14, L42, D43.

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Introduction

Slotting allowances, the practice in which manufacturers make lump-sum payments to retailers for shelf space, are common in supermarket retailing. Slotting fees are paid for new products through new product introduction allowances as well as for premium shelf placement for existing products, for instance on end caps and in special displays. The magnitude of the practice is significant. As early as 1990, slotting allowances accounted for more than 16% of a new product's introductory costs (Deloitte & Touche 1990).

The economic rationale for slotting allowances is controversial. It is possible that slotting allowances enhance efficiency by allocating scarce shelf space according to market prices (Sullivan 1997), by better allocating the risk of new product failure between retailer and manufacturer (Bloom, Gundlach, and Cannon 2000), or by creating a signaling element for manufacturers to reveal private information about product success to retailers (Chu 1992; Lariviere and Padmanabham 1997; Desiraju 2001; Richards and Patterson 2001). The rate of product failure is very high in U.S. supermarkets, with estimates as high as 80%–90% of new products (FTC 2001), which lends gravitas to mechanisms that are capable of redistributing the risk of product failure between manufacturers and retailers and that permit manufacturers to signal the quality of their matches between consumers and brands. At the same time it is clear that slotting allowances can have anti-competitive effects as a retailer mechanism for exerting market power in consumer markets (Shaffer 1991) or as a manufacturer instrument to control the mix of retail prices (Innes and Hamilton 2006, 2009). Slotting allowances may reduce product variety through foreclosure of smaller suppliers (Marx and Shaffer 2004, Shaffer 2005). Due to the various potential roles of the practice, the Federal Trade Commission (FTC), which regulates

the grocery industry, refused to provide guidelines for slotting allowances, citing the need for further investigation on the efficiency effects (FTC 2001).

The object of the present paper is to show that the strategic use of slotting allowances to raise prices has desirable efficiency effects on the market allocation of product variety. In short, we argue that slotting allowances that serve as a strategic instrument to raise retail prices have a stimulating effect on retail product lines, widening the equilibrium range of product variety in the marketplace. To isolate the efficiency gains from the retail variety assortment, we illustrate our result in a setting with no price effects on welfare and show in this context that oligopolistic retailers fail to exhaust the social returns to product variety. The reason is that introducing new variants in a product category intensifies price competition among retailers, leading to a narrower range of product variety in the market equilibrium than the socially optimal variety allocation. Slotting allowances remedy this problem. Indeed, we show that slotting allowances fully align the market equilibrium with the socially optimal resource allocation. This finding implies a heretofore unrecognized tradeoff between the price and variety effects of slotting allowances.

The analysis of strategic variety-setting behavior by retailers is important for two reasons. First, models with endogenous product variety selection are essential to understanding the role of new product introduction fees. Second, the median number of stock-keeping units (SKUs) in supermarkets increased 52 percent (from 16,500 to 25,153) over the period 1990-2004 (Progressive Grocer), highlighting the linkage between slotting allowances and equilibrium range of product variety provided by supermarkets.

2. The Model

Consumer's variety preferences in the product category are represented by locations around the circumference of a unit circle, over which consumers are uniformly distributed. Each

consumer has unit demand for the variant in the product category that matches most closely with her preferred product characteristics, and retailers array their product variants on the unit circle to facilitate matches between consumers and brands. Consumers facing equal prices for variants in the product category prefer to consume the variant that offers the closest match with their preferred product characteristics and select between retailers according to the quality of the match.

Consumers also have spatial preferences for shopping with the nearest retailer. We consider a Hotelling (1929) duopoly model with retailers spatially located at the ends of a unit line segment. Consumers are distributed uniformly between the two retailers and incur transportation costs of t per unit of distance to travel to their desired retailer.

Figure 1 depicts the layout of the model. Each retailer carries an endogenous number of differentiated variants ($v_1, v_2, v_3, \dots, v_n$) within a single product category. The location of the critical consumer who prefers to shop with retailer 1 over shopping with retailer 2 (θ^*) hence depends on the consumer's distance from the retailer and on the expected quality of the match between consumer preferences and product characteristics available in the retailer's variants.

