Slotting Allowances and Buy-Back Clauses

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Abstract

In this paper we investigate some of the most frequent arguments for the use of slotting allowances. It has been claimed that slotting allowances can be profitability used to increase retail profits at the cost of increasing consumer prices. A second argument is that slotting allowances can be used by producers of new product to signal the demand potential of their products. We find that in a perfect information setting slotting allowances will never arise in equilibrium. Moreover, we question whether slotting allowances can serve as a signalling device. We argue that buy-back clauses are far better instruments to signal profitability of new product launches in the grocery sector.

JEL classification: L12, L40.

1 Introduction[1]

Slotting allowances are fixed fees paid by producers of goods for access to shelf space. These instruments are particularly frequent used in the grocery industry. The aim of this article is to explore some of the most central motives that have been attributed to the use of slotting allowances.

In the received literature several motives have been put forward for the use of slotting allowances. One motive is that slotting allowances are efficient contractual forms that enable retailers to allocate scarce shelf space to the products that are most valued by the consumers. A second argument is that slotting allowances can be used as a strategic instrument to increase wholesale and retail prices to the detriment for consumers' surplus.

The latter argument is analyzed in Shaffer (1991) and relies on strategic delegation. In this model two identical producers compete for access to limited shelf space in two retail outlets. Each outlet is differentiated from the other and can at most store one of the products. Upstream competition ensures that the producers earn zero and in equilibrium each producer contract with one retailer each. In equilibrium each producer offers his retailer a marginal price above costs. This will induce the retailer to increase its price, and the rival retailer responds to this by increasing its price as well. Wholesale prices above marginal costs will normally generate upstream profits, but due to harsh upstream competition this profit is competed away when the producers can offer slotting allowances. The basis idea is thus similar to that of Bonnano and Vickers (1988) and relies on the same set of assumptions; contracts are perfectly observable, verifiable and non-renegotiable. If each producer could sign secret side contract or secretly renegotiate on the equilibrium contracts the equilibrium with wholesale prices above marginal costs would collapse. When contracts involve wholesale prices equal to marginal costs no slotting allowance can be paid.

In the grocery industry we believe that the assumption of contract observability

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and commitment is especially unappealing, and in this centext we wish to abstract from the issue of strategic delegation. As a consequence we limit attention to structures where the downstream sector is a monopoly, i.e., there is only one retailer. With this assumption all issues related to the type of strategic delegation to dampen downstream competition vanish and we can focus on other arguments. Of course, even with downstream monopoly slotting allowances may be detrimental to consumers. One example is if their use contribute to retail prices above the monopoly level set by a retailer facing the true production and distribution costs.

The other types of arguments forwarded in the literature for the use of slotting allowances is that these are instruments used by producers to signal profitability of their products, or by retailers to screen between producers of products with different demand potential.[2] In the grocery sector retailers each year face a considerable number of new product introductions. A substantial number of new introductions fail within a short period of time in the sense that they do not make enough sale to defend their stocking costs. This problem may seem large for retailers, but may also be a considerable problem for producers of new products. If retailers are underinformed about the profitability of new products they may be reluctant to introduce new products and too few introductions may actually occur. The signalling motive for slotting allowances stress that this informational asymmetry can be resolved by the use of slotting allowances. By paying the retailer some profit up front with a slotting allowance a producer of a profitable product can signal its profitability. Thus, slotting allowances are claimed to resolve the potential informational asymmetry between producers and retailers, and lead to more introduction of new products valued by the consumers.

Lariviere and Padmanabhan (LP) (1997) analyses the signalling argument.[3] In their model a retailer faces a producer that can either be a high demand or a low demand producer. The producer offer a combination of a wholesale price and a slotting allowance, and based on the offer the retailer is able to infer a high demand

[2]There is also a small literature that focuses on exclusion and foreclosure. See Shaffer (2003) and Gabrielsen (1996).

[3]See also Chu (1992), Sullivan (1997) and Rao and Mahi (2003).

producer's offer that cannot be replicated by a low demand producer. Based on the offer, the retailer chooses which quantity to buy and then sets its price to the consumers. The exact characteristic of the equilibrium depends crucially on the retailer's opportunity cost of stocking the product. When the opportunity cost is low enough (or zero) the least cost signalling contract involves a high wholesale price and no slotting allowance. If the opportunity cost is high enough the equilibrium offer consists of a combination of a high wholesale price and a positive slotting allowance.

