Consumers' Shopping Costs as a Cause of Slotting Fees: A Rent-Shifting Mechanism[*]

Preliminary Version

Stéphane Caprice[†]   Vanessa von Schlippenbach[‡]

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Abstract

This paper explains the emergence of slotting fees in a sequential bargaining framework with one retailer and two suppliers of substitutable goods. We take consumers' shopping costs explicitly into accout. To economize on their shopping time, consumers tend to bundle their purchases inducing positive demand externalities. If the complementarity effect dominates the original substitution effect, the wholesale price negotiated with the first supplier is upward distorted in order to shift rent from the second supplier. As long as the first supplier has only little bargaining power, she compensates the retailer for the upward distorted wholesale price by paying a slotting fee.

JEL-Classification: L22, L42

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1 Introduction

During the last decades, the retail industry has been subject to an ongoing consolidation process (EC 1999, OFT 1998). This has limited the suppliers' trading alternatives coming along with an increase of large retailers' gatekeeper control towards final consumer markets. Thus, goods have to pass "the decision-making screen of a single dominant retailer" to be distributed to final consumers (FTC 2001). One concern is that retailers are in the position to charge slotting fees and comparable upfront payments from their suppliers because of their gatekeeper power. The average amount of (so-called) slotting fees per item, per retailer and per metropolitan area ranges from \$2,313 to \$21,768 (FTC 2003), whereas it varies widely within product categories. In particular, small manufacturers often complain that they are more likely to pay slotting fees than large manufacturers (FTC 2001, 2003).[1] However, the retailer's bargaining power does not suffice to explain the emergence of slotting fees in supplier-retailer relationships, as large retailers like Wal-Mart and Costco with tremendous bargaining power vis-à-vis their suppliers never charge slotting fees (FTC 2001).

Our paper provides a new explanation for the emergence of slotting fees in supplier-retailer relationships by explicitly taking into account consumers' shopping costs.[2] To economize on their shopping costs, consumers tend to bundle their purchases by shopping at one stop. That is, about 70% of consumers evince one-stop shopping behavior in spending about 80% of their weekly expenditures for fast moving consumer goods on a weekly main trip (UK Competition Commission 2000).[3] If consumers bundle their purchases, their buying decision depends rather on the price for the whole shopping basket than on individual product prices. This induces positive demand externalities between the products offered at a retail outlet. Referring to these positive demand externalities, we show that slotting fees may emerge as a result of a rent shifting mechanism in a three-party negotiation framework with complete information.[4]

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[1] For example, the investigation of the Heinz-Beechnut "baby-food" merger has shown that the market leader for babyfood does not pay slotting fees to retailers, while the smaller competitors do (Innes and Hamilton, 2006).

[2] Following Shaffer (1991), we define slotting allowances as a negative fixed transfer in a two-part tariff contract between a manufacturer and a retailer.

[3] For an early account of consumers' shopping behavior and the related positive demand externalities, see Stahl (1987). See also Stahl (1982) and Beggs (1994).

[4] We thus depart from a large literature demonstrating that slotting fees are introduced for

We consider a monopolistic retailer that negotiates sequentially with two suppliers of substitutable products. In a similar framework Marx and Shaffer (1999) show that below-cost pricing in intermediate good markets can arise as it allows the retailer and the first supplier to extract rents from the second supplier. This is due to the fact that the retailer's disagreement payoff with the second supplier is decreasing in the price at which she can buy additional units from the first supplier. Accordingly, downward distortion of the wholesale price with the first supplier improves the retailer's disagreement payoff in the second negotiation and, thus, allows her to extract rents from the second supplier. Taking consumers' shopping costs explicitly into account, we show that the wholesale price negotiated with the first supplier can also be upward distorted. Upward distortion occurs if the positive demand externalities resulting from consumers' shopping costs outweigh the original substitution effect. In this case, a higher wholesale price for the first good does not only reduce its own demand, it also lowers the demand for the second good. This, in turn, diminishes the marginal contribution of the second supplier to the joint profit with the retailer. Hence, the retailer's bargaining position in the second negotiation improves which allows her again to extract rents from the second supplier. That is, the upward distorted wholesale price makes the first supplier the residual claimant of the rent shifted from the second supplier. If the first supplier has a sufficiently low level of bargaining power, she pays a fixed fee to compensate the retailer for the higher wholesale price and to transfer the shifted rent from the second supplier to the retailer. Thus, slotting fees may emerge in a sequential bargaining framework when consumers are one-stop shoppers by bundling their purchases to economize on their shopping costs. Precisely, slotting allowances rely on the upward distortion of wholesale prices which has to be compensated by the first supplier if her bargaining power vis-à-vis the retailer is sufficiently low. A ban of slotting fees in intermediate good markets would reduce the extent of upward distortion and thus improve overall welfare.

We further aim at explaining why some suppliers within a category pay slotting fees, while their competitors do not. For this purpose, we endogenize the order of negotiation. Considering different degrees of exogenously given bargaining power for the suppliers, we show that the retailer prefers to negotiate first with the weaker supplier in order to improve her bargaining position vis-à-vis the stronger

signaling or screening purposes (Kelly 1992, Chu 1992, DeVuyst 2005 and Sullivan 1997).

supplier. Since slotting fees are only paid by the first supplier, suppliers with little bargaining power are more likely to pay slotting fees than market or brand leaders. Moreover, we find that powerful retailers do not charge slotting fees. They already capture a large share of the overall industry profit such that their incentive to distort wholesale prices for strategic purposes is relatively low. This is consistent with the observation that the largest and most powerful retailers like Wal-Mart or Costco never charge slotting fees from their suppliers (FTC 2001).

We contribute to the literature on slotting fees based on the strategic use of contracts in vertically related industries.[5] Shaffer (1991) shows that slotting fees can constitute a facilitating mechanism for softening competition in downstream markets. In the context of multi-product markets Innes and Hamilton (2006) demonstrate how a monopolistic supplier and competitive retailers can use slotting fees to obtain vertically integrated monopoly profits. Miklos-Thal et al. (2009) and Bedre (2008) also find that slotting fees can be used to internalize intrabrand contracting externalities. They can also be used in order to exclude competitors at both the upstream (Shaffer 2005) and the downstream level (Marx and Shaffer 2007b). In this literature, the emergence of slotting fees mainly refers to the presence of retail competition.[6] Marx and Shaffer (2009) depart from this literature by showing that slotting fees may allow the retailer to capture more efficiently the value of her shelf space when shelf space is scarce without taking into account downstream competition.

The remainder of the paper is organized as follows: We introduce our model and detail consumer's shopping behavior in Section 2. We then analyze subgame perfect equilibria of the game in Section 3. Section 4 extends our basic framework by allowing to endogenize the order of negotiations. Welfare implications are discussed in Section 5. Finally, we summarize our results and conclude.

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[5] This literature on the strategic use of contracts in vertically related markets is based on the seminal papers of Bonnano and Vickers (1988) as well as Rey and Stiglitz (1988). For more details, see Caillaud and Rey (1995).

[6] See also, Foros and Kind, 2008 and Kuksov and Pazgal, 2007.

