WORKING PAPERS IN ECONOMICS

No. 7/13

TOMMY STAAHL GABRIELSEN AND
BJØRN OLAV JOHANSEN

THE OPPORTUNISM PROBLEM REVISITED: THE CASE OF RETAILER SALES EFFORT

Department of Economics
UNIVERSITY OF BERGEN

The opportunism problem revisited: the case of retailer sales effort.

Tommy Staahl Gabrielsen and Bjørn Olav Johansen*

Department of Economics, University of Bergen, Norway

September 19, 2013

Abstract

We study a setting where the opportunism or commitment problem identified by Hart and Tirole (1990) may arise. An upstream monopolist may sell its product to two differentiated downstream retailers. Contract unobservability induces the manufacturer and each retailer to free-ride on margins earned by rival retailers, resulting in low transfer prices and low overall profit. O'Brien and Shaffer (1992) proposed a solution to this problem involving squeezing retail margins by using maximum RPM and high transfer prices. We show that when retail demand depends in any degree of retail sales effort, this equilibrium breaks down, and the opportunism problem reappears with full force. We show that no type of own-sale contracts or combination of own-sale restraints will solve the problem if sales effort matter. Moreover we show that certain horizontal commitments, as for example industry-wide minimum RPM, may restore the fully integrated outcome, but only in special cases.

*Department of Economics, University of Bergen, Fosswinckels Gate 14, N-5007 Bergen, Norway (tommy.gabrielsen@econ.uib.no, bjorn.johansen@econ.uib.no). We would like to thank Steinar Vagstad and Mario Monti for comments on an earlier draft of this article. We would also like to thank Gordon Klein and the rest of the participants at the kick-off workshop "Competition and Bargaining in Vertical Chains" at DICE in Düsseldorf for their comments.

1 Introduction

The opportunism problem arising when a manufacturer contracts secretly with downstream retailers has been recognized in the literature for a long time. An upstream manufacturer with market power has an interest of restricting supply to its retailers to preserve its market power which in turn can be shared with the retailers. However, due to secret contracts when contracting with each retailer, the manufacturer has an incentive to free-ride on the margins earned by his other retailers. This incentive, known as the "opportunism problem" has been shown by Hart and Tirole (1990) with downstream Cournot competition, O'Brien and Shaffer (1992) with Bertrand competition and also by McAfee and Schwartz (1994). In general, the problem prevents the manufacturer from realizing its market power upstream. Even though the manufacturer might be in a monopoly position, its inability to commit itself opens for opportunistic behavior which prevents the monopolist from achieving the monopoly outcome. The flavour of the problem is similar to the Coasian conjecture facing a monopolist of a durable good; the monopolist can not avoid reducing his price.

Recently, in an EU merger case concerning Unilever and a smaller upstream competitor, the DG-Comp presented evidence where retailers expressed explicit concerns for the opportunism problem. As usual in merger cases in upstream markets, the fear was that the merger would allow the merged entity to increase its prices to retailers. The EU-commission found evidence indicating that retailers across the concerned EU member states "would accept (input)price increases if applied generally in the market" and Unilever presented evidence where "retailers expressed doubts on how they can be sure that Unilever indeed would uniformly increase prices across all customers", indicating the awareness of the opportunism problem among retailers.[1]

The essence of the problem can be illustrated with downstream price competition. In this case, when negotiating with each retailer, the manufacturer and each retailer are maximizing their bilateral profits, and thus ignores quasi-rents earned by the other retailers. This induces each retailer and the manufacturer to free-ride on these rents, and in equilibrium they end up setting transfer prices at marginal cost. There has been several proposals in the literature suggesting how the manufacturer may circumvent the problem. Hart and Tirole (1990) argue that vertical integration may be a way to remonopolize the market. If an upstream monopolistic firm can vertically integrate with one of several homogeneous retailers, he will have no incentive to supply the unintegrated retailers and the manufacturer can restore the monopoly outcome. Also, as noted by Hart and Tirole

[1]See case M.5658 UNILEVER / SARA LEE BODY CARE (2010), #216 and 219.

(1990) and Rey and Tirole (2006) signing an exclusive dealing contract with one retailer may also solve the problem. However, if retailers serve partially overlapping markets there will be a loss of potential profit from selling though a single retailer in the downstream market. In these cases vertical integration and exclusive contracts will generally not be enough to fully solve the problem.

O'Brien and Shaffer (1992) proposed a different solution. They showed that by squeezing the downstream margins, through individual price ceilings (maximum RPM) coupled with high wholesale prices, the manufacturer may solve the problem. Intuitively, the problem arises due to positive quasi-rents earned by retailers, and by eliminating these rents, no free-riding can occur. The result that maximum RPM can eliminate opportunism has later been confirmed also by Rey and Verge (2004) and Montez (2012), but in different settings. Montez (2012) shows that a monopolist producer may eliminate opportunism by using buybacks and (sometimes) a price ceiling. In a similar setting as O'Brien and Shaffer (1992), Rey and Verge (2004) show that equilibria with wary beliefs (as opposed to passive beliefs as in O'Brien and Shaffer, 1992) exist and reflect opportunism, and that a maximum RPM with a price squeeze will eliminate the scope for opportunism also in this case. In sum, these papers suggest that a maximum price may be detrimental to consumers because it eliminates the scope for opportunism. Since in most jurisdictions maximum RPM is considered unproblematic, these results challenges antitrust policy that tends to focus solely on minimum and fixed RPM. Our contribution in relation to this literature is to introduce retailer sales effort into the model.

Our paper is therefore also related to the literature that show that RPM may encourage retailers to offer sales service which otherwise might not be offered due to the free-riding problem between retailers (Telser, 1960 and Mathewson and Winter, 1984). This literature assumes that retail contracts are observable before retailers compete at the final stage. The focus in this literature is how vertical restraints (RPM) may solve vertical externalities and improve the efficiency in the vertical structure. Mathewson and Winter (1984) show that the manufacturer in such a case will adopt a minimum RPM in order to prevent free-riding and encourage retailer sales effort when there are positive effort spillovers between the retailers.

In sum, these two branches of the literature tell us that with unobservable contracts and no sales effort, maximum RPM may be detrimental because it increases prices to consumers by solving the opportunism problem. On the other hand, when contracts are observable and sales effort is of any importance for demand, RPM may be efficiency enhancing for the vertical structure as it may be used to control retail sales effort and prevent free-riding. We believe that unobservable contracts in most cases is the most realistic assumption. Also we find it hard to come up with an example where retailer sales effort is of no importance for retail demand. We therefore propose a model incorporating both these features, i.e. unobservable contracts and that retail demand depends on retail sales effort. Such a model has to our knowledge not been studied before, and the analysis produces interesting results.

We first show that when the manufacturer is only allowed to use two-part tariffs, we obtain the standard outcome: the manufacturer's opportunism problem prevents extraction of the full monopoly rent, and, moreover, that the unique contract equilibrium in this case yields the standard Bertrand prices and effort levels. Second, we show that the use of general non-linear contracts and RPM, as suggested by O'Brien and Shaffer (1992), is not sufficient to restore the monopoly profits. In fact, we show that (purely bilateral) RPM contracts, irrespective of type, has *no* effect, and we therefore obtain standard Bertrand prices and effort level in all equilibria. Importantly, this result holds irrespective of the importance of retailers' effort, and irrespective of the type of spillovers in effort. Hence, short of any 'horizontal' agreement that restrict the manufacturer's contracts with rival retailers, there exists no vertical own-sale contracts or (combination of) own-sale restraints that can solve the opportunism problem.