In LP (1997) the producer launches a new product and announces the terms of trade consisting of a wholesale price and a slotting allowance, and the retailer either accepts or rejects the offer. Next, retailer sets retail price and consumer demand is realized.[4] One potential problem with this setup is that at the contracting phase the retailer is not informed about the consumer demand for the product. To get this information the retailer must stock the product, put it in shelves and then (presumably after some time) the true demand potential is revealed. If this is the case, i.e. that the retailer must buy the desired quantity of the product following a contract offer of the kind just described, then slotting allowances can no longer be used as a signalling device. Any contract offered by a high demand producer can be profitably replicated by a low demand producer, and the retailer has no means to distinguish between the two. Thus, if this is the way it works in reality, which we believe is the case, then the producer needs an alternative instrument to signal its demand potential. Basically, what is needed is a transfer between the retailer and the producer contingent on the realized demand ex post. A natural instrument of this kind, and that often used in the grocery industry, is a buy-back clause (BBC). With a BBC the producer agrees to buy back any unsold units of his product at a certain price. Intuitively, a BBC reduces the incentive a low demand producer have to overstate the demand for his product. Also when production is costly, a producer will be more careful to overproduce in order to mimic a high demand product.

The basic interest of this paper is to explore in what circumstances we can get

[4] In the model the retailer also expends merchandising effort, but this is unessential for the main results in the paper.

slotting allowances as a part of an equilibrium strategy. A slotting allowance can be defined as a negative franchise fee. Thus, in this paper we generally allow contracts to consist of wholesale prices and fixed fees, but we put no restriction on the sign of the fixed fees, i.e. fixed fees can go either way. If a fixed fee is paid from a producer to a retailer it is a slotting allowance, and if the payment goes the other way it is denoted a franchise fee.

As argued above, in order to abstract from strategic issues, we focus on setting with a single retailer. We start with a setting where information about costs and demand conditions is symmetric and perfect. Here we consider the cases where retailer have limited shelf space and when shelf space is not a limiting factor.[5] We also consider the effect of variance in the division of bargaining power between the producers and the retail sector. The most prominent result from this analysis is that we show that slotting allowance will never be part of an equilibrium strategy. Secondly, we explore the signalling argument in a setting where producers have private information about their product's demand potential. When the producers' contract set is limited to wholesale prices, quantities and fixed fees we show that a separating equilibrium does not exist. Whatever contract that a high demand producer can offer can always be profitably replicated by a low demand producer and thereby incurring a loss onto the retailer. We also show that a simple buy-back (BBC) clause, where a producer contracts to buy back any unsold units of his product at a specified price, resolves the problem. When producers may use BBC in conjunction with wholesale price, quantity and fixed fee, a separating equilibrium always exists. I all these equilibria slotting allowances never appear as a part of the equilibrium contracts.

The paper is organized as follows. The next section explores the scope for slotting allowances under symmetric and perfect information. Then, in section 3, we consider asymmetric information and the signalling argument.

[5]The question of limited shelf space is central to the literature of slotting allowances. For more on this, see Marx and Shaffer (2004) and Gabrielsen and Sørgard (1999).

2 Symmetric and perfect information

We consider two producers, producing differentiated products and one retailer with one or two slots. Each of the producers have marginal costs c_i (common knowledge) and all other marginal distribution costs are normalized to zero. Each producer offer a wholesale price w_i and a fixed fee A_i up-front to each retailer. As noted before $A_i > 0$ is a franchise fee and $A_i < 0$ is a slotting allowance. The true inverse demand for the two products are:

$$\begin{aligned} p_1 &= a - q_1 - bq_2 \\ p_2 &= 1 - q_2 - bq_1 \end{aligned}$$

where $a > 1$, hence product 1 is the most profitable product. The parameter b measures the degree of substitutability between the products. By simultaneously solving this system we get direct demands

$$\begin{aligned} q_1 &= \frac{1}{b^2 - 1} (b - a + p_1 - bp_2) \\ q_2 &= \frac{1}{b^2 - 1} (ab + p_2 - bp_1 - 1) \end{aligned}$$

In this section we assume that the retailer and the producers have perfect and symmetric information about demand and cost conditions. The next section considers the case where producers have private information about demand potential for their products.