Consumers incur a “matching cost” of δ per unit of distance in characteristic space between the location of their most preferred product and the nearest product characteristics contained in variants within the retailer's category. Prior to her arrival in a store, the preferences of a given consumer are unknown to the retailer. Given the ex ante uniform distribution of consumer preferences for products in the category, retailers optimally locate product variants symmetrically on the circle. Measuring variants continuously on the circle, this implies that the expected consumer matching cost when shopping at a retailer with v symmetric variants is

$$2v \int_0^{1/2v} \delta x dx = \frac{\delta}{4v}. \quad (1)$$

Letting \bar{u} denote the gross value each consumer receives from consuming her most preferred product variant, expected consumer utility from shopping at retailer i is

$$u_i(p_i, v_i) = \bar{u} - \delta / 4v_i - p_i, \quad (2)$$

where p_i is the (symmetric) price charged by retailer i for each variant in the product category. Notice that consumer utility net of matching cost is increasing in v_i . A greater range of product variety arrayed on the unit circle by retailer i improves the quality of the match between consumers and products, so that a wide range of product variety and low prices work jointly to attract customers into the store.¹

Consumers incur increasing transaction costs over distance to visit retailers. The decision to shop with a given retailer commensurately depends on the transaction cost required to visit the retailer relative to the consumption opportunity afforded by that retailer's product assortment and prices. Given the menu of product variety and prices available at each retailer, the location of the critical consumer is given by

$$\theta^*(p_1, v_1; p_2, v_2) = \frac{t + u_1(p_1, v_1) - u_2(p_2, v_2)}{2t}. \quad (3)$$

Social Optimum

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

$$W = \bar{u} - \delta / 4v - c - 2fv$$

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

Market Equilibrium

Strategic interaction between retailers is modeled as a three-stage game. In the first stage, the contract stage, retailer i simultaneously contracts with manufacturers using a two-

¹ This formulation is similar to Hamilton (2009) and Hamilton and Richards (2009), with the exception here that consumers have unit demand for a single variant in the category rather than symmetric demand for all retail variants.

part tariff pricing structure comprised of a slotting allowance (s_i) and wholesale price (w_i) for each product variant (v_i) the retailer decides to offer. In the second stage, the manufacturers of each of the v_i products simultaneously either accept or reject the retailer's contracts. In the third and final stage, retailers compete in prices to attract consumers into their stores.

Given the range of product variety selected by the retailers and placed under contract, retailer i seeks to maximize

$$\pi_1 = \theta^*(p_1, v_1; p_2, v_2)(p_1 - w_1) - fv_1 + s_1, \quad (4)$$

where f is the marketing cost associated with widening the product variety range. We suppress retailer-specific fixed costs.

Substituting (2) and (3) into (4), the first-order necessary condition for a maximum is

$$p_1 - w_1 = 2t\theta^*(p_1, v_1; p_2, v_2) \quad (5)$$

for retailer 1 and

$$p_2 - w_2 = 2t(1 - \theta^*(p_1, v_1; p_2, v_2)) \quad (6)$$

for retailer 2.

Let $p_1^e(v_1, w_1, v_2, w_2)$ and $p_2^e(v_1, w_1, v_2, w_2)$ denote the simultaneous solution to equations (5) and (6). Substitution of (2), (5), and (6) into (3) defines the location of the critical consumer, which we denote by $\theta^e(w_1, v_1, w_2, v_2)$.

The equilibrium prices in (5) and (6) can be written compactly as

$$p_1^e(w_1, v_1, w_2, v_2) = (2k_1 + k_2)/3, \quad (7)$$

$$p_2^e(w_1, v_1, w_2, v_2) = (k_1 + 2k_2)/3, \quad (8)$$

where $k_1 = w_1 + t + \frac{\delta(v_1 - v_2)}{4v_1v_2}$ and $k_2 = w_2 + t - \frac{\delta(v_1 - v_2)}{4v_1v_2}$. 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. As a retailer widens his product range, consumers are attracted, allowing prices (and margins) to rise within the category for the retailer, while the rival retailer compensates for the loss in relative variety by discounting his prices to entice consumers. This contrasts with the effect of wholesale prices, where a rise in wholesale prices by one retailer raises the retail prices of both retailers.

Substitution of (2), (7), and (8) into (3) defines the location of the critical consumer, which is

$$\theta^e(w_1, v_1, w_2, v_2) = \frac{3t + w_2 - w_1 + \delta(v_1 - v_2) / 4v_1v_2}{6t}. \quad (9)$$

Changes in variety shift consumers towards the retailer with relatively greater variety provision.