2 Model

Consider a vertical structure with two upstream firms U_i, $i = 1, 2$, and a downstream firm D. Each upstream firm produces a single good, whereas U_1 produces good 1 and U_2 produces good 2. The upstream firms sell their goods that are imperfect substitutes to the downstream retailer for subsequent distribution to final consumers. While the upstream firms bear positive constant marginal costs of production $c > 0$, the downstream firm's marginal costs of distribution are normalized to zero. All firms incur zero fixed costs.

Negotiations. We assume that the downstream firm negotiates sequentially with her suppliers about a two-part supply tariff $T_i(w_i, F_i)$, which entails a linear wholesale price w_i and a fixed fee F_i. The retailer negotiates first with supplier U_1 and then enters into negotiations with supplier U_2. Each retailer-supplier pair aims at maximizing its respective joint profit when determining the wholesale price.[7] The surplus is divided such that each party gets her disagreement payoff plus a share of the incremental gains from trade, with proportion $\delta_i \in [0, 1]$ going to the supplier and with proportion $1 - \delta_i$ going to the retailer. In the case of $\delta_i = 0$ the retailer makes take-it or leave-it offers to the suppliers U_i, while the opposite occurs if $\delta_i = 1$.

Demand. In modelling consumer behavior, we follow the approach by Stahl (1982). Consumers are uniformly distributed with density one along a circle or a line of infinite length. The location of consumers is denoted by θ. In addition to goods 1 and 2, the economy involves a numeraire good 0. While the numeraire is available everywhere along the circle or line, both consumer goods have to be purchased at the retail store which is located at θ^D. Consumers incur transportation cost t per unit distance. A consumer, thus, bears shopping costs of $\left| \theta - \theta^D \right| t$ when shopping at the retailer. Assuming that consumers are identical in income I and preferences, their gross utility is given by

$$u(x_0, x_1, x_2) = x_0 + \sum_{i=1}^{2} x_i \left(1 - \frac{x_i}{2} \right) - \sigma x_1 x_2, \tag{1}$$

where $\sigma \in [0, 1)$ indicates the degree of substitutability between goods 1 and 2. Given that both goods are distributed by the retailer at prices (p_1, p_2) and the

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[7] For a non-cooperative foundation of the generalized Nash bargaining solution, see Binmore et al. (1986).

price for the numeraire is normalized to one, the utility-maximizing demand of a consumer located at θ refers to[8]

$$\widetilde{x}_0(p_1, p_2), \ \widetilde{x}_1(p_1, p_2), \ \widetilde{x}_2(p_1, p_2) = \arg \max_{x_0, x_1, x_2} u(x_0, x_1, x_2) \tag{2}$$

$$\text{s.t. } x_0 + p_1 x_1 + p_2 x_2 + \left| \theta - \theta^D \right| t \leq I.$$

Consumers refrain from shopping at the retailer if their utility from local consumption and thus from purchasing only the numeraire exceeds their maximal utility from buying at the retailer, i.e.

$$u(I, 0, 0) = I \geq u(\widetilde{x}_0(p_1, p_2), \widetilde{x}_1(p_1, p_2), \widetilde{x}_2(p_1, p_2)). \tag{3}$$

Accordingly, the location of the consumer who is indifferent whether to buy at the retailer or not, is implicitly given by

$$\tilde{\theta}(p_1, p_2) = \left\{ \theta \mid u(\widetilde{x}_0(p_1, p_2), \widetilde{x}_1(p_1, p_2), \widetilde{x}_2(p_1, p_2)) = I \right\}. \tag{4}$$

Combining (2) and (4), good $i's$ overall demand in the market refers to

$$X_i(p_1, p_2) = 2\widetilde{x}_i(p_1, p_2)\tilde{\theta}(p_1, p_2). \tag{5}$$

These demand functions are continuous in all variables. Differentiating (5) with respect to p_j, we obtain

$$\frac{\partial X_i(p_1, p_2)}{\partial p_j} = 2\tilde{\theta}(p_1, p_2)\underbrace{\frac{\partial \widetilde{x}_i(p_1, p_2)}{\partial p_j}}_{>0} + 2\widetilde{x}_i(p_1, p_2)\underbrace{\frac{\partial \tilde{\theta}(p_1, p_2)}{\partial p_j}}_{<0} \tag{6}$$

$$\text{with:} \quad i = 1, 2, i \neq j.$$

Obviously, $\partial \widetilde{x}_i(p_1, p_2)/\partial p_j$ indicates the standard substitution effect. It determines how the individual consumer's demand for good i is affected by the price p_j. As both goods are imperfect substitutes, this effect is strictly positive. However, $\partial \tilde{\theta}(p_1, p_2)/\partial p_j$ quantifies the impact of price p_j on the size of the market, i.e. on the mass of consumers buying at the retailer. This market area effect is negative as consumers bundle their purchases of both goods to save transportation costs. That is, a higher price for good i induces a higher price for the whole shopping basket such that less consumers are willing to buy at the retailer. Accordingly, a higher price for one product reduces not only the overall

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[8] To simplify notations, some arguments are omitted in the demand functions.

demand for the respective product but also the overall demand for the other product offered at the retailer. This kind of complementary between goods 1 and 2 occurs, although goods are substitutable from a consumption point of view.[9] Due to these two countervailing effects, overall demand for good i, i.e. X_i, reacts ambiguously to an increasing price of good j, i.e. p_j.

Let us now consider the case where the retailer fails to achieve an agreement with supplier U_2 and offers only good 1. Consumers' utility from consumption then refers to

$$u(x_0, x_1, 0) = x_0 + x_1 - \frac{1}{2}x_1^2, \tag{7}$$

yielding the utility-maximizing demands

$$\widetilde{x}_0(p_1, \infty), \ \widetilde{x}_1(p_1, \infty) = \arg\max_{x_0, x_1} u(x_0, x_1, 0) \tag{8}$$

$$\text{s.t. } x_0 + p_1 x_1 + \left| \theta - \theta^D \right| t \leq I.$$

The consumer who is indifferent between visiting the retail store or staying with local consumption of the numeraire is then given by

$$\tilde{\theta}(p_1, \infty) = \left\{ \theta \middle| u(\widetilde{x}_0(p_1, \infty), \widetilde{x}_1(p_1, \infty), 0) = I \right\}. \tag{9}$$

Thus, if the retailer sells only good 1, the overall market demand refers to

$$X_1(p_1, \infty) = 2\widetilde{x}_1(p_1, \infty)\tilde{\theta}(p_1, \infty). \tag{10}$$

Analogously, if the retailer sells only product 2, the overall demand for good 2 refers to

$$X_2(\infty, p_2) = 2\widetilde{x}_2(\infty, p_2)\tilde{\theta}(\infty, p_2). \tag{11}$$

Profits. Using the respective demand function as well as the properties of the bargaining process in the intermediate goods market, we specify the respective profit functions of the downstream retailer and the upstream suppliers as

$$\pi_{1,2}^D = R(p_1, p_2) - \sum_{i=1}^{2} F_i, \ i \neq j, \ i = 1, 2 \tag{12}$$

$$\text{with:} \quad R(p_1, p_2) = \sum_{i=1}^{2} (p_i - w_i) X_i(p_1, p_2)$$

and

$$\pi_{1,2}^{U_i} = (w_i - c) X_i(p_1, p_2) + F_i, \ \text{with } i = 1, 2, i \neq j, \tag{13}$$

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[9] For more details, see Stahl (1987).

respectively. Summarizing, we solve the following three-stage game: In the first stage, the retailer negotiates with supplier U_1 about a two-part delivery contract. Negotiations with supplier U_2 take place in the second stage. Finally, the retailer sets prices and consumers make their purchase decision. We proceed by backward induction where our solution concept corresponds to subgame perfection.