In this section we also explore the consequences of alternative division of bargaining power between the upstream and downstream sector. Bargaining power is normally attributed to the ability to offer take-it-or-leave-it contracts. In a bilateral relationship (for instance a vertical bilateral monopoly) this ability can potentially have an enormous value. We know that in a vertical chain of monopoly where two-part tariffs can be used, an upstream producer that holds all bargaining power will set an efficient wholesale price (equal its marginal cost) and appropriate all downstream surplus (the monopoly rent) with the fixed fee. We start by exploring the effect of allocating some of the bargaining power to the downstream sector in a bilateral monopoly situation.

2.1 Bilateral monopoly

With only one upstream producer demand is simply $q = 1 - p$. Let the upstream marginal cost be c. The downstream retailers sets p given the negotiated wholesale price w and fixed fee A. Then we have the following intuitive result:

Proposition 1 *With full information and bilateral monopoly the equilibrium outcome never includes slotting allowances.*

Proof: Retail profit is written

$$\pi_D = (p - w)(1 - p) - A$$

and upstream profits

$$\pi_U = (w - c)(1 - p) + A$$

Thus, the retailer solves

$$\max_p \pi_D = \max_p (p - w)(1 - p) - A$$

which yields the optimal retail price $p = \frac{1}{2}w + \frac{1}{2}$.

We know that in this setting the efficient outcome entails $w = c$, and then the profits of the upstream and downstream firm can be written

$$\begin{aligned} \pi_D &= \left(\frac{1}{2} - \frac{1}{2}c\right)^2 - A \\ \pi_U &= A \end{aligned}$$

Applying the Generalized Nash Bargaining Solution, the bargaining outcome solves

$$\arg\max_A \Pi = (\pi_U)^{(1-\gamma)} (\pi_D)^{\gamma}$$

and the first-order condition yields

$$A = \frac{(1-c)^2}{4}(1-\gamma) \geq 0$$

i.e. a franchise fee. **QED**.

With two upstream producers and a single retailer, things change. Now the benefit a producer can derive from the ability to offer take-it-or-leave-it offers is limited by the degree of substitutability between upstream producers. Obviously, if upstream producers are perfect substitutes the value of having bargaining power in the sense we have defined it evaporates completely. The reason of course being that the downstream firm can threaten to exclude each product from the market and therefore induce harsh competition for access to the retail asset.

2.2 Upstream duopoly

With two differentiated upstream producers we assume that the reservation profit from each upstream producer is zero as there are no alternative to contracting with the downstream retailer. We consider two cases; one where the downstream retailer has unlimited shelf space and a second case where the downstream retailer only has the capacity to store one of the products in question.

2.2.1 Unlimited shelf space

Suppose that the retailer has two available slots. If so, we know that he will accept both products, wholesale prices will be efficient, i.e. $w_i = c_i$, and each upstream producer will at most extract its increment to the industry profit.[6] When product 1 is sold alone the retailer's profit is written:

$$\begin{aligned} \pi_D &= \pi_D(w_1 = c_1) - A_1 = \\ \max_{p_1}(p_1 - c_1)(a - p_1) - A_1 &= \left(\frac{1}{2}a - \frac{1}{2}c_1\right)^2 - A_1 = \frac{1}{4}a^2 - A_1 \end{aligned}$$

and when product 2 is sold exclusively retail profit is:

$$\begin{aligned} \pi_D &= \pi_D(w_2 = c_2) - A_2 = \\ \max_{p_2}(p_2 - c_2)(1 - p_2) - A_2 &= \left(\frac{1}{2} - \frac{1}{2}c_2\right)^2 - A_2 = \frac{1}{4} - A_2 \end{aligned}$$

[6] This result is well known from the received literature, see Bernheim and Whinston (1998), Gabrielsen (1997) and O'Brien and Shaffer (1997).

