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Slotting Allowances to Coordinate Manufacturers' Retail Sales Effort

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Abstract: Slotting allowances are fees paid by manufacturers to get access to retailers' shelf space. Although the main attention towards slotting allowances has been within the grocery industry, slotting allowances have also been applied within e.g. e-commerce and mobile telephony. In these industries we observe that distributors have large market power due to their control of access to the customers.We analyze how shifting bargaining power from manufacturers to retailers and the use of slotting allowances affect consumers' surplus and channel profit when the manufacturer undertakes non-contractible retail sales effort (through e.g. advertising, promotions and product quality control). We show that with a simple linear wholesale tariff consumers are better off if the retailer has the bargaining power than if it belongs to the manufacturer. With retail bargaining power a change from a linear wholesale tariff to slotting allowances harms the consumers and increases channel profit. As a consequence, the welfare effects of slotting allowances are ambiguous.

[1]We would like to thank Derek Clark and seminar participants at the University of Tromsø and at the 14th International Conference on Retailing and Service Science, San Francisco, for valuable comments

1 Introduction

Although the main attention towards slotting allowances has been within the grocery industry, slotting allowances have also been applied within e.g. e-commerce and mobile telephony. In these industries we observe that distributors have large market power due to their control of access to the customers. The strand of literature analyzing telecommunications markets has usually assumed that the access providers have the bargaining power, but due to historical reasons they have typically been considered as upstream firms (offering access as an input to competing downstream firms).[2] However, if we consider content provision over new digital platforms within e-commerce, mobile networks, and broadcasting, the distributors (the platform providers) are often acting as retailers, where the content providers take the role as upstream input providers. Mobile telephony providers, for instance, control their subscribers' access to various content and entertainment services. For the vast majority of these services the mobile providers may be considered as retailers with significant buying power due to their control of access to the customers. The rationale behind slotting allowances that we put forward, i.e. to ensure that upstream providers are given proper marginal reward for non-contractible effort, seems to be a topical issue in this market. A major problem for the retailers (the mobile providers) is to ensure non-contractible demand-enhancing effort among the (small) upstream content providers. These markets are still in their infancy, but we observe that up-front payments (slotting fees) are paid by content providers in order to get access to the distributors' subscribers. The retailers in return pay unit wholesale prices (that depend e.g. on the number of downloads) and/or different types of revenue sharing schemes.

There seems to be a broad consensus that channel bargaining power has shifted from upstream firms to downstream firms in many industries over the last couple of decades. In the grocery industry we have further observed increasingly more

[2] A conventional market structure also analyzed within this literature is that the upstream access provider is vertically integrated into the downstream market. The downstream subsidiary competes towards rivals that buy access from the upstream unit of the vertically integrated firm. The vertically integrated firm offers take it or leave it contracts to the downstream rivals.

widespread use of slotting allowances, which are fixed fees that manufacturers pay to retailers in order to get access to their shelf space (Bloom et al., 2000, Lariviere and Padmanabhan, 1997). The use of slotting allowances has also become common in a number of other industries, such as the markets for e-commerce and mobile telephony (Wilkie et al., 2002). However, it is important to note that even in the extreme case where downstream firms have all the bargaining power, they will typically not have full channel control. This is due to the fact that it is generally impossible to write complete and enforceable contracts between independent upstream and downstream firms.

The purpose of the present paper is to analyze how shifting bargaining power and the use of slotting allowances affect consumers and channel profit. To this end we set up a simple model with one downstream firm ("retailer") and one upstream firm ("manufacturer"), where the latter may undertake investments that increase consumer demand for the good it produces. Such sales effort by the manufacturer may be related to retail promotions programs, advertising and product quality control[3] (see discussion by e.g. Lal, 1990, and Desai, 1997). Independent upstream and downstream firms cannot write complete and verifiable contracts if effort is imperfectly observed.[4]

The manufacturer's ability to recapture possible investments in sales effort is positively related to its bargaining power. To the extent that the manufacturer's investments are non-contractible, one might therefore reasonably expect that the firm will make smaller investments the lower its bargaining power. We show that this is not necessarily correct. On the contrary, if the bargaining power is shifted over to the retailer, the manufacturer may find it optimal to increase non-contractible investments. The intuition for this result hinges on the fact that the manufacturer will have greater incentives to make sales effort investments the larger her profit margin. In order to induce such investments, the retailer may therefore offer the

[3]In the grocery industry, for instance, it is difficult for the retailer to observe the effort a manufacturer is investing in product quality controls in order to prevent, e.g., e.coli and salmonella.

[4]Regarding advertising, the retailer may observe the level of advertising outlays, but it may be difficult to specify the quality of advertising (see, e.g., Mathewson and Winter, 1985).

manufacturer a high unit wholesale price. Indeed, this wholesale price - and the subsequent sales effort investment - may be higher than what the manufacturer would go for if she had the bargaining power.

A wholesale unit price above marginal costs creates a double marginalization problem. This problem is enhanced by a shift of bargaining power from the manufacturer to the retailer if it leads to a higher wholesale unit price. We nonetheless show that consumers are better off if the retailer has the bargaining power than if it belongs to the manufacturer. This is true independent of whether we allow for slotting allowances. However, a change from a simple linear wholesale tariff to a two-part tariff with slotting allowances harms the consumers and increases channel profit. The welfare effects of slotting allowances are consequently ambiguous.

To see why consumers may be harmed by slotting allowances, note that a high unit wholesale price increases the retailer's expenditure and therefore tends to reduce his profitability. The point is that if the retailer has the bargaining power, and is able to use a two-part tariff, he can recapture these expenditures through the slotting allowance. Other things equal, the retailer will therefore set a higher unit wholesale price with than without slotting allowances, even if this increases the end-use price and magnifies the double marginalization problem.

Double marginalization is usually a vertical externality that, e.g., upstream firms with market power impose on downstream firms with market power.[5] In the case at hand, there is no externality, since the retailer imposes double marginalization on himself. At first glance, we may then expect that the retailer will use ancillary instruments, such as revenue-sharing, to cancel out the double marginalization effects caused by slotting allowances. We argue, however, that such ancillary restraints may be hard to implement.

In the grocery industry the boost of slotting allowances has coincided with a trend towards higher retail concentration. Both in the United States and in Europe the grocery retailing sector has become strikingly more concentrated over the last decades (Bloom et al., 2000, Dobson and Waterson, 1999, and Clarke et al., 2002).

[5] The double marginalization problem was first identified by Spengler (1950), but Cournot (1838) discussed a similar effect when firms offer complementary products.

The increase in the retail market power has been seen as one of the major reasons why the use of slotting allowances has become more widespread.[6] According to a US-based survey by Bloom et al. (2000), retailers and manufactures in the grocery industry agree that greater retail power has contributed to more use of slotting allowances.

