Retail Price Parity as a Channel-Coordination Mechanism in Dual Distribution

Michele Bisceglia[†] Mark Israel[*] Salvatore Piccolo[‡] Paolo Ramezzana[§]

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Abstract. When a manufacturer distributes its products through both a direct sales channel and an independent retailer, a fundamental tension arises between the efficiencies of direct distribution and the need to incentivize the retailer. To induce the retailer to undertake noncontractible actions that enhance demand, such as pre- and post-sale assistance, the manufacturer must grant it a high gross margin. This, however, creates incentives for the manufacturer to undercut the retailer ex post through its direct channel. We show that a retail price parity (RPP) policy, which requires identical retail prices across the direct and independent channels, can increase industry profits. By allowing the manufacturer to commit not to undercut the retailer, RPP strengthens the retailer's incentives to undertake valuable noncontractible actions and enables supply contracts that increase joint profits. Because higher effort improves service quality, RPP may also increase consumer welfare even when it leads to higher monetary retail prices. These findings offer guidance for managers designing dual distribution strategies and inform policy discussions on the competitive effects of price-parity clauses.

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[†] Yale University and CEPR.

[*] Econic Partners LLC.

[‡] University of Bergamo and Econic Partners LLC.

[§] Compass Lexecon.

1 Introduction

When a manufacturer distributes its products through both a direct sales channel and independent retailers, it typically earns higher gross margins on direct sales because these transactions do not require sharing margins with intermediaries. This margin asymmetry creates an incentive for the manufacturer to undercut independent retailers by reducing the retail price in the direct channel, thereby diverting demand toward its own outlet.

However, this logic appears at odds with the widespread observation that many vertically integrated manufacturers commit not to undercut third-party retailers in their direct sales channel. They do so through formal contractual clauses, uniform national pricing policies, or self-enforcing reputational mechanisms. We refer to such commitments as retail price parity (RPP) policies. RPP is widespread across consumer product categories, including apparel, sporting goods, home appliances, and electronics (Carlton and Chevalier, 2001; Cattani et al., 2006; Wang et al., 2009). Well-known brands such as Nike, Adidas, Apple, Samsung, and Bose routinely maintain identical prices across their own stores and major retail partners. Moreover, despite the substantial growth of direct-to-consumer channels in recent decades, manufacturers have continued to rely heavily on independent distributors, contrary to what a standard foreclosure logic might predict.

These observations raise some important questions. Why would a manufacturer operating a dual distribution system voluntarily restrict its own pricing discretion, forgoing the flexibility and potential margin gains available through its direct channel? What are the strategic and competitive implications of adopting an RPP policy?

We argue that RPP serves as a commitment mechanism that addresses a fundamental incentive problem created by noncontractible downstream effort and, more broadly, as a reassurance device that helps stabilize dual distribution systems. In many retail markets, independent retailers provide valuable market reach and undertake costly actions — such as pre-sale and post-sale assistance, in-store demonstrations, merchandising, and local advertising — that enhance demand but are difficult to specify, monitor, or enforce in a contract. Because these actions are inherently hard to measure and enforce contractually, they must be incentivized through margin-based compensation and shielded from opportunistic diversion of sales to the manufacturer's direct channel. RPP is a simple tool to balance these two objectives and achieve effective channel coordination.

We derive these insights in a formal model in which a manufacturer distributes its product through both its own direct channel and a differentiated third-party retailer. The retailer can increase demand at its outlet by exerting costly, noncontractible effort of the type described above. The relationship between the manufacturer and the retailer is governed by a two-part tariff contract — consisting of a fixed fee and a constant wholesale price — with a resale price maintenance (RPM) clause, which fixes the retailer's price.[1] Starting from this baseline, we investigate whether adding an RPP clause is profitable for the contracting parties, and how such a clause affects market outcomes, channel coordination, and consumer welfare.

[1] A similar logic would apply if the contract did not include RPM and the independent retailer retained full pricing discretion. However, as we argue in Section 2, that case is less interesting for both conceptual and practical reasons.

We show that, absent RPP, the manufacturer faces an *ex-post opportunism problem.* To induce high retail effort, it must grant the independent retailer a sufficiently high gross margin, implemented through a low wholesale price and a high RPM price. This contractual structure, however, creates an ex-post incentive for the manufacturer to divert sales toward its direct channel, where it captures the full margin, by lowering its own retail price to undercut the retailer. Although this undercutting is profitable for the manufacturer ex post, it has important drawbacks for the joint profitability of the supply chain from an ex-ante point of view. First, it leads to unprofitably low retail prices. Second, it undermines the third-party retailer's incentives to exert noncontractible effort. Because of these effects, absent RPP, equilibrium joint profits fall below the benchmark in which distribution channels are fully coordinated and ex-post encroachment is credibly avoided.

Against this background, an RPP policy — whereby the manufacturer commits not to undercut the retailer — can raise profits by serving as a commitment device that addresses ex-post opportunism, restores the effectiveness of margin-based incentives, and improves channel coordination. Moreover, when RPP significantly strengthens incentives for noncontractible effort, its adoption can also benefit consumers.

Importantly, the logic and qualitative results discussed above continue to hold also when the integrated manufacturer can increase the intensity of noncontractible effort it exerts on its direct sales. If effort at a retailer reduces demand at other retailers (negative effort externalities), the manufacturer can increase the effort it exerts on its direct sales to divert sales from the independent retailer toward its direct sales channel, thus partially circumventing the constraint that RPP imposes on the monetary price of direct sales. This weakens, but does not eliminate, the commitment value of RPP and its potential to be profitable for firms and beneficial to consumers. In this richer setting, RPP still strengthens the third-party retailer's incentives to exert noncontractible effort, but it also has the drawback of imposing a common retail price in an intrinsically asymmetric environment; the two channels are, in fact, vertically differentiated because the integrated firm has stronger incentives to exert effort than the independent retailer. Nonetheless, the commitment value of RPP outweighs this drawback when horizontal differentiation between retailers is significant, which makes third-party effort provision particularly valuable.[2]

Perhaps more surprisingly, when noncontractible effort has a strong effect on demand, the manufacturer finds it profitable to divert sales from the independent retailer by exerting very high effort and so, absent RPP, it optimally charges a higher retail price than the independent retailer. In these circumstances, RPP can increase profits by lowering, rather than raising, the direct channel's relative monetary price, thereby inducing the manufacturer to scale back its excessively high effort. This form of RPP can be implemented through a price-matching guarantee to consumers in the direct sales channel.

Finally, our results also extend to linear wholesale contracts. Absent profit-sharing through

[2] If, instead, effort at one retailer increases demand at *both* retailers, effort becomes a public good, which is undersupplied in equilibrium, and retail competition takes place only through monetary prices. As we explain in Section 3.4, this implies that RPP always increases profits, because it reduces competition and improves incentives to exert effort.

a fixed fee, the manufacturer's objective is the same at the contracting and at the pricing-and-effort stages if the retailer's participation constraint is nonbinding. In this case, there is no ex-post opportunism, hence RPP cannot profitable. However, if the manufacturer's optimal wholesale price makes the third-party retailer's participation constraint binding, the ex-ante objective is the same as under two-part tariffs. Then, ex-post opportunism again emerges whenever the manufacturer finds it optimal to grant the retailer a positive unit margin so as to elicit its effort. By reassuring the independent retailer that it will not be undercut, RPP enables the manufacturer to charge a higher wholesale price or to achieve greater effort in the indirect channel. In the latter case, RPP may, again, simultaneously increase profits and enhance consumer welfare.

Managerial and policy implications. These findings carry relevant managerial implications for the use of RPP clauses in dual distribution systems. Rather than viewing parity as a mere pricing constraint, managers should treat it as a deliberate governance tool within an integrated channel strategy. Although direct-to-consumer channels generate higher margins and create incentives to undercut retail partners, such encroachment can erode business relations with third-party retailers, discourage service and brand-building investments, and ultimately reduce total channel value. A credible commitment to price parity can sustain downstream effort, reinforce coordination across channels, and enhance long-run performance.

Our model identifies a number of factors that are important in determining whether the commitment value of RPP is likely to outweigh the inefficiencies arising from imposing a uniform price across asymmetric retail outlets. If the services of third-party retailers are particularly important (e.g., because they make it possible to serve consumer segments that are less accessible to the manufacturer through direct sales), or relatively more effective than the manufacturer's services at boosting demand (even for consumers that could be reached by both direct and third party channels), RPP generates substantial surplus for the supply chain. A similar conclusion applies if retail services at a given retailer expand demand at all retailers (positive retail externalities). Conversely, maintaining pricing flexibility is optimal for manufacturers that can efficiently serve most consumers through their direct sales channel, as when third-party retailers provide limited differentiation or their services have a lesser impact on consumer demand relative to the manufacturer's services.

Our analysis also has important implications for the policy debate on price parity clauses. These clauses are often evaluated primarily through their immediate effect on prices, with concern that they may soften intrabrand competition. Our results suggest that such an assessment is incomplete. RPP affects not only prices but also incentives for downstream effort and investment. When third-party retailers provide valuable noncontractible services, price parity provisions strengthen their incentives to supply these services by protecting them from opportunistic undercutting. In these environments, RPP may enhance consumer welfare by sustaining higher service quality, improved brand presentation, and greater product support, even if retail prices rise. A narrow price-based evaluation thus risks overlooking the welfare benefits associated with improved effort and quality provision.

Related literature. Our paper contributes to the literature on vertical restraints as instruments for achieving channel coordination.[3] When studying the optimal structure of wholesale contracts within a vertical supply chain, the Chicago School approach, rooted in the pioneering work of Spengler (1950) and Telser (1960), advocates restraints on retail prices that align incentives within the supply chain, arguing that when only linear wholesale contracts are admissible, RPM addresses double marginalization and enhances efficiency.[4]

If firms can instead use two-part tariffs, RPM becomes necessary to overcome the manufacturer's opportunism problem arising under secret contracts in the presence of downstream competition (Hart and Tirole, 1990; O'Brien and Shaffer, 1992; McAfee and Schwartz, 1994). Absent vertical restraints, each retailer anticipates that, once the fixed fee has been stipulated, the upstream monopolist has incentives to favor competing retailers with better terms in order to re-capture downstream profit margins. This opportunism problem reduces each retailer's willingness to pay for inputs and prevents the industry from fully maximizing profits. In this context, O'Brien and Shaffer (1992) show that a manufacturer can use two types of price restraints to overcome this problem. One solution is to offer each retailer a maximum resale price (set at the industry-profit-maximizing level) and a wholesale price that eliminates retail margins and, with them, the manufacturer's incentive to behave opportunistically. Alternatively, the manufacturer can commit to an industry-wide price floor — i.e., to retail price parity.

Gabrielsen and Johansen (2017) challenge these conclusions in a model where consumer demand depends also on retailers' noncontractible effort. In their model, individual RPM contracts have no effect on equilibrium outcomes because the manufacturer has incentives to grant each retailer a positive margin to induce effort, which implies that opportunism persists even in the presence of RPM. Industry-wide RPM mitigates this problem but does not fully solve it, because it cannot fully control noncontractible effort, which remains a source of opportunism.[5]

In the literature discussed above, the manufacturer distributes only through third-party retailers. By contrast, we consider a dual distribution system and show that vertical restraints address a different source of opportunism — namely, the manufacturer's ex-post incentive to steer sales towards its direct channel after stipulating contracts with third-party retailers. We abstract from opportunism in arm's-length contracting with multiple third-party retailers of the type discussed above by considering a single third-party retailer and focus on the incremental value of RPP relative to individual RPM.

We have studied the effects of RPM in an industry with a vertically integrated firm in previous work (Bisceglia et al., 2026). However, that paper examines a common-agency setting with manufacturer effort and focuses on the incremental effects of backward vertical integration

[3] Other contractual channel-coordination mechanisms include quantity discounts (Ingene and Parry, 1995; Weng, 1995; Raju and Zhang, 2005), consumer price discounts (Gerstner and Hess, 1995; Wierenga and Soethoudt, 2010) or franchise agreements (Lal, 1990; Desai and Srinivasan, 1995).

[4] Modern versions of this argument have been developed in the applied mechanism-design literature, where retailers are better informed than manufacturers about local demand conditions and/or their costs (see, e.g., Gal-Or, 1991; Blair and Lewis, 1994; Martimort and Piccolo, 2007, 2010; Kastl et al., 2011). In these models, manufacturers can better screen retailers, reduce distortions, and improve efficiency by directly controlling retail prices.

[5] Under public contracts, where opportunism is absent, individual RPM achieves full channel coordination even in the presence of retail effort (Mathewson and Winter, 1984) or upstream competition (Rey and Vergé, 2010).

on top of RPM.[6] In contrast, in this paper we take the industry structure as given — whether resulting from the manufacturer's forward integration, encroachment, or decision to distribute also through an independent retailer — and abstract from the competitive and welfare effects of these strategies, which have been widely examined in the literature (see, e.g., Riordan, 2008, for a survey on vertical integration; Arya et al., 2007, and Hotkar and Gilbert, 2021, on manufacturer encroachment; Jullien et al., 2023, on the choice between direct-to-consumer model and dual distribution).