On the other hand, when exploring horizontal contracts, such as a commitment to industry-wide vertical price fixing, we show that such contracts can *mitigate* the manufacturer's opportunism problem. Yet, we show that the fully integrated outcome is restored only in special cases where a industry-wide price restraint is used. Importantly, the price restraint will here have to be introduced as a minimum price, not as a maximum price. Moreover, we explore the welfare effects of allowing for industry-wide minimum RPM. We show that, even if consumers value sales effort, and even if there is freeriding among retailers, the consumers benefit from a industry-wide price floor only in special cases.

The rest of the papers is organized as follows. The next section presents our model, our basic assumptions and our benchmark. Section 3 contains the analysis and presents our main results assuming own-sale contracts, and in Section 4 we derive our results with horizontal contracts. Section 5 briefly discusses vertical integration as a mean to solve the problem. Our conclusions are contained in Section 6.

2 The model

We follow O'Brien and Shaffer (1992) (OS from now on) and consider the classic setup for the opportunism problem with downstream price competition. We have a vertically related industry with an upstream monopolist, M, who produces an intermediate good which he sells to two downstream differentiated retailers, R_1 and R_2, using unobservable non-linear contracts. The two retailers transform the manufacturer's good on a one-to-one basis into two symmetrically differentiated final goods, and sell them to consumers.

In contrast to OS, but as in Mathewson and Winter (1984) we introduce retailer sales effort that enhance demand. We denote retailer R_i's demand by $D_i(\mathbf{e}, \mathbf{p})$, where $\mathbf{e} = (e_1, e_2)$ denotes the vector of the retailers' sales effort, and $\mathbf{p} = (p_1, p_2)$ denotes the vector of retail prices. For all $D_i(.) > 0$, demand is assumed to be downward sloping in the own-price p_i and increasing in own-effort e_i, with $\partial_{e_i} D_i > 0$ and $\partial_{e_i e_i} D_i \leq 0$.[2] For some of our results, we will invoke the following set of assumptions about the retailers' demand (assuming both D_i and D_j are positive):

A1. *All else equal, a uniform increase in p_1 and p_2 causes D_i to fall, which implies that $\partial_{p_i} D_i + \partial_{p_j} D_i < 0$*
A2. *All else equal, a uniform increase in e_1 and e_2 causes D_i to rise, which implies that $\partial_{e_i} D_i + \partial_{e_j} D_i > 0$*
A3. *All else equal, a marginal increase in p_i causes total demand to fall, $\partial_{p_i} D_i + \partial_{p_i} D_j < 0$*
A4. *All else equal, a marginal increase in e_i causes total demand to rise, $\partial_{e_i} D_i + \partial_{e_i} D_j > 0$*

For any p_j, we also assume that there is a choke-price, $p_i = \overline{p}(p_j)$, implicitly defined by $D_i(p_i, p_j) = 0$, above which demand for good i is zero. Because the retailers are substitutes, we have that $\overline{p}'(p_j) > 0$.

We make no specific assumption about the effect of R_i's effort on the rival's demand, $\partial_{e_i} D_j$. Hence, we allow for both positive, negative and no spillovers in retail effort. We denote the retailer's effort cost by $C_i = C(e_i)$, which is assumed to be twice continuously differentiable, with $C_i'(e_i) > 0$ and $C_i''(e_i) > 0$ $\forall e_i > 0$, and it is assumed to satisfy the Inada conditions at 0 and ∞. We will denote R_i's per-unit effort cost by $\mu_i = \mu(e_i) := C_i/D_i$. All other retailing costs are assumed to be zero. We assume throughout the analysis that a retailer's sales effort is non-verifiable and hence also non-contractable.

We consider the following simple two-stage game played between the manufacturer and the two retailers: At stage 1 (the contracting stage), the manufacturer makes take-it-

[2] We will sometimes denote by $\partial_{x_i} f$ the parital derivative of f with respect to x_i, $\partial_{x_i x_i} f$ the second partial derivative, $\partial_{x_i x_j} f = \partial^2 f / \partial x_i \partial x_j$ the cross-partial derivative, and so on.

or-leave-it contract offers T_1 and T_2 simultaneously and secretly to each retailer, which the retailers subsequently either accept or reject. A retailer never observes his rival's contract terms. At stage two (the competition stage), accepted contracts are implemented and retailers compete by simultaneously choosing their prices and effort levels.

A contract $T_i(.)$ can take various (non-linear) forms. We will consider three classes of contracts used by M at the contracting stage:

1. Simple two-part tariffs, of the form $T_i(D_i) = F_i + w_i D_i$, where F_i is a fixed fee and w_i is a per-unit transfer price. We will denote these contracts by (F_i, w_i).

2. 'General own-sale contracts'. A (non-linear) contract T_i between M and R_i is called an own-sale contract if it *does not* put restrictions on M's trade relationship (contract) with retailer R_j.
   Own-sale contracts can in general include any restriction or requirement for the quantity resold by R_i, and any restriction or requirement for the price that R_i is allowed to charge in the downstream market. I.e., own-sale contracts can put restrictions on the buyer's actions in the downstream market but do not put restrictions on the seller's actions vis-a-vis other retailers in the upstream market.
   Examples of restrictions that can be included in own-sale contracts are individual price floors or ceilings, restrictions on the customers/ geographic area that the retailer is allowed to sell to; restrictions or requirements for the quantity bought or resold (quantity or sales forcing), retroactive discounts, market-share discounts, etc.

3. 'Horizontal contracts'. A (non-linear) contract between M and R_i is called a horizontal contract if it puts restrictions on M's trade relationship (contract) with the rival retailer R_j.
   Examples of this are industry-wide vertical price fixing; any commitments from M to sell exclusively to R_i; agreements that give R_i exclusive rights to a specific set of consumers or over a specific geographic area, non-discrimination clauses, etc. All of these provisions put restrictions on the contract that M can legally offer to R_j.

We let M's profit be given $\pi_M = \sum_{i=1}^{2}(T_i - cD_i)$, and let R_i's profit be given by $\pi_i = (p_i - \mu_i) D_i - T_i$.

To stick as close as possible to OS' original analysis, we will employ the "contract equilibrium" concept formalized by Cremér and Riordan (1987).

Definition 1. *Let* $\mathbf{A}$ *be the set of allowable contracts and* $\mathbf{s} = (s_i)$ be the vector of retailers strategies in the downstream market, where $s_i = (p_i, e_i)$, $i \in \{1, 2\}$. *A contract* *equilibrium with unobservable contracts is then a vector of supply contracts* $\mathbf{T}^* \in \mathbf{A}$*, and Nash equilibrium in prices and effort levels* $\mathbf{s}^*$ *induced by these contracts, such that* $\forall i$ *and* $\forall T_i \in \mathbf{A}$*,* T_i^* *is the contract that maximizes the bilateral joint profit of* M *and* R_i*, taking* $\left(T_j^*, s_j^*\right)$ *as given. Formally,* $\mathbf{T}^* \in \mathbf{A}$ *constitutes a contract equilibrium iff*

$$\pi_M\left(\mathbf{T}^*, \mathbf{s}^*\right) + \pi_i\left(\mathbf{T}^*, \mathbf{s}^*\right) \geq \pi_M\left(T_i', s_i', T_j^*, s_j^*\right) + \pi_i\left(T_i', s_i', T_j^*, s_j^*\right),$$

$\forall i$ and $\forall T_i' \in \mathbf{A}$, and where, the contract T_i' induces the strategy s_i' by R_i at the final stage, given $\left(T_j^*, s_j^*\right)$.