3   Equilibrium analysis

By working backwards we solve for the equilibrium strategies of the downstream retailer and the upstream suppliers taking the order of negotiation as given. We relax this assumption in the next section.

Stage 3 - Downstream Prices. Taking the contracts with each supplier as given, the retailer sets the prices for both goods in the last stage of the game. Maximizing (12) with respect to (p_1, p_2), we obtain the equilibrium downstream prices $p_1^*(w_1, w_2)$ and $p_2^*(w_1, w_2)$.[10] We denote the equilibrium utility maximizing demand, i.e. $x_i(p_1^*, p_2^*)$, as well as the overall equilibrium demand, i.e. $X_i(p_1^*, p_2^*)$, as $x_i(w_1, w_2)$ and $X_i(w_1, w_2)$, respectively. Correspondingly, the reduced profit functions of the downstream and the upstream firms are given by

$$\pi_{1,2}^{D*} = R(w_1, w_2) - \sum_{i=1}^{2} F_i \tag{14}$$

$$\pi_{1,2}^{U_i*} = (w_i - c) X_i(w_1, w_2) + F_i, \tag{15}$$

if the retailer sells both products to final consumers. If, however, only the upstream firm U_1 supplies the retailer, we denote the reduced profit functions as

$$\pi_{1,0}^{D*} = R(w_1, \infty) - F_1 \tag{16}$$

$$\pi_{1,0}^{U_1*} = (w_1 - c) X_1(w_1, \infty) + F_1, \tag{17}$$

while the upstream firm U_2 makes zero profit, i.e. $\pi_{1,0}^{U_2*} = 0$. Analogously, if the retailer fails to achieve an agreement with supplier U_1, the respective reduced

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[10]Due to the linearity of the demand function we get $p_i^*(w_i, \infty)$.

profit functions are given by

$$\pi_{0,2}^{D*} = R(\infty, w_2) - F_2 \tag{18}$$

$$\pi_{0,2}^{U_1*} = 0 \tag{19}$$

$$\pi_{0,2}^{U_2*} = (w_2 - c) X_2(\infty, w_2) + F_2. \tag{20}$$

Stage 2 - Negotiation with the second supplier. In the second stage of the game the downstream firm negotiates with the second supplier U_2 about a two-part tariff $T_2(w_2, F_2)$. The firms take the contract $T_1(w_1, F_1)$ with the first supplier U_1 as given and choose $T_2(w_2, F_2)$ as to maximize their joint profit. Using the reduced profit functions, the equilibrium bargaining outcome of the retailer and the second supplier can be characterized by the solution of

$$\max_{w_2, F_2} \left(\pi_{1,2}^{U_2*} \right)^{\delta_2} \left(\pi_{1,2}^{D*} - \pi_{1,0}^{D*} \right)^{1-\delta_2}. \tag{21}$$

The supplier's disagreement payoff equals zero as the suppliers do not have any alternative to get their goods distributed if they fail to achieve an agreement with the retailer. In the case of negotiation break-down with one supplier, the retailer may still sell the competitor's good. Solving (21) for the equilibrium wholesale price $\widehat{w}_2$ and the equilibrium fixed fee $\widehat{F}_2$, we obtain:

Lemma 1 *If the gains from trade between the retailer and the second supplier U_2 are positive, there exist a unique equilibrium with*

$$\widehat{w}_2 = c \ \text{and} \ \widehat{F}_2(w_1) = \delta_2 \left(R(w_1, c) - R(w_1, \infty) \right).$$

Proof. See Appendix. ∎

As the negotiation outcome between the retailer and the second supplier does not affect the contract chosen in the first stage, they have no incentive to distort the wholesale price in the second stage. The equilibrium wholesale price, therefore, equals marginal cost and maximizes the joint profit of the retailer and the second supplier. That is, the retailer becomes the residual claimant to the joint profit whereas the supplier U_2 receives a lump-sum payment $\widehat{F}_2(w_1)$ from the retailer. This payment corresponds to the supplier's incremental contribution to the joint profit weighted according to her bargaining power.

Considering that the retailer and the first supplier fail to achieve an agreement in the first stage of the game, the outside options for both the retailer and the

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second supplier refer to zero. In this out-of-equilibrium event, the negotiated wholesale price is still equal to marginal costs, while the fixed fee F_2 refers to $\widehat{F}_2(\infty) = \delta_2 R(\infty, c)$. Then, the second supplier gets a payoff of $\delta_2 R(\infty, c)$, and the retailer earns $(1 - \delta_2) R(\infty, c)$.

Stage 1 - Negotiation with the first supplier. Anticipating the equilibrium strategies in stages two and three, the retailer and the first supplier negotiate about a two-part delivery tariff $T_1(w_1, F_1)$. While the disagreement profit of the upstream supplier refers to zero, the outside option of the retailer equals $\pi_{0,2}^{D*} = (1 - \delta_2) R(\infty, c)$. Using our previous results, the respective profits of both the upstream supplier U_1 and the downstream retailer are given by

$$
\begin{aligned}
\pi_{1,2}^{D*} &= R(w_1, c) - F_1 - \widehat{F}_2(w_1) \qquad\qquad (22)\\
&= R(w_1, c) - F_1 - \delta_2 \left(R(w_1, c) - R(w_1, \infty) \right),
\end{aligned}
$$

and

$$
\pi_{1,2}^{U_1*} = (w_1 - c) X_1(w_1, c) + F_1, \qquad\qquad (23)
$$

respectively. Thus, the equilibrium bargaining outcome of the retailer and the first supplier can be characterized by the solution of

$$
\max_{w_1, F_1} \left(\pi_{1,2}^{U_1*} \right)^{\delta_1} \left(\pi_{1,2}^{D*} - \pi_{0,2}^{D*} \right)^{1-\delta_1}. \qquad\qquad (24)
$$

Maximizing (24) with respect to w_1 and F_1 and rearranging terms, we obtain

$$
\frac{\partial}{\partial w_1} \left[(w_1 - c) X_1(w_1, c) + R(w_1, c) \right] - \delta_2 \frac{\partial}{\partial w_1} \left[R(w_1, c) - R(w_1, \infty) \right] = 0. \quad (25)
$$

The first term of (25) determines the impact of an increasing w_1 on the overall industry profit. It becomes zero if the wholesale price equals marginal cost, i.e. $w_1 = c$. In turn, the second term refers to the impact of an increasing w_1 on the incremental contribution of the second supplier U_2 (see Lemma 1). Depending on the sign of the second term, the retailer and the first supplier tend to upward or downward distort the wholesale price w_1.