Finally, because industry-wide RPM in our model imposes a price-parity constraint between direct and intermediated channels, our work relates to the literature on wide price-parity clauses (e.g., Johansen and Vergé, 2017; Hagiu and Wright, 2024, Gomes and Mantovani, 2025). These papers study sellers that distribute through digital platforms and operate under an agency model (i.e., sellers retain pricing discretion while platforms levy sales commissions). In wholesale-distribution models — as the model that we consider in this paper — prior work has instead focused, among other aspects, on constraints on the ability to discriminate through input prices — i.e., on wholesale price-parity provisions (see, e.g., O'Brien and Shaffer, 1994; Arya et al., 2008; Inderst and Shaffer, 2009; Bisceglia et al., 2021).

Outline. The remainder of the paper is organized as follows. Section 2 demonstrates the commitment value of RPP in a simple setting, where the independent retailer is the only firm to choose noncontractible effort levels (from a binary support). Section 3 generalizes the analysis by allowing both the integrated and the independent retailer to choose effort levels (from a continuous support). Section 4 shows that the main results of the previous sections, which we derived with two-part tariffs, carry through with linear wholesale contracts. Section 5 concludes.

2 A stylized model

To develop intuition about ex-post opportunism and the commitment value of RPP in the clearest possible way, we begin with a stylized model, which we later extend along several dimensions.

Supply and demand. Consider an industry in which an upstream manufacturer, M, distributes its product through two channels: its own integrated retail division, R_1, and a differentiated independent retailer, R_2. The two retailers compete for consumers and are differentiated along both horizontal (e.g., positioning or format) and vertical (e.g., quality or service level) dimensions, as described below. Each retailer R_i (with $i = 1, 2$) can stimulate demand at its outlet by exerting costly effort, e_i, such as providing customer service, local promotion, or merchandising support. Higher effort increases demand but entails increasing and convex costs, $\psi(e_i)$, which reflect diminishing returns to managerial attention and operational intensity.

[6] Relatedly, Hunold and Muthers (2017) examine the competitive effects of RPM with upstream competition and retail effort, but restrict attention to linear wholesale contracts. For an earlier analysis of RPM in a successive-monopoly model with double moral hazard, see Romano (1994).

Retail effort is nonverifiable and therefore noncontractible. In particular, M cannot directly condition its contract with R_2 on the latter's effort choice, e_2. This contractual friction creates a standard incentive problem: while retail effort enhances overall channel performance, R_2's incentives to exert effort may not be fully aligned with the manufacturer's objectives.

Consumer demand at retailer R_i is denoted by $q_i(p_i, p_{-i}, e_i, e_{-i})$, with p_i denoting the retail price at R_i. For simplicity, the demand function is symmetric and additively separable between prices and efforts.[7] Moreover, as is standard, we assume that demand is continuous and twice differentiable, with $q_i(\cdot)$ being decreasing in p_i, increasing in p_{-i} and e_i, and such that own effects dominate cross effects. Industry profits, gross of effort costs, are thus given by:

$$\Pi(p_1, p_2, e_1, e_2) \equiv \sum_{i=1,2} (p_i - c)\, q_i(\cdot),$$

where $c \geq 0$ denotes the manufacturing marginal cost. We assume that $\Pi(\cdot)$ is concave in (p_1, p_2) for any (e_1, e_2).

Wholesale contract. M and R_2 engage in generalized Nash bargaining over a two-part tariff distribution contract consisting of a fixed fee F and a wholesale price w (Section 4 considers linear wholesale contracts). The contract includes an individual resale price maintenance (RPM) clause that pins down p_2 (with sufficiently large penalties for deviations), and may also include a retail price parity (RPP) clause — that is, a commitment by M to set $p_1 = p_2$ for sales made through its direct channel.

Notice that, under individual RPM, the parties can always replicate the profit obtained when granting R_2 full pricing discretion (price delegation) by directly setting the retail price that R_2 would choose if given autonomy to do so. Moreover, as we show below, under RPM p_2 is set to maximize industry profits, unlike under price delegation, implying that RPM is strictly profitable. Consistent with this observation, RPM or similar clauses are observed in most sectors for branded consumer goods. Therefore, in what follows, we take as granted that the distribution contract includes an RPM clause and focus on the profitability and welfare implications of additionally imposing RPP.[8]

Assumptions. In the baseline model of this section, we assume the following: (i) effort is binary, $e_i \in \{e_\ell, e_h\}$ with $e_h > e_\ell \geq 0$, $\psi(e_\ell) = 0$, and $\psi(e_h) \equiv \psi > 0$, and (ii) the integrated retailer's effort is exogenously fixed at $e_1 = e_h$ (e.g., the integrated entity has already sunk its

[7] We discuss the implications of symmetry at the end of Section 2.2. The assumption of additive separability, i.e.,

$$q_i(\cdot) = d_p(p_i, p_{-i}) + d_e(e_i, e_{-i}),$$

ensures the existence and uniqueness of equilibrium. This assumption holds in the linear demand specifications that we adopt later in the paper to prove possibility results.

[8] Notice also that an RPP clause is well defined only when the price charged by the independent retailer is contractually specified in advance. If instead the retailer had full pricing discretion, it would be nearly impossible for the manufacturer to monitor and match every price change, making a parity commitment practically unenforceable. Moreover, under price delegation such a commitment would grant the independent retailer excessive power over the manufacturer's pricing decisions.

effort cost prior to contracting with the independent retailer). Section 3 below generalizes the analysis by allowing both retailers to choose their effort levels from continuous supports.

In this setting, industry profits are maximized when also the independent retailer exerts high effort ($e_2 = e_h$) if and only if

$$\psi \leq \psi^M \equiv \Pi(p_h^M, p_h^M, e_h, e_h) - \Pi(p_{1\ell}^M, p_{2\ell}^M, e_h, e_\ell), \tag{1}$$

with $\psi^M > 0$ because R_2's effort increases industry demand $(q_1 + q_2)$, where p_h^M denotes the industry monopoly price — i.e., the symmetric maximizer of $\Pi(\cdot)$ — when $e_2 = e_h$, and $p_{i\ell}^M$ the industry monopoly price of product $i = 1, 2$ when $e_2 = e_\ell$ and so products are vertically differentiated.

Timing and solution concept. The timing of the game is as follows:

$t = 1$ M and R_2 bargain over the contract (F, w, p_2). We consider both the case in which the contract does not include an RPP clause ($p_1 = p_2$) and the case in which it does.

$t = 2$ R_2 chooses e_2 and, absent RPP, M sets p_1.

Consumers then observe prices and effort levels, demand is realized, and payments and profits are made.

Since the contract selected at $t = 1$ is common knowledge among firms at $t = 2$, the resulting game is one of complete information and the solution concept is Subgame Perfect Nash Equilibrium.[9]

2.1 Ex-post opportunism without RPP

Suppose that M controls p_2 through individual RPM but does not commit to RPP. At $t = 2$, given its distribution contract (w, p_2), R_2 chooses $e_2^*(w, p_2) = e_h$ if and only if it earns a sufficiently large margin on its sales, i.e.,

$$p_2 - w \geq \frac{\psi}{\Delta} > 0, \tag{2}$$

where

$$\Delta \equiv q_2(p_2, p_1, e_h, e_h) - q_2(p_2, p_1, e_\ell, e_h) > 0$$

is the incremental demand obtained by R_2 when it chooses high effort, holding prices fixed (and given that $e_1 = e_h$). Since demand is separable in prices and effort, Δ is constant — i.e., it does not depend on retail prices.

[9] If the model had multiple independent retailers, under secret contracts M would face the standard opportunism problem when contracting with such retailers, as in Gabrielsen and Johansen (2017). Considering a single independent retailer allows us to abstract from these issues and isolate the novel effects of RPP in dual distribution systems.

Simultaneously, the integrated retailer R_1 chooses its retail price p_1 by solving

$$\max_{p_1 \geq 0} (p_1 - c)q_1(\cdot) + (w - c)q_2(\cdot).$$

If R_2 earns a positive margin — i.e., $p_2 > w$ — R_1's pricing problem at $t = 2$ departs from industry profit maximization because it does not internalize the variable profit, $(p_2 - w)q_2(\cdot)$, earned by the independent retailer. The first-order condition of this problem, which pins down M's optimal price $p_1^* (w, p_2, e_2)$, is

$$\underbrace{q_1(\cdot) + (p_1^* - c)\frac{\partial q_1(\cdot)}{\partial p_1} + (p_2 - c)\frac{\partial q_2(\cdot)}{\partial p_1}}_{= \frac{\partial \Pi (\cdot)}{\partial p_1}} - (p_2 - w) \frac{\partial q_2(\cdot)}{\partial p_1} = 0. \tag{3}$$

Because $q_2 (\cdot)$ is increasing in p_1, the last term implies that, given the contract and the rival's effort, the integrated retailer sets a lower price than the industry-profit-maximizing one whenever R_2's margin is strictly positive: an *ex-post opportunism problem.*

Moving backward to the contracting stage ($t = 1$), generalized Nash bargaining over a two-part tariff with RPM implies that M and R_2 choose w and p_2 to maximize their joint bilateral profit, which coincides with industry profits:[10]

$$\max_{p_2 \geq w \geq 0} \Pi \left(p_1^* \left(w, p_2, e_2^* \left(w, p_2\right)\right), p_2, e_h, e_2^* \left(w, p_2\right)\right) - \psi \left(e_2^* \left(w, p_2\right)\right). \tag{4}$$

Since (3) implies that the integrated retailer's pricing behavior is closer to maximizing industry profits the smaller $p_2 - w$, it is optimal to grant R_2 the smallest margin compatible with the effort level that firms want to implement.

Hence, if the parties do not find it profitable to induce high effort by R_2, they optimally set $w_\ell^*(p_2) = p_2$, which, as explained above, completely eliminates ex-post opportunism in the choice of p_1. Then, since both p_2 at the contracting stage and p_1 ex post are chosen to maximize industry profit conditional on $e_2 = e_\ell$, we have monopoly pricing — i.e., $p_{i\ell}^* = p_{i\ell}^M$ for $i = 1, 2$ — yielding industry profits $\Pi \left(p_{1\ell}^M, p_{2\ell}^M, e_h, e_\ell\right)$. This solution, however, does not implement the industry monopoly outcome if industry profits are maximized for $e_2 = e_h$ — i.e., if $\psi < \psi^M$, where ψ^M is defined in (1).

Moving to the case in which the parties implement $e_2 = e_h$, R_2's incentive-compatibility condition in (2) implies that the optimal contract that induces a high level of effort is such that

$$w_h^*(p_2) = p_2 - \frac{\psi}{\Delta} < p_2, \tag{5}$$

[10] The resulting profit is split through the fixed fee based on the parties' bargaining weights and outside options; R_2's outside option equals zero, and the integrated firm's outside option equals its standalone monopoly profit, which is lower than the industry monopoly profit due to product differentiation.

and the optimal p_2 solves

$$\max_{p_2} \Pi \left(p_1^* \left(w_h^*(p_2), p_2, e_h\right), p_2, e_h, e_h\right).$$

Because $p_2 > w_h^*(p_2)$, ex-post opportunism implies that it is never possible to fully maximize industry profits conditional on $e_2 = e_h$: if p_2 were set at the industry monopoly level p_h^M, the integrated retailer would have ex-post incentives to set $p_1 < p_h^M$.

Denoting by p_{ih}^* the equilibrium prices at retail unit $i = 1, 2$ if $e_2 = e_h$, the parties choose to implement high effort at R_2 if and only if[11]

$$\psi \leq \psi^* \equiv \Pi \left(p_{1h}^*, p_{2h}^*, e_h, e_h\right) - \Pi \left(p_{1\ell}^M, p_{2\ell}^M, e_h, e_\ell\right),$$

with $\psi^* < \psi^M$ because ex-post opportunism implies that

$$\Pi \left(p_{1h}^*, p_{2h}^*, e_h, e_h\right) < \Pi \left(p_h^M, p_h^M, e_h, e_h\right).$$

The following then holds.

Proposition 1. *In the equilibrium without RPP:*

1. *For $\psi \leq \psi^*$, the contract grants R_2 a gross margin*

$$p_{2h}^* - w_h^* = \frac{\psi}{\Delta} > 0,$$

so that R_2 exerts high effort ($e_2^* = e_h$). Equilibrium prices are such that $p_{1h}^* < p_{2h}^*$, which implies that industry profits fall short of the monopoly level.

2. *For $\psi > \psi^*$, the contract grants R_2 a zero gross margin ($p_{2\ell}^* = w_\ell^*$) and implements low effort ($e_2^* = e_\ell$). Equilibrium prices maximize industry profits conditional on $e_2 = e_\ell$ ($p_{i\ell}^* = p_{i\ell}^M$ for $i = 1, 2$). Since, for all $\psi \in (\psi^*, \psi^M)$, industry profits are maximized at $e_2 = e_h$, the downward effort distortion implies that industry profits fall short of the monopoly level.*

When effort costs are low ($\psi \leq \psi^*$), M and R_2 agree on a contract that induces $e_2 = e_h$ by granting R_2 a positive margin. Because of this, at $t = 2$, M shifts sales toward its own outlet by undercutting the independent retailer — i.e., $p_{1h}^* < p_{2h}^*$. This ex-post opportunism distorts the retail prices away from the monopoly outcome, thereby reducing industry profits.