When both products are sold by the downstream retailer his profit is written

$$\begin{aligned}
\pi_D &= \pi_D(w = c) - A_1 - A_2 = \\
& \max_p (p_1 - c_1)q_1 + (p_2 - c_2)q_2 - A_1 - A_2 \\
&= \frac{a^2 - 2ab + 1}{4(1 - b^2)} - A_1 - A_2
\end{aligned}$$

Maximizing retail profit and normalizing costs to zero $c_i = 0$ the optimal prices simply are

$$\begin{aligned}
p_1 &= \frac{1}{2}a \\
p_2 &= \frac{1}{2}
\end{aligned}$$

Then we can show:

Proposition 2 *With full information, two differentiated upstream producer, one downstream retailer with unlimited shelf space and negotiations over* $\{w, A\}$ *both products are always stored. Moreover equilibrium offers involve wholesale prices equal to marginal costs and non-negative fixed fees.*

Proof: Look at the negotiations between D and producer 1. Producer 1 will be accepted when

$$\begin{aligned}
\pi_D(w &= c = 0) - A_1 - A_2 \geq \pi_D(w_2 = c_2) - A_2 \\
\frac{a^2 - 2ab + 1}{4(1 - b^2)} - A_1 - A_2 &\geq \frac{1}{4} - A_2 \\
A_1 &\leq \frac{a^2 - 2ab + 1}{4(1 - b^2)} - \frac{1}{4}
\end{aligned}$$

Similarly, producer 2 will be accepted when

$$\begin{aligned}
\pi_D(w &= c = 0) - A_1 - A_2 \geq \pi_D(w_1 = c_1) - A_1 \\
\frac{a^2 - 2ab + 1}{4(1 - b^2)} - A_1 - A_2 &\geq \frac{1}{4}a^2 - A_1 \\
A_2 &\leq \frac{a^2 - 2ab + 1}{4(1 - b^2)} - \frac{1}{4}a^2
\end{aligned}$$

Suppose that both producers offer exacly these fees. Then, Nash bargaining between 1 and D solves

$$\begin{aligned}
&\max_{A_1}\left(\frac{a^2-2ab+1}{4(1-b^2)}-A_1-A_2-\left(\frac{1}{4}-A_2\right)\right)^{\gamma}(A_1)^{(1-\gamma)}\\
&\max_{A_1}\left(\frac{a^2-2ab+1}{4(1-b^2)}-\frac{1}{4}-A_1\right)^{\gamma}(A_1)^{(1-\gamma)}\\
&\max_{A_1}(\theta_1-A_1)^{\gamma}(A_1)^{(1-\gamma)}\\
\text{where }\theta_1 &= \frac{a^2-2ab+1}{4(1-b^2)}-\frac{1}{4}
\end{aligned}$$

θ_1 denotes the incremental profit contribution of product 1. The first-order condition to this problem yields:

$$A_1=\theta_1-\theta_1\gamma\geq 0$$

Similarly, when producer 2 negotiates with the retailer

$$\begin{aligned}
&\max_{A_2}\left(\frac{a^2-2ab+1}{4(1-b^2)}-A_1-A_2-\left(\frac{1}{4}a^2-A_2\right)\right)^{\gamma}(A_2)^{(1-\gamma)}\\
&\max_{A_2}\left(\frac{a^2-2ab+1}{4(1-b^2)}-\frac{1}{4}a^2-A_2\right)^{\gamma}(A_2)^{(1-\gamma)}\\
&\max_{A_2}(\theta_2-A_2)^{\gamma}(A_2)^{(1-\gamma)}\\
\text{where }\theta_2 &= \frac{a^2-2ab+1}{4(1-b^2)}-\frac{1}{4}a^2
\end{aligned}$$

and the first-order condition yields

$$A_2=\theta_2-\theta_2\gamma\geq 0$$

We see that the fixed fees are always positive, hence no slotting allowance will arise in equilibrium. **QED.**

When the retailer has all bargaining power ($\gamma=1$) the fixed fee is zero, and the retailer earns the joint collusive profit. When the producer has all the bargaining power ($\gamma=0$) the producer extracts his product's increment to the collusive profit. Let us now consider the case where the retailer has limited shelf space, i.e. the case where he at most can stock one of the products.