Lemma 2 *If trade takes place between the retailer and the first supplier U_1, there exists a unique equilibrium wholesale price that is either downward or upward distorted, i.e.*

$$
\widehat{w}_1 = c - \frac{\delta_2 \left(X_1(\widehat{w}_1, c) - X_1(\widehat{w}_1, \infty) \right)}{\partial X_1(\widehat{w}_1, c)/\partial w_1}. \qquad\qquad (26)
$$

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The respective fixed fee refers to

$$\widehat{F}_1 = -(1-\delta_1)(\widehat{w}_1 - c)X_1(\widehat{w}_1, c) \tag{27}$$
$$+\delta_1[(1-\delta_2)[R(\widehat{w}_1, c) - R(\infty, c)] + \delta_2 R(\widehat{w}_1, \infty)].$$
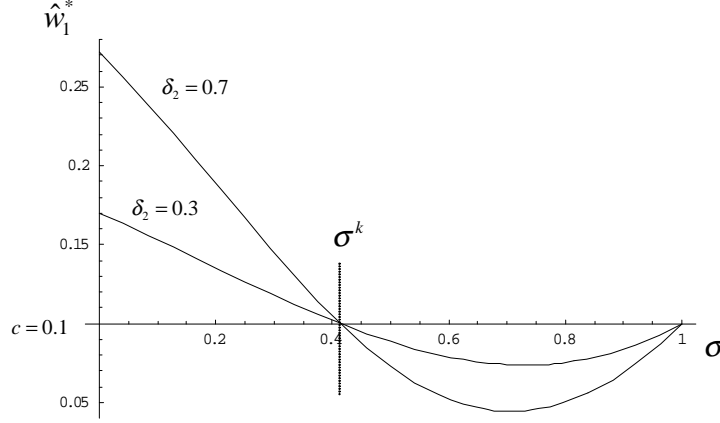
Proof. See Appendix. ∎

The distortion of the wholesale price in the first stage enables the retailer to extract rent from the second supplier. The direction of distortion is indicated by the sign of $\Delta X = X_1(\widehat{w}_1, c) - X_1(\widehat{w}_1, \infty)$.[11] For $\Delta X > 0$ the wholesale price is upward distorted, while it is downward distorted as long as $\Delta X \leq 0$. The actual sign of $X_1(\widehat{w}_1, c) - X_1(\widehat{w}_1, \infty)$ depends on the trade-off between the substitution effect, i.e. $x_1(\widehat{w}_1, c) - x_1(\widehat{w}_1, \infty) < 0$, and the market area effect, i.e. $\theta(\widehat{w}_1, c) - \theta(\widehat{w}_1, \infty) > 0$. As long as products are sufficiently strong substitutes, the substitution effect dominates the market area effect. This provides the retailer and the first supplier with an incentive to negotiate a per-unit price that undercuts marginal costs.[12] That is, a lower wholesale price for the first good increases the retailer's opportunity costs of buying from the second supplier. This strengthens the retailer's disagreement payoff in the negotiation with the second supplier. If instead goods are sufficiently differentiated, the market area effect dominates the substitution effect. The positive demand externalities resulting from shopping costs imply that an increasing wholesale price for good 1 does not only reduce the demand for good 1, it also lowers the demand for good 2. Correspondingly, upward distortion of the wholesale price reduces the incremental contribution of the second supplier in the case of highly differentiated products and enables the retailer to extract rents from the second supplier. The direction of distortion, therefore, depends on the degree of product differentiation. The more differentiated the products are the more likely the wholesale price is upward distorted (Figure 1).

Lemma 3 *There exists a threshold σ^k that is is implicitly given by $X_1(c, c, \sigma^k) \equiv X_1(c, \infty)$. For all $\sigma < \sigma^k$ ($\sigma \geq \sigma^k$) the wholesale price negotiated with the first supplier is upward (downward) distorted. The extent of distortion, i.e. $|\widehat{w}_1 - c|$, is increasing in the bargaining power of the second supplier, i.e. δ_2.*

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[11] This is true since $\partial X_i^*(w_i, c)/\partial w_i < 0$ always holds.

[12] Note that the result where the substitution effect dominates coincides with the findings of Marx and Shaffer (1999).

Proof. See Appendix. ∎

Wholesale price $\widehat{w}_1$ in $\sigma(0;1)$ for $c = 0.1$

The bargaining power of the second supplier, i.e. δ_2, has no impact on whether the wholesale price is upward or downward distorted. It only affects the extent of distortion (see (26)). The distortion of the wholesale price induces inefficiencies which have to be compensated by the benefit of shifting rent from the second supplier. The retailer distorts the wholesale price with the first supplier to get a larger share of a smaller pie. Though the distortion of the wholesale price increases her share of the overall profit, it reduces the overall profit at the same time. A strong bargaining position vis-à-vis the second supplier, therefore, reduces the retailer's incentives to distort the wholesale price, as she already captures a relatively large share of the overall profits. Accordingly, the retailer benefits from less distortion of the wholesale price in the first negotiation if her bargaining power in the second negotiation is relatively strong. That is, she is better off with a smaller share of a larger pie. This implies that the extent of distortion is decreasing in the retailer's bargaining power vis-à-vis the second supplier.

If the wholesale price undercuts marginal costs, i.e. $\sigma \geq \sigma^k$, the retailer has to compensate the first supplier by paying a fixed fee. Otherwise the first supplier's participation constraint would be violated. If instead, the wholesale price is upward distorted, i.e. $\sigma < \sigma^k$, it is rather the case that the first supplier has to compensate the retailer for the relatively high wholesale price by paying a

slotting fee. This is true as long as her bargaining power is sufficiently low. The more bargaining power she has, the lower the slotting fee. In other words, the first supplier gets a larger share of the shifted rent from the second supplier the higher her bargaining power vis-à-vis the retailer. Accordingly, the fixed fee F_1 is increasing in the first supplier's bargaining power, i.e. δ_1.[13] There exists a threshold δ_1^k, which is implicitly given by $\widehat{F}_1(\delta_1^k) \equiv 0$ resulting in

$$\delta_1^k = \frac{(\widehat{w}_1 - c)X_1(\widehat{w}_1, c)}{(\widehat{w}_1 - c)X_1(\widehat{w}_1, c) + (1 - \delta_2)\left(R(\widehat{w}_1, c) - R(\infty, c)\right) + \delta_2 R(\widehat{w}_1, \infty)}. \quad (28)$$

Hence, the first supplier pays a slotting fee to the retailer if her bargaining power is sufficiently low, i.e. $\delta_2 < \delta_2^k$. Furthermore, the retailer is more likely to charge slotting fees if the suppliers differ strongly in their bargaining power. That is, the higher the bargaining power of the second supplier, i.e. the higher δ_2, and the lower the bargaining power of the first supplier, i.e. the lower δ_1, the more slotting fees the first supplier has to pay. That is, a higher bargainig power of the second supplier makes it more profitable for the retailer to distort the wholesale price with the first supplier to extract rent from the second supplier. In turn, the first supplier is more likely to compensate the retailer for the increased wholesale price the lower her bargaining power.