There are two schools of thought that dominate the debate over whether slotting allowances enhance or lower welfare. The market power school argues that slotting allowances may have anti-competitive effects either by mitigating competition among retailers or by reducing product variety through foreclosure of smaller suppliers and/or retailers. The efficiency school, on the other hand, argues that slotting allowances may have positive welfare effects by solving problems connected to uncertainty and/or asymmetric information, and by allocating scarce shelf space.

1.1 Related Literature

The present paper is related both to the efficiency-enhancing and the market power school. Shaffer (1991), who may be considered as the founder of the market power school, considers competition between two retailers in the end-user market. He assumes that the retailers have complete bargaining power over manufacturers, and shows that a high wholesale price may be needed to soften retail competition.[7] When wholesale prices rise, retail competition softens. Thus channel profit increases, and this profit is captured by the retailers through slotting allowances.[8] By the same

[6] Rey, Thal and Vergé (2005) further emphasize that even the products of leading manufacturers typically represent a very small proportion of the total business for the major retailers, while the largest manufacturers are highly dependent on their major buyers.

[7] Shaffer (1991) is based on the strategic delegation literature, where Fershtman and Judd (1987) is the seminal paper, and it is a crucial assumption that all prices are observable. In an extension of Shaffer (1991), Foros and Kind (2006) show that when retail chains form buyer groups for procurement activities, slotting allowances may be used to dampen intra-retailer competition even if rival retail chains cannot observe the wholesale contracts.

[8] There have also been concerns that slotting allowances may have anti-competitive effects through foreclosure of smaller suppliers and/or retailers, see Shaffer (2005), Marx and Shaffer (2006), and Rey, Thal and Vergé (2005).

token, we show that when slotting allowances lead to a higher wholesale price, the manufacturer's incentives to make effort investments increase. While this could be beneficial for the consumers, and thus support the efficiency school, the subsequent higher end-user price harms the consumers, lending support to the market power school.[9]

The present analysis is also related to the strand of literature analyzing how vertical restraints can solve channel coordination problems.[10] Since bargaining power has been assumed to be in the hands of the manufacturer (the franchisor), the majority of papers focus on non-contractible sales efforts by the retailer (the franchisee). If the manufacturer has all the bargaining power, and the retailer is the one who makes unobservable sales efforts, we have a standard double marginalization problem without vertical restraints. In this case the manufacturer may achieve the outcome under channel integration by using a two-part tariff, i.e. a franchising fee in addition to the unit wholesale price (see e.g. Lal, 1990). Lal (1990), Desai (1997) and Rao and Srinavasan (1995) assume that both the retailer and the manufacturer undertake value-adding sales efforts that cannot be observed by the other party. Lal (1990) argues that an ancillary restraint (in addition to a two-part tariff) is only needed if *both* the manufacturer and the retailer undertake non-contractible sales efforts. Below, we show that we need not make such a strong assumption: a two-part tariff is unable to achieve the outcome with channel integration even if *only* the manufacturer undertakes non-contractible sales efforts.

[9] Under asymmetric information, where the manufacturer has private information about e.g. product quality, slotting allowances may be used as a signaling or screening device (Chu, 1992, Lariviere and Padmanabhan, 1997, and Desai, 2000). Slotting allowances may also be used to balance the risk between manufacturer and retailers regarding new products (Sullivan, 1997). Bloom et al. (2000) and Rao and Mahi (2003) find no support for slotting allowances as a signaling device in the grocery industry. In contrast, Sudhir and Rao (2006) and Sullivan (1997) find some empirical support for the signaling rationale.

[10] See Rey and Tirole (2006), Rey and Vergé (2005), and Motta (2004) for recent overviews.

2 The model

We consider a channel model with one retailer and one manufacturer, where the manufacturer may undertake non-contractible sales efforts that increase the consumers' willingness to pay for the good.[11] In our framework there are two decision variables that directly affect the channel profit; the retailer's choice of end-user price and the manufacturer's sales efforts. We show that the size (and distribution) of the channel profit depends indirectly on the wholesale tariff. The unit wholesale price will in particular affect both the retail price and the effort level. If the unit wholesale price is above the manufacturer's marginal cost, a double marginalization problem arises. In isolation, this has a negative effect on channel profitability. However, a high unit wholesale price will at the same time ensure a high level of sales effort by the manufacturer, and this tends to have a positive effect on channel profitability.

The retailer faces the linear demand curve $\widetilde{q} = v + x - p + \epsilon$, where v is the market potential, x is the level of sales effort by the manufacturer, p is the retail price, and ϵ is an uncertainty term with mean zero. Defining $E[\widetilde{q}] \equiv q$, expected demand can be written as

$$q = v + x - p. \tag{1}$$

With this demand function we can express consumer surplus as

$$CS = \frac{q^2}{2}. \tag{2}$$

The manufacturer's cost of providing sales effort is given by $C(x) = \phi x^2/2$, and is independent of the quantity sold in the retail market. This specification corresponds to the case where the sales effort is, e.g., different kinds of promotion activities, advertising outlays or product quality control. Upstream marginal costs equal c, and we normalize the channel's unit costs at the downstream level to zero.

In order to ensure that the second-order conditions are satisfied in all the cases we consider below, we shall make the following assumption:

Assumption 1: $\phi > 1/2$

[11] We abstract from the fact that also the retailer may undertake some sales effort; see the Introduction and Section 3 for a discussion.

2.1 The Integrated Channel

Channel profit is maximized by solving the optimization problem

$$\max_{p,x} \pi_{ic} = (p-c)q - \frac{\phi x^2}{2}, \tag{3}$$

where subscript ic is short-hand for integrated channel.

The integrated channel's first-order conditions read

$$\frac{\partial \pi_{ic}}{\partial x} = 0 => (p-c) - \phi x = 0 \text{ and } \frac{\partial \pi_{ic}}{\partial p} = 0 => \left(q + p\frac{dq}{dp}\right) - c = 0, \tag{4}$$

where we note for later use that $\partial\pi_{ic}/\partial p = 0$ can be reformulated as

$$p = \frac{v+x}{2} + \frac{c}{2} \tag{5}$$

Solving the expressions in (4) simultaneously we find

$$x_{ic} = \frac{1}{2\phi - 1}(v-c), \quad p_{ic} = \frac{(v+c)\phi - c}{2\phi - 1}. \tag{6}$$

The FOCs describe an equilibrium if $\phi > 1/2$, in which case we have

$$\pi_{ic} = \frac{\phi}{2(2\phi - 1)}(v-c)^2.$$

From this it follows that consumer surplus and welfare (the sum of consumer surplus and profit) equal respectively

$$CS_{ic} = \frac{\phi^2}{2(2\phi-1)^2}(v-c)^2 \text{ and } W_{ic} = \frac{\phi(3\phi-1)}{2(2\phi-1)^2}(v-c)^2 \tag{7}$$

2.2 The Disintegrated Channel

In the rest of the paper we consider a disintegrated channel, such that the retailer and the manufacturer maximize profit non-cooperatively. We analyze a two-stage game. At stage 1 either the retailer or the manufacturer, depending on who has the channel market power, proposes a wholesale tariff which the other party can accept or reject.