2.2.2 Limited shelf space

Now, suppose that the retailer has only one slot available. If so the the retailer sets $p_1 = \frac{a}{2}$ if product 1 is accepted and $p_2 = \frac{1}{2}$ if product 2 is accepted. The retail profit in these two cases are written

$$\begin{aligned} \pi_D &= \pi_D(w_1 = c_1 = 0) - A_1 = \frac{1}{4}a^2 - A_1 \\ \pi_D &= \pi_D(w_2 = c_2 = 0) - A_2 = \frac{1}{4} - A_2 \end{aligned}$$

In this case we have:

Proposition 3 *With full information, two differentiated upstream producer, one downstream retailer with limited shelf space and negotiations over $\{w, A\}$ only product 1 is stored. Moreover equilibrium offers involve wholesale prices equal to marginal costs and non-negative fixed fees.*

Proof: The retailer will accept product 1 when

$$\frac{1}{4}a^2 - A_1 \geq \frac{1}{4} - A_2$$

Competition will drive $A_2 = 0$, hence the Nash bargaining outcome between producer 1 and D is determined by

$$\max_{A_1} \left(\frac{1}{4}a^2 - A_1 - \left(\frac{1}{4} - A_2\right)\right)^{\gamma} (A_1)^{(1-\gamma)}$$

$$\max_{A_1} \left(\frac{1}{4}\left(a^2 - 1\right) - A_1\right)^{\gamma} (A_1)^{(1-\gamma)}$$

$$(1-\gamma)(\frac{1}{4}a^2 - \frac{1}{4}) = A_1 \geq 0$$

Hence, neither in this case slotting allowances are produced in equilibrium. **QED.**

Here, when the producers have all the bargaining power, the high demand producer earns the difference between his product's monopoly profit and the monopoly profit of his competitor. On the other hand, if the retailer has all the bargaining power, producers end up earning zero and the retailer captures the monopoly rent from the most profitable product.

To sum up, we have seen in this section that in full information setting we are unable to generate slotting allowances as a part of the equilibrium strategies of the producers. We now turn to the case where producers have private information about the true demand potential of their products.

3 Asymmetric information and signalling

Then assume that $c_i \in \{0, \bar{c}\}$ is common knowledge, and $a_i \in \{1, a\}$ is private information for the upstream producers. Since the relevant information for profitability is the difference $a_i - c_i$ we can simplify this case by assuming that all firms produce with the same constant marginal cost $c_i = c$.

In this section we limit attention to the case where the retailer has limited shelf space. An alternative interpretation of this assumption is that the retailer faces a new product launch, but are unable to verify whether the product has a high or low demand potential. When each of the products are sold without competition of the other, the demand for the product i question becomes

$$q_i = a_i - p_1$$

$a_i \in \{1, a\}$. In a separating equilibrium where the retailer correctly infers the product's type, the retailer solves

$$\max_{p_i}(p_i - w_i)(a_i - p_i) - A_1$$

yielding $p_i = \frac{1}{2}(a_i + w_i)$ as the optimal retail price.

We first consider the case where contracts are $\{w, A\}$ and where the retailer buys input from the producer given such a contract. Then we consider the case where contracts are $\{w, A, \beta\}$ where $\beta \geq 0$ is the buy-back price specified by the producer. Under this contract the producer offers to supply the retailer any desired quantity of his product at wholesale price w and a fixed fee A (that can be positive or negative) and buy back unsold units at price β.

In characterizing a separating equilibrium we use the Perfect Bayesian Equilibrium (PBE) as solution concept. A PBE in this setting are contracts $\{w, A, \beta\}$ and supporting retailer beliefs. When the retailer correctly infers that he is dealing with a high demand producer offering a wholesale price of w, the supplied quantity will be $q = a - p = a - \frac{1}{2}(a + w) = \frac{a-w}{2}$. Hence, if a low demand producer would mimic this contract the low demand product would sell less than the supplied quantity.

The high demand producer's maximization problem is

$$\begin{aligned}
&\max_{w,A,\beta}(w-c)\left(\frac{a-w}{2}\right)+A\\
&s.t\\
&\text{IR: } \left(\frac{a+w}{2}-w\right)\left(\frac{a-w}{2}\right)-A\geq 0\\
&\text{SI: } (w-c)\left(\frac{a-w}{2}\right)+A-\beta\left(\frac{a-w}{2}-q_L\right)\leq 0
\end{aligned}$$