Because the margin required to induce high effort at R_2, and hence the severity of ex-post opportunism, is increasing in the cost of effort, sufficiently high effort costs dissuade firms from implementing $e_2 = e_h$, even though such an effort level would arise in the industry monopoly outcome. In this region of parameters ($\psi^* < \psi < \psi^M$), the profit loss arises from an effort

[11] More precisely, since prices p_{ih}^* depend on ψ through R_2's margin, ψ^* is the (unique and positive) solution of $\psi = \Pi \left(p_{1h}^*, p_{2h}^*, e_h, e_h\right) - \Pi \left(p_{1\ell}^M, p_{2\ell}^M, e_h, e_\ell\right)$ (see the Appendix).

distortion rather than a pricing distortion: $e_2 = e_\ell$ can in fact be implemented without granting a positive margin to R_2, which eliminates ex-post opportunism in the choice of p_1.

These inefficiencies create room for additional contractual restraints that can eliminate, or at least mitigate, the ex-post opportunism problem and increase industry profits.

2.2 The commitment value of RPP

We now characterize the equilibrium when, in addition to specifying p_2 through RPM, M can also commit to retail price parity — i.e., to $p_1 = p_2 \equiv p$. Since both retail prices are now set at $t = 1$, the only decision at $t = 2$ is R_2's choice of e_2, which still follows condition (2). At $t = 1$, the bargaining parties maximize industry profits, subject to $e_2 = e_2^* (w, p)$ and the price-equality constraint imposed by RPP:

$$\max_{p \geq w \geq 0} \Pi (p, p, e_h, e_2^* (w, p)) - \psi (e_2^* (w, p)) . \tag{6}$$

Whenever the industry monopoly outcome requires $e_2 = e_h$, firms can achieve this outcome by adopting an RPP clause. Specifically, they can use RPM and RPP to specify contractually the symmetric monopoly price, $p = p_h^M$, at both retailers, and provide proper effort incentives to R_2 by setting $w = w_h^*(p_h^M)$, with $w_h^*(\cdot)$ defined in (5). Since the integrated firm does not control any noncontractible variable that would allow it to steer sales toward its retail unit and reduce R_2's variable profit after the contract has been signed, these vertical restraints always implement the industry monopoly outcome.

Proposition 2. *Commitment to RPP implements the industry monopoly outcome, thus strictly increasing industry profits relative to the equilibrium without RPP, for all $\psi < \psi^M$.*

By preventing the ex-post opportunism problem that would arise when firms seek to induce $e_2 = e_h$, RPP eliminates both the inefficiencies identified in Proposition 1, enabling the industry to attain the profit-maximizing outcome.

In this simple model, RPP fully solves the opportunism problem for two reasons. First, R_1's effort level is pre-committed at the efficient level. Therefore, once the contract has been signed, the retail price p_1 is the only instrument the integrated firm can use to shift demand toward its own channel, and RPP removes its ability to manipulate this instrument. Second, conditional on both firms exerting the same effort level, demand (and thus the industry monopoly price) is symmetric across retail units.[12] As a result, a restraint that sets equal prices across retailers is consistent with industry-profit maximization. If demand were asymmetric, RPP would impose a uniform price in an asymmetric environment and might not be profitable. As we shall see in Section 3, even with a symmetric demand system, if the integrated firm could vary its effort level to redirect sales to its own outlet, the two outlets would become endogenously vertically differentiated, and RPP would entail the downside just described.

[12]Under the assumptions that e_1 is pre-committed at the industry monopoly level and demand is symmetric, restricting attention to binary effort levels is immaterial for the results of Proposition 2.

2.3 Welfare effects of RPP

As we have shown above, RPP can sustain higher effort by R_2, which, all else equal, increases consumer surplus. However, since RPP also tends to increase prices, the net effect of RPP on consumer welfare depends on the structure of demand.

To explore this trade-off, we consider a specification of consumer preferences à la Singh and Vives (1984):

$$U(\cdot) \equiv \sum_{i=1,2} q_i - \frac{1}{2} \sum_{i=1,2} q_i^2 - \gamma q_1 q_2 - \sum_{i=1,2} \rho_i q_i, \tag{7}$$

which yields the following linear demand system:

$$q_i(\cdot) \equiv \frac{1-\gamma-\rho_i+\gamma\rho_{-i}}{1-\gamma^2}, \quad \forall i = 1,2, \tag{8}$$

where

$$\rho_i \equiv p_i - \alpha e_i \tag{9}$$

denotes the quality-adjusted price at R_i, with $\alpha > 0$ capturing the importance of retail effort and $\gamma \in (0,1)$ measuring the degree of substitutability between retailers.[13] Within this setting, the following holds.[14]

Proposition 3. *Commitment to RPP may benefit consumers. Under the linear demand system in (8)–(9), RPP increases consumer welfare if it induces the independent retailer to exert high effort — i.e., for all $\psi \in (\psi^*, \psi^M)$.*

For $\psi \leq \psi^*$, R_2 exerts high effort irrespective of whether RPP is in place. Therefore, the effects of RPP on consumer welfare solely depend on how it affects equilibrium prices. Absent RPP, when choosing p_2 at $t = 1$, firms take into account how the integrated firm will choose p_1 at $t = 2$. In particular, they know that the absence of commitment will induce the integrated firm to choose a p_1 that is too low from the standpoint of industry profit maximization. This affects the choice of p_2 as follows. On the one hand, provided that prices are strategic complements, at the contracting stage firms may optimally raise p_2 above the industry monopoly level, so as to soften the integrated retailer's ex-post incentive to set a too low p_1. On the other hand, the fact that p_1 will anyhow be lower than in the industry monopoly causes the residual demand curve at R_2 to shift inward, which, all else equal, calls for a lower p_2. Under the linear demand system in (8)–(9), these two effects exactly offset each other, yielding $p_2^* = p_h^M$. Ex-post opportunism by the integrated retailer then implies $p_1^* < p_2^* = p_h^M$. Against this starting point, RPP raises p_1 from p_1^* to p_h^M and leaves p_2 unchanged at $p_{2h}^* = p_h^M$, thus harming consumers.

[13] If $\gamma = 0$, products are independent and the industry monopoly outcome can be implemented via a cost-based two-part tariff without any vertical restraint. Conversely, if $\alpha = 0$, exerting effort is never useful and, as standard, an individual RPM contract with $w = p_2$ set at the monopoly price implements the industry monopoly outcome, making RPP again irrelevant.

[14] We assume $c \leq 1$ and

$$0 \leq e_\ell < e_h < \frac{(1-c)(1-\gamma)+\alpha e_\ell}{\alpha\gamma},$$

which guarantee that both products always have positive demand.

For $\psi \in (\psi^*, \psi^M)$, instead, the adoption of RPP causes e_2 to increase from e_ℓ to e_h in a context where pricing is monopolistic in any case because of the absence of ex-post opportunism (given that R_2's margin is zero when $e_2 = e_\ell$). Since firms cannot perfectly price discriminate vis-à-vis consumers, the additional value of effort generated by RPP can be partially appropriated by consumers. This is always the case with the linear demand system in (8)–(9), implying that RPP benefits consumers whenever it stimulates the independent retailer's effort.

3 A general model with effort at both retailers

In the simple model of Section 2, the retail price in the direct channel, p_1, was the manufacturer's only ex-post instrument to steer demand away from the independent retailer. By committing not to control this instrument through RPP, the manufacturer could fully reassure the independent retailer that it would not undercut it ex post. Once we allow, more realistically, the manufacturer to choose its noncontractible effort endogenously, the reassurance effect of RPP becomes weaker if the integrated retailer can still divert demand away from R_2 by increasing its effort ex post, which also entails vertical differentiation between the retailers' products. Whether RPP remains profitable under endogenous effort provision in the direct sales channel is therefore nontrivial and requires careful analysis.

To explore this issue, suppose that the two retailers simultaneously choose effort levels $e_1, e_2 \in [0, \infty)$ after the contracting stage (together with p_1 at $t = 2$ when RPP is not in place). The rest of the model remains as described in Section 2. To illustrate possibility results, we assume that the demand system takes the linear form in (8), with the quality-adjusted price defined in (9). This specification features negative effort spillovers — i.e., an increase in R_i's effort reduces demand at the rival outlet R_{-i} — implying that retailers compete in effort to attract consumers, which, as explained above, undermines the commitment value of RPP (Section 3.4 discusses the robustness of our insights to alternative demand specifications). Moreover, we consider a quadratic specification for the effort cost function,

$$\psi(e_i) \equiv \frac{e_i^2}{2}, \quad \forall i = 1, 2, \tag{10}$$

normalize $c = 0$, and assume

$$\alpha \leq \sqrt{2(1-\gamma)},$$

which guarantees concavity of the industry monopoly profit in prices and efforts.[15] The industry monopoly prices, efforts, and quality-adjusted prices are denoted by p^M, e^M, and ρ^M, respectively, with $e^M > 0$ because $\psi(0) = \psi'(0) = 0$ and effort increases industry demand.

[15] This restriction is a sufficient condition for all second-order conditions of the optimization problems considered in this section to hold. Intuitively, if α were too high, the model would allow profits to be generated without bound by increasing effort alone. Our results are qualitatively unchanged if we instead conduct the analysis using a marginal-cost parameterization — i.e., define $\psi(e_i) \equiv \psi e_i^2$ and normalize $\alpha = 1$. Intuitively, a higher ψ holding α fixed discourages effort provision in the same way as a lower α holding ψ fixed. The advantage of our formulation is that the second-order conditions impose an upper bound on α, rather than a lower bound on ψ, resulting in a bounded parameter range.

3.1 Ex-post price and effort opportunism without RPP

At $t = 2$, given a contract (w, p_2), R_2 chooses effort e_2 to solve

$$\max_{e_2 \geq 0} \, (p_2 - w) \, q_2(p_2, p_1, e_2, e_1) - \psi(e_2),$$

which yields the first-order condition

$$(p_2 - w) \frac{\partial q_2(\cdot)}{\partial e_2} = \psi'(e_2). \tag{11}$$

Since $\psi'(e_2) > 0$ for all $e_2 > 0$, R_2 exerts strictly positive effort if and only if $p_2 - w > 0$, and its optimal effort increases in $p_2 - w$.

If M controls p_2 through individual RPM but does not commit to RPP, at $t = 2$ the integrated retailer chooses both e_1 and p_1, solving

$$\max_{e_1 \geq 0, p_1 \geq 0} \, (p_1 - c) \, q_1(\cdot) + (w - c) \, q_2(\cdot) - \psi(e_1) \tag{12}$$

The first-order condition with respect to p_1 is again (3), while the first-order condition with respect to e_1 yields

$$\underbrace{\sum_{i=1,2} (p_i - c) \frac{\partial q_i(\cdot)}{\partial e_1}}_{= \frac{\partial \Pi(\cdot)}{\partial e_1}} - (p_2 - w) \underbrace{\frac{\partial q_2(\cdot)}{\partial e_1}}_{(-)} = \psi'(e_1). \tag{13}$$

Therefore, whenever R_2 earns a positive margin, the integrated retailer has incentives to choose both a retail price that is too low (holding e_1 fixed) and retail effort that is too high (holding p_1 fixed) from the perspective of industry profit maximization. Because it earns the full margin $(p_1 - c)$ from direct sales but only the wholesale margin $(w - c)$ from sales intermediated by R_2, the integrated retailer distorts the quality-adjusted price at its own store downward so as to steer demand toward this more profitable channel.

Solving the system of first-order conditions (3), (13) and (11) yields the equilibrium strategies $p_1^*(w, p_2)$ and $e_i^*(w, p_2)$ for $i = 1, 2$. At the bargaining stage, the contracting parties take these strategies as given and choose (w, p_2) to maximize industry profits, which are shared through the fixed fee.

Lemma 1. *Without RPP, the equilibrium does not implement the industry monopoly outcome. With the demand and cost functions in (8)–(10),* $e_1^* > e^M > e_2^* > 0$, $p_2^* < p^M$, *and* $\rho_1^* < \rho^M < \rho_2^*$.

Since $\psi(0) = \psi'(0) = 0$ and industry demand is increasing in e_2, firms find it optimal to induce $e_2 > 0$, which requires granting R_2 a positive margin. As discussed above, this implies that the integrated firm has incentives to steer demand toward its direct sales channel by choosing excessively high effort and low quality-adjusted price in that channel. To mitigate ex-post opportunism, the parties reduce R_2's gross margin by choosing a relatively large wholesale price, which results in excessively low effort and high quality-adjusted price at R_2.

As in the simple model of Section 2, ex-post opportunism prevents the industry from achieving the monopoly outcome. However, here the monetary retail price at R_1 need not be lower than that at R_2. When demand is sufficiently responsive to effort (i.e., $\alpha > \widetilde{\alpha}$ in Figure 1), the higher quality of R_1's product (due to $e_1^* > e_2^*$) allows R_1 to charge a higher monetary price than R_2. Similarly, because $e_1^* > e^M > e_2^*$, R_1's monetary price may be higher than the industry monopoly price, whereas R_2's monetary price is always smaller than p^M.