We presuppose that the manufacturer's choice of effort is non-contractible.[12] It is consequently reasonable to assume that the manufacturer's sales effort (x) and the retailer's choice of end-user price (p) are determined simultaneously at stage 2.[13]

In this section we analyze a wholesale tariff of the form $T(w, S) = wq - S$, where w is the unit wholesale price and $S \gtreqless 0$ is a fixed fee from the manufacturer to the retailer. If $S > 0$ we have a slotting allowance paid by the manufacturer to the retailer, while we have a franchising fee if $S < 0$. The profits of the retailer (subscript r) and manufacturer (subscript m) are consequently given by respectively

$$\pi_r = (p - w)(v + x - p) + S \tag{8}$$

and

$$\pi_m = (w - c)(v + x - p) - \frac{\phi}{2}x^2 - S. \tag{9}$$

We solve the game by using backward induction. Since the outcome of the second stage does not depend on the sign or size of S, the first-order conditions for this stage are found by solving $\partial\pi_m/\partial x = \partial\pi_r/\partial p = 0$ independent of whether there is a fixed fee. We thus have

$$\frac{\partial \pi_m}{\partial x} = 0 => (w - c) - \phi x = 0 \text{ and } \frac{\partial \pi_r}{\partial p} = 0 => \left(q + p\frac{dq}{dp}\right) - w = 0. \tag{10}$$

The retailer will obviously never sell its good below his marginal costs. This means that we must have $p \geq w$. Comparing equations (4) and (10) we therefore immediately see that the effort level in the disintegrated channel must be lower than the one which maximizes total profit for a given p. The integrated channel makes effort investments until the entire *channel's* marginal profit $(p - c)$ is equal to marginal

[12]If the manufacturer's sales effort is observed and verified by the retailer, the level of effort may be agreed on directly in a contract. For some type of advertising the level of outlays may be observed, but it may nonetheless be difficult to verify the effort level (see the Introduction). In general, it is unlikely that it is possible to write complete and enforceable contracts on retail sales effort.

[13]It is reasonable to assume that the wholesale tariff is decided before retail prices. This is due to the fact that retailers do not have long-term contracts with their customers, while the wholesale contractual arrangements often are set for no less than a year (see e.g. discussion by Rey and Stiglitz, 1995).

investment costs (ϕx), while the disintegrated channel invests only up to the point where the *manufacturer's* marginal profit ($w - c$) equals marginal investment costs (ϕx).

It is straight forward to show that $\frac{\partial \pi_r}{\partial p} = 0$ implies $p = \frac{v+w+x}{2}$, so that the retailer sets a price which is increasing in his marginal costs (w) and the manufacturer's sales effort (x). In contrast, for the integrated channel it follows from $\frac{\partial \pi_r}{\partial p} = 0$ that $p = \frac{v+c+x}{2}$. Other things equal, the end-user price will therefore be higher in the disintegrated channel if $w \geq c$ (double marginalization). However, since the effort level x will be relatively low in the disintegrated channel, we cannot ascertain at the outset whether the end-user price will be lower in the disintegrated or the integrated channel.

Solving the two FOCs in (10) simultaneously yields

$$p(w) = \frac{v+w}{2} + \frac{w-c}{2\phi} \text{ and } x(w) = \frac{w-c}{\phi}, \tag{11}$$

provided that $w \geq c$.

The simple expressions in equation (11) indicate that there will be a trade-off when the wholesale tariff is determined at stage 1: A high value of w may lead to an excessively high end-user price, but will also give the manufacturer an incentive to make effort investments (which we know will be too low from the channel's point of view). Indeed, the manufacturer will not make any investments unless the profit margin is positive; if $w \leq c$ she will optimally set $x^* = 0$.

Letting $\Pi = \pi_r + \pi_m$, welfare with a disintegrated channel can be expressed as

$$W = CS + \Pi. \tag{12}$$

2.3 Linear wholesale tariff

In absence of a fixed fee ($S = 0$), the wholesale tariff is simply the linear price (subscript lp); $T_{lp} = w_{lp} q$.

2.3.1 The manufacturer has the bargaining power

Assume first that the bargaining power belongs to the manufacturer (superscript M). The optimal wholesale unit price is then found by solving $w_{lp}^{M} = \arg\max \pi^{M}$, which yields

$$w_{lp}^{M} = \frac{v+c}{2}. \tag{13}$$

Using (11) and (13) we have

$$p_{lp}^{M} = \frac{(v+c)\,\phi - c}{2\phi - 1} + \frac{(2\phi+1)(\phi-1)}{4\phi\,(2\phi-1)}\,(v-c) \tag{14}$$

and

$$x_{lp}^{M} = \frac{1}{2\phi}\,(v-c)\,. \tag{15}$$

Inserting for equilibrium prices and investments, profits can be written as

$$\pi_{m,lp}^{M} = \frac{(v-c)^2}{8} \text{ and } \pi_{r,lp}^{M} = \frac{(1+\phi)^2}{16\phi^2}\,(v-c)^2\,, \tag{16}$$

while consumer surplus and welfare are given by

$$CS_{lp}^{M} = \frac{(1+\phi)^2}{32\phi^2}\,(v-c)^2 \quad \text{and} \quad W_{lp}^{M} = \frac{3+6\phi+7\phi^2}{32\phi^2}\,(v-c)^2\,. \tag{17}$$

2.3.2 The retailer has the bargaining power

If the retailer has the bargaining power (superscript R), the unit wholesale price is found by solving $w_{lp}^{R} = \arg\max \pi_r$ s.t. (11). The manufacturer's participation constraint requires that $w \geq c$. Other things equal, it would therefore be optimal for the retailer to set $w = c$ in order to minimize his marginal costs. However, by setting $w > c$, the retailer will induce the manufacturer to invest in sales effort. This will generate a positive shift in the consumers' demand curve, allowing the retailer to charge a higher price and/or sell a larger quantity. To clearly see the trade-off between these two effects, we can use equation (11) to find

$$\frac{d\,(p-w)}{dw} = \frac{dq}{dw} = \frac{1-\phi}{2\phi} \tag{18}$$

To interpret this, note from (11) that $dx/dw = 1/\phi$. The manufacturer will thus undertake greater effort investments subsequent to an increase in w the smaller is ϕ.