The first constraint is the retailer's participation constraint saying that when the retailer correctly infers that he is dealing with a high demand producer he must earn a non-negative profit from accepting this contract. The second constraint is the signalling constraint. This constraint says that a low demand producer must find it unprofitable to mimic the terms of a high demand product. If a low type offers the same terms $\{w, A, \beta\}$ as the high type, his product will sell less than the high type product at the high type product's price. Therefore the BBC clause involves a repayment from the low type to the retailer of the difference between the quantity bought, i.e. $\frac{a-w}{2}$, and the quantity sold of the low type product, here denoted by q_L, times the buy-back price β. The quantity actually sold of the low type's product at the high type's price is $q_L = \max\{0, 1 - \frac{a+w}{2}\} = \max\{0, \frac{2-a-w}{2}\}$. Therefore the signalling constraint is written

$$(w-c)\left(\frac{a-w}{2}\right)+A-\beta\left(\frac{a-w}{2}-\max\{0,\frac{2-a-w}{2}\}\right)\leq 0$$

We start buy solving the above problem when $\beta = 0$, i.e. when for exogenous reasons BBC's are unavailable. If so the problem of the high type reduces to

$$\begin{aligned}
&\max_{w,A}(w-c)\left(\frac{a-w}{2}\right)+A \\
&s.t \\
&\left(\frac{a+w}{2}-w\right)\left(\frac{a-w}{2}\right)-A \geq 0 \\
&(w-c)\left(\frac{a-w}{2}\right)+A \leq 0
\end{aligned}$$

Then we have:

Proposition 4 *When $\beta = 0$ no separating equilibria exists.*

Proof: It suffices to look at the signalling constraint and high type's maximization problem and noting that they are identical. Hence there exists no profitable contract $\{w, A\}$ offered by the high type that cannot be mimicked by the low type. **QED.**

The problem of the high type is that there is no way he can distinguish himself from the low type with the present contract instruments. In order to have a separating contract we must allow the parties to contingent contract on retail demand rather than retail supply. A BBC serves this purpose.

When β is positive the high type's problem is:

$$\begin{aligned}
&\max_{w,A,\beta}(w-c)\left(\frac{a-w}{2}\right)-A \\
&s.t \\
&\left(\frac{a+w}{2}-w\right)\left(\frac{a-w}{2}\right)+A \geq 0 \\
&(w-c)\left(\frac{a-w}{2}\right)-A-\beta\left(\frac{a-w}{2}-\max\{0,\frac{2-a-w}{2}\}\right) \leq 0
\end{aligned}$$

Then we have:

Proposition 5 *In the game where buy-back clauses can be offered, for any $a > 1$ there always exist a separating equilibrium. All equilibria involves full rent extraction of retail profit though franchise fees. There exists a critical $a(c) \equiv a^*$ such that when*

$a \in [1, a^*]$ *both constraints bind and* $w > c$, $\beta = p_H < 1$, *and* $A > 0$. *When* $a \in (a^*, \infty)$ *only the retailer's IR-constraint binds and* $w = c$, $\beta = p_H \geq 1$ *and* $A > 0$.

Proof: Note that we must have that $q \geq 0 \iff w \leq a$. Suppose first that $\frac{2-a-w}{2} \geq 0 \iff w \leq 2-a$. If so, the signalling constraint is written

$$(w-c)\left(\frac{a-w}{2}\right) + A - \beta(a-1) \leq 0$$

Suppose further that only this constraint binds. We see that a high demand producer would like to relax this constraint as much as possible by setting β as high as possible. Suppose therefore that β is set at its maximum level $\beta = \frac{1}{2}(a+w)$. Then $A =$ -$(w-c)\left(\frac{a-w}{2}\right) + \frac{1}{2}(a+w)(a-1)$. Then the high type's unconstrained maximization problem is:

$$\max_w \frac{1}{2}(a+w)(a-1)$$

From this problem we see that the high type would like to set w as high as possible, i.e. $w = 2-a$.The intuition is that a high w induces a high β and hence it becomes less tempting for the low demand producer to mimic. If so we have that $\pi_H = a-1$, $A = -(a-1)(1-a-c) > 0$ for $a \geq 1$, i.e. a franchise fee. The retail price is $p_H = \beta = 1$. We must also check that the IR-constraint does not bind. For this to be true we must have:

$$\begin{aligned}
\left(\frac{a+w}{2} - w\right)\left(\frac{a-w}{2}\right) - A &\geq 0 \\
&\Updownarrow \\
\left(\frac{a+w}{2} - w\right)\left(\frac{a-w}{2}\right) + (w-c)\left(\frac{a-w}{2}\right) - \frac{1}{2}(a+w)(a-1) &\geq 0 \\
&\Updownarrow \\
c(1-a) &\geq 0
\end{aligned}$$

which never holds.