3.2 Can RPP still mitigate opportunism?

Suppose now that the contract between M and R_2 also includes an RPP clause ($p_1 = p_2 \equiv p$). At the final stage, the independent retailer still sets effort solving first-order condition (11), with $p_2 = p$. Therefore, its optimal effort strategy, $e_2^P(w,p)$, is increasing in the retail margin $p - w$. The integrated retailer maximizes the same objective as in (12) but now only with respect to effort e_1. Solving the first-order condition (13), with $p_1 = p$, yields its effort strategy, $e_1^P(w,p)$, which satisfies $e_1^P(w,p^M) > e^M$ for all $w < p^M$. Therefore, the industry monopoly outcome cannot be implemented even with RPP because the integrated retailer's ex-post opportunism problem in effort provision remains: formally, because R_2 is granted a positive margin to induce $e_2 = e^M > 0$, if the contract specified $p_1 = p_2 = p^M$, the integrated retailer would set $e_1 > e^M$ to steer consumers away from R_2.

At the contracting stage, firms correctly anticipate the best-response effort functions $e_i^P(w,p)$, for $i = 1, 2$, and choose the wholesale and retail price that maximize industry profits.

Lemma 2. *The equilibrium does not implement the industry monopoly outcome even with a commitment to RPP. With the demand and cost functions in (8)–(10):*

- $e_1^P > e^M > e_2^P > 0$, $p^P < p^M$, *and* $\rho_1^P < \rho^M < \rho_2^P$;
- $p^P > p_2^*$, $w^P < w^*$, *and thus* $e_2^P > e_2^*$.

The integrated retailer's ex-post opportunism in effort provision implies that even when the contract includes an RPP clause, effort levels and quality-adjusted prices are still distorted away from the industry monopoly outcome in the same directions as in the scenario without RPP. However, the ability to commit to p_1 through RPP mitigates ex-post opportunism. In particular, it enables firms to set a lower wholesale price ($w^P < w^*$), because once the retail price at R_1 is fixed at the contracting stage, there is no longer a need to reduce R_2's gross margin to as to weaken R_1's ex-post price undercutting incentives. As a result, R_2 earns a higher gross margin, exerts higher effort ($e_2^P > e_2^*$), and sells its product at a higher monetary price ($p^P > p_2^*$). The latter occurs because with RPP consumers have a higher willingness to pay for R_2's product and the common price p^P also applies to the even higher-quality product sold by R_1, as the price-parity constraint implies $e_1^P > e_2^P$.[16] Precisely because the price equality constraint implies

[16]Indeed, comparing the left-hand sides of (11) and (13) shows that, when $p_1 = p_2$, for any additively separable demand function the marginal revenue of effort is strictly higher for the integrated than for the independent retailer for any $w > c$, which must hold in equilibrium (if $w = c$, the two retailers would compete in effort as in a duopoly, inefficiently dissipating profits). Notice that if $p^P > p_1^*$, then, since $w^P < w^*$, (13) implies that $e_1^P > e_1^*$. Yet, it also is possible that firms set $p^P < p_1^*$ so as to induce $e_1^P < e_1^*$.

asymmetric effort levels, hence vertical differentiation between the retailers' products, RPP has ambiguous effects on firms' quality-adjusted prices and, as we shall show in the next section, is not necessarily profitable.

It is worth observing here that the manufacturer's ability to commit at the bargaining stage to an arbitrary value of p_1, different from p_2, would dominate RPP and always increase profits relative to individual RPM. Intuitively, although such a commitment would not fully eliminate the ex-post opportunism problem, since e_1 is still chosen after contracting, it would prevent ex-post price undercutting by the integrated retailer without imposing the same retail price across (endogenously) vertically differentiated outlets.

However, committing to an arbitrary p_1 is substantially more difficult in practice and is thus far less common than RPP. Indeed, in large distribution networks with many competing third-party and in-house outlets, RPP is easier to implement than individual RPM, because the manufacturer only needs to specify a single retail price in each distribution contract. Alternatively, RPP can be (and often is) enforced informally through reputational mechanisms, with deviations risking a breakdown in the business relationship: manufacturers can build a reputation for not undercutting independent retailers, and retailers can offer price-matching guarantees to consumers. Finally, a manufacturer can commit to RPP by advertising a price directly on the product packaging or in its promotional communications: such Manufacturer Suggested Retail Price (MSRP) practices effectively introduce RPP alongside RPM.

3.3 Profitability and welfare effects of RPP

In environments where noncontractible retail effort affects demand, a commitment to RPP entails the following trade-off. On the one hand, RPP mitigates the ex-post opportunism problem by preventing the integrated retailer from using its pricing flexibility to divert sales away from the indirect sales channel. On the other hand, forcing both outlets to charge the same retail price prevents prices from reflecting (and controlling) quality differences across the two channels. The following proposition characterizes the net profitability of RPP.

Proposition 4. *With the demand and cost functions in (8)–(10), the effects of RPP on industry profits are as follows:*

1. *RPP is always profitable if* $p_1^* \leq p_2^*$. *In this case,* $\rho_1^P > \rho_1^*$.
2. *If instead* $p_1^* > p_2^*$, *RPP might be profitable if either (i)* $p^P > p_1^* > p_2^*$, *or (ii)* $p_1^* > p^P > p_2^*$, $e_1^P < e_1^*$, $\rho_1^P > \rho_1^*$, *and* $\rho_2^P < \rho_2^*$.

As in the simple model of Section 2, RPP is profitable when the integrated retailer would otherwise undercut the price agreed upon with R_2 (i.e., when $p_1^* < p_2^*$; case 1 of Proposition 4). That is, a contractual promise not to undercut R_2 (i.e., a promise to charge $p_1 \geq p_2$), is always profitable. As illustrated in Figure 1, in our model $p_1^* < p_2^*$ only if effort has a moderate impact on demand ($\alpha < \widetilde{\alpha}$). In these circumstances, RPP serves as a commitment device to raise monetary prices at both retailers and the quality-adjusted price at the integrated retailer, bringing these variables closer to their industry monopoly values, i.e., $p^M > p^P > p_2^* \geq p_1^*$ and $\rho^M > \rho_1^P > \rho_1^*$.

More surprisingly, in the presence of ex-post effort opportunism, a different type of RPP may be profitable when the integrated retailer would otherwise charge a higher price than the resale price negotiated with R_2 (i.e., when $p_1^* > p_2^*$; case 2 of Proposition 4). That is, a *price-matching guarantee* to consumers, whereby M promises to match any lower price available at R_2 (so that $p_1 \leq p_2$)can be profitable. As illustrated in Figure 1, this occurs through two distinct mechanisms (corresponding to cases 2*(i)* and 2*(ii)* of Proposition 4):

(i) If the importance of effort is intermediate ($\widetilde{\alpha} < \alpha \leq 1$), RPP may still be profitable when it raises both prices, bringing them closer to the monopoly level (i.e., $p^M > p^P > p_1^* > p_2^*$), even though it increases effort at R_1 and has ambiguous effects on both quality-adjusted prices.

(ii) If effort is very important for demand ($\alpha > 1$), the ex-post opportunism problem in effort provision is most severe. Preventing the integrated retailer from setting a higher monetary price relative to R_2 (which implies $p_1^* > p^M > p^P > p_2^*$ in equilibrium) discourages such opportunistic behavior and yields a lower level of e_1 (i.e., $e^M < e_1^P < e_1^*$), which ultimately results in a higher quality-adjusted price at R_1. Therefore, as in case 1, the profitability of RPP here hinges on its ability to move quality-adjusted prices closer to the industry monopoly outcome (i.e., $\rho^M > \rho_1^P > \rho_1^*$ and $\rho^M < \rho_2^P < \rho_2^*$).

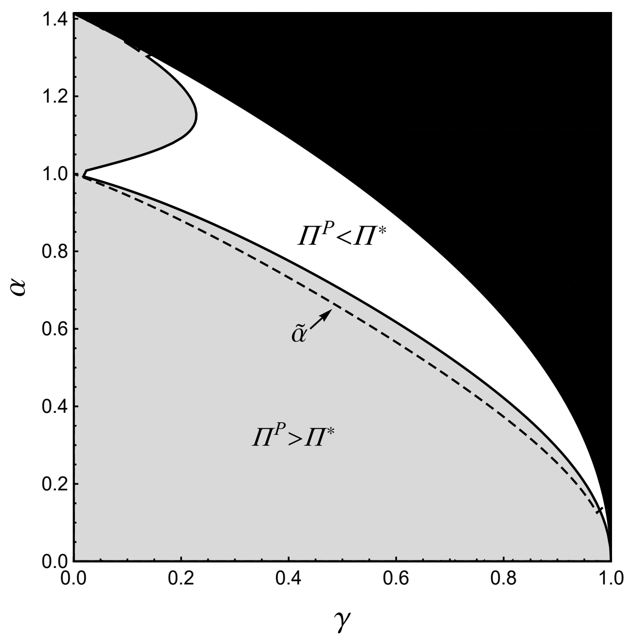

Figure 1: *Profitability of RPP.* Industry profit is higher under RPP in the gray region and lower in the white region. The blackened region represents parameter values that do not satisfy the restriction $\alpha \leq \sqrt{2(1-\gamma)}$. The threshold $\widetilde{\alpha}$ is such that $p_1^* \leq p_2^*$ if and only if $\alpha \leq \widetilde{\alpha}$.

Building on these insights, we can finally analyze the effects of RPP on consumer welfare.

Proposition 5. *A commitment to RPP can simultaneously increase industry profits and enhance consumer welfare. With the demand and cost functions in (8)–(10), this may happen only if* $p^P > p_1^* > p_2^*$*,* $\rho_1^P < \rho_1^*$*, and* $\rho_2^P > \rho_2^*$*. Moreover, RPP may benefit consumers even when it is not profitable for the firms.*

As illustrated in Figure 2, even though here RPP always yields higher effort by R_2, it does not necessarily benefit consumers. Whereas in the simple model of Section 2 there is no ex-post opportunism when firms implement low effort at R_2 (i.e., when $e_2 = e_\ell$), which results in monopoly pricing absent RPP, in the current setting ex-post opportunism is present both with and without RPP and, as discussed above, is more severe without RPP. Since ex-post opportunism tends to lower prices, all else equal the adoption of RPP leads to higher prices, which makes it possible for it to be profitable but harmful to consumers. This always occurs in the regions of profitability 1 and 2*(ii)* in Proposition 4, where RPP serves as a commitment device to raise R_1's quality-adjusted price.

Conversely, RPP is both profitable and consumer-welfare-increasing in a subset of parameters in case 2*(i)*; in particular, when it lowers ρ_1, even though it then raises ρ_2 (otherwise, RPP would not be profitable). Consumers overall benefit in this region because they are eager to substitute toward the more convenient product offered by R_1 when the two retailers' products are sufficiently close substitutes (i.e., when γ is large). This observation also implies that consumers may benefit from RPP even when it is not profitable for firms, provided that it reduces at least one product's quality-adjusted price. Notably, in the parameter region where RPP is both profitable and beneficial to consumers, it leads to higher monetary prices for both products.

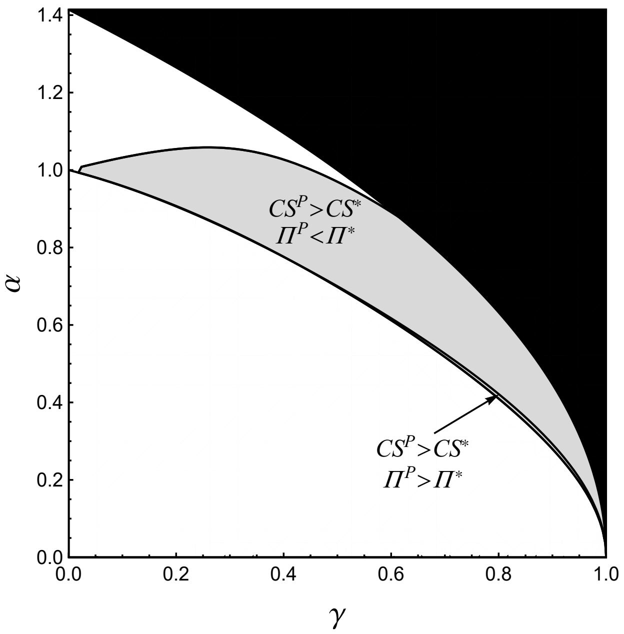

Figure 2: *Consumer welfare effects of RPP.* Consumer welfare is higher under RPP in the gray region and lower in the white region.

3.4 Alternative demand specifications

We conclude this section by discussing the robustness of our insights to alternative demand specifications.[17] In particular, we first allow R_1 and R_2's noncontractible efforts to have different effects on consumer demand, and then allow each retailer's effort to increase, instead of decreasing, demand at the other retailer, so that effort becomes a public good.

Asymmetric returns from effort. So far, we have assumed that the efforts of both retailers have the same effect on demand, captured by α. However, the efforts of the two retailers play very different roles in our model. The greater the impact of the third-party retailer's effort (e_2) on demand, the more valuable RPP becomes. This is because, when e_2 is more valuable, M grants higher gross margins to R_2 and has thus greater ex-post incentives to behave opportunistically, which magnifies the commitment value of RPP. By contrast, the greater the impact of the direct sales channel's effort (e_1) on demand, the easier it becomes for M to circumvent RPP by increasing e_1, thereby weakening the commitment value of RPP. In the fully symmetric model studied above, the latter effect tends to dominate, and so, as shown in Figure 1, RPP is more profitable for low values of α.