Put differently, the smaller is ϕ, the larger is the positive shift in the demand curve that the retailer can generate by increasing w. For $\phi < 1$ this effect is sufficiently strong to outweigh the higher marginal costs for the retailer, while the opposite is true for $\phi > 1$. This suggests that whether the retailer prefers a relatively high or low value of w depends on whether ϕ is greater or smaller than unity. Formally, this is verified by differentiating equation (8):

$$\frac{d\pi_r}{dw} = \frac{1-\phi}{\phi} q,$$

which shows that the retailer's profit level is decreasing in w if $\phi > 1$ ($\frac{d\pi_r}{dw} < 0$). The best the retailer can do in this case is to set $w = c$, and accept that the manufacturer makes no investments in effort. If $\phi < 1$, on the other hand, we have $\frac{d\pi_r}{dw} > 0$. In order to maximize the manufacturer's incentives to make effort investments, the retailer will then raise the price he pays to the manufacturer (w) above the manufacturer's preferred level (given by equation (13)). Indeed, he will set w so high that the manufacturer's participation constraint is binding; $\pi_m = 0$. It is straight forward to show that this implies that $w = v$.

Depending on the size of ϕ we thus have[14]

$$\begin{aligned} \phi &> 1: w_{lp}^R = c;\ x_{lp}^R = 0;\ p_{lp}^R = \frac{v+c}{2};\ \pi_{r,lp}^R = \frac{(v-c)^2}{4};\ \pi_{m,lp}^R = 0. \\ \phi &\in \left(\frac{1}{2}, 1\right): w_{lp}^R = v;\ x_{lp}^R = \frac{v-c}{\phi};\ p_{lp}^R = \frac{(2\phi+1)v-c}{2\phi};\ \pi_{r,lp}^R = \frac{(v-c)^2}{4\phi^2};\ \pi_{m,lp}^R = 0. \end{aligned} \quad (19)$$

With $\phi \in \left(\frac{1}{2}, 1\right)$ the manufacturer would like to commit to a relatively low effort level. However, observing a high value of w the best the manufacturer can do is to make large effort investments, a fact that the retailer can utilize to his own benefit. No matter how large ϕ is, the manufacturer thus makes zero profit when the retailer has the channel bargaining power.

Summing up the results so far, we can state:

Proposition 1: *Assume a linear wholesale tariff, and suppose that*

[14] Note that the retailer is indifferent between setting $w_{lp}^R = c$ and $w_{lp}^R = v$ at $\phi = 1$.

a) the manufacturer has the bargaining power. Then both the retailer and the manufacturer make positive profits. The manufacturer's effort level equals $x_{lp}^M = \frac{v-c}{2\phi}$.

b) the retailer has the bargaining power. Then the manufacturer makes zero profit. The manufacturer's effort level equals $x_{lp}^R = \frac{v-c}{\phi} > x_{lp}^M$ *if* $\phi < 1$*, while* $x_{lp}^R = 0 < x_{lp}^M$ *if* $\phi > 1$.

Inserting for equilibrium prices and effort, consumer surplus and welfare can be expressed as:

$$\begin{aligned} \phi &> 1 : CS_{lp}^R = \frac{1}{8}(v-c)^2;\ W_{lp}^R = \frac{3}{8}(v-c)^2 \\ \phi &\in \left(\frac{1}{2}, 1\right) : CS_{lp}^R = \frac{1}{8\phi^2}(v-c)^2;\ \ W_{lp}^R = \frac{3}{8\phi^2}(v-c)^2 \end{aligned} \tag{20}$$

It can be verified that profit, consumer surplus and the manufacturer's effort level are higher under the integrated than under the disintegrated channel. More interesting is the comparison between the outcomes where the retailer and the manufacturer have the bargaining power. Using equations (15) - (17) and (19) - (20) above, we find the following:

Proposition 2: *Assume a linear wholesale tariff and that the manufacturer has the bargaining power. In this case*

a) consumer surplus is lower than if the retailer has the bargaining power for all values of ϕ.

b) channel profit is higher than if the retailer has the bargaining power if and only if $\phi \in (\phi_1, \phi_2)$, where $\phi_1 \equiv \frac{\sqrt{10}-1}{3} \approx 0.72$ *and* $\phi_2 \equiv \sqrt{2}+1 \approx 2.41$.

c) welfare is higher than if the retailer has the bargaining power if and only if $\phi \in (\phi_3, \phi_4)$, where $\phi_3 \equiv \frac{6\sqrt{2}-3}{7} \approx 0.78$ *and* $\phi_4 = \frac{3+2\sqrt{6}}{5} \approx 1.58$.

Proposition 2a says that consumer surplus is highest if it is the retailer who has the bargaining power in the disintegrated channel. However, Propositions 2b and 2c show that the size of ϕ is decisive for whether the same is true for total channel profit and welfare. This is illustrated in Figure 1. The solid line measures the difference between industry profit when the manufacturer and the retailer have the bargaining power, while the dotted line shows the corresponding difference in welfare. To see the intuition for this result, suppose that ϕ is "high" ($\phi >> 1$), in which case optimal effort investments are relatively low. Then the fact that $x_{lp}^R = 0$ does not have a big negative effect on profit or welfare - the avoidance of double marginalization is more important ($w_{lp}^R = 0 < w_{lp}^M$). Indeed, as $\phi \to \infty$ (investment costs become prohibitively high) it cannot be optimal either for the society as a whole or for integrated channel profit when $w > c$. If ϕ is "low" ($\phi << 1$), on the other hand, the fact that $x_{lp}^R > x_{lp}^M$ has a beneficial effect on both welfare and total channel profit. It is thus only for some intermediate values of ϕ that industry profit and welfare are highest if the manufacturer has the bargaining power - as we approach $\phi = 1$ from below, the negative effect of $w_{lp}^R > w_{lp}^M$ becomes more and more important, while $x_{lp}^R < x_{lp}^M$ has an increasingly large negative impact as we approach $\phi = 1$ from above.