This equilibrium concept is very simple and tractable. It says that in a contract equilibrium, there is no room for a retailer-manufacturer pair $M - R_i$ to revise their contract and increase their bilateral joint profit, holding fixed M's contract with R_j, and holding fixed R_j's choice of effort and price. A contract equilibrium's defining characteristic is therefore that it survives bilateral deviations, i.e. where a pair $M - R_i$ decides to secretly renegotiate their contract terms.[3] Note that, with restrictions on the set of allowable contracts, there may exist a contract outside the set, $T_i' \notin \mathbf{A}$, that, if T_i' could be enforced by a court, would allow $M - R_i$ to increase their bilateral joint profits.

2.1 Two benchmarks

Under our assumptions on the demand, when marginal transfer prices are constant and equal to M's marginal cost c, the final-stage Bertrand game has a unique equilibrium where both retailers exert the same effort and set the same prices, characterized by

$$\{p^B, e^B\} = \arg\max_{p_i, e_i} \left(p_i - c - \mu_i\right) D_i\left(e_i, e^B, p_i, p^B\right) \tag{1}$$

In the following we will refer to p^B as the 'standard Bertrand price'. We denote respectively by $D^B := D_i\left(e^B, e^B, p^B, p^B\right)$ and $\pi^B = \left(p^B - c - \mu\left(e^B\right)\right) D^B$ the quantity sold and the profit earned (gross of any fixed transfers) by each retailer in this standard Bertrand equilibrium.

[3] As noted by Rey and Vergé (2004), however, a weakness with contract equilibria is that they do not always survive multilateral deviations, where the manufacturer revises his offers and deviates (secretly) with both retailers simultaneously. Hence, a contract equilibrium does not always constitute a perfect Bayesian equilibrium (with passive beliefs). To avoid the latter, one could imagine a contracting game where the manufacturer uses a pair of agents that simulatenously and independently negotiates contracts with the retailers on the manufacturer's behalf. This would rule out multilateral deviations per construction.

Next, we characterize the outcome when the industry is fully integrated (both vertically and horizontally). The overall industry profit can be written

$$\Pi = \sum_{i=1}^{N=2} (p_i - c - \mu_i) D_i \tag{2}$$

The integrated monopolist's first-order conditions for the retail price and sales effort, can be written as

$$\partial_{p_i}\Pi = \sum_{k=1}^{N=2} (p_k - c) \partial_{p_i} D_k + D_i = 0, \ i = 1, 2 \tag{3}$$

and

$$\partial_{e_i}\Pi = \sum_{k=1}^{N=2} (p_k - c) \partial_{e_i} D_k - C_i' = 0, \ i = 1, 2 \tag{4}$$

We let $p_1 = p_2 = p^I$ and $e_1 = e_2 = e^I$ denote the prices and effort levels respectively that simultaneously solves the monopolist's first order conditions, and denote by $\Pi^I > 2\pi^B$ the resulting integrated profit.

3 Analysis and main results

In this section we analyze the equilibrium outcome under different assumptions regarding the set of allowable contracts. We start by exploring the simplest case where the manufacturer is confined to using simple two-part tariffs. Then we proceed by investigating the equilibrium outcome under the OS contract assumptions, i.e. allowing general non-linear contracts and RPM. We then expand the set of allowable contracts by investigating any type of 'own-sale' contracts (as defined above). We show that there is no contract of this type that is able to mitigate the opportunism problem.

3.1 Two-part tariffs

Suppose M has offered a contract $\left(w_j^*, F_j^*\right)$ to R_j, and that this contract induces price and effort $\left(p_j^*, e_j^*\right)$ by R_j at the final stage. Given this, we can write the retailers' profit as

$$\pi_i = (p_i - w_i - \mu_i) D_i \left(e_i, e_j^*, p_i, p_j^*\right) - F_i, \ i = 1, 2 \tag{5}$$

which yields the first-order conditions

$$(p_i - w_i) \partial_{p_i} D_i + D_i = 0, \ i = 1, 2 \tag{6}$$

and

$$(p_i - w_i)\, \partial_{e_i} D_i - C_i' = 0,\ \ i = 1, 2 \tag{7}$$

We let $p_i^*(w_i)$ and $e_i^*(w_i)$, $i = 1, 2$, be the price and effort levels that simultaneously solve the retailers' first-order conditions, where $\partial_{w_i} p_i^* > 0$ and $\partial_{w_i} e_i^* < 0$, and $p_i^*\left(w_j^*\right) = p_j^*$ and $e_i^*\left(w_j^*\right) = e_j^*$ (due to symmetry). We can then write the joint profit of $M - R_i$, which we denote by V_{M-R_i}, as a function of R_i's contract terms, as

$$V_{M-R_i} = \left\{ \sum_{k=1}^{N=2} \left(p_k^* - c - \mu\left(e_k^*\right)\right) D_k^* \right\} - \left(p_j^* - w_j^* - \mu_j\left(e_j^*\right)\right) D_j^* + F_j^*,\ i \neq j \in 1, 2 \tag{8}$$

The first-order condition for maximizing (8) wrt. w_i, is

$$\begin{aligned} \partial_{w_i} V_{M-R_i} =& \partial_{w_i} p_i^* \left[D_i + \left(p_i^* - c\right) \partial_{p_i} D_i\right] + \partial_{w_i} e_i^* \left[\left(p_i^* - c\right) \partial_{e_i} D_i - C_i'\right] \\ &+ \left(w_j^* - c\right) \left(\partial_{w_i} p_i^* \partial_{p_i} D_j + \partial_{w_i} e_i^* \partial_{e_i} D_j\right) = 0,\ \ i \neq j \in 1, 2 \end{aligned} \tag{9}$$

Substituting (6) and (7) into (9), and simplifying, gives the following necessary conditions for $(\mathbf{F}^*, \mathbf{w}^*, \mathbf{p}^*, \mathbf{e}^*)$ to form a contract equilibrium:

$$\sum_{k=1}^{N=2} \left(w_k^* - c\right) \left\{ \partial_{w_i} p_i^* \partial_{p_i} D_k + \partial_{w_i} e_i^* \partial_{e_i} D_k \right\} = 0,\ i = 1, 2 \tag{10}$$

We can rewrite (10) using matrix notation as $(\mathbf{w}^* - \mathbf{c})\, \mathbf{D_d} = \mathbf{0}$, where $\mathbf{w}^* = (w_1^*, w_2^*)$, $\mathbf{c} = (c, c)$ and

$$\mathbf{D_d} = \begin{bmatrix} \partial_{w_1} p_1^* \partial_{p_1} D_1 + \partial_{w_1} e_1^* \partial_{e_1} D_1 & \partial_{w_1} p_1^* \partial_{p_1} D_2 + \partial_{w_1} e_1^* \partial_{e_1} D_2 \\ \partial_{w_2} p_2^* \partial_{p_2} D_1 + \partial_{w_2} e_2^* \partial_{e_2} D_1 & \partial_{w_2} p_2^* \partial_{p_2} D_2 + \partial_{w_2} e_2^* \partial_{e_2} D_2 \end{bmatrix} \tag{11}$$

Note that, if consumer demand is unaffected by retailers' effort, as is the setting in OS' original model, then $\mathbf{D_d}$ reduces to a 2-by-2 matrix of demand derivatives with respect to prices only. By assumptions A1-A4, $\mathbf{D_d}$ is always invertible. This gives us the following result.

Proposition 1. *(Two-part tariffs) A contract equilibrium always exists where the marginal wholesale prices* (w_1^*, w_2^*) *are the same and equal to* M*'s marginal production cost* c*. By assumptions A1-A2, contract equilibria with* $w_1 = w_2 > c$ *or* $w_1 = w_2 < c$*, do not exist. By assumptions A1-A4, the contract equilibrium with* $w_1^* = w_2^* = c$ *is unique.*

Proposition 1 confirms the opportunism problem that arises with unobservable contracting, but here generalized to a setting where the retailers also exert some sales effort downstream.