Proposition 1 *The retailer charges slotting fees from the first supplier if products are sufficiently strong differentiated, i.e. $\sigma < \sigma^k$, and if the first supplier's bargaining power is relatively low, i.e. $\delta_1 < \delta_1^k$. Furthermore, comparative statics reveal that slotting fees are more likely to occur if the second supplier's bargaining power is increasing, i.e. $\partial \delta_1^k / \partial \delta_2 > 0$.*

Proof. See Appendix. ∎

Obviously, slotting fees do not arise if the retailer makes take-it-or-leave-it offers, i.e. $\delta_1 = \delta_2 = 0$. These results coincide with the observation that large and powerful retailers such as Wal-Mart or Costco never ask for slotting fees (FTC, 2001). This is due to the fact that powerful retailers rather maximize the overall industry profit as they already capture a large share from the overall profit. In turn, they have only a limited incentive to distort the wholesale price to extract rents,

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[13]Note that the derivative $dF_1^*/d\delta_1$ is strictly positive as we obtain $dF_1^*/d\delta_1 = (w_1^* - c)X_1(w_1^*, c) + (1 - \delta_2)\left[R(w_1^*, c) - R(\infty, c)\right] + \delta_2 R(w_1^*, \infty) > 0.$

4 Order of Negotiation

So far, we have taken the order of negotiations as exogenous. We relax this assumption in order to examine whether suppliers with relatively strong or relatively low bargaining power are more likely to be the first the retailer negotiates with. We introduce a zero stage, where the retailer decides with whom of her suppliers she negotiates first. Without loss of generality, we assume that the supplier U_1 has less bargaining power than supplier U_2, i.e. $\delta_1 < \delta_2$.

Our previous results indicate that the distortion of the wholesale price is increasing in the bargaining power of the second supplier. If the retailer negotiates first with the weaker supplier, i.e. U_1, the distortion becomes larger but also the benefits from rent-shifting are increasing. However, when negotiating first with the stronger supplier, i.e. U_2, the wholesale price is less distorted but also the gains from rent-shifting are lower. It turns out that the retailer is strictly better off when negotiating first with the weaker supplier in order to improve her bargaining position vis-à-vis the stronger supplier.[14]

Due to the retailer's preference to negotiate first with the weaker supplier, the supplier with the relatively higher level of bargaining never pays slotting fees. In turn, the supplier with the lower level of bargaining power is charged a slotting fee as long as her bargaining power is sufficiently low. Moreover, the higher the bargaining power of the second supplier the more likely the first supplier has to pay a slotting fee to the retailer, since $\partial \delta_1^k / \partial \delta_2 > 0$ (see Proposition 1).

Proposition 2 *For $\delta_1 < \delta_2$ it is always optimal for the retailer to negotiate first with supplier U_1. Hence, a supplier with little bargaining power vis-à-vis the retailer is more likely to pay slotting fees than a supplier with high bargaining power.*

Our findings confirm the concerns of small manufacturers which are commonly associated with a low level of bargaining power. They complain that they have to pay slotting fees to get their products distributed by the retailer, while their larger competitors do not. We even find that the likelihood of slotting fees to be

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[14]Similar results have been obtained by Marx and Shaffer (2007a). However, we extend their work by allowing for rent shifting contracts as introduced in Marx and Shaffer (1999). In Marx and Shaffer (1999) as well as in our model quantities are generally distorted such that they do not maximize the overall joint payoff of all three parties.

paid by the small suppliers is increasing in the asymmetry of suppliers. That is, the more bargaining power the second supplier has compared to the bargaining power of the first supplier, the more likely slotting fees are charged by the retailer.

5 Social Welfare

Our previous analysis has shown that slotting fees arise as a result of a rent-shifting mechanism in a sequential bargaining framework. However, slotting fees do not occur if the retailer negotiated simultaneously with her suppliers implying wholesale prices for both products equal to marginal costs ("marginal-cost pricing regime"). In order to assess the welfare implications of slotting fees, we therefore compare welfare in the case of upward distortion with the marginal-cost pricing regime.

Social welfare is given by the sum of consumer surplus and overall industry profit, i.e. $W = CS + \Pi$. Given the linearity of consumers' shopping costs, consumer surplus is given by

$$CS = \left[u(\cdot) - x_0(w_1, c) - \sum_{i=1}^{2} p_i(w_1, c)x_i(w_1, c) \right] \tilde{\theta}(w_1, c), \qquad (29)$$

while the industry profit corresponds to

$$\Pi = \left(\sum_{i=1}^{2} p_i(w_1, c)x_i(w_1, c) - \sum_{i=1}^{2} cx_i(w_1, c) \right) 2\tilde{\theta}(w_1, c). \qquad (30)$$

Using $\tilde{\theta}(w_1, c) = (u(\cdot) - x_0(w_1, c) - \sum_{i=1}^{2} p_i(w_1, c)x_i(w_1, c))/t$, differentiating (29) with respect to w_1 and applying the envelope theorem, we obtain

$$\frac{\partial CS}{\partial w_1} = -\frac{\partial p_1(w_1, c)}{\partial w_1} X_1(w_1, c) < 0 \qquad (31)$$

Hence, consumer surplus is strictly decreasing in w_1. A higher degree of upward distortion negatively affects consumer surplus. In turn, below-cost pricing occurring in the case of strong substitutes benefits consumers. The overall industry profit, however, is maximized for a wholesale price equal to marginal costs, since

$$\frac{\partial \Pi}{\partial w_1} = (w_1 - c)\frac{\partial X_1(w_1, c)}{\partial w_1} \lesseqgtr 0 \text{ for } w_1 \gtreqless c.$$

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While the overall industry profit is increasing in w_1 for all $w_1 \leq c$, it is decreasing for all $w_1 > c$. Hence, an upward distortion of the wholesale price negotiated with the first supplier reduces both consumer surplus as well as industry profit compared to the marginal-cost pricing regime. Accordingly, we can state:

Lemma 4 *Slotting fees induced by a rent-shifting mechanism and an upward distortion of the wholesale price negotiated with the first supplier imply a welfare loss.*

Note that the slotting fee itself only serves as mean to transfer rents from the first supplier to the retailer. Thus, it does not affect social welfare. The welfare loss rather refers to the upward distortion of the wholesale price negotiated with the first supplier which is the precondition for the emergence of slotting fees in vertical relations. The retailer's incentive to optimally distort the wholesale price in the first negotiation is limited if there is no possibility to get rents transferred from the first supplier as in the case of forbidden slotting fees.