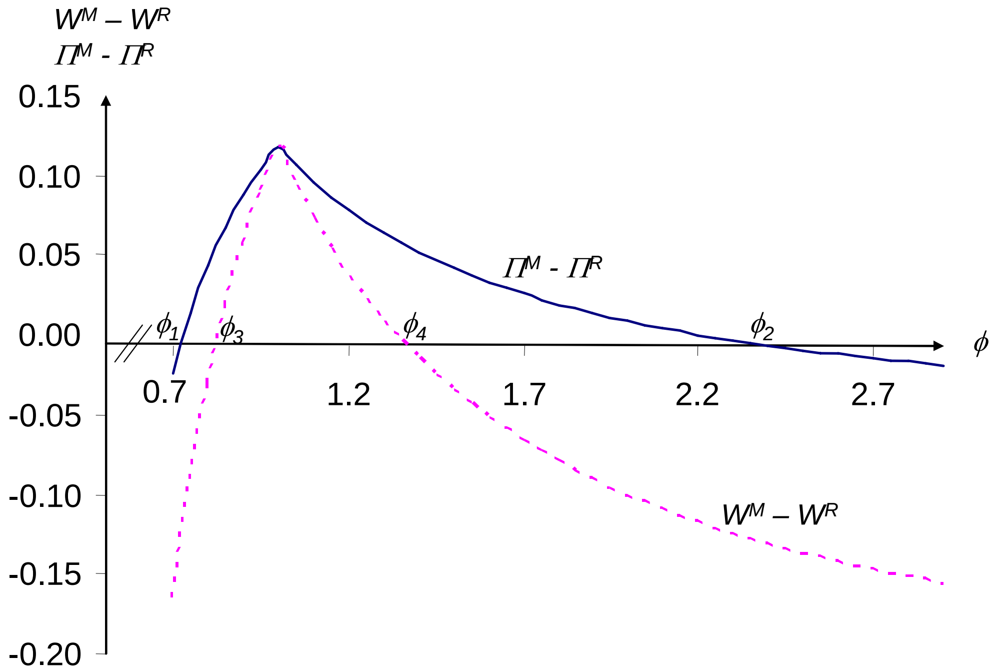

Figure 1: *Bargaing power, channel profit and welfare.*

2.4 Two-part tariff

As discussed in the Introduction, the significant increase in the use of slotting allowances has raised a discussion of how they affect welfare. Among the questions that have been taken up, is whether slotting allowances can be used as a tool to soften competition at the upstream and downstream level (which would typically have a negative welfare effect) or as a signalling/screening device (with possible positive welfare effects).

What will be the consequences of slotting allowances in the present context, where we abstract from horizontal competition and signalling/screening? To answer that question, we shall in the following assume that the retailer has bargaining power, and that he possibly uses this power to charge a slotting allowance. A slotting allowance (sa) can be considered as a fixed positive fee paid by the manufacturer to the retailer (i.e. a negative franchising fee). We therefore consider a wholesale tariff of the form $T_{sa} = w_{sa}q - S$ with $S \geq 0$. It can be shown that this requires that $\phi \geq \frac{1}{2}\sqrt{5} - \frac{1}{2}$, and in the following we shall assume that this inequality holds:

Assumption 2: *Let the wholesale tariff be given by $T_{sa} = w_{sa}q - S$ with $S \geq 0$. Assume that the retailer has the bargaining power and that $\phi \geq \frac{1}{2}\sqrt{5} - \frac{1}{2} \approx 0.62$.*

At the end of the section we provide a discussion of what changes both if $\phi \in \left(\frac{1}{2}, \frac{1}{2}\sqrt{5} - \frac{1}{2}\right)$ and if the manufacturer has the bargaining power.

We maintain the same timing structure as above. In the present context this means that the retailer decides the wholesale tariff T_{sa} at stage 1. At stage 2 the retailer sets the end-user price and the manufacturer decides the effort level. The difference from the case with a simple linear wholesale tariff, is that the existence of a slotting allowance implies that the retailer has one more instrument available. More specifically, at any given level of the unit wholesale price the retailer can now use the slotting allowance S to capture the whole channel profit. Thereby the manufacturer's non-negative profit constraint is binding, and the slotting allowance becomes

$$S = (w - c)\, q - \frac{\phi}{2} x^2.$$

Since the outcome of the second stage is independent of any fixed fees, the end user price $p(w)$ and the manufacturer's effort level $x(w)$ are also in this case given by equation (11). The retailer thus still faces the trade-off that a high unit wholesale price both increases his marginal costs and the manufacturer's effort level.

Inserting for $S = (w - c)\, q - \frac{\phi}{2} (x)^2$ into the retailer's profit function in equation (8) his objective function at stage 1 can be written as

$$\pi_r = \max_w \left\{ (p - c)\, q - \frac{\phi}{2} x^2 \right\}. \tag{21}$$

Note that this profit expression is the same as the one we have for the integrated channel in equation (3). Therefore w does not enter directly. However, w appears indirectly through the manufacturer's response function $x(w)$ at stage 2 (and the retailer's simultaneous choice of $p(w)$).

Solving (21) with respect to w we have

$$w_{sa} = \underbrace{\frac{v + c}{2}}_{w_{lp}^M} + \underbrace{\frac{1 - \phi}{\phi} q}_{\partial \pi_r / \partial w}. \tag{22}$$

The intuition for equation (22) is as follows. With slotting allowances, the retailer maximizes total channel profit at stage 1, taking into account the responses at stage 2. As shown above, an increase in w enhances downstream profit if $\phi < 1$. In this case the retailer will therefore set the unit wholesale price higher than the one which maximizes upstream profit under a linear tariff (w_{lp}^M). If $\phi > 1$, on the other hand, the retailer will set $w_{sa} < w_{lp}^M$.

Inserting for (22) into (1) and (11) yields

$$w_{sa} = w_{lp}^M + \frac{1 - \phi^2}{2\left(\phi^2 + 2\phi - 1\right)} (v - c), \tag{23}$$

where the denominator $\phi^2 + 2\phi - 1 > 0$ in the relevant area, and $w_{lp}^M = \frac{v+c}{2}$.

Recall that the retailer imposes a double marginalization problem on himself in order to induce the manufacturer to undertake effort in the case with a linear tariff if and only if $\phi < 1$. This is true also with a two-part tariff; by using equation (23) it can be shown that the double marginalization problem disappears only in the limit as $\phi \to \infty$ (i.e. $w_{sa} \to c$ as $\phi \to \infty$).

By using equations (11) and (23) we can compute the equilibrium values of p and x. It is most instructive to write these as functions of p_{lp}^M and x_{lp}^M (which are given from equations (14) and (15), respectively):

$$p_{sa} = p_{lp}^M + \frac{\left(1-\phi^2\right)(1+\phi)}{4\left(2\phi-1+\phi^2\right)\phi}(v-c) \text{ and } x_{sa} = x_{lp}^M + \frac{1-\phi^2}{2\left(2\phi-1+\phi^2\right)\phi}(v-c).$$

The end-user price is positively related to the unit wholesale price for two reasons. First, because it increases the marginal cost of the retailer, and second because it increases the manufacturer's effort level, and therefore the consumers' willingness to pay for the good. This explains why $p_{sa} > p_{lp}^M$ and $x_{sa} > x_{lp}^M$ if and only if $\phi < 1$ (i.e., when $w_{sa} > w_{lp}^M$).

Figure 2 summarizes how the manufacturer's effort level depends on the different contexts we have considered, and illustrates that the relationship between tariff structure and bargaining power on the one hand, and the manufacturer's effort level on the other hand, is complex. The crucial factor is whether an increase in the unit wholesale price induces the manufacturer to increase her effort level so much that it outweighs the negative effect of higher marginal costs for the retailer. If this is the case, the retailer prefers a unit wholesale price which is so high that $x_{lp}^R > x_{lp}^M$. In our model this is true if $\phi < 1$, while the opposite holds if $\phi > 1$.

With slotting allowances, the retailer chooses w (and therefore indirectly x) such that aggregate profit is maximized. However, as noted above, the manufacturer's effort level is always higher in the integrated than in the disintegrated channel. This reflects the fact that the firms are unable to fully internalize the positive profit effects of a higher effort in the non-cooperative equilibrium.