3.2 General own-sale contracts and RPM

We now turn to the situation where M is allowed to use RPM together with more general non-linear contracts. In fact, we allow the manufacturer to impose any restrictions on the retailer's own-sales. Before we move on, we state the following Lemma, which we have adopted from OS' original paper and generalized to a setting that allows for retailers' sales effort

Lemma 1. *If* $(\mathbf{T}^*, \mathbf{s}^*)$ *forms a contract equilibrium with general own-sale contracts (and RPM), then* $\forall j$, T_j^* *is continuous and differentiable at the quantity* D_j^* *induced by* $(\mathbf{T}^*, \mathbf{p}^*)$. *If the contracts entail a commitment to industry-wide price fixing, then the same result holds, as long as there are spillovers in retailers' sales effort.*

Proof. See the Appendix.

Lemma 1 greatly simplifies the rest of the analysis, and the intuition for the result is straightforward: First, notice that if $T_j^*(D_j)$ was not continuous at $D_j = D_j^*$, then either a marginal reduction or a marginal increase in D_j would cause the payment from R_j to M to either jump up or down. This means that either $M - R_i$ could increase their bilateral joint profit by inducing a marginal change in p_i (or, with spillovers in effort, by inducing a marginal change in e_i) that would cause T_j^* to jump up, or R_j could increase his profit through marginal changes in either p_j or e_j that would cause T_j^* to jump down. For this reason, T_j^* has to be continuous at the equilibrium quantity D_j^*. From this it just remains to show that $T_j^*(D_j)$ also is differentiable at $D_j = D_j^*$, which is shown in the Appendix.

Next, notice that Lemma 1 has implications for what types of vertical restraints M can impose on its retailers in equilibrium. For example, any "sales-forcing" contracts, or contracts that seek to force the retailer to reach a certain market share threshold, would be ineffectual. The reason is simply that these tariffs (per definition) would have to jump when deviating slightly from the "forcing" quantity or market-share. Retroactive discounts would be ineffectual for exactly the same reason.

When proceeding the analysis, we first show that it is impossible for the manufacturer to induce the integrated profit Π^I when using general own-sale contracts and RPM. To see this, notice that in any contract equilibrium $(\mathbf{T}^*, \mathbf{s}^*)$, p_i^* and e_i^* would have to solve[4]

$$\left\{\sum_{k=1}^{N=2} (p_k^* - c)\, \partial_{p_i} D_k + D_i^*\right\} - \partial_{p_i} D_j \left(p_j^* - T_j^{*\prime}\right) = 0 \tag{12}$$

and

$$\left\{\sum_{k=1}^{N=2} (p_k^* - c)\, \partial_{e_i} D_k - C_i'\right\} - \partial_{e_i} D_j \left(p_j^* - T_j^{*\prime}\right) = 0. \tag{13}$$

Note that the terms in the curly brackets are equal to zero when both $p_i^* = p_j^* = p^I$ and $e_i^* = e_j^* = e^I$. Hence, given that $p_j^* = p^I$ and $e_j^* = e^I$, for it to be optimal for the pair $M - R_i$ to induce $p_i^* = p^I$ and $e_i^* = e^I$, at the quantity D_j^* the marginal transfer price $T_j^{*\prime}$ would have to be equal to the integrated price, p^I. However, note that R_j's first-order condition for optimal sales effort at the final stage is $\left(p_j^* - T_j^{*\prime}\right) \partial_{e_i} D_j - C_j' = 0$. At $T_j^{*\prime} = p^I$, R_j's profit on the last unit sold when exerting sales effort $e_j = e^I > 0$, is negative. Hence, $p_i^* = p_j^* = p^I$ and $e_i^* = e_j^* = e^I$ cannot both hold in equilibrium.

Proposition 2. *(General own-sale contracts) In equilibrium, it is not possible for the manufacturer to induce the integrated profit* Π^I.

The intuition for this result is straightforward. To overcome the opportunism problem, the manufacturer has to take into account R_j's quasi-rents when making his contract offer to R_i, and vice versa. As suggested by OS, one way to do this is to eliminate the retailers' quasi-rents completely. For example, by fixing the retail prices and then squeezing the retailers' mark-ups through high marginal transfer prices. However, to induce the retailers to exert some effort, the retailers have to earn strictly positive quasi-rents on the margin, to cover their marginal effort cost. Because it is not possible for the manufacturer to achieve both simultaneously, the integrated outcome is unattainable.

We now show that general own-sale contracts and RPM in fact yield the same outcome as simple two-part tariffs do. To see this, note that first-order maximizing condition for R_i at the final stage is $(p_i^* - T_i^{*\prime})\, \partial_{e_i} D_i - C_i' = 0$. Substituting this into (13), and simplifying, leaves us with the following necessary conditions for $(\mathbf{T}^*, \mathbf{s}^*)$ to form a contract equilibrium:

$$\left\{\sum_{k=1}^{N=2} (p_k^* - c)\, \partial_{p_i} D_k + D_i^*\right\} - \partial_{p_i} D_j \left(p_j^* - T_j^{*\prime}\right) = 0,\ i = 1, 2 \tag{14}$$

[4] Because the manufacturer can use RPM, he is free to use T_i to induce the right level of effort e_i. Hence, we can think of $M - R_i$ as choosing both p_i and e_i directly at the contracting stage.

and

$$\sum_{k=1}^{N=2} (T_k^{*\prime} - c)\, \partial_{e_i} D_k = 0,\ \ i = 1, 2 \tag{15}$$

Condition (15) can be rewritten with matrix notation as $(\mathbf{T}' - \mathbf{c})\, \mathbf{D_e} = 0$, where $\mathbf{T}' = (T_1^{*\prime}, T_2^{*\prime})$ and $\mathbf{D_e}$ is the 2-by-2 matrix of demand derivatives with respect to retailer sales effort. By assumption A2, $\mathbf{D_e}$ is always invertible, which gives us the following result.

Proposition 3. *(General own-sale contracts) In all contract equilibria we have that i) the marginal transfer prices are the same for each retailer and equal to the manufacturer's marginal cost c, ii) retail prices are equal to p^B, and iii) each retailer's sales effort is equal to e^B.*

Proposition 3 shows that by introducing just a small effect of retailer sales effort on demand, the manufacturer's opportunism problem is restored with full force, and the RPM equilibrium introduced by OS breaks down. The intuition for this is the following: To overcome the temptation to offer the retailers sweetheart deals, that would allow a retailer to charge a lower price at its rival's expense, the manufacturer can impose a price ceiling equal to p^I and then squeeze the retailers' sales margins by charging high marginal transfer prices, $T_i^{*\prime} \to p^I$, $i = 1, 2$. However, this cannot arise in any contract equilibrium if retailers also exert some sales effort. The reason is that, given that the retailers' mark-ups are squeezed, the manufacturer can profitably deviate with either retailer and charge it a slightly lower marginal transfer price, which would induce the retailer to make (more) sales effort at the last stage of the game. This means that a strategy of squeezing the retailers' margins cannot arise in any contract equilibrium, and that each retailer has to earn strictly positive quasi-rents. This opens the door for opportunism again.

From Lemma 1 we also know that it does not work to combine RPM with any other own-sale restrictions or tariff schemes, such as restrictions on the retailer's customer base, sales forcing, market-share contracts, retroactive discounts, etc.