A simple way to highlight the asymmetric roles of effort at R_1 and R_2 is to represent the effect of each R_i's effort on demand with a coefficient α_i, with $\alpha_1 \neq \alpha_2$. In particular, suppose that R_i's demand has the same form as in (8), but now the quality-adjusted price at R_i is

$$\rho_i \equiv p_i - \alpha_i e_i.$$

Because $\partial[q_1 + q_2]/\partial e_2 = \alpha_2/(1+\gamma)$, R_2's effort is more valuable from an industry profit maximization viewpoint when α_2 is larger. Mitigating ex-post opportunism (which dampens this effort provision) through RPP is thus more likely to increase industry profits when α_2 is larger. Conversely, since $\partial q_1/\partial e_1 = \alpha_1/(1-\gamma^2)$ and $\partial q_2/\partial e_1 = -\gamma\alpha_1/(1-\gamma^2)$, when α_1 is larger the integrated retailer can more easily divert demand from R_2 by increasing its effort. Since RPP only constrains monetary prices, it cannot prevent such effort opportunism and is thus less likely to be profitable when α_1 is larger. Overall, as illustrated in Figure 3 below, RPP is thus more likely to be profitable when $\alpha_2 > \alpha_1$, provided that α_2 is not excessively large relative to α_1, because in that case the model would become very asymmetric and the inefficiency of imposing equal retail prices would dominate.

Effort as a public good. In the demand specification considered so far, $\partial q_2/\partial e_1 < 0$, implying that the integrated retailer steals demand from the third-party retailer at $t = 2$ by increasing its effort level and selling a vertically differentiated product. This type of competition through effort arises, for instance, in cases where a better customer experience at R_1 induces some consumers that would otherwise prefer buying at R_2 to purchase instead from R_1. However, in certain cases, the effort exerted by a retailer may boost the demand for the manufacturer's product at

[17] It is worth mentioning that a linear demand system à la Shubik and Levitan (1980), as in Gabrielsen and Johansen (2017), would yield the same qualitative results as the linear demand system à la Singh and Vives (1984) that we consider throughout.

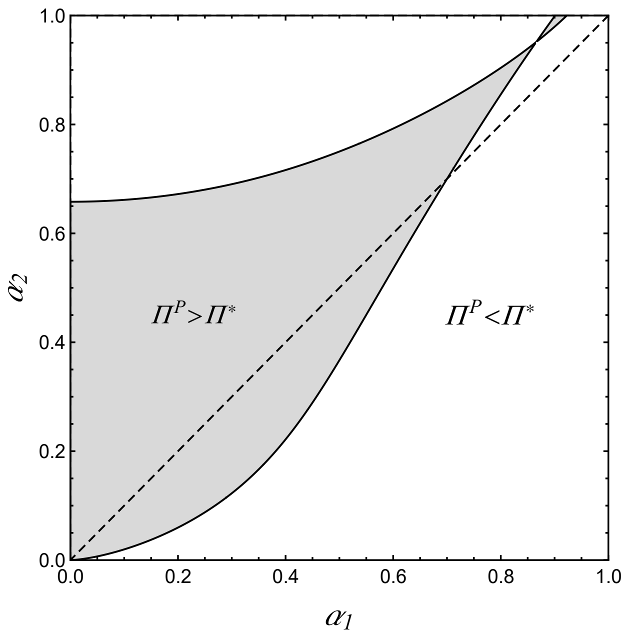

Figure 3: *Profitability of RPP with asymmetric returns from effort*; $\gamma = 0.5$.

all sales points. This is, for example, the case for activities that increase consumers' awareness and appreciation of the product, such as marketing campaigns or "show-rooming" phenomena, whereby a consumer examines the product at one retailer but subsequently purchases it from another. In these circumstances, retail effort is a public good, which both retailers have incentives to under-supply after the contracting stage. RPP can then be used to enhance the efficiency of effort provision but, by preventing ex-post price-undercutting by R_1, it can harm consumers.

Proposition 6. *When effort is a perfect public good — i.e., demand at each R_i is increasing in aggregate effort:*

$$q_i(\cdot) = q(p_i, p_{-i}, e_1 + e_2),$$

RPP is always profitable. However, under the linear demand specification in (8) with quality-adjusted prices

$$\rho_i \equiv p_i - \alpha(e_1 + e_2)$$

and the cost function in (10),[18] *RPP reduces consumer surplus for all admissible parameter values.*

When effort is a perfect public good, the products sold at the two retailers are not vertically differentiated for any effort profile, since each outlet benefits equally from both retailers' efforts. In this setting, an efficient contract stipulates a cost-based two-part tariff ($w = c$) and a uniform retail price ($p_1 = p_2 \equiv p$). This ensures that both retailers have symmetric objectives and therefore choose the same effort level in period $t = 2$, which minimizes aggregate effort-provision costs for any given total effort, e_1+e_2.[19] Given symmetry in optimal prices, imposing equal retail

[18] We assume $\alpha \leq \sqrt{(1+\gamma)/2}$ in order for all second-order conditions to hold.

[19] By contrast, under negative effort spillovers, a cost-based two-part tariff is not optimal because it induces

prices through RPP does not generate any distortions. Consequently, RPP is always profitable and increases both monetary prices and effort levels. However, under our linear?quadratic specification, the consumer loss from eliminating price competition outweighs the benefits of higher effort provision, so RPP ultimately reduces consumer welfare.

4 Linear contracts

This section considers the same model as in Section 3 under the assumption that M cannot levy a fixed fee and is thus constrained to offer a linear wholesale contract. Once again, a straightforward replication argument implies that M always finds it optimal to include an individual RPM clause in its contract with R_2. We therefore suppose that M makes a take-it-or-leave-it offer (w, p_2) to R_2. We first consider the case in which M does not commit to RPP and then the case in which it does so. The rest of the model is as in Section 3, with the formal results stated for the demand and cost functions in (8)–(10) and $c = 0$.

4.1 Double marginalization and opportunism without RPP

For any contract signed at $t = 1$, the subgame at $t = 2$ remains the same as under two-part tariffs. Suppose that M does not commit to RPP. Then, at $t = 1$, it solves

$$\max_{p_2 \geq w \geq 0} [p_1^*(\cdot) - c] q_1(p_1^*(\cdot), p_2, e_1^*(\cdot), e_2^*(\cdot)) + (w - c) q_2(p_2, p_1^*(\cdot), e_2^*(\cdot), e_1^*(\cdot)) - \psi(e_1^*(\cdot)), \tag{14}$$

subject to R_2's participation constraint

$$(p_2 - w)\, q_2(p_2, p_1^*(\cdot), e_2^*(\cdot), e_1^*(\cdot)) - \psi(e_2^*(\cdot)) \geq 0, \tag{15}$$

where the best-response price and effort functions, $p_1^*(w, p_2)$, and $e_i^*(w, p_2)$ for $i = 1, 2$, are the same as in Section 3.1. As in our baseline analysis, granting R_2 a positive margin $(p_2 - w)$ is needed to induce its effort, but this distorts the objective of the integrated retailer away from industry profit maximization.

The main difference relative to the previous section is that, whereas with two-part tariffs M could use the fixed fee to extract R_2's profits and was thus free to choose the wholesale price to control R_2's effort, with linear pricing this is no longer possible: The wholesale price is the only instrument the manufacturer has to achieve the two contrasting objectives mentioned above, i.e., extracting profits from R_2 (which can only be done by increasing w) and controlling R_2's effort (with a lower w inducing a higher e_2). This introduces another source of inefficiency, implying that, contrary to the case with two-part tariffs, individual RPM is no longer sufficient to achieve the industry monopoly outcome even when there is no intrabrand competition and thus no ex-post opportunism (i.e., even for $\gamma = 0$). This is because M either implements the efficient effort level ($e_2 > 0$) by setting $p_2 > w$ and so generates double marginalization, or it

excessive effort from the standpoint of industry profit maximization; in that case, the manufacturer sets $w > c$, which leads to $e_1 > e_2$ and hence vertical differentiation between the two outlets, creating a downside for RPP.

avoids double marginalization by setting $p_2 = w$ and so forgoes R_2's effort provision ($e_2 = 0$).

A second potential difference relative to the analysis in Section 3 is that, if R_2's participation constraint in (15) is slack, M solves the same profit maximization problem at $t = 1$ and $t = 2$ and so there is no ex-post opportunism. Ex-post opportunism is, however, present if R_2's participation constraint binds and $e_2 > 0$, because in this case M maximizes industry profits when offering the contract at $t = 1$ but considers only its own wholesale margin on R_2's sales when choosing p_1 at $t = 2$.[20] The interplay between double marginalization and ex-post opportunism yields the following results.

Lemma 3. *With linear wholesale contracts and the demand and cost functions in (8)–(10), the unique equilibrium without RPP is such that R_2's participation constraint (15) always binds. Moreover:*

- $e_2^* = 0$ *if and only if* $\alpha < \sqrt{1-\gamma^2}$, *otherwise* $e_2^* > 0$;
- $e_1^* > e_2^*$ *and* $\rho_1^* < \rho_2^*$ *for all admissible parameter values.*

R_2's participation constraint is always binding in equilibrium. If effort is relatively unimportant for demand, M sets $p_2^* = w^*$, and so $e_2^* = 0$. Otherwise, M finds it optimal to choose $p_2^* > w^*$ such that the effort level $e_2^* > 0$ it induces makes (15) binding. The latter case features full extraction of R_2's profits by M and thus, as explained above, both double marginalization and ex-post opportunism.

In both circumstances, M has incentives to steer sales towards its direct channel, R_1, by exerting more effort and implementing a lower quality-adjusted price relative to R_2. This is the case for two reasons. First, regardless of whether M implements positive effort at R_2, it does not face the trade-off between effort incentives and double marginalization in its direct sales channel. Second, when M implements $e_2^* > 0$, since (15) binds, the same ex-post opportunism problem arising under two-part tariffs resurfaces.

4.2 RPP as an imperfect commitment device

Suppose now that the manufacturer commits to RPP ($p_1 = p_2 \equiv p$). Then, at the contracting stage it solves

$$\max_{p \geq w \geq 0} (p-c)q_1(p,p,e_1^P(\cdot),e_2^P(\cdot)) + (w-c)q_2(p,p,e_2^P(\cdot),e_1^P(\cdot)) - \psi(e_1^P(\cdot)), \tag{16}$$

subject to R_2's participation constraint

$$(p-w)\,q_2(p,p,e_2^P(\cdot),e_1^P(\cdot)) - \psi(e_2^P(\cdot)) \geq 0, \tag{17}$$

where $e_i^P(w,p)$, for $i = 1,2$, are the best-response effort functions characterized in Section 3.2. The equilibrium resulting from this profit maximization problem has the following features.

[20] This cannot be the case in the simple model of Section 2 because in that model R_2's participation constraint is never binding when M implements high effort ($e_2 = e_h$). Accordingly, in a binary-effort model with linear contracts there is no ex-post opportunism and so RPP is never profitable.

Lemma 4. *In the equilibrium with linear wholesale contracts and RPP, with the demand and cost functions in (8)–(10):*

- $e_2^P = 0$ *if and only if* $\alpha \leq \sqrt{\frac{2(1-\gamma^2)}{\gamma+3}} < \sqrt{1-\gamma^2}$, *otherwise* $e_2^P > 0$;
- $e_1^P > e_2^P$ *and so* $\rho_1^P < \rho_2^P$ *for all admissible parameter values.*

Unlike in the case with individual RPM discussed above, in the equilibrium with RPP R_2's participation constraint is not necessarily binding. Specifically, if the solution to the system of first-order conditions of the unconstrained problem in (16) satisfies R_2's participation constraint in (17), it constitutes the equilibrium contract with RPP; otherwise, R_2's participation constraint is binding. Intuitively, when faced with the price-equality constraint, M may prefer to leave a positive profit to R_2 rather than distort effort incentives too much.

In the case where R_2's participation constraint binds, also with RPP M finds it too costly to implement $e_2 > 0$ and so gives up on the independent retailer's effort when α is sufficiently low. However, for intermediate levels of α, the equilibrium features positive R_2's effort if and only if RPP is employed. This is because, by reassuring the independent retailer that it will not be undercut, RPP increases the quantity R_2 expects to sell. Then, a lower unit margin is enough to cover R_2's optimal effort cost, which makes inducing its effort less costly.

4.3 Profitability and welfare effects of RPP

As with two-part tariffs, also with linear wholesale contracts RPP entails both benefits and costs for M. The benefits again arise from the mitigation of ex-post opportunism. By reassuring R_2 that it will not be undercut ex post, RPP makes R_2 more willing to accept a lower margin, thereby relaxing its participation constraint. When this constraint is binding both without and with RPP, M gains additional room for manoeuvre in extracting profits through the wholesale price and/or implementing higher levels of R_2's effort. In other words, RPP shifts outward the possibility frontier of the feasible combinations of w and e_2 that M can achieve. The downside of RPP, namely that it imposes a price-equality constraint on vertically differentiated products, is magnified here, since diverting sales toward the direct channel by setting $p_1 < p_2$ is efficient due to the presence of double marginalization in the indirect channel. This notwithstanding, RPP may still be profitable.