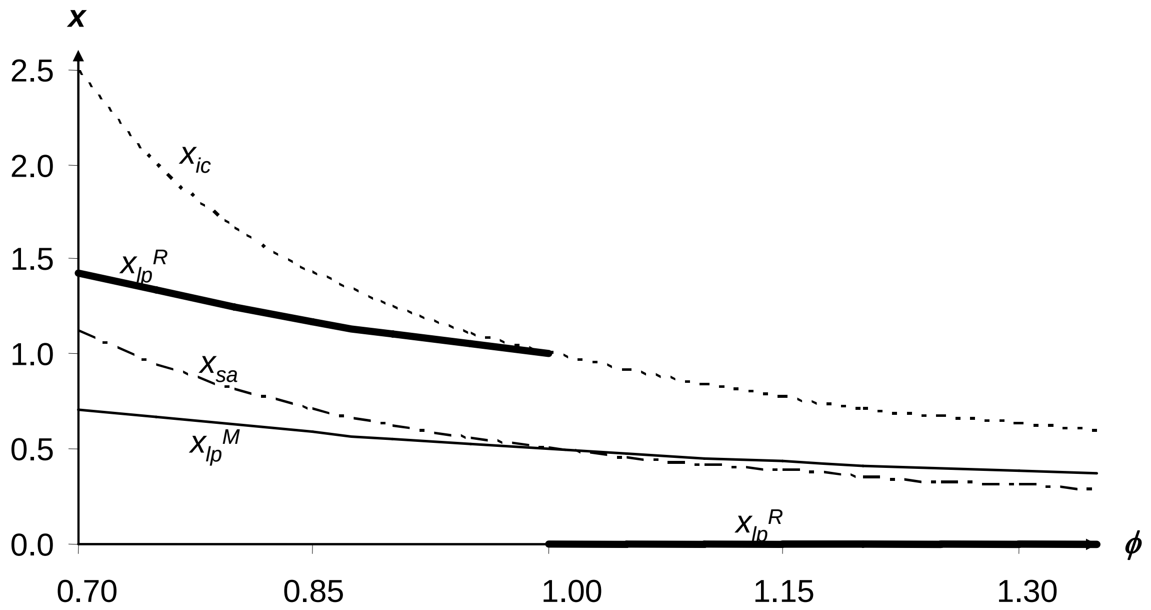

Figure 2: *Manufacturer's effort level.*

We can now use equation (23) to find that channel profit, which is here the same as retail profit, equals

$$\Pi_{sa} = \hat{\pi}_r = \frac{\phi(\phi+2)}{4(2\phi-1+\phi^2)}(v-c)^2, \tag{24}$$

while consumer surplus and welfare are given by

$$CS_{sa} = \frac{\phi^2(\phi+1)^2}{8(2\phi-1+\phi^2)^2}(v-c)^2 \text{ and } W = \frac{\phi(7\phi+10\phi^2-4+3\phi^3)}{8(2\phi-1+\phi^2)^2}(v-c)^2. \tag{25}$$

Since the retailer at stage 1 maximizes total channel profit when it uses slotting allowances, aggregate profit must clearly be at least as high in this case as when we have a linear wholesale tariff. However, as the firms act non-cooperatively, profits will be lower than with channel integration. Comparing equations (17), (20) and (25) it is further straight forward to verify the following:

Proposition 3: *Assume a two-part tariff where the retailer uses slotting allowances. For $\phi \geq \frac{1}{2}\sqrt{5}-\frac{1}{2} \approx 0.62$ it will then be the case that*

a) consumer surplus and welfare are lower than in the integrated channel ($CS_{sa} < CS_{ic}$ and $W_{sa} < W_{ic}$)

b) consumer surplus and welfare are higher than if the manufacturer has the bargaining power and the firms use a linear wholesale tariff ($CS_{sa} > CS_{lp}^{M}$ and $W_{sa} > W_{lp}^{M}$)

c) consumer surplus is lower than if the retailer has the bargaining power and the firms use a linear tariff ($CS_{sa} < CS_{lp}^{R}$)

d) welfare is lower than if the retailer has the bargaining power and the firms use a linear tariff iff $\phi > 2.07$ ($W_{sa} \lesseqgtr W_{lp}^{R}$ if $\phi \gtreqless 2.07$)

There will always be an element of double marginalization in the disintegrated channel. This explains the result in Proposition 3a. The explanation for Proposition 3b is that the double marginalization problem will be particularly pronounced if the manufacturer has the bargaining power and the firms use a linear wholesale tariff. Indeed, we will then have double marginalization even in the limit $\phi \to \infty$ – the manufacturer is able to make a positive profit only by having a positive mark-up.

The only reason why the retailer might prefer $w > c$ could be to induce the manufacturer to make effort investments: other things equal, an increase in w partly implies that income is transferred from the retailer to the manufacturer. With a linear wholesale tariff, this has a negative effect on the retailer's profit. However, with a two-part tariff the retailer can recapture the manufacturer's income gain by increasing the size of the slotting allowance. This tends to make the retailer more willing to set a high value of w. Indeed, he will be willing to increase w at the expense of a higher end-user price and lower downstream profit as long as total channel profit increases. In this sense the double marginalization problem is magnified with slotting allowances compared to a linear wholesale price where the retailer has the bargaining power. This is the reason why $CS_{sa} < CS_{lp}^{R}$, as stated in Proposition 3c. Nonetheless, since $\Pi_{sa} > \Pi_{lp}^{R}$, Proposition 3d shows that welfare is still higher with slotting allowances if $\phi < 2.07$.

In Assumption 2 we presupposed that $\phi > \frac{1}{2}\sqrt{5} - \frac{1}{2} \approx 0.62$. To see the reason for this, it is useful to compute the size of S. We then find

$$S = (w - c)\, q - \frac{\phi}{2} x^2 = \frac{\phi\left(\phi + \phi^2 - 1\right)}{2\left(2\phi - 1 + \phi^2\right)^2} (v - c)^2 ,$$

from which it follows that $S < 0$ for $\phi \in \left(\frac{1}{2}, \frac{1}{2}\sqrt{5} - \frac{1}{2}\right)$. In this area the retailer will thus pay the manufacturer a fixed fee. A fixed fee from the retailer to the manufacturer is commonly described as a franchising fee, and taken to imply that the manufacturer has the bargaining power. However, this is not true here, since we have presupposed that the bargaining power belongs to the retailer:

Proposition 4: *Assume that $\phi \in \left(\frac{1}{2}, \frac{1}{2}\sqrt{5} - \frac{1}{2}\right)$. Even if the retailer has the bargaining power, he will then pay a fixed fee to the manufacturer.*

The reason for this somewhat surprising result, is that the manufacturer becomes "too sensitive" to changes in w if marginal effort costs are sufficiently low. More precisely, if $\phi \in \left(\frac{1}{2}, \frac{1}{2}\sqrt{5} - \frac{1}{2}\right)$ and w is so high that $(w - c)\, q \geq \frac{\phi}{2} x^2$, the manufacturer would make excessive effort investments from the retailer's (and thus the channel's) point of view . To ensure that the manufacturer's participation constraint is fulfilled, and channel profit is maximized, the retailer thus pays her a fixed fee. Consistent with this it can thus be verified that in this area we have $w_{sa} < w_{lp}^R$ and $x_{sa} < x_{lp}^R$.