Each manufacturer is willing to accept the slotting contract proposed by a retailer provided he receives a payment no less than his opportunity costs. We assume a competitive manufacturing industry and normalize these opportunity costs to zero without loss of generality. Accordingly, each manufacturer accepts the contract proposed by retailer i whenever

$$(w_i - c)\theta^e - s_i \geq 0, \quad (10)$$

where c is unit manufacturing cost. In (10), the manufacturer compensates the retailer for any departure of the contracted price from unit cost through the payment of a slotting allowance, as in Shaffer (1991). The optimal terms in the retailer's contract specify that the manufacturer's participation constraint be met with equality in (10).

In the contract stage, retailer 1 chooses the terms of the contract so as to maximize profits in (4) subject to the (binding) participation constraint (10) and the pricing stage solutions above. Substituting the pricing stage solutions into (4) and (10), the contracting problem is

$$\underset{w_1, v_1}{\text{Max}} \pi_1(w_1, v_1, w_2, v_2) = \theta^e(w_1, v_1, w_2, v_2) \left(p_1^e(w_1, v_1, w_2, v_2) - c \right) - fv_1.$$

The first-order necessary conditions for a profit maximum for retailer 1 are

$$(p_1 - c) \frac{\partial \theta^e(w_1, v_1, w_2, v_2)}{\partial v_1} + \theta^e(w_1, v_1, w_2, v_2) \frac{\partial p_1^e(w_1, v_1, w_2, v_2)}{\partial v_1} - f = 0, \quad (11)$$

$$(p_1 - c) \frac{\partial \theta^e(w_1, v_1, w_2, v_2)}{\partial w_1} + \theta^e(w_1, v_1, w_2, v_2) \frac{\partial p_1^e(w_1, v_1, w_2, v_2)}{\partial w_1} = 0. \quad (12)$$

Differentiating (7) and (9) and incorporating terms in (11) and (12), the solution to these equations in the symmetric equilibrium, $v_1 = v_2 = v$, $w_1 = w_2 = w$, and $\theta^e = 1/2$, is

$$w^e = c + t$$

and

$$v^e = \sqrt{\delta/8f},$$

with equilibrium prices of $p^e = 2c + t$. In equilibrium, slotting allowances lead to the optimal provision of variety.

To understand this result, consider the outcome in the event that slotting allowances are banned by antitrust legislation. In this case $w_1 = w_2 = c$ and the market equilibrium is determined by (7), (8), and (11). In the symmetric equilibrium, $v_1 = v_2 = v$ and $\theta^e = 1/2$, the equilibrium prices and variety range are $p^{e,ns} = c + t$ and $v^{e,ns} = \sqrt{\delta/12f} < v^*$. Widening the product range imposes a negative externality on the rival retailer, who responds by reducing category prices. Each retailer is deterred from widening his product range by his rival's category pricing effect, narrowing the variety range from the efficient level of provision.

Now consider the option to employ slotting allowances. The ability to contract for a higher wholesale price in a two-part tariff with the manufacturer provides the retailer with an independent control on retail prices. A slotting allowance that elevates the wholesale price signals the rival retailer the intent to set a higher price in the retail market, which allows the

retailer to widen his product variety range without precipitating a decrease in category prices by his rival. Raising wholesale prices and widening the range of product variety in tandem allows the retailer to maintain the retail prices of his rival, eliminating the negative externality of a category price discount. Because each retailer is able to fully extract the rents from his own provision of product variety, slotting allowances are set at a level to capitalize all gains from variety provision. Retail prices rise in the product category of each retailer until the equilibrium variety range attains the social optimum.

3. Discussion

Much attention has been focused on the strategic role of slotting allowances in facilitating higher retail prices. In this paper we have shown that slotting allowances that lead to higher retail prices also serve to increase the provision of retail product variety by raising retailer returns in the category. In our setting with unit demands, slotting allowances align market behavior with the social optimum.

In settings with elastic demand, slotting allowances introduce welfare effects through both price and variety effects. Preliminary work suggests that slotting allowances reduce welfare through higher prices, but increase welfare through greater variety ranges among retailers, leading to offsetting social implications. Understanding the role of slotting allowances in altering retail variety ranges as well as prices in richer market settings is essential to properly characterize the welfare implications of this important retail practice.

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Figure 1