Proposition 7. *Under the demand and cost functions in (8)–(10), with linear wholesale contracts, RPP can be profitable only if R_2 exerts positive effort even without RPP ($e_2^* > 0$) and its participation constraint binds both with and without RPP. Moreover, there exist values of parameters for which RPP is both profitable and beneficial to consumers.*

If M is unwilling to induce R_2's effort absent RPP, it prefers to channel more sales through its direct outlet, where effort provision is more efficient because there is no double-marginalization distortion. In this region of parameters, imposing a price-equality constraint is therefore not profitable. If instead α is sufficiently large so that M does elicit R_2's effort absent RPP, then RPP becomes profitable if and only if γ takes intermediate values.

As in the model of Section 3, when R_2 does not provide valuable differentiation (i.e., γ is relatively large), M can efficiently serve most consumers through its direct channel, and RPP limits its ability to do so. The reason why, unlike with two-part tariffs, RPP is also unprofitable when γ is small relates to double marginalization. As under two-part tariffs, when retailers are highly differentiated the reassurance effect of RPP is limited because the independent retailer is not worried about losing sales to the integrated firm. However, in the present setting, efficient effort provision by R_2 requires an inefficiently high retail price due to double marginalization, and avoiding RPP allows M to profitably set a lower quality-adjusted price in its direct channel. Finally, when RPP is used to incentivize higher effort by R_2, it may also benefit consumers.

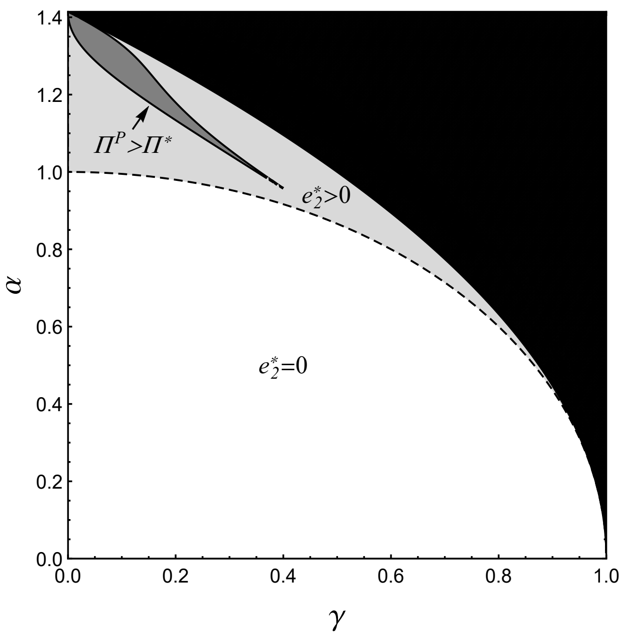

Figure 4: *Profitability of RPP with linear wholesale contracts.* The manufacturer's profit is higher under RPP in the dark gray region. The profitability region is a subset of the light gray region, $\alpha > \sqrt{1-\gamma^2}$, where $e_2^* > 0$ absent RPP.

5 Concluding remarks

This paper has examined why manufacturers operating dual distribution systems frequently commit to retail price parity (RPP) vis-à-vis independent retailers. When retailers undertake actions that are difficult to contract upon — such as pre- and post-sale services, merchandising, and local marketing — manufacturers must grant them positive margins to incentivize effort. To avoid paying these margins on a large volume of sales, manufacturers have an incentive to divert sales to their direct channels, where they capture the full margin. RPP serves as a commitment device that mitigates this ex-post opportunism, strengthening retailers' incentives to invest in demand-enhancing activities and improving the overall efficiency of the distribution system.

Our analysis shows that the profitability of RPP hinges on the value of in-house and third-party effort, the degree of substitutability between channels, and the structure of contracts.

When independent retailers provide valuable differentiation and their effort plays a central role in driving demand, RPP can increase profits by preventing opportunistic undercutting and protecting retailers' incentives. Conversely, when in-house effort is relatively more effective or the double marginalization problem in the indirect channel (arising under linear wholesale contracts) makes third-party effort provision less efficient, manufacturers may optimally retain pricing flexibility and steer most consumers toward their direct channel.

More broadly, our findings contribute to the understanding of channel governance in omnichannel environments. Rather than necessarily reflecting managerial inertia or anticompetitive intent, retail price parity can emerge as a rational and forward-looking strategy to sustain cooperative investment and long-run value creation when important third-party actions are difficult to contract upon. The analysis suggests that pricing policies in dual distribution systems should be evaluated also taking into account their effects on incentives and channel coordination — not solely on prices or margins.

In environments where distribution systems are increasingly integrated, with manufacturers simultaneously competing with and relying upon their retail partners, mechanisms that credibly align incentives become central to channel stability. Retail price parity represents one such simple mechanism.

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Appendix

Proof of Proposition 1. At the contracting stage, the wholesale contract is obtained maximizing the generalized Nash product

$$\max_{F,w,p_2} [\pi_1 + F - \pi_1^0]^\mu \cdot [\pi_2 - F]^{1-\mu},$$

where $\mu \in [0,1]$ (resp. $1-\mu$) is the manufacturer's (resp. R_2's) bargaining weight,

$$\pi_1 = (p_1^*(\cdot) - c)q_1(p_1^*(\cdot), p_2, e_h, e_2^*(\cdot)) + (w-c)q_2(p_2, p_1^*(\cdot), e_2^*(\cdot), e_h),$$

and

$$\pi_2 = (p_2 - w)q_2(p_2, p_1^*(\cdot), e_2^*(\cdot), e_h) - \psi(e_2^*(\cdot)),$$

are the agreement payoffs (with $e_2^*(w,p_2)$ and $p_1^*(w, p_2, e_2^*(w,p_2))$ being the best-response functions in $t=2$ characterized in the text), and $\pi_1^0 = \max_{p_1}(p_1 - c)q_1^0(p_1, e_h)$, with $q_1^0(\cdot)$ denoting consumer demand for R_1's product if it is the only available product, is the integrated firm's disagreement payoff (R_2's outside option from not selling M's product is normalized to zero). Since firms can always replicate the disagreement outcome by setting $p_2 \to \infty$ and inducing no effort at R_2, we can assume without loss of generality that they reach an agreement. Then, taking the first-order condition with respect to F and substituting it back into the above optimization problem implies that (w, p_2) are chosen to maximize $\pi_1 + \pi_2 = \Pi(\cdot) - \psi(e_2^*(\cdot))$, i.e., solve problem (4), and the resulting joint profit is shared through the fixed fee, $F^* = \mu\pi_2 - (1-\mu)[\pi_1 - \pi_1^0]$.

If, at $t=1$, the firms do not want to induce high effort at R_2, they need to write a contract with $w > p_2 - \frac{\psi}{\Delta}$, so that (5) does not hold and so $e_2^*(w,p_2) = e_\ell$. The optimal choice at the bargaining stage in this case is then $w = p_2$, so that (3) implies that, at $t=2$, p_1 is chosen to maximize industry profit. As a result, at $t=1$, M and R_2 choose $p_{2\ell}^* = p_{2\ell}^M$, which implies that $p_{1\ell}^* = p_{1\ell}^M$ and so industry profit equals $\Pi\left(p_{1\ell}^M, p_{2\ell}^M, e_h, e_\ell\right)$.

If instead M and R_2 want to induce high effort at R_2, they optimally do so by writing a contract with $w = w_h^*(p_2)$ defined in (5), as any higher wholesale price would not induce $e_2 = e_h$, and (3) implies that any lower wholesale price distorts the integrated retailer's price decision further away from industry profit maximization. The first-order condition with respect to p_1 in (3) then rewrites as

$$\frac{\partial\Pi\left(p_1, p_2, e_h, e_h\right)}{\partial p_1} - \frac{\psi}{\Delta}\frac{\partial q_2\left(p_2, p_1, e_h, e_h\right)}{\partial p_1} = 0. \tag{18}$$

Since $\partial q_2/\partial p_1 > 0$, the first-order condition with respect to p_2 implies that at equilibrium (i.e., at $p_i = p_{ih}^*$ for $i = 1,2$),

$$\frac{\partial\Pi\left(p_1, p_2, e_h, e_h\right)}{\partial p_2} = 0 < \frac{\partial\Pi\left(p_1, p_2, e_h, e_h\right)}{\partial p_1} = \frac{\psi}{\Delta}\frac{\partial q_2\left(p_2, p_1, e_h, e_h\right)}{\partial p_1},$$

which, because of the symmetry and concavity of Π, implies that $p_{1h}^* < p_{2h}^*$.

Therefore, if firms want to implement $e_2 = e_h$, they achieve profit $\Pi\left(p_{1h}^*, p_{2h}^*, e_h, e_h\right) - \psi$, and so implementing high effort at R_2 is optimal if and only if $\psi \leq \psi^*$, where ψ^* is defined as the solution of $\psi = \Pi\left(p_{1h}^*, p_{2h}^*, e_h, e_h\right) - \Pi\left(p_{1\ell}^M, p_{2\ell}^M, e_h, e_\ell\right)$, given that p_{ih}^* $(i = 1, 2)$ depend on ψ. This fixed point is unique and positive because from (18) it follows that $\Pi\left(p_{1h}^*, p_{2h}^*, e_h, e_h\right)$ is decreasing in ψ and equals the monopoly profit $\Pi\left(p_h^M, p_h^M, e_h, e_h\right)$ (which is larger than $\Pi\left(p_{1\ell}^M, p_{2\ell}^M, e_h, e_\ell\right)$ because effort increases industry demand) at $\psi = 0$.

Since $\Pi\left(p_{1h}^*, p_{2h}^*, e_h, e_h\right) < \Pi\left(p_h^M, p_h^M, e_h, e_h\right)$ because $\Pi\left(p_1, p_2, e_h, e_h\right)$ is uniquely maximized at $p_1 = p_2 = p_h^M$, from the definition of ψ^M in (1) we have that $0 < \psi^* < \psi^M$, because the second terms of ψ^* and ψ^M are equal whereas the first term of ψ^M is larger than the first term of ψ^*.

Summing up, for $\psi \leq \psi^*$, firms implement $e_2 = e_h$ but achieve lower profit than in the industry monopoly outcome because $\Pi\left(p_{1h}^*, p_{2h}^*, e_h, e_h\right) < \Pi\left(p_h^M, p_h^M, e_h, e_h\right)$; for $\psi > \psi^*$, firms implement $e_2 = e_\ell$ and the resulting profit, $\Pi\left(p_{1\ell}^M, p_{2\ell}^M, e_h, e_\ell\right)$ is lower than the industry monopoly profit $\Pi\left(p_h^M, p_h^M, e_h, e_h\right) - \psi$ for all $\psi \in (\psi^*, \psi^M)$. ■

Proof of Proposition 2. For all $\psi < \psi^M$, under RPP $(p_1 = p_2 \equiv p)$ firms can replicate the monopoly outcome (in which $e_2 = e_h$) by setting $p = p_h^M$, i.e., contractually specifying the symmetric monopoly price conditional on $e_2 = e_h$, and $w = w_h^*(p_h^M)$, so as to satisfy (5) and induce $e_2 = e_h$. Since such an outcome yields the maximum achievable industry profits, it solves the maximization problem in (6), which is derived from firms' contracting problem over (F, w, p) by the same steps as in the proof of Proposition 1 above. Moreover, since we have shown in Proposition 1 that the industry monopoly profit cannot be achieved under individual RPM, it follows that the adoption of RPP is strictly profit-increasing for all $\psi < \psi^M$. ■

Proof of Proposition 3. For all $\psi \leq \psi^M$, the industry monopoly outcome, which is implemented in the equilibrium with RPP, features $e_2 = e_h$ and $p_h^M = \frac{1}{2}(1 + c + \alpha e_h)$. The resulting consumer welfare is

$$U^M = \frac{(1 - c + \alpha e_h)^2}{4(1 + \gamma)}.$$

Following the steps outlined in the text, we find that the equilibrium without RPP has the following features:

- For $\psi \leq \psi^*$, $e_i^* = e_h$ for $i = 1, 2$ and we find $p_2^* = p_h^M$, which, from (3), implies that $p_1^* < p_h^M$. Therefore, since both effort levels and p_2 are unchanged but p_1 is higher with RPP, we can conclude that $U^* > U^M$.
- For $\psi \in (\psi^*, \psi^M)$, $p_i^* = p_{i\ell}^M = \frac{1}{2}(1 + c + \alpha e_i)$ for $i = 1, 2$, with $e_1 = e_h$ and $e_2 = e_\ell$, and

$$U^* = U^M + \frac{\alpha(e_h - e_\ell)(2\alpha\gamma e_h - 2(1 - c)(1 - \gamma) - \alpha(e_h + e_\ell))}{8\left(1 - \gamma^2\right)},$$

  where the second summand is always negative under the considered parametric restrictions, and so $U^* < U^M$.