What changes if the bargaining power belongs to the manufacturer instead of the retailer? The only difference is that the manufacturer then captures the entire channel profit, but the unit wholesale price will still be given by equation (23). The reason is that the firm with the bargaining power will always choose the unit wholesale price that maximizes channel profit if we have a two-part tariff. Therefore the end-user price as well as sales effort, consumer surplus and total welfare are all unaffected by whether the bargaining power is in the hands of the retailer or the manufacturer.[15]

[15] Note that if the manufacturer has the bargaining power, we will observe a positive franchising fee for all ϕ where the second-order conditions are satisfied, inclusive of the range $\phi \in \left(\frac{1}{2}, \frac{1}{2}\sqrt{5} - \frac{1}{2}\right)$. The is simply because it will never be optimal to set the end-user price below marginal costs. Thereby it is not necessary to pay the retailer a fixed fee to satisfy his participation constraint.

3 How to Achieve the Integrated Channel Outcome?

Above, we have shown that the same outcome cannot be achieved with a two-part tariff as under channel integration. In this Section we shall discuss revenue sharing and delegation of retail pricing as ancillary restraints that may be used to solve this problem. However, let us first emphasize why the coordination problem is more complex when non-contractible sales effort is undertaken by the manufacturer rather than by the retailer.

3.1 Non-contractible Sales Effort by the Retailer versus the Manufacturer

Since bargaining power has conventionally been assumed to be in the hands of the manufacturer (the franchisor), the majority of papers within the franchising literature focus on non-contractible sales effort by the retailer (the franchisee). In this case the following result is well known from the literature (e.g. Lal, 1990):

Remark 1: *Assume that the retailer makes a non-contractible sales effort. Then the two-part tariff $T = wq - S$, with $w = c$, achieves the same outcome as under channel integration.*[16]

The intuition behind the result in Remark 1 is that when one and the same firm decides both the effort level and the end-user price, it will internalize the interdependencies between the two variables. The double marginalization problem is then solved by setting $w = c$. If the retailer has the bargaining power we have $S > 0$, while the opposite is true if the manufacturer has the bargaining power.

Lal (1990) starts out with a model structure where the retailer undertakes non-contractible effort, but extends the model such that both the retailer and the man-

[16] For proof, see e.g. Lal (1990) and Rey and Vergé (2005) for the case where the manufacturer has the bargaining power. It is straightforward to show that we have the same outcome when the retailer has the bargaining power.

ufacturer undertake non-contractible effort. He then shows that a two-part tariff cannot achieve the channel integration outcome, and that the outcome may be improved by using a revenue-sharing scheme in addition to a two-part tariff. From this Lal (pp. 316) draws the conclusion that "the need for royalties [revenue sharing] arises only in the presence of factors affecting retail demand that are controlled by both the franchisor and the franchisee". However, as shown above, a two-part tariff is insufficient to replicate the outcome under channel integration even if it is only the manufacturer who undertakes unobservable sales effort.

Let us now discuss some ancillary restraints that may be used to achieve the integrated outcome in the case at hand.

3.2 Revenue sharing

Within the franchising literature it is often assumed that the franchisor may offer a three-part tariff to the franchisee; a lump-sum franchising fee, a unit wholesale price, and a revenue sharing rate expressed as a fraction of the franchisee's gross revenues (see e.g. Lal, 1990). An analogous contract in the present case will be that the retailer offers the manufacturer a contract of the form $T_{rs} = \{S, w, \alpha\}$, where S is the slotting allowance, w is the unit wholesale price, and $1 - \alpha$ is the fraction of the gross retail sales revenue that the retailer pays to the manufacturer (the subscript rs indicates that revenue sharing is used in addition to a slotting allowance). We assume that $0 < \alpha \leq 1$ (see below). The timing structure is similar to the basic model, such that the retailer decides on the contract offer $T = \{S, w, \alpha\}$ at stage 1, and at stage 2 the retailer and the manufacturer decide on p and x, respectively. The profits to the retailer and the manufacturer are given by:

$$\pi^R_{r,rs} = (\alpha p - w)(v + x - p) + S$$

$$\pi^R_{m,rs} = [(1-\alpha)p + w - c](v + x - p) - S - \phi\frac{x^2}{2}$$

Holding x fixed, and solving the first-order condition $\partial\pi^R_{r,rs}/\partial p = 0$ at stage 2, we find that

$$p_{rs} = \frac{v+x}{2} + \frac{w}{2\alpha}. \tag{26}$$

Since $\partial^2 \pi^R_{r,rs}/\partial p^2 = -2\alpha$, the second-order condition is fulfilled if $\alpha > 0$.

Comparing (5) and (26) we see that the retailer can ensure the same end-user price as under channel integration for any given x if he sets the unit wholesale price equal to $w_{rs} = \alpha c$.

Holding p fixed, we further find from stage 2 that $\partial \pi^R_{m,rs}/\partial x = 0$ implies $x = [p(1-\alpha) + w - c]/\phi$. Using equation (26) and $w_{rs} = \alpha c$ this yields:

$$x_{rs} = \frac{(v-c)(1-\alpha)}{2\phi - (1-\alpha)}, \tag{27}$$

From equations (6) and (27) we note that the retailer in the limit can achieve the same effort level as under channel integration ($x_{rs} \to x_{ic}$) if he lets $\alpha \to 0$.[17] This in turn implies that $p_{rs} \to p_{ic}$. Consequently, the unit wholesale price is used as an instrument to implement the integrated channel price, whereas the revenue sharing parameter is used to implement the integrated channel sales effort. As before the retailer may use the slotting allowance, S, to redistribute the profit. We thus have the following result:

Proposition 5: *Assume that the retailer uses a wholesale contract that combines the use of slotting allowances and linear wholesale prices with revenue sharing. The manufacturer receives a fraction $1-\alpha$ of the stage 2 gross retail revenue, where $\alpha \in (0,1]$. When $w_{rs} = \alpha c$ and $\alpha \to 0$ at stage 1, the retail price and the level of sales effort approach the outcome under the integrated channel. The retailer uses S to redistribute profit.*

In their analysis of non-contractible effort by the manufacturer, Lal (1990) and Rao and Srinavasan (1995) assume that the unit wholesale price must be non-