If the retailer negotiates with her first supplier under a ban of slotting fees, i.e. under the constraint $F_1 \geq 0$, the bargaining outcome is characterized by

$$\widetilde{w}_1, \widetilde{F}_1 := \arg \max_{w_1, F_1} \left(\pi_{1,2}^{U_1*} \right)^{\delta_1} \left(\pi_{1,2}^{D*} - \pi_{0,2}^{D*} \right)^{1-\delta_1} \text{ s.t. } F_1 \geq 0. \tag{32}$$

As the constraint $F_1 \geq 0$ is binding for all $\delta_1 < \delta_1^k$, we get:

Proposition 3 *Under a ban of slotting fees the wholesale price in the first negotiation is less distorted, i.e. $\widetilde{w}_1 < \widehat{w}_1$ if $\delta_1 < \delta_1^k$ and $\widetilde{w}_1 = \widehat{w}_1$ otherwise. Note the the distortion of the wholesale price is increasing in the bargaining power of the first supplier, i.e. $d\widetilde{w}_1/d\delta_1 > 0$.*

Proof. See Appendix. ∎

If slotting fees are forbidden, there is no possibility to shift rents from the first supplier to the retailer in the case of an upward distorted wholesale price. Accordingly, the retailer and the first supplier have to share their joint profit by the linear wholesale price. This reduces the retailer's incentive to distort the wholesale price in the first negotiation. Thus, the upward distortion of the wholesale price is reduced the more bargaining power the retailer has vis-à-vis the first supplier. As a ban of slotting fees allows to reduce the inefficiencies from distorting wholesale prices, we can state that social welfare is increasing if slotting fees in vertical relations are forbidden.

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6 Conclusion

We have shown that slotting fees can be caused by a rent-shifting mechanism in a three-party negotiation framework. Precisely, we have analyzed a simple vertical structure with one retailer that negotiates sequentially with two upstream suppliers of imperfect substitutes about a non-linear delivery contract. Both goods are supposed to belong to consumers' shopping basket. Taking consumers' shopping costs explicitly into account, positive demand externalities arise between both goods offered at the retailer. If this complementarity effect dominates the original substitution effect, the wholesale price in the first negotiation is upward distorted. This reduces the demand for the first product. At the same time, it lowers the demand for the second good because of the complementarity induced by consumers' shopping costs. Thus, slotting fees are used to transfer rents from the first supplier to the retailer.

Our model allows us to explain why slotting fees may vary within categories. That is, the supplier the retailer negotiates first with might pay slotting fees, while the second supplier never does. We further show that the retailer has always an incentive to negotiate first with the weaker supplier in order to improve her bargaining position vis-à-vis the more powerful second supplier. Accordingly, our analysis reveals various hypotheses that are empirically testable. First, slotting allowances are more likely to be paid by suppliers with relatively little bargaining power vis-à-vis the retailer. Second, slotting allowances are more likely to occur in intermediate good markets, the more suppliers differ in their bargaining strength vis-à-vis the retailer. We also find that powerful retailers never charge slotting fees as they already capture a large share of the industry profit.

In our framework, slotting fees are not necessarily used to exploit those suppliers that pay them. It is rather the case that they are induced by a rent-shifting mechanism at the expenses of those suppliers that do not pay slotting fees, i.e. the more powerful suppliers in the intermediate good market. Even though slotting fees only transfer rents between vertically related agents, their occurrence comes along with a welfare loss. This is due to the fact that slotting fees are induced by an upward distorted wholesale price in the first negotiation. As wholesale prices are less distorted if slotting fees are forbidden, we can state that a ban of slotting fees improves social welfare.

Appendix

Proof of Lemma 1. Maximizing (21) with respect to w_2 and F_2, we obtain the following first order conditions

$$\frac{\partial NP_2}{\partial w_2} = \delta_2 \left(\pi_{1,2}^{D*} - \pi_{1,0}^{D*}\right) \frac{\partial \pi_{1,2}^{U_2*}}{\partial w_2} + (1 - \delta_2)\pi_{1,2}^{U_2*} \frac{\partial \left[\pi_{1,2}^{D*} - \pi_{1,0}^{D*}\right]}{\partial w_2} = 0 \quad (33)$$

$$\frac{\partial NP_2}{\partial F_2} = \delta_2 \left(\pi_{1,2}^{D*} - \pi_{1,0}^{D*}\right) - (1 - \delta_2)\pi_{1,2}^{U_2*} = 0. \quad (34)$$

Using (33) and (34), we easily obtain

$$\frac{\delta_2 \left(\pi_{1,2}^{D*} - \pi_{1,0}^{D*}\right)}{(1 - \delta_2)\pi_{1,2}^{S_2*}} = -\frac{\partial \left(\pi_{1,2}^{D*} - \pi_{1,0}^{D*}\right)/\partial w_2}{\partial \pi_{1,2}^{S_2*}/\partial w_2} = 1, \quad (35)$$

implying

$$-\partial \left(\pi_{1,2}^{D*} - \pi_{1,0}^{D*}\right)/\partial w_2 = \partial \pi_{1,2}^{U_2*}/\partial w_2. \quad (36)$$

Applying the envelope theorem, we get

$$(w_2 - c)\partial X_2(w_1, w_2)/\partial w_2 = 0. \quad (37)$$

The equality is fulfilled for

$$\widehat{w}_2 = c. \quad (38)$$

Combining (38) together with (34), we obtain

$$\widehat{F}_2(w_1) = \delta_2 \left(R(w_1, c) - R(w_1, \infty)\right). \quad (39)$$

Proof of Lemma 2: Maximizing (24) with respect to w_1 and F_1, we obtain the following first order conditions:

$$\frac{\partial NP_1}{\partial w_1} = \delta_1 \left(\pi_{1,2}^{D*} - \pi_{0,2}^{D*}\right) \frac{\partial \pi_{1,2}^{U_1*}}{\partial w_1} + (1 - \delta_1)\pi_{1,2}^{U_1*} \frac{\partial \left(\pi_{1,2}^{D*} - \pi_{0,2}^{D*}\right)}{\partial w_1} = 0, \quad (40)$$

$$\frac{\partial NP_1}{\partial F_1} = \delta_1 \left(\pi_{1,2}^{D*} - \pi_{0,2}^{D*}\right) - (1 - \delta_1)\pi_{1,2}^{U_1*} = 0 \quad (41)$$

$$\text{with} \quad : \quad \frac{\partial \pi_{1,2}^{U_1*}}{\partial w_1} = X_1(w_1, c) + (w_1 - c)\frac{\partial X_1(w_1, c)}{\partial w_1}$$

$$\text{and} \quad : \quad \frac{\partial \left(\pi_{1,2}^{D*} - \pi_{0,2}^{D*}\right)}{\partial w_1} = -X_1(w_1, c) + \delta_2 \left(X_1(w_1, c) - X_1(w_1, \infty)\right)$$

Using (40) and (41) and applying the envelope theorem, the equilibrium wholesale price w_1^* is given by

$$\widehat{w}_1 = c - \frac{\delta_2 \left(X_1(\widehat{w}_1, c) - X_1(\widehat{w}_1, \infty)\right)}{\partial X_1(\widehat{w}_1, c)/\partial w_1}. \quad (42)$$