Then suppose that a is very high so that $\max\{0, \frac{2-a-w}{2}\} = 0$. If so,

$$\begin{aligned}
&\max_{w,A}(w-c)\left(\frac{a-w}{2}\right)+A \\
&s.t \\
&A = -(w-c)\left(\frac{a-w}{2}\right)+\frac{1}{2}(a+w)\left(\frac{a-w}{2}\right)
\end{aligned}$$

or the unconstrained problem

$$\begin{aligned}
&\max_{w}(w-c)\left(\frac{a-w}{2}\right)-\left((w-c)\left(\frac{a-w}{2}\right)-\frac{1}{2}(a+w)\left(\frac{a-w}{2}\right)\right) \\
&\Updownarrow \\
&\max_{w}\frac{1}{4}a^2-\frac{1}{4}w^2 \Longleftrightarrow w=0
\end{aligned}$$

If so $p_H = \beta = \frac{a}{2} > 1$ and $A = \frac{1}{2}ac + \frac{1}{4}a^2 > 0$. The IR constraint of the retailer is written

$$\begin{aligned}
\left(\frac{a+w}{2}-w\right)\left(\frac{a-w}{2}\right)-\frac{1}{2}ac-\frac{1}{4}a^2 &\geq 0 \\
-\frac{1}{2}ac &\geq 0
\end{aligned}$$

which never holds. Hence, it cannot be that only the SI-constraint binds in the optimal solution.

Then suppose that both constraints bind. When a is low ($\frac{2-a-w}{2} \geq 0 \Leftrightarrow w \leq 2-a$), the optimal w is the solution to the IR and SI constraints

$$\begin{aligned}
\left(\frac{a+w}{2}-w\right)\left(\frac{a-w}{2}\right) &= A \\
-(w-c)\left(\frac{a-w}{2}\right)+\frac{1}{2}(a+w)(a-1) &= A
\end{aligned}$$

or

$$(w-c)\left(\frac{a-w}{2}\right)-\frac{1}{2}(a+w)(a-1)+\left(\frac{a+w}{2}-w\right)\left(\frac{a-w}{2}\right)=0$$

yielding

$$w = c-(a-1)+\sqrt{(c+1)^2-4ca}$$

We must have that $w \leq 2-a$ or

$$\begin{aligned} c-(a-1)+\sqrt{(c+1)^2-4ca} &\leq 2-a \\ &\Updownarrow \\ c-(a-1)+\sqrt{(c+1)^2-4ca}-2+a &\leq 0 \\ &\Updownarrow \\ a &\geq 1 \end{aligned}$$

We must also have that $(c+1)^2-4ca \geq 0 \iff a \leq \frac{1}{4c}(c+1)^2$, and $w \geq c \iff c-(a-1)+\sqrt{(c+1)^2-4ca} \geq c \iff a \leq \sqrt{5c^2-2c+1}-2c+1 \equiv a^*$. Also $w \leq a \iff c-(a-1)+\sqrt{(c+1)^2-4ca} \leq a \iff a \geq 1$.

Hence, when summing up we have that when $a \in [1, a^*]$ both constraints bind and $w = c-(a-1)+\sqrt{(c+1)^2-4ca}$ and $A = \left(\frac{1}{2}c - a + \frac{1}{2}\sqrt{2c-4ac+c^2+1}+\frac{1}{2}\right)^2 > 0$.

Then suppose that a is high ($\frac{2-a-w}{2} < 0 \Leftrightarrow w > 2-a$) and that both constraints are binding. Then the optimal w is the solution to

$$\begin{aligned} \left(\frac{a+w}{2}-w\right)\left(\frac{a-w}{2}\right) &= A \\ -(w-c)\left(\frac{a-w}{2}\right)+\frac{1}{2}(a+w)\left(\frac{a-w}{2}\right) &= A \end{aligned}$$

or

$$\begin{aligned} (w-c)\left(\frac{a-w}{2}\right)-\frac{1}{2}(a+w)\left(\frac{a-w}{2}\right)+\left(\frac{a+w}{2}-w\right)\left(\frac{a-w}{2}\right) &= 0 \\ &\Updownarrow \\ \frac{1}{2}c(w-a) &= 0 \\ w &= a \end{aligned}$$

which obviously cannot be a valid solution.