4 Horizontal contracts

Intuitively, the reason why general own-sale contracts cannot be used to curtail opportunism and induce higher prices, is that these contracts do not restrict the type of offers the manufacturer can (legally) make to rival retailers. Hence, imposing individual price ceilings and then squeezing the retailers' margins, for example, does not work because the manufacturer is allowed to secretly offer one of the retailers a lower marginal transfer price – which in turn would induce that retailer to make some sales effort downstream and increase her joint profit with the manufacturer. In turn this deviation provides an incentive to deviate on the resale prices as well.

Horizontal restraints, such as industry-wide RPM and closed territory distribution (CTD), on the other hand, may work, because these contracts (by definition) restricts the set of contracts that the manufacturer can establish with rival retailers. We now analyze these two types of restraints in turn and provide conditions for when these restraints may (not) help the manufacturer fully restore the first-best outcome.

4.1 Industry-wide price fixing

Industry-wide vertical price fixing describes a situation where the manufacturer is able to commit to adopting a common resale price throughout the downstream market. We can model this by incorporating a stage prior to the contracting stage, where the manufacturer commits publicly to an industry-wide resale price to be imposed on both of its retailers, before negotiating transfer prices privately and secretly with each retailer at stage 2.[5]

Definition 2. *We define* p^S *and* $e^S := e^* \left(p^S\right)$ *as the semi-collusive*[6] *price and effort level respectively, where*

$$e^* (p) := \arg\max_{e_i} \left[p - c - \mu_i\right] D_i \left(e_i, e^* (p), p, p\right)$$

and

$$p^S = \arg\max_{p} \left[p - c - \mu\left(e^* (p)\right)\right] \sum_i D_i \left(e^* (p), e^* (p), p, p\right).$$

Finally, we let Π^S *represent the semi-collusive profit,*

$$\Pi^S := \left(p^S - c - \mu\left(e^S\right)\right) \sum_i D_i \left(e^S, e^S, p^S, p^S\right)$$

We now show that the use of industry-wide price fixing may allow the manufacturer to induce the integrated optimum Π^I, but only as long as there are no spillovers in sales effort. To see this, note first that, in any contract equilibrium $(\mathbf{T}^*, \mathbf{s}^*)$ with industry-wide

[5] This resembles the set-up in Dobson and Waterson (2007), who analyze the use of observable *linear* tariffs and industry-wide RPM in a bilateral oligopoly setting.

[6] This might involve a slight abuse of the term "semi-collusion", but from the defintion it should be clear what we mean.

RPM, e_i^* would have to solve the condition

$$\left\{\sum_{k=1}^{N=2}\left(p^*-c\right)\partial_{e_i}D_k-C_i'\right\}-\partial_{e_i}D_j\left(p^*-T_j^{*\prime}\right)=0,\ i=1,2 \tag{16}$$

Substituting in retailer i's condition for optimal sales effort, $\left(p^*-T_i^{*\prime}\right)\partial_{e_i}D_i-C_i'=0$, we obtain the following necessary condition for $(\mathbf{T}^*,\mathbf{s}^*)$ to arise as a contract equilibrium:

$$\sum_{k=1}^{N=2}\left(T_k^{*\prime}-c\right)\partial_{e_i}D_k=0,\ i=1,2 \tag{17}$$

which is identical to condition (15) above. Hence, in all contract equilibria, the marginal transfer prices are again equal to the manufacturer's marginal cost c. Importantly, this result is independent of the industry-wide resale price chosen by M at the first stage of the game.We state this in Lemma 2 below.

Lemma 2. *(Industry-wide RPM) In all contract equilibria the marginal transfer prices are the same for each retailer and equal to the manufacturer's marginal cost c.*

With an industry-wide resale price equal to p set by the manufacturer at the first stage of the game, the unique Nash equilibrium at the final stage therefore has each retailer exerting sales effort equal to $e^*(p)$ (Definition 2). The manufacturer's optimal industry-wide resale price in this game is therefore characterized by

$$p^*=\arg\max_p\left[p-c-\mu\left(e^*(p)\right)\right]\sum_i D_i\left(e^*(p),e^*(p),p,p\right) \tag{18}$$

We then have the following result.

Proposition 4. *(Industry-wide RPM) If the manufacturer can commit to an industry-wide price floor he is able to induce the semi-collusive outcome Π^S as defined in Definition 2. The semi-collusive outcome may coincide with the fully integrated outcome Π^I, but only as long as $\partial_{e_i}D_j=0$, $i\neq j\in\{1,2\}$.*

The intuition is again very simple. Each retailer will only take into account the effect of its sales effort on its own demand. Hence, when facing a marginal transfer price equal to the true marginal cost of the manufacturer, and the minimum retail price is set at the integrated level p^I, each retailer will provide too little service with positive spillovers and too much service when spillovers are negative. Hence, $p^S=p^I$ and $e^S=e^I$ cannot both hold when there are spillovers in effort.

Without spillovers in sales effort, on the other hand, allowing for industry-wide RPM fully restores the manufacturer's ability to induce the integrated outcome: The manufacturer can then commit to the integrated price p^I at the first stage of the game, and marginal transfer prices equal to c – which characterizes the unique equilibrium at the contracting stage – are then sufficient to induce each retailer to exert the integrated level of sales effort e^I at the final stage.

Note also that $\Pi^S \geq 2\pi^B$ has to hold, because the manufacturer could always replicate the outcome $2\pi^B$ by committing to the standard Bertrand price p^B at the first stage. Moreover, we may also note that the industry-wide resale price p^S, would have to be introduced either as a fixed price or as a price floor – not as a price ceiling. The reason is that all contract equilibria are again characterized by marginal cost pricing for the manufacturer's product. Hence, a minimum or fixed price $p^* > p^B$ is needed to prevent retailers from charging the standard Bertrand price at the final stage. Therefore, according to our analysis, minimum or fixed RPM may be harmful in some cases – especially when the effect of sales effort is relatively small and insignificant – whereas maximum RPM is never harmful in this case. This is also in line with current competition policy in the EU, for example.

To provide a sense for the potential welfare implications of allowing for an industry-wide price floor in our setting, we are going to evaluate consumers' welfare using two different representative utility functions,

$$U_1 = Y + v \sum_{i=1}^{2} q_i - \frac{1}{1+\gamma} \left\{ \frac{1}{2} \sum_{i=1}^{2} (2q_i - A_i)\, q_i + \frac{\gamma}{2} \left(\sum_{i=1}^{2} q_i \right)^2 \right\} \tag{19}$$

and

$$U_2 = Y + v \sum_{i=1}^{2} q_i - \frac{1}{B\,(1+\gamma)} \left(\sum_{i=1}^{2} q_i^2 + \frac{\gamma}{2} \left(\sum_{i=1}^{2} q_i \right)^2 \right), \tag{20}$$

where Y is consumers' income, q_i is the quantity purchased by the consumer from retailer $i \in \{1, 2\}$, and $\gamma \in [0, \infty)$ is a measure for the substitutability between retailers. In U_1, we have

$$A_i = (2 + \gamma\,(1+\alpha))\, e_i + (2\alpha + \gamma\,(1+\alpha))\, e_j, \;\; i \neq j \in \{1, 2\}$$

where $\alpha \in [0, 1]$ is a measure for spillovers in effort provision. I.e., we consider here positive spillovers only, but of a varying degree.

In U_2, we have $B = a + e_1 + e_2$, where $a \geq 0$, which implies that each retailer's demand is a function of the sum of the retailers' effort only (each retailer's effort spills fully over to the rival). Finally, we assume that the retailers' effort cost is given by $C_i = \theta e_i^2/2$, $i = 1,2$, where $\theta > 1$.