Using (41), the fixed fee is given by

$$
\begin{aligned}
\widehat{F}_1 \;=\;& -\left(1-\delta_1\right)\left(\widehat{w}_1 - c\right)X_1(\widehat{w}_1, c) \\
& +\delta_1\left[\left(1-\delta_2\right)\left[R(\widehat{w}_1, c) - R(\infty, c)\right] + \delta_2 R(\widehat{w}_1, \infty)\right].
\end{aligned}
\tag{43}
$$

Proof of Lemma 3. In order to prove Lemma 3 we assume concavity of the objective function, i.e. the Nash Product formalized in (24).[15] Reformulating (26), we obtain

$$
\Phi(w_1) \;=\; (w_1 - c)\frac{\partial X_1(w_1, c)}{\partial w_1} + \delta_2\left(X_1(w_1, c) - X_1(w_1, \infty)\right)
\tag{44}
$$
$$
\text{with} \quad : \quad \Phi(\widehat{w}_1) = 0.
$$

Substituting $w_1 = c$, we get

$$
\Phi(c) = \delta_2\left(X_1(c, c) - X_1(c, \infty)\right) = \delta_2\left[\frac{27(1-c)^3}{64t}\left(\frac{1}{(1+\sigma)^2} - \frac{1}{2}\right)\right].
\tag{45}
$$

Solving (45), we obtain that $\Phi\left(c\right) > 0$ holds for all $\sigma < -1+\sqrt{2}$. For $\sigma \geq -1+\sqrt{2}$ we get $\Phi\left(c\right) \leq 0$. Using the concavity of the objective function, the equilibrium wholesale price satisfies $\widehat{w}_1 > c$ for $\sigma < -1 + \sqrt{2}$ and $\widehat{w}_1 \leq c$ otherwise.

Comparative statics reveal that $d\left|\widehat{w}_1 - c\right|/d\delta_2 > 0$. Applying the implicit function theorem to the first-order condition, (44) indicates $sign\left[d\left|\widehat{w}_1\right|/d\delta_2\right] = sign\left[\partial\Phi(\widehat{w}_1, \delta_2)/\partial\delta_2 = X_1(\widehat{w}_1, c) - X_1(\widehat{w}_1, \infty)\right]$ because of the assumed concavity of the objective function $\Phi(w_1)$. The analysis of $X_1(\widehat{w}_1, c) - X_1(\widehat{w}_1, \infty)$ shows that $\partial\Phi(w_1, \delta_2)/\partial\delta_2 < 0$ if $X_1(\widehat{w}_1, c) - X_1(\widehat{w}_1, \infty) < 0$ and $\widehat{w}_1 < c$ implying $d\left|\widehat{w}_1\right|/d\delta_2 > 0$; otherwise $\partial\Phi(w_1, \delta_2)/\partial\delta_2 > 0$ if $X_1(\widehat{w}_1, c) - X_1(\widehat{w}_1, \infty) > 0$ and $\widehat{w}_1 > c$ implying $d\widehat{w}_1/d\delta_2 > 0$.

Proof of Proposition 1. The retailer charges slotting allowances from upstream suppliers as long as $\sigma < \sigma^k$ and $\delta_1 < \delta_1^k$ (see 28). Applying comparative statics to δ_1^k with respect to δ_2, we get

$$
\frac{d\delta_1^k}{d\delta_2} = -\frac{d\widehat{F}_1/d\delta_2}{d\widehat{F}_1/d\delta_1}.
\tag{46}
$$

Inspection of (27) directly implies that $d\widehat{F}_1/d\delta_1 = (\widehat{w}_1 - c)X_1(\widehat{w}_1, c) + R(\widehat{w}_1, c) - \delta_2\left[R(\widehat{w}_1, c) - R(\widehat{w}_1, \infty)\right] - (1-\delta_2)R(\infty, c) > 0$. Hence the sign of $d\delta_1^k\left(\delta_2\right)/d\delta_2$ equals the sign of $-d\widehat{F}_1/d\delta_2$ with

$$
-d\widehat{F}_1/d\delta_2 = -\frac{\partial\widehat{F}_1}{\partial w_1}\frac{\partial\widehat{w}_1}{\partial\delta_2} - \frac{\partial\widehat{F}_1}{\partial\delta_2}.
\tag{47}
$$

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[15] The concavity has been checked by simulations.

Obviously it holds that $\partial \widehat{F}_1/\partial \delta_2 = -\delta_1 \left[R(\widehat{w}_1, c) - R(\widehat{w}_1, \infty) - R(\infty, c)\right] < 0$ for all $\sigma > \sigma^k$. From $\Phi\left(\widehat{w}_1\left(\delta_2\right), \delta_2\right) = 0$, we know that the sign of $\partial \widehat{w}_1\left(\delta_2\right)/\partial \delta_2$ equals the sign of $\partial \Phi/\partial \delta_2 = X_1(\widehat{w}_1, c) - X_1(\widehat{w}_1, \infty)$ which is positive for $\sigma < \sigma^k$. Accordingly, we get that $d\delta_1^k/d\delta_2 > 0$ if $-\partial \widehat{F}_1/\partial w_1 > 0$. We rewrite $\widehat{F}_1\left(\delta_1, \widehat{w}_1\right)$ as the sum of two terms, $-(\widehat{w}_1 - c)X_1(\widehat{w}_1, c)$ and $\delta_1\left[(\widehat{w}_1 - c)X_1(\widehat{w}_1, c) + R(\widehat{w}_1, c) - \delta_2\left[R(\widehat{w}_1, c) - R(\widehat{w}_1, \infty)\right]\right] - (1 - \delta_2)R(\infty, c)$. The second term corresponds to δ_1 of the joint profit between the first supplier and the retailer. The derivative of this term with respect to w_1 is zero, i.e. $\Phi\left(\widehat{w}_1\right) = 0$. This enables us to write $-\partial \widehat{F}_1/\partial w_1 = \partial\left[(w_1 - c)X_1(w_1, c)\right]/\partial w_1\big|_{w_1 = \widehat{w}_1}$. Using $\Phi\left(\widehat{w}_1\right) = 0$, this term is positive implying that $d\delta_1^k/d\delta_2 > 0$.

Using (25), we can write

$$\left[\frac{\partial(w_1 - c)X_1(w_1, c)}{\partial w_1} + (1 - \delta_2)\frac{\partial R(w_1, c)}{\partial w_1} + \delta_2 \frac{\partial R(w_1, \infty)}{\partial w_1}\right]\Bigg|_{w_1 = \widehat{w}_1} = 0. \quad (48)$$

Since $\partial\left[R(w_1, c)\right]/\partial w_1 < 0$ and $\partial\left[R(w_1, \infty)\right]/\partial w_1$, it follows that $\partial\left[(w_1 - c)X_1(w_1, c)\right]/\partial w_1\big|_{w_1 = \widehat{w}_1} > 0$.