Therefore, RPP has an ambiguous effects on consumer welfare and, under the considered demand specification, it benefits consumers if and only if $\psi \in (\psi^*, \psi^M)$. ■

Proof of Lemma 1. To start with, let us characterize the industry monopoly outcome, which is obtained solving

$$\max_{(e_i,p_i)_{i=1,2}} \sum_{i=1,2} (p_i - c)q_i(p_i, p_{-i}, e_i, e_{-i}) - \psi(e_i).$$

Taking the first-order conditions with respect to efforts and prices implies that e^M and p^M solve

$$(p^M - c)\frac{\partial[q_i(\cdot) + q_{-i}(\cdot)]}{\partial e_i} = \psi'(e^M),$$

and

$$q_i(\cdot) + (p^M - c)\frac{\partial[q_i(\cdot) + q_{-i}(\cdot)]}{\partial p_i} = 0,$$

where quantities are evaluated at $p_i = p^M$ and $e_i = e^M$ for $i = 1, 2$. Notice that $p^M > c$, $\partial[q_i(\cdot) + q_{-i}(\cdot)]/\partial e_i > 0$, and $\psi(0) = \psi'(0) = 0$ imply that $e^M > 0$.

In order for firms to implement the industry monopoly outcome, under individual RPM the contract should specify $p_2 = p^M$ and w such that R_2's optimal effort, obtained from (11), equals e^M. Since $e^M > 0$, (11) implies that $w < p^M$. But then, the first-order conditions of the integrated retailer (3)–(13) imply that $(e_1, p_1) \neq (e^M, p^M)$.

Under the demand and cost specifications in (8)–(10), setting $c = 0$, the monopoly outcome is given by

$$e^M = \frac{\alpha}{2(1+\gamma) - \alpha^2}, \quad \text{and} \quad p^M = \frac{1+\gamma}{2(1+\gamma) - \alpha^2}.$$

As for the equilibrium with individual RPM, solving the system of first-order conditions (11), (13), and (3), we find

$$e_2^*(w, p_2) = \frac{\alpha(p_2 - w)}{1 - \gamma^2}, \quad e_1^*(w, p_2) = \frac{\alpha(1-\gamma)^2(1+\gamma) - \alpha\gamma\left(\alpha^2 + \gamma^2 - 1\right)(p_2 - w)}{\left(1 - \gamma^2\right)\left(2\left(1 - \gamma^2\right) - \alpha^2\right)},$$

and

$$p_1^*(w, p_2) = \frac{(1-\gamma)\left(1+\gamma^2\right) - \gamma\left(\left(\alpha^2 + \gamma^2 - 1\right)p_2 - \left(1 - \gamma^2\right)w\right)}{2\left(1 - \gamma^2\right) - \alpha^2}.$$

Using these functions and maximizing industry profits with respect to w and p_2 then yields the equilibrium contract

$$w^* = \frac{\gamma(1+\gamma)((1-\gamma)^2\gamma(1+\gamma) + 2\alpha^2(1-\gamma) - \alpha^4)}{2\gamma^2(1-\gamma^2)^2 + 4\alpha^2(1-\gamma^2) - 4\alpha^4 + \alpha^6},$$

and

$$p_2^* = w^* + \frac{\alpha^2(2 - 2\gamma - \alpha^2)(1 - \gamma^2)}{2\gamma^2(1-\gamma^2)^2 + 4\alpha^2(1-\gamma^2) - 4\alpha^4 + \alpha^6},$$

It can be checked that for all $\alpha \leq \sqrt{2(1-\gamma)}$, all factors in the expressions for w^* and p_2^* are positive. Hence, $p_2^* > w^* > 0$. Substituting these values back into $p_1^*(\cdot)$ and $e_i^*(\cdot)$ for $i = 1, 2$, yields the other equilibrium values, with

$$p_1^* < p_2^* \quad \Longleftrightarrow \quad \alpha < \widehat{\alpha} \equiv \sqrt{\frac{3 + (1-\gamma)\left(\gamma - \sqrt{\gamma(5\gamma+2)+1}\right)}{2}} \in \left(0, \sqrt{2(1-\gamma)}\right),$$

$$e_1^* - e^M = \frac{\alpha^3\gamma(1-\gamma^2)((2-\alpha^2)^2 - 2\gamma^2 - 2\gamma^4)}{(2-2\gamma^2-\alpha^2)(2(1+\gamma)-\alpha^2)(2\gamma^2(1-\gamma^2)^2 + 4\alpha^2(1-\gamma^2) - 4\alpha^4 + \alpha^6)} > 0,$$

$$e_2^* - e^M = -\frac{2\alpha\gamma^2(1-\gamma^2)^2}{(2(1+\gamma)-\alpha^2)(2\gamma^2(1-\gamma^2)^2 + 4\alpha^2(1-\gamma^2) - 4\alpha^4 + \alpha^6)} < 0,$$

$$\rho_1^* - \rho^M = -\frac{\alpha^2\gamma(1-\gamma^2)^2((2-\alpha^2)^2 - (4-\alpha^2)\gamma^2)}{(2-2\gamma^2-\alpha^2)(2(1+\gamma)-\alpha^2)(2\gamma^2(1-\gamma^2)^2 + 4\alpha^2(1-\gamma^2) - 4\alpha^4 + \alpha^6)} < 0,$$

and

$$\rho_2^* - \rho^M = \frac{\alpha^2\gamma^2(1-\gamma^2)^2}{(2(1+\gamma)-\alpha^2)(2\gamma^2(1-\gamma^2)^2 + 4\alpha^2(1-\gamma^2) - 4\alpha^4 + \alpha^6)} > 0,$$

because (tedious but simple) algebraic manipulations imply that all factors are positive for all $\alpha \leq \sqrt{2(1-\gamma)}$. ■

Proof of Lemma 2. In order for firms to implement the industry monopoly outcome, under RPP the contract should specify $p_1 = p_2 = p^M$ and w such that R_2's optimal effort, obtained from (11), equals e^M. Since $e^M > 0$, (11) implies that $w < p^M$. But then, the first-order condition (13) of the integrated retailer would imply $e_1 < e^M$. Therefore, firms cannot implement the industry monopoly outcome even under RPP.

Under the demand and cost specifications in (8) and (10), setting $c = 0$, the first-order conditions (13) and (11), for $p_1 = p_2 = p$, give

$$e_1^P(w,p) = \frac{\alpha(p-\gamma w)}{1-\gamma^2}, \quad \text{and} \quad e_2^P(w,p) = \frac{\alpha(p-w)}{1-\gamma^2}.$$

Using these functions and maximizing industry profits with respect to w and p then yields the equilibrium contract

$$w^P = \frac{2(1+\gamma)^2}{4(1+\gamma)(1+\gamma^2) - \alpha^2(2+\gamma^2)},$$

and

$$p^P = w^P + \frac{2(1-\gamma^2)}{4(1+\gamma)(1+\gamma^2) - \alpha^2(2+\gamma^2)},$$

which, substituted back into $e_i^P(\cdot)$, yields the other equilibrium values. It can be checked that for all $\alpha \leq \sqrt{2(1-\gamma)}$, all factors in the expressions for w^P and p^P are positive, and so $p^P > w^P > 0$. We then have:

$$e_1^P - e^M = \frac{\alpha\gamma(4(1+\gamma) - \alpha^2(2+\gamma))}{(2(1+\gamma)-\alpha^2)(4(1+\gamma)(1+\gamma^2) - \alpha^2(2+\gamma^2))} > 0,$$

$$e_2^P - e^M = -\frac{\alpha\gamma^2(4(1+\gamma) - \alpha^2)}{(2(1+\gamma)-\alpha^2)(4(1+\gamma)(1+\gamma^2) - \alpha^2(2+\gamma^2))} < 0,$$

$$\rho_1^P - \rho^M = -\frac{\alpha^2\gamma((1+\gamma)(4+\gamma)-\alpha^2(2+\gamma))}{(2(1+\gamma)-\alpha^2)(4(1+\gamma)(1+\gamma^2)-\alpha^2(2+\gamma^2))} < 0,$$

and

$$\rho_2^P - \rho^M = \frac{\alpha^2\gamma^2(3+3\gamma-\alpha^2)}{(2(1+\gamma)-\alpha^2)(4(1+\gamma)(1+\gamma^2)-\alpha^2(2+\gamma^2))} > 0,$$

because (tedious but straightforward) algebraic manipulations imply that all factors are positive for all $\alpha \leq \sqrt{2(1-\gamma)}$. Finally, the comparisons of equilibrium values under individual RPM *vs.* RPP are established in the accompanying Mathematica file. ■

Proof of Propositions 4 and 5. The results are established using the demand and cost functions in (8)–(10), for $c = 0$, and shown in Figures 1 and 2. See the accompanying Mathematica file for the comparison of equilibrium values in each of the considered region of parameters. ■

Proof of Proposition 6. Suppose firms can set arbitrarily both retail prices p_1 and p_2 at the contracting stage. Then, they choose (w, p_1, p_2) to maximize industry profit, subject to the best-response effort strategies obtained from (11)–(13), denoted by $e_i^*(w, p_1, p_2)$, where now $\partial q_i/\partial e_i = \partial q_i/\partial e_{-i} \equiv \partial q_i/\partial e$. Then, using the best-response effort functions, the first-order conditions with respect to w, p_1, and p_2, are given by

$$\left[(p_1-c)\frac{\partial q_1(\cdot)}{\partial e} + (w-c)\frac{\partial q_2(\cdot)}{\partial e}\right]\frac{\partial e_2^*(\cdot)}{\partial w} + (p_2-w)\frac{\partial q_2(\cdot)}{\partial e}\frac{\partial e_1^*(\cdot)}{\partial w} = 0, \tag{19}$$

$$q_1(\cdot) + (p_1-c)\left[\frac{\partial q_1(\cdot)}{\partial p_1} + \frac{\partial q_1(\cdot)}{\partial e}\frac{\partial e_2^*(\cdot)}{\partial p_1}\right] + (p_2-c)\left[\frac{\partial q_2(\cdot)}{\partial p_1} + \frac{\partial q_2(\cdot)}{\partial e}\frac{\partial e_2^*(\cdot)}{\partial p_1}\right] + (p_2-w)\frac{\partial q_2(\cdot)}{\partial e}\left[\frac{\partial e_1^*(\cdot)}{\partial p_1} - \frac{\partial e_2^*(\cdot)}{\partial p_1}\right] = 0, \tag{20}$$

$$q_2(\cdot) + (p_2-c)\left[\frac{\partial q_2(\cdot)}{\partial p_2} + \frac{\partial q_2(\cdot)}{\partial e}\frac{\partial e_1^*(\cdot)}{\partial p_2}\right] + (p_1-c)\left[\frac{\partial q_1(\cdot)}{\partial p_2} + \frac{\partial q_1(\cdot)}{\partial e}\frac{\partial e_2^*(\cdot)}{\partial p_2}\right] + (w-c)\frac{\partial q_2(\cdot)}{\partial e}\left[\frac{\partial e_2^*(\cdot)}{\partial p_2} - \frac{\partial e_1^*(\cdot)}{\partial p_2}\right] = 0. \tag{21}$$

The solution to this system of first-order conditions is $w^P = c$ and $p_1 = p_2 \equiv p^P$ that solves

$$q_i(\cdot) + (p^P - c)\left[\frac{\partial q_i(\cdot)}{\partial p_i} + \frac{\partial q_i(\cdot)}{\partial p_{-i}} + \frac{\partial q_i(\cdot)}{\partial e}\frac{\partial[e_1^*(\cdot)+e_2^*(\cdot)]}{\partial p_i}\right] = 0, \tag{22}$$

where $q_i(\cdot)$ is evaluated at $p_1 = p_2 = p^P$ and $e_1 = e_2 = e_i^*(w, p^P, p^P)$ for $i = 1, 2$, and so $q_1(\cdot) = q_2(\cdot)$. Indeed, at $w = c$, (19) holds because $\partial e_2^*(\cdot)/\partial w = -\partial e_1^*(\cdot)/\partial w$, while (20) and (21) are symmetric and boil down to (22).

Notice that this outcome, featuring a symmetric price, can be implemented through RPP. By contrast, absent RPP, if firms were to set $w = c$ and $p_2 = p^P$, then at $t = 2$ the integrated retailer would have an incentive to charge a different price, since the left-hand side of (22) is different than that of (3), which describes the pricing behavior of R_1 at $t = 2$. This establishes that RPP is always strictly profitable.