Finally suppose that only the retailer's IR constraint binds. If so the problem of the high demand producer becomes

$$\begin{aligned} &\max_w (w-c)\left(\frac{a-w}{2}\right)+A \\ &s.t \\ \left(\frac{a+w}{2}-w\right)\left(\frac{a-w}{2}\right) &= A \end{aligned}$$

or

$$\max_w (w-c)\left(\frac{a-w}{2}\right)+\left(\frac{a+w}{2}-w\right)\left(\frac{a-w}{2}\right)$$
$$\Updownarrow$$
$$\max_w \left(-\frac{1}{4}\right)(w-a)(a-2c+w)$$

The first-order condition yields $w=c$ and

$$\begin{aligned} A &= \frac{1}{4}(c-a)^2 > 0 \\ p_H &= \beta = \frac{a+c}{2} \end{aligned}$$

We must check that the SI-constraint do not bind

$$\begin{aligned} (w-c)\left(\frac{a-w}{2}\right)+A-\beta\left(\frac{a-w}{2}-\max\{0,\frac{2-a-w}{2}\}\right) &\le 0 \\ &\Updownarrow \\ \frac{1}{4}(c-a)^2-\left(\frac{a+c}{2}\right)\left(\frac{1}{2}a-\frac{1}{2}c-\max\left(0,1-\frac{1}{2}c-\frac{1}{2}a\right)\right) &\le 0 \end{aligned}$$

When $a \le 2-c$ the SI-constraint is written

$$\begin{aligned} \frac{1}{4}(c-a)^2-\left(\frac{a+c}{2}\right)\left(\frac{1}{2}a-\frac{1}{2}c-1+\frac{1}{2}c+\frac{1}{2}a\right) &< 0 \\ &\Updownarrow \\ \frac{1}{4}\left(2a+2c-4ac-a^2+c^2\right) &< 0 \end{aligned}$$

This condition holds whenever

$$a > \sqrt{5c^2-2c+1}-2c+1 \equiv a^*$$

and when $a > 2-c$ the constraint is written

$$\begin{aligned} \frac{1}{4}(c-a)^2-\left(\frac{a+c}{2}\right)\left(\frac{1}{2}a-\frac{1}{2}c\right) &\le 0 \\ &\Updownarrow \\ \frac{1}{2}c(c-a) &\le 0 \end{aligned}$$

which always holds. Hence when $a > 2-c$, the proposed solution solution constitutes a separating equilibrium. **QED.**

There are several things to notice. First we have shown that without buy-backs no separating equilibrium with slotting allowances exists. With buy-backs there always exists separating equilibria. Moreover, these equilibria are characterized by the absence of slotting allowances. Producers always charge franchise fees.

4 Concluding remarks

In this paper we have investigated some of the most frequent arguments for the use of slotting allowances. It has been claimed that slotting allowances can be profitability used to increase retail profits at the cost of increasing consumers prices. This result is based on strategic delegation, and as such based on assumptions that we fins particularly unrealistic for the grocery industry. Abstracting from strategic motives we have analyzed the question in a setting with downstream monopoly. We have shown that if the contracting parties have symmetric and perfect information about cost and demand conditions, slotting allowances never arise as a part of an equilibrium strategy. This result is rather robust and holds both when the upstream sector is a monopoly as well a differentiated duopoly. It also holds for the cases when the downstream monopolist has limited shelf space and well as when shelf space is abundant. Moreover we have also shown that this basic result holds for any kind of division of bargaining power between the producers and the retail sector.

A second argument for the use of slotting allowances is that these can be used by producers of new product to signal the demand potential of their products. If producers have private information about their product's true demand potential, it has been claimed that slotting allowances may sometimes be used to signal profitability. By paying slotting fees up front, high demand producers may signal that they posses a high demand product. However, if it is the case that retailers must purchase products before demand is realized, a reasonable assumption we argue, slotting allowances alone turn out to be worthless as signalling devices. This result finds some support in empirical evidence. Several surveys confirms this view. For instance Bloom et al (2000) report that neither producers nor retailers believe that slotting fees serves as a signal or screen for new products.

In this case buy-back clauses may serve as an alternative signalling device. When BBC's can be used fixed fees are always positive, i.e. they are franchise fees, thus slotting allowances play no role.

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