Subject to the income restraint, we get the following consumer direct demand functions:

$$q_i^* = D_i = \frac{1}{2}\left(v + e_i + \alpha e_j - (1+\gamma)\, p_i + \frac{\gamma}{2}(p_1 + p_2)\right),\ i = 1,2$$

from U_1 and

$$q_i^* = D_i = \frac{a + e_1 + e_2}{2}\left(v - (1+\gamma)\, p_i + \frac{\gamma}{2}(p_1 + p_2)\right),\ i = 1,2$$

from U_2. Note finally that for $a = 1$ and $e_1 = e_2 = 0$, U_1 and U_2 both yield the same Shubik-Levitan (1980) demand function.

By comparing the representative consumer's net utility when retailers set the standard Bertrand prices and effort levels $\left(p^B, e^B\right)$, with the consumer's net utility under the semi-collusive price and effort levels $\left(p^S, e^S\right)$, we get the following result.

Proposition 5. *Given the utility function U_1, consumer surplus always falls when we allow the manufacturer to commit to an industry-wide price floor. Given the utility function U_2, we have the following:*

- *If $a > (v-c)^2 / (12\theta)$, consumer surplus always falls with an industry-wide price floor.*
- *If $a < (v-c)^2 / (12\theta)$, consumer surplus may increase with an industry-wide price floor, but only as long as the degree of substitution between retailers γ is sufficiently high. The lower bound for the degree of substitution required for consumer's surplus to increase in some cases, is $\underline{\gamma} \approx 20.9$ (when $a = 0$)*

This result is important, because it challenges the claim that – in a setting where retailers freeride on each other's service provisions – price floors create efficiencies that ultimately benefit the end consumers. This claim is based on the earlier literature that investigates the manufacturer's rationale for using vertical restraints (e.g., RPM) in a game with perfect information (e.g. Mathewson and Winter, 1984). The crucial assumption that differentiates the results in this literature from ours, is the assumption that the manufacturer can commit to a set of public contracts.

An example of the linear model given by (19) above, but casted in a setting with observable contracts, is given in Motta (2004, pp 326-331). Motta shows that price floors in that case always increase both consumer and overall welfare. On the other hand, our proposition states that if the manufacturer can commit to a common price floor for both retailers, but we assume that retailers otherwise do not have information about rivals' contract terms, the result in Motta is turned around; consumers then always lose when we allow the manufacturer to commit to a set of minimum prices. However, the welfare implications for consumers clearly depends on how demand reacts to retailers' effort. If effort is critical for generating consumer demand (e.g., U_2 with $a = 0$), then consumer surplus *may* increase with public price floors – but only if very little service effort would be provided without the publicly observable price restraint (i.e., when competition is very fierce).

To sum up, the analysis above shows that in a setting where retailers provide valuable services, consumers in many cases will lose when we allow for a publicly imposed price floor, given that the retailers' contract terms are otherwise unobservable.

4.2 Closed territory distribution

Closed territory distribution (CTD) is the contractual provision that gives retailers exclusive rights to sell the manufacturer's product to customers residing in their assigned areas. CTD generally also imply that a retailer is required to turn away any potential customer who has his residence or place of business outside of the assigned area (Warren, 1968 p.1).

To gain some insight on how CTD and industry-wide RPM may or may not restore the integrated outcome, consider the following situation: Imagine that the retailer's demand can be written $D_i = m_i q_i$, where m_i is the mass of customers buying from R_i, and q_i is the demand of each individual customer. Using this, we can write the integrated firm's first-order condition for optimal sales effort as

$$\left(p^I - c\right)\left\{q_i \partial_{e_i} m_i + m_i \partial_{e_i} q_i + q_j \partial_{e_i} m_j + m_j \partial_{e_i} q_j\right\} - C_i' = 0,\ i \neq j \in 1,2 \qquad (21)$$

We can then decompose the effect of e_i on R_i's mass of customers, $\partial_{e_i} m_i$, into three: 1) The number of new customers coming into the market to buy from R_i, and who are residing in R_i's territory, denoted by n_i^i. 2) The number of new customers coming into the market to buy from R_i, but who are residing in R_j's territory, denoted by n_i^j. 3) The number of the retailers' 'current' customers choosing to switch (territories) stores, i.e., a business-stealing effect, denoted by b.

Similarly, we can decompose the effect of R_i's sales effort on R_j's mass of customers, $\partial_{e_i} m_j$, into two: 1) The number of new customers coming into the market to buy from

R_j, and who are residing in R_j's territory, denoted by $\widehat{n}_j^j$. 2) The number of the retailers' current customers choosing to switch (territories) stores, which is just $-b$.

Next, we denote by $x = \partial_{e_i} q_i$, the change in consumption for R_i's customers, and by $\widehat{x} = \partial_{e_i} q_j$ the change in consumption for R_j's customers. Using this, and by imposing symmetry, $q_i = q_j = q$ and $m_i = m_j = m$, we can rewrite the vertically integrated firm's first-order condition as

$$\left(p^I - c\right) \left\{ \left(n_i^i + n_i^j + \widehat{n}_j^j\right) q + m\left(x + \widehat{x}\right) \right\} - C_i' = 0 \tag{22}$$

Notice that, by imposing CTD, the manufacturer eliminates both n_i^j and b from $\partial_{e_i} m_i$, as these are the customers that R_i has to turn down. We let $\delta \in [0, 1]$ denote the share of n_i^j that, after being turned down, choose to buy from their assigned retailer instead. ($\delta = 0$ is the situation where every new customer who is turned down, chooses to exit the market again.) Hence, with CTD, we have $\partial_{e_i} m_i = n_i^i$ and $\partial_{e_i} m_j = \widehat{n}_j^j + \delta n_i^j$. Using this, we can write M and R_i's first-order condition for maximizing their bilateral joint profit, given CTD and an industry-wide resale price equal to p^I, as

$$\left\{ \left(p^I - c\right) \left[\left(n_i^i + \widehat{n}_j^j + \delta n_i^j\right) q + m\left(x + \widehat{x}\right)\right] - C_i' \right\} - \left(\left(\widehat{n}_j^j + \delta n_i^j\right) q + m\widehat{x} \right) \left(p^I - T_j^{*\prime}\right) = 0 \tag{23}$$

Substituting in the condition for retailer optimality at the final stage, $\left(p^I - T_i^{*\prime}\right)\left(n_i^i q + mx\right) - C_i' = 0$, we get the following conditions for $(\mathbf{T}^*, \mathbf{e}^*)$ to arise in a contract equilibrium:

$$\left(T_i^{*\prime} - c\right)\left(n_i^i q + mx\right) + \left(T_j^{*\prime} - c\right)\left(\widehat{n}_j^j q + \delta n_i^j q + m\widehat{x}\right) = 0,\ i \neq j \in 1, 2 \tag{24}$$

Assuming that $n_i^i q + mx > \left|\widehat{n}_j^j q + \delta n_i^j q + m\widehat{x}\right|$, this system again has a unique solution in which the marginal transfer prices are equal to the manufacturer's marginal cost, c. Hence, given that the manufacturer imposes the vertically integrated price p^I, R_i's optimal level of effort is characterized by $\left(p^I - c\right)\left(n_i^i q + mx\right) - C_i' = 0$. Comparing this to the integrated monopolists first-order condition above, we can see that the retailer will exert the optimal level of effort, e^I, only as long as $q\widehat{n}_j^j + qn_i^j + m\widehat{x} = 0$, for example when $\widehat{n}_j^j = n_i^j = \widehat{x} = 0$. We have the following result.