To assess its effects on consumer surplus, let us consider the linear demand specification in (8) with quality-adjusted prices $\rho_i \equiv p_i - \alpha(e_1 + e_2)$, the cost function in 10, and the normalization

$c = 0$. Absent RPP, the equilibrium contract is

$$w^* = \frac{(\gamma+1)\left(\alpha^2+\gamma^2+\gamma-\alpha^2\gamma\right)^2}{2\left(2\alpha^6(1-\gamma)^2-\alpha^4(1-\gamma^2)(7+\gamma)+\alpha^2(1+\gamma)^2(4-\gamma(3\gamma+2))+\gamma^2(1+\gamma)^3\right)} > 0,$$

$$p^* = w^* + \frac{\alpha^2\left(1-\gamma^2\right)\left(2(\gamma+1)-\alpha^2(1-\gamma)\right)}{2\alpha^6(1-\gamma)^2-\alpha^4(1-\gamma^2)(7+\gamma)+\alpha^2(1+\gamma)^2(4-\gamma(3\gamma+2))+\gamma^2(1+\gamma)^3} > w^*,$$

which can be substituted into the price and effort best-response functions to obtain p_1^* and e_i^*, $i = 1, 2$. With RPP, we have

$$p^P = \frac{\gamma+1}{2(1+\gamma)-3\alpha^2} > 0 \quad \text{and} \quad e_1^P = e_2^P = \frac{p^P\alpha}{1+\gamma}.$$

Substituting the equilibrium values into consumer's utility (7) and comparing the resulting expression with and without RPP shows that, in the admissible range of parameters, RPP always harms consumers (see the accompanying Mathematica file). ■

Proof of Lemma 3. The integrated manufacturer's contracting problem (14)–(15) does not admit an interior solution, in which R_2' participation constraint is slack. Indeed, the Hessian matrix is indefinite: its eigenvalues are

$$\frac{1}{(1-\gamma^2)^2(2-\alpha^2-2\gamma^2)}\left(\alpha^4-2\alpha^2(1-\gamma^2)+\gamma^2(1-\gamma^2)^2 \pm \sqrt{\Delta^*}\right),$$

where

$$\Delta^* \equiv (2-\gamma^2)^2(1-\gamma^2)^4-2\alpha^2(1-\gamma^2)^3(6-5\gamma^2+\gamma^4)+\alpha^8(2-2\gamma^2+\gamma^4)+\alpha^4(1-\gamma^2)^2(17-16\gamma^2+5\gamma^4)-2\alpha^6(5-10\gamma^2+7\gamma^4-2\gamma^6) > 0,$$

of which only the smallest one is negative, which implies that the solution to the system of first-order conditions with respect to p_2 and w is a saddle point. Therefore, R_2's participation constraint must bind.

There are two possibilities. The first one is that $w = p_2$, so that $e_2^*(\cdot) = 0$. In this case, the integrated firm's profit is maximized for $w^0 = p_2^0 = \frac{1}{2}$, with ex-post choices

$$p_1^0 = \frac{1}{2} + \frac{\alpha^2(1-\gamma)}{2\left(2-\alpha^2-2\gamma^2\right)}, \quad e_1^0 = \frac{\alpha(1-\gamma)}{2-\alpha^2-2\gamma^2} > 0,$$

so that

$$\rho_1^0 = \frac{1}{2} - \frac{\alpha^2(1-\gamma)}{2\left(2-\alpha^2-2\gamma^2\right)} < \frac{1}{2} = \rho_2^0.$$

The resulting profit is

$$\Pi^0 = \frac{4-\alpha^2-4\gamma}{4(2-\alpha^2-2\gamma^2)}.$$

The second possibility is that $w = \overline{w}(p_2)$, where

$$\overline{w}(p_2) = \frac{2\left(1-\gamma^2\right)^2\left(2-\alpha^2-\gamma^2-\gamma\right)-\left(\alpha^4\left(1-2\gamma^2\right)-4\alpha^2\left(1-\gamma^2\right)^2+2\left(2-\gamma^2\right)\left(1-\gamma^2\right)^2\right)p_2}{\alpha^4\left(2\gamma^2-1\right)+2(\alpha^2-\gamma^2)\left(1-\gamma^2\right)^2},$$

where $\overline{w}(p_2) < p_2$ is checked ex post in equilibrium. Substituting $\overline{w}(p_2)$ into the manufacturer's profit and maximizing with respect to p_2, we find the equilibrium values

$$p_2^* = w^* + \frac{(2-\alpha^2-2\gamma)(1-\gamma^2)^2(\alpha^4 - 2\alpha^2(1-\gamma^2)^2 - 2\gamma^2(1-\gamma^2)^2)}{\alpha^8(1-2\gamma^2) - 2\alpha^6(3-\gamma^2)(1-\gamma^2)^2 - 4\gamma^2(1-\gamma^2)^4 - 2\alpha^2(4-\gamma^2)(1-\gamma^2)^4 + 4\alpha^4(1-\gamma^2)^2(3-3\gamma^2+\gamma^4)} > w^*,$$

and

$$w^* = \frac{6\alpha^6(1-\gamma^2)^2 + 4\gamma^3(1-\gamma^2)^4 + 8\alpha^2(1-\gamma)^4(1+\gamma)^3(1+\gamma+\gamma^2) - \alpha^8(1-2\gamma^2) - 4\alpha^4(1-\gamma^2)^2(3-\gamma^2-\gamma^3)}{4\alpha^6(3-\gamma^2)(1-\gamma^2)^2 + 8\gamma^2(1-\gamma^2)^4 + 4\alpha^2(4-\gamma^2)(1-\gamma^2)^4 - 2\alpha^8(1-2\gamma^2) - 8\alpha^4(1-\gamma^2)^2(3-3\gamma^2+\gamma^4)} > 0,$$

from which, using the best-response price and effort functions, we obtain p_1^* and the equilibrium effort levels. These equilibrium values are such that $e_1^* > e_2^*$ and $\rho_1^* < \rho_2^*$ (see the accompanying Mathematica file). Finally, the integrated firm's profit is $\Pi^* = \Pi^0 + \Delta\Pi$, where

$$\Delta\Pi \equiv \frac{(2-\alpha^2-2\gamma)^2(1-\gamma^2)(\alpha^4(3-4\gamma^2+\gamma^4) - \alpha^6 - (2\alpha^2+\gamma^2)(1-\gamma^2)^3)}{2(2-\alpha^2-2\gamma^2)(2\alpha^6(3-\gamma^2)(1-\gamma^2)^2 + 4\gamma^2(1-\gamma^2)^4 + 2\alpha^2(4-\gamma^2)(1-\gamma^2)^4 - \alpha^8(1-2\gamma^2) - 4\alpha^4(1-\gamma^2)^2(3-3\gamma^2+\gamma^4))}$$

is positive if and only if $\alpha > \sqrt{1-\gamma^2}$ (see the accompanying Mathematica file). ■

Proof of Lemma 4. Solving the first-order conditions with respect to w and p of M's unconstrained contracting problem (16) yields a candidate equilibrium

$$\tilde{w}^P = \frac{(1+\gamma)\left(1-\gamma\left(1-2\alpha^2+(1-\gamma)\gamma\right)\right)}{2\alpha^2(1+\gamma)\left(3-\gamma^2\right) - \alpha^4(2\gamma+3) - \left(1-\gamma^2\right)^2},$$

and

$$\tilde{p}^P = \frac{(1+\gamma)\left(\alpha^2\left(3-\gamma^2\right) - (1-\gamma)^2(\gamma+1)\right)}{2\alpha^2(1+\gamma)\left(3-\gamma^2\right) - \alpha^4(2\gamma+3) - \left(1-\gamma^2\right)^2}.$$

Substituting these values into the best-response effort functions we then find

$$\tilde{e}_1^P = \frac{\alpha(1+\gamma)\left(3\alpha^2+\gamma^2-1\right)}{2\alpha^2(1+\gamma)\left(3-\gamma^2\right) - \alpha^4(2\gamma+3) - \left(1-\gamma^2\right)^2},$$

and

$$\tilde{e}_2^P = \frac{\alpha^2(\gamma+3)+2\gamma^2-2}{2\alpha^2(1+\gamma)\left(3-\gamma^2\right) - \alpha^4(2\gamma+3) - \left(1-\gamma^2\right)^2}.$$

This solution satisfies R_2's participation constraint if and only if

$$\underline{\alpha} \equiv \sqrt{\frac{2(1-\gamma^2)}{3+\gamma}} \le \alpha \le \overline{\alpha} \equiv \sqrt{\frac{2(2+\gamma-2\gamma^2-\gamma^3)}{3+3\gamma+2\gamma^2}},$$

with $\underline{\alpha} \in (0, \sqrt{1-\gamma^2})$ and $\overline{\alpha} < \sqrt{2(1-\gamma)}$. Under this parametric restriction, $(\tilde{w}^P, \tilde{p}^P)$ is the global maximum point of M's profit, and so the considered solution is the equilibrium of the game. This solution is such that $\tilde{p}^P > \tilde{w}^P > 0$, $\tilde{e}_1^P > \tilde{e}_2^P > 0$, and so $\tilde{\rho}_1^P < \tilde{\rho}_2^P$ (see the accompanying Mathematica file). M's profit is

$$\widetilde{\Pi}^P = \frac{\alpha^2(\gamma+2)(2\gamma+1)}{2\left(2\alpha^2(2\gamma+1)((2-\gamma)\gamma+2) - \left(1-2\gamma^2+\gamma\right)^2 - \alpha^4(\gamma+1)(3\gamma+2)\right)}.$$

Outside this parameter range, R_2's participation constraint is binding. Then, as in the scenario without RPP, we should distinguish two cases, depending on whether M implements or not positive effort at R_2. The first possibility is that M sets

$$w^{0P} = p^{0P} = \frac{2(1+\gamma)}{4-\alpha^2+4\gamma},$$

so that

$$e_2^{0P} = 0 \quad \text{and} \quad e_1^{0P} = \frac{2\alpha}{4-\alpha^2+4\gamma} > 0,$$

implying that $\rho_1^{0P} < \rho_2^{0P}$. This solution yields profit

$$\Pi^{0P} = \frac{2}{4-\alpha^2+4\gamma}.$$

Alternatively, in a candidate equilibrium with $e_2 > 0$, the binding R_2's participation constraint implies $w = \overline{w}(p)$, where

$$\overline{w}(p) = \frac{2(1-\gamma)^2(1+\gamma) - \left(2(1-\gamma)^2(1+\gamma) - \alpha^2(1-2\gamma)\right)p}{\alpha^2(1-2\gamma^2)},$$

and $\overline{w}(p) < p$ is be checked ex post in equilibrium. Substituting $w = \overline{w}(p)$ into M's objective and maximizing for p, we find

$$p^P = \frac{2(1+\gamma)(2-\gamma(2+2(1-\gamma)\gamma^3 - \alpha^2(3-4\gamma+2\gamma^3)))}{(2(1-\gamma)^2(1+\gamma)-\alpha^2(1-2\gamma))(2(1+\gamma)(1+\gamma^2)+\alpha^2(1+6\gamma+4\gamma^2))},$$

and

$$w^P = \frac{2+4\gamma-2\gamma^3}{\alpha^2\left(1+6\gamma+4\gamma^2\right)+2(1+\gamma)\left(1+\gamma^2\right)}.$$

The corresponding effort levels, obtained from the best-response effort functions, are

$$e_1^P = \frac{2\alpha(2+\alpha^2\gamma(4-\gamma-4\gamma^2)-2\gamma(1+\gamma-2\gamma^2+\gamma^4))}{(2(1-\gamma)^2(1+\gamma)-\alpha^2(1-2\gamma))(2(1+\gamma)(1+\gamma^2)+\alpha^2(1+6\gamma+4\gamma^2))},$$

$$e_2^P = e_1^P - \frac{2\alpha\left(1+\gamma(1-\gamma)\right)}{\alpha^2\left(1+6\gamma+4\gamma^2\right)+2(1+\gamma)\left(1+\gamma^2\right)} < e_1^P,$$

and so $\rho_1^P < \rho_2^P$. Using these values, we can compute M's profit,

$$\Pi^P = \frac{2\alpha^2\left(1+\gamma-\gamma^2\right)^2}{(2(1-\gamma)^2(1+\gamma)-\alpha^2(1-2\gamma))\left(\alpha^2\left(1+6\gamma+4\gamma^2\right)+2(1+\gamma)\left(1+\gamma^2\right)\right)}.$$

In the accompanying Mathematica file, we show that *(i)* for all $\alpha < \underline{\alpha}$, $\Pi^P < \Pi^{0P}$, implying that the equilibrium is $w^{0P} = p^{0P}$ (and so $e_2^P = 0$), and *(ii)* for all $\alpha \geq \overline{\alpha}$, $\Pi^P > \Pi^{0P}$, implying that the equilibrium is $w^P < p^P$ (and so $e_2^P > 0$). ■

Proof of Proposition 7. From the results of Lemma 3 and 4, we have that:

- For $\alpha \leq \underline{\alpha}$, irrespective of whether RPP is in place, M sets $w = p_2$ and so $e_2 = 0$. Then, since there is no ex-post opportunism and products are vertically differentiated because $e_1 > e_2$, M gains more by charging $p_1 \neq p_2$, and so RPP is never profitable.

- For $\underline{\alpha} < \alpha < \overline{\alpha}$, the equilibrium contract with RPP is the unconstrained maximizer of the manufacturer's problem (16) and R_2 exerts positive effort and makes a positive profit. In this region of parameters, irrespective of whether M implements positive effort absent RPP, RPP is not profitable — i.e., $\widetilde{\Pi}^P < \max\{\Pi^0, \Pi^*\}$ (see the accompanying Mathematica file).

- For $\alpha \geq \overline{\alpha}$, with RPP R_2 exerts positive effort but makes zero profit. Within this region of parameters, as illustrated in Figure 4, RPP is profitable in a subset of parameters in which positive effort prevails also absent RPP. Moreover, in the accompanying Mathematica file we check that $CS^P > CS^*$ for $\alpha = 1$ and $\gamma = 0.356$. ■