[17] The retailer can get infinitely close to the integrated channel outcome, but cannot implement it perfectly. The reason for this is that the manufacturer will undertake the optimal sales effort only if she receives the entire channel's profit margin, $p-c$ (which means that $\alpha = 0$). However, in that case the profit margin of the retailer would be equal to zero, making him indifferent to which price he sets at stage 2.

negative. They further argue that upstream marginal costs c may be normalized to zero without any loss of generality. On this background, Lal (1990) finds that the optimal contract "takes the form where the wholesale price is set equal to marginal cost" (pp. 315).[18] However, their normalization of marginal costs to zero is not entirely innocent. To see why, assume that we set the wholesale price equal to marginal costs, $w = c$, in the present model, where $c > 0$. Then (26) becomes $p = (v + x)/2 + c/2\alpha$. For any given investment, x, the only way to achieve the optimal end-user price is then to set $\alpha = 1$; i.e. to give the entire channel's profit margin to the retailer. However, when $\alpha = 1$, the manufacturer will not invest at all. Thus, in general it is optimal to set the unit wholesale price *below* marginal costs (in the present case we have that $w_{rs} \to 0 < c$ when $\alpha \to 0$).[19]

What if the bargaining power is controlled by the manufacturer instead of by the retailer? Also in this case we find that $w_{rs} = \alpha c$ and $\alpha \to 0$. However, in contrast to the case where the retailer decides the wholesale tariff, the manufacturer does not need to (and cannot) use a fixed fee. The reason is that she captures almost the entire channel profit when $\alpha \to 0$.

3.3 Delegation of Retail Pricing

When the bargaining power is controlled by the retailer, delegation of retail pricing may be an alternative solution to solve the double marginalization problem. The discussion above makes it clear that the retailer faces a trade-off when he sets the unit wholesale price. On the one hand, the retailer wants to use the marginal cost of the

[18] As mentioned above, Lal (1990) first assumes that only the retailer makes non-contractible effort. Then he assumes that both the retailer and the manufacturer undertake non-contractible sales efforts. In the latter case, Lal shows that with given conditions there will exist a revenue sharing rule $\alpha \in (0, 1)$ that simultaneously provides the desired levels of effort by the retailer and manufacturer when the wholesale price equals zero (which is a special case of $w = \alpha c$ in our context). In contrast to us, Lal (1990) assumes that effort levels provided can be either high or low.

[19] If the wholesale price is set equal to marginal costs, $w = c$, then the retailer must implement a rule of profit sharing rather than revenue sharing. The profit to the retailer then becomes $\alpha(p - c)q + S$.

entire channel when he determines the retail price. This indicates that it is optimal to set $w = c$. Thereby the double marginalization problem will be eliminated. On the other hand, the retailer wants to set $w > c$ in order to stimulate the manufacturer to invest in sales effort. This suggests that the retailer has incentives to separate the unit wholesale price paid to the manufacturer from the marginal cost which is used to calculate the end-user price. Building on the strategic delegation literature, where Fershtman and Judd (1987) is the seminal work, we will briefly discuss how this may work out. To this end, assume that the retailer splits his activities between a headquarter (HQ) and a retail subsidiary, where the former is responsible for procurements and the latter for end-user pricing. We maintain the same basic timing structure as we have used earlier. This means that HQ decides the wholesale tariff offered to the manufacturer at stage 1. The good is then sold from the HQ to the retail subsidiary at a unit transfer price t that is possibly different from w. The retail subsidiary thus perceives t as the real marginal costs when he determines the end-user price which maximizes his own profit at stage 2 (simultaneously with the manufacturer's choice of sales effort).

The following result can now be verified:

Proposition 6: *Assume that the retailer headquarters can*

(i) delegate retail pricing, such that the subsidiary uses the transfer price t when it decides the end-user price, and

(ii) credibly commit to the size of t before the manufacturer decides its sales effort.

The combination of (i), (ii) and slotting allowances allows the retailer to achieve the same outcome as under channel integration.

The intuition behind this result is the following. Suppose first that the HQ cannot credibly commit to t before the manufacturer decides the level of x. Then the HQ considers x as given when it decides t. The best the HQ can do is then to set $t = w$, and delegation will not solve the double marginalization problem. This result resembles Hirschleifer (1956), who shows that it is optimal for a HQ to set the transfer price to a monopoly retail subsidiary equal to the real marginal costs. In the case at hand, the real marginal cost is w after the retailer and the manufacturer have agreed on the wholesale tariff.

In contrast, if the retailer HQ can commit to the transfer price before the manufacturer decides the level of sales effort, the HQ sets the transfer price equal to true marginal costs, $t = c$. Then the HQ eliminates the double marginalization problem caused by the use of slotting allowances, and the HQ may use the wholesale price w to achieve the same level of sales effort as under an integrated channel; i.e. $w = p_{ic}$. Slotting allowances are again used to redistribute profit.

The assumption that the retailer uses delegation of retail pricing is in fact consistent with market observations in the grocery industry (Dobson and Waterson, 1999). In several countries we observe relatively large buyer groups, each consisting of several sub-chains (or brands). While the headquarters of the buyer groups takes care of procurement activities, the sub-chains seem to be quite autonomous with respect to end-user pricing.[20]

What begs a question is in particular whether the HQ has the ability to commit to an observable arm's length transfer price before the manufacturer decides the level of sales effort. In general, such a commitment will be difficult to implement.

4 Concluding remarks

The present paper has analyzed how different specifications of wholesale tariffs and a shift of bargaining power from manufacturers to retailers affect consumers and industry profit. While slotting allowances tend to harm consumers, the consumers are nonetheless better off if the bargaining power rests with the retailer than with the manufacturer. However, as long as the manufacturer can undertake some non-contractible sales effort, a two-part tariff (where the slotting allowance constitutes the fixed fee) is an insufficient instrument to eliminate the double marginalization problem. Indeed, the use of a two-part tariff in this setting magnifies the double marginalization problem, even though total channel profit is higher than if only a

[20] See also Foros and Kind (2006) for further discussions on the impact of buyer groups on the usage of slotting allowances.

simple linear wholesale tariff is used.

Ancillary restraints, such as revenue sharing and delegation of end-user pricing, can reduce or eliminate double marginalization. A potential problem of using revenue sharing, however, is the administration costs. The manufacturer needs to monitor the retailer in order to verify the retailer's information about the revenue. We may therefore expect to observe revenue sharing in circumstances where these administration costs are relatively low compared to the potential efficiency enhancing effects. In several industries improved information systems have significantly reduced monitoring costs. One industry where we have consequently observed increased usage of revenue sharing is the video rental industry (Cachon and Lariviere, 2005, and Dana and Spier, 2001). In the grocery sector, retailers collect a lot of information through inventory and revenue management systems. However, since these systems are controlled by the retailers, manufacturers (and in particular smaller manufacturers) may not have the ability to monitor and verify the information given by the retailers.

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