Proof of Proposition 2. Denoting the supplier the retailer negotiates first with by index i and the second supplier by index j, the downstream firm's profit is given by

$$\begin{aligned}
\pi_{i,j}^D\left(w_i\right) &= \delta_i\left(1 - \delta_j\right)R(\infty, c) + (1 - \delta_i)\left[(w_i - c)X_i(w_i, c) + R(w_i, c)\right] \\
&\quad - (1 - \delta_i)\delta_j\left[R(w_i, c) - R(w_i, \infty)\right] \quad (49) \\
\text{with } i &= 1, 2, \ i \neq j.
\end{aligned}$$

We denote the wholesale prices negotiated at the first stage by w_1^* if the retailer negotiates first the supplier U_1 (regime $1, 2$). Analogously, w_2^* refers to the wholesale price negotiated in the first stage, if the retailer negotiates first the supplier U_2 (regime $2, 1$). Since the distortion of the wholesale price in the first stage is increasing in the bargaining power of the second supplier, we have $0 < |w_2^*| < |w_1^*|$ (see Lemma 3). Moreover, we have $\pi_{1,2}^D\left(w_1^*\right) > \pi_{1,2}^D\left(w_2^*\right)$ since w_1^* maximizes the joint profit of the first supplier and the retailer. To prove $\pi_{1,2}^D\left(w_1^*\right) > \pi_{2,1}^D\left(w_2^*\right)$, we have to show that $\pi_{1,2}^D\left(w_2^*\right) > \pi_{2,1}^D\left(w_2^*\right)$. Analyzing $\Delta\pi^D(w_2^*) = \pi_{1,2}^D\left(w_2^*\right) - \pi_{2,1}^D\left(w_2^*\right)$, we get

$$\Delta\pi^D(w_2^*) = (\delta_2 - \delta_1)\left[(w_2^* - c)X_i(w_2^*, c) + R(w_2^*, \infty) - R(\infty, c)\right]. \quad (50)$$

Since $(\delta_2 - \delta_1) > 0$, we have to show that $(w_2^* - c)X_i(w_2^*, c) + R(w_2^*, \infty) - R(\infty, c) > 0$. Denoting $\overline{w}_1$ the wholesale price negotiated in the first stage for $\delta_2 = 1$, we get

$$\left\{ \frac{\partial \left[(w_1 - c) X_1 (w_1, c) + R (w_1, c) \right]}{\partial w_1} - \frac{\partial \left[R (w_1, c) - R (w_1, \infty) \right]}{\partial w_1} \right\} \Bigg|_{w_1 = \overline{w}_1} = 0. \tag{51}$$

We rewrite (51) by $\partial A (w_1) / \partial w_1 - \partial B (w_1) / \partial w_1 = 0$, where $A (w_1)$ denotes the industry surplus and $B (w_1)$ the incremental contribution of the second supplier. Since $\partial A (w_1) / \partial w_1 < 0$ and $\partial B (w_1) / \partial w_1 < 0$ and by using $A (w_1) / \partial w_1 - \partial B (w_1) / \partial w_1 < 0$ due to the concavity of objective function, we get

$$A (c) - A (w_1) < B (c) - B (w_1) \; \forall \; w_1 < \overline{w}_1. \tag{52}$$

Since $|w_2^*| < |\overline{w}_1|$, we obtain $A (c) - A (w_2^*) < B (c) - B (w_2^*)$ for $w_1 = w_2^*$. Rewriting this previous inequality, we get

$$(w_2^* - c)X_i(w_2^*, c) + R(w_2^*, \infty) - R(\infty, c) > 0, \tag{53}$$

where the term at the LHS refers to $\Delta \pi^D (w_2^*)$. Hence, we have $\pi_{1,2}^D (w_2^*) - \pi_{2,1}^D (w_2^*) > 0$.

Proof of Proposition 3. The first order condition of the bargaining problem stated in (32) with respect to w_1 is given by

$$\Phi (w_1) = (1 - \delta_1) (w_1 - c) X_1 (w_1, c) \left[(1 - \delta_2) \frac{\partial R(w_1, c)}{\partial w_1} + \delta_2 \frac{\partial R(w_1, \infty)}{\partial w_1} \right] \tag{54}$$

$$+ \delta_1 \frac{\partial \left[(w_1 - c) X_1 (w_1, c) \right]}{\partial w_1} \left[(1 - \delta_2) (R(w_1, c) - R(\infty, c)) + \delta_2 R(w_1, \infty) \right].$$

Recall that $\widehat{w}_1$ satisfies

$$\frac{\partial \left[(w_1 - c) X_1 (w_1, c) \right]}{\partial w_1} + (1 - \delta_2) \frac{\partial R(w_1, c)}{\partial w_1} + \delta_2 \frac{\partial R(w_1, \infty)}{\partial w_1} \Bigg|_{w_1 = \widehat{w}_1} = 0. \tag{55}$$

Using (55), we can write

$$\Phi (\widehat{w}_1) = \frac{\partial (w_1 - c) X_1 (w_1, c)}{\partial w_1} \tag{56}$$

$$\times \left[\begin{array}{c} - (1 - \delta_1) (w_1 - c) X_1 (w_1, c) + \\ \underbrace{\delta_1 \left[(1 - \delta_2) (R(w_1, c) - R(\infty, c)) + \delta_2 R(w_1, \infty) \right]}_{T1} \end{array} \right] \Bigg|_{w_1 = \widehat{w}_1}.$$

Since $\partial (w_1 - c) X_1 (w_1, c) / \partial w_1 > 0$ and $T1$ referring to $\widehat{F}_1$ is negative for any

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$\delta_1 < \delta_1^k$, it follows that $\Phi(\widehat{w}_1) < 0$. Because of the the concavity of the objective function, we get $\widetilde{w}_1 < \widehat{w}_1$.

In order to analyze the comparative statics, i.e. $d\widetilde{w}_1/d\delta_1 > 0$, we apply the implicit function theorem, i.e.

$$\frac{\partial \Phi}{\partial \delta_1} = -[(w_1 - c) X_1 (w_1, c)] \left[(1 - \delta_2) \frac{\partial R(w_1, c)}{\partial w_1} + \delta_2 \frac{\partial R(w_1, \infty)}{\partial w_1} \right] \qquad (57)$$
$$+ \frac{\partial [(w_1 - c) X_1 (w_1, c)]}{\partial w_1} [(1 - \delta_2)(R(w_1, c) - R(\infty, c)) + \delta_2 R(w_1, \infty)]$$

Looking at the first-order condition, we can rewrite $\Phi(\widetilde{w}_1)$ as

$$\Phi(\widetilde{w}_1) = \left. \frac{\delta_1 [\partial \Phi(.)/\partial \delta_1] + [(w_1 - c) X_1 (w_1, c)]}{\left[(1 - \delta_2) \frac{\partial R(w_1, c)}{\partial w_1} + \delta_2 \frac{\partial R(w_1, \infty)}{\partial w_1} \right]} \right|_{w_1 = \widetilde{w}_1} = 0. \qquad (58)$$

Since $\partial R(w_1, c)/\partial w_1 < 0$ and $\partial R(w_1, \infty)/\partial w_1 < 0$, we get from $\Phi(\widetilde{w}_1) = 0$ that $\partial \Phi(.)/\partial \delta_1 > 0$ implying $d\widetilde{w}_1/d\delta_1 > 0$.

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