Proposition 6. *(CTD) Given that there are spillovers in sales effort, $\partial_{e_i} D_j \neq 0$, CTD (possibly in addition to RPM) may help to restore the integrated outcome, but only as long as 1) the spillover consists of a pure business-stealing effect ($\partial_{e_i} D_j = -b$), and 2) each retailer's sales effort does not attract more customers into the market who resides in the rival's territory ($n_i^j = \widehat{n}_j^j = 0$). In all other cases, CTD yields either too much or too* *little sales effort in equilibrium.*

Note that, without spillovers in effort, industry-wide RPM is enough to restore the integrated outcome, as demonstrated by Proposition 4. With spillovers this is no longer the case. However in this case, introducing CTD may help to restore the integrated outcome, but only as long as the spillover consists of a pure business stealing effect, and moreover, as long as sales effort does not attract more customers into the market from the rival's territory. Intuitively, this has to be the case because CTD only corrects only for the first externality (the business-stealing effect), and does not correct for the second.

5 Discussion

Our results confirm that, generally, purely bilateral, vertical contracts cannot solve the manufacturer's opportunism problem. To fully restore the integrated outcome, the manufacturer's contract with R_i would have to be (indirectly) contingent on R_j's price, p_j, as well as the quantity sold, D_j, and vice versa. I.e., the contracts need to include a credible horizontal commitment from the manufacturer, and this may be difficult to implement in practice.

One solution that has been proposed in the literature, is for the manufacturer to condition each retailer's contract terms explicitly on the terms offered to rival retailers – e.g., through non-discrimination or most-favoured customer clauses (MFC). This requires the *actual* marginal wholesale terms of rival retailers to be verifiable in court. However, given the widespread practice in many industries of negotiating secret, "backroom" discounts that do not show up on the retailers' invoices, it is reasonable to assume that the actual wholesale terms are at least difficult to verify.

Other industry-wide practices, such as price fixing agreements, may be a more viable solution, e.g. when facilitated through industry trade agreements. The latter we have seen implemented in European book markets, e.g. in Spain, France and Germany. Committing to closed territories (CTD) would be an even more effective solution, as we have shown, but may be much harder to implement and monitor. Yet, in general, even these types of horizontal agreements will not suffice to implement the first-best as long as the rest of the contract terms are individually negotiated.

As in Hart and Tirole (1990), our results therefore stress the value (in an unregulated market) for a manufacturer of owning his distribution network. This is a more efficient way of both curbing opportunism and controlling effort and at the same time – compared to using (purely vertical) contractual restraints, e.g. individual price restraints and rebate schemes. Of course, to fully restore the first-best in our model, both retailers would have to be fully integrated into the manufacturer's network. To see this, suppose the manufacturer has integrated with retailer 1, and suppose also that the manufacturer can use RPM in its contract with retailer 2. Evaluated at the first-best, the first-order conditions for the integrated unit at the final stage of the game, given that retailer 2 has accepted the contract terms, are

$$\left(p^I - c\right) \partial_{p_1} D_1 + D_1 + (T_2^{*\prime} - c)\, \partial_{p_1} D_2 = 0$$

and

$$\left(p^I - c\right) \partial_{e_1} D_1 - C_1' + (T_2^{*\prime} - c)\, \partial_{e_1} D_2 = 0$$

Note that $T_2^{*\prime} = p^I$ for $p_1 = p^I$ and $e_1 = e^I$ to be optimal at stage 2 for the integrated manufacturer. On the other hand, we have the first order condition for the unintegrated retailer 2, which is simply $\left(p^I - T_2^{*\prime}\right) \partial_{e_2} D_2 - C_2' = 0$. But with $T_2^{*\prime} = p^I$, retailer 2 would exert zero effort, and hence, in general, $p_1 = p_2 = p^I$ and $e_1 = e_2 = e^I$ cannot be achieved without the manufacturer being fully integrated with both retailers. With differentiated retailers as in our model, it also follows that the integrated outcome cannot be achieved through exclusion of retailers.

6 Conclusion

Earlier literature suggest that with unobservable contracts and no importance of retail sales effort, the opportunism problem may be solved with imposing maximum RPM. As this raises retail prices, consumers are hurt. On the other hand, with observable contracts another branch of the literature focuses on how RPM may solve vertical externalities when there are spillovers between retailers from retail sales effort. When retailers also exert some sales effort, the latter literature argues that RPM may be efficiency enhancing by allowing a manufacturer to exert vertical control of retailer sales effort. These contradicting results of the effects of RPM calls for a more unified approach. In this article we propose such an approach. We consider a model where both opportunism and retail sales effort are incorporated. This is done by introducing retail sales service with spillovers in the framework of O'Brien and Shaffer (or unobservable contracts in the framework of Mathewson and Winter, 1984). By doing this, new insights emerge.

We show that the opportunism problem arising from contract unobservability in vertical relations may be significant harder to solve than has been recognized in the literature before. Specifically, the result that maximum RPM mitigates opportunism, as proposed by O'Brien and Shaffer (1992), breaks down once retail demand depends to any extent of service provided at the retail level. Since the basic problem stems from positive margins at the retail level, and the intrinsic temptation to free-ride on the margins, OS's solution simply was to eliminate these margins by using maximum RPM and high transfer prices. This is true if retail service has no impact whatsoever on retail demand. If retail sales effort only has a minimal effect on demand this equilibrium breaks down, as the manufacturer would wish to lower its transfer price to each retailer, inducing higher sales. Positive margins, in turn, completely reopens the door for opportunism again. We have shown that when retail service has any positive impact on demand, and for any size and sign of spillovers from such activity, then there are no own-sale contracts that will solve the opportunism problem.

However, if contracts are horizontal in nature the opportunism problem may be mitigated. For example, if the manufacturer may commit to industry-wide minimum RPM, the fully integrated outcome may be restored, but only when there are no spillovers from retailers' sales effort. However, if there are (positive or negative) spillovers in retailers' sales effort, the profit realized in equilibrium will be less than the fully integrated profit. Importantly, and in contrast to the earlier literature on vertical restraints, we find that even though the retailers offer valuable services, consumers are often harmed when allowing for industry-wide price agreements, given that the contract terms of rivals are otherwise unobservable; we find that consumers benefit only in cases where 1) retailers' sales effort is critical to generate demand, and 2) fierce downstream competition leads to very little effort being provided without a price agreement.

We also show that closed territory distribution only solves the problem in very specific circumstances. Finally, we argue that both vertical integration and exclusion will generally not enable the manufacturer to realize the vertically integrated outcome.

Competition policy in many countries tends to be more hostile against minimum of fixed RPM than maximum RPM. In fact, in most jurisdictions maximum RPM is regarded as unproblematic. Several recent articles has challenged this view by showing that also maximum RPM may be detrimental to consumers. Montez (2012) shows that a monopolist may avoid the opportunism problem by using buybacks that are sometimes coupled with maximum RPM. More relevant to our analysis are O'Brien and Shaffer (1992) and Rey and Verge (2004). They both suggest that maximum RPM may be detrimental to consumers because it is an instrument to solve the opportunism problem. The most important policy implication from our analysis is that this suggestion is not very robust. If retail demand depends to any extent of retail sales effort, maximum RPM has no effect on the outcome.

7 Appendix

Proof of Lemma 1.

The following proof follows closely the proof in O'Brien and Shaffer (1992), which we have modified to encompass both retailers' sales effort and RPM.

The proof consists of three steps.

Step 1. For all $j \neq i \in \{1,2\}$, $T_j^*(D_j)$ is continuous at the quantity induced by $\mathbf{T}^*$.

Proof. Let D_j^* be the quantity induced by $\mathbf{T}^*$, and suppose that $T_j^*(D_j)$ were not continuous at D_j^*. Then for some infinitesimal change in D_j^*, T_j^* would either jump up or jump down. It cannot jump down, because retailer j could then adjust his effort by a small amount and induce a discrete reduction in its payment. It cannot jump up, for then M and R_i could jointly adjust p_i and/ or e_i, and induce a discrete jump in their bilateral profits. Hence, T_j^* must be continuous at D_j^*. *Q.E.D.*

Step 2. The function $T_j^*(D_j)$ satisfy $T_{j+}^{*\prime} \geq T_{j-}^{*\prime}$, for all $j \neq i \in \{1,2\}$, where $T_{j+}^{*\prime}$ and $T_{j-}^{*\prime}$ are the right-hand (+) and left-hand (-) partial derivatives of T_j^*, respectively, evaluated at D_j^*.

Proof. From step 1, we know that T_j^* has both a left-hand (-) and a right-hand (+) derivative at D_j^*. Retailer j's first-order conditions for optimal effort then requires that

$$\left(\partial_{e_j}\pi_j\right)_- = \partial_{e_j} D_j \left(p_j^* - T_{j-}^{*\prime}\right) - C'(e_j) \geq 0 \tag{A1}$$

and

$$\left(\partial_{e_j}\pi_j\right)_+ = \partial_{e_j} D_j \left(p_j^* - T_{j+}^{*\prime}\right) - C'(e_j) \leq 0 \tag{A2}$$

using the fact that $\partial_{e_j} D_j > 0$. Together, (A1) and (A2) yields $T_{j+}^{*\prime} \geq T_{j-}^{*\prime}$ as a necessary condition for retailer optimality. *Q.E.D.*

Step 3. The function $T_j^*(D_j)$ satisfies $T_{j-}^{*\prime} \geq T_{j+}^{*\prime}$ for all $j \neq i \in \{1,2\}$, when evaluated at $D_j = D_j^*$.

Proof. In every contract equilibrium with general own-sale contracts and RPM, the M's contract with R_i per definition solves

$$\max_{p_i,e_i} \left\{ (p_i - c) D_i \left(e_i, p_i, e_j^*, p_j^*\right) + T_j^* - C(e_i) \right\} \tag{A3}$$

This yields the following first-order conditions for the price p_i:

$$(p_i - c)\,\partial_{p_i} D_i + D_i \geq -\partial_{p_i} D_j T_{j-}^{*\prime} \tag{A4}$$

and

$$(p_i - c)\,\partial_{p_i} D_i + D_i \leq -\partial_{p_i} D_j T_{j+}^{*\prime} \tag{A5}$$

using the fact that $\partial_{p_i} D_j > 0$. Together, (A4) and (A5) imply that $-\partial_{p_i} D_j T_{j-}^{*\prime} \leq -\partial_{p_i} D_j T_{j+}^{*\prime}$, or $T_{j-}^{*\prime} \geq T_{j+}^{*\prime}$ because $-\partial_{p_i} D_j < 0$. Together with step 1, this implies that $T_{j-}^{*\prime} = T_{j+}^{*\prime}$ for the contracts to be bilateral best responses with general own-sale contracts and RPM.

The rest of the proof considers the case where deviations on the price are not possible (i.e., the case of industry-wide price fixing). Note first that, even though M cannot deviate with R_i on the price p_i, as is the case with an industry-wide resale price p^*, M's contract with R_i still has to solve

$$\max_{e_i} \left\{ (p^* - c)\, D_i \left(e_i, p^*, e_j^*, p^*\right) + T_j^* - C\left(e_i\right) \right\} \tag{A6}$$

The case without spillovers is trivial and not important to our results. In the following we therefore consider only the cases with negative and positive spillovers, respectively.

With negative spillovers, the first-order conditions for (A6) are

$$(p^* - c)\,\partial_{e_i} D_i - C'\left(e_i\right) \geq -\partial_{e_i} D_j T_{j+}^{*\prime} \tag{A7}$$

and

$$(p^* - c)\,\partial_{e_i} D_i - C'\left(e_i\right) \leq -\partial_{e_i} D_j T_{j-}^{*\prime} \tag{A8}$$

Together, (A4) and (A5) yield the condition $-\partial_{e_i} D_j T_{j-}^{*\prime} \geq -\partial_{e_i} D_j T_{j+}^{*\prime}$, or $T_{j-}^{*\prime} \geq T_{j+}^{*\prime}$, because $-\partial_{e_i} D_j > 0$ in this case.

With positive spillovers, the first-order conditions for (A6) are

$$(p^* - c)\,\partial_{e_i} D_i - C'\left(e_i\right) \geq -\partial_{e_i} D_j T_{j-}^{*\prime} \tag{A9}$$

and

$$(p^* - c)\,\partial_{e_i} D_i - C'\left(e_i\right) \leq -\partial_{e_i} D_j T_{j+}^{*\prime} \tag{A10}$$

Together, (A9) and (A10) yield the condition $-\partial_{e_i} D_j T_{j+}^{*\prime} \geq -\partial_{e_i} D_j T_{j-}^{*\prime}$, or $T_{j-}^{*\prime} \geq T_{j+}^{*\prime}$, because $-\partial_{e_i} D_j < 0$ in this case. *Q.E.D.*

The proof is completed by noting that steps 2 and 3 together imply that $T^{*\prime}_{j-} = T^{*\prime}_{j+}$ when evaluated at $D_j = D^*_j$, both for the case with general own-sale contracts and RPM, and for the case with general non-linear contracts, industry-wide price fixing and spillovers in effort. Q.E.D.

References

[1] Cremér, J. and Riordan, M.H. (1987). On governing multilateral transactions with bilateral contracts. RAND Journal of Economics, (18), 436-451.

[2] Dobson, P. and Waterson, M. (2007). The competition effects of industry-wide vertical price fixing in bilateral oligopoly. International Journal of Industrial Organization (25), 935-962.

[3] Hart, O. and Tirole, J. (1990). Vertical integration and market foreclosure. Brookings Papers on Economic Activity: Microeconomics, 205-286.

[4] Mathewson, G. and Winter, R. (1984). An Economic Theory of Vertical Restraints, RAND Journal of Economics , 15: 27-38

[5] McAfee, R.P. and Schwartz, M. (1994). Opportunism in Multilateral Vertical Contracting: Nondiscrimination, Exclusivity, and Uniformity. The American Economic Review, (84), 210-230.

[6] Montez, J. (2012). How buybacks eliminate opportunism in vertical contracting. Working paper, London Business School.

[7] O'Brien, D. P. and Shaffer, G. (1992). Vertical control with bilateral contracts. RAND Journal of Economics, (23), 299-308.

[8] O'Brien, D. P. and Shaffer, G. (1994). The welfare effects of forbidding discriminatory discounts: A secondary line analysis of Robison-Patman. The Journal of Law, Economics and Organization, (10), 296-317.

[9] Rey, P. and Tirole, J. (2006). A Primer on Foreclosure. In Armstrong M. and Porter, R. (eds.) Handbook of Industrial Organization, vol.3, North Holland, 2007.

[10] Rey, P. and Vergé, T. (2004). Bilateral control with vertical contracts. RAND Journal of Economics, (35), 728-746.

[11] Telser, L. (1960). Why Should Manufacturers Want Fair Trade?, Journal of Law and Economics, 3: 86-105.

[12] Warren, R.G. (1968). Economics of closed-territory distribution. Antitrust Law & Economics Review, (2), 111-124.

Department of Economics
University of Bergen
Fosswinckels gate 14
N-5007 Bergen, Norway
Phone: +47 55 58 92 00
Telefax: +47 55 58 92 10
http://www.svf.uib.no/econ