

# Recommended Retail Prices, Maximum RPM and the Role of Buyer Power

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November 2005

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## Abstract

The study investigates the effect of buyer power on vertical price restrictions such as Recommended Retail Prices (RRP) and Maximum Resale Price Maintenance (RPM). Buyer power affects both the level of the unit discount obtained by the retailer when purchasing goods from the manufacturer and the retail price control. We show that only when a retailer's buyer power is small can RRP be an equilibrium solution while, if buyer power is high, Maximum RPM occurs. RRP is dominated, from a welfare point of view, by Maximum RPM, since the latter eliminates double marginalization. Hence we find no reason, unlike the current attitude of antitrust authorities, to prefer RRP to Maximum RPM. The presence of buyer power gives rise to a second distortion, the unit discount, which does not enable any vertical price restriction to achieve its first best outcome. The best situation for society, in this second best world, arises when the parties' bargaining power is curbed, as claimed by the famous Galbraith conjecture.

JEL classification: L1, L4

Keywords: Recommended retail prices, Maximum RPM, successive monopoly, buyer power.

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## 1 Introduction

In many industries a manufacturer recommends a retail price to his retailers and, when selling the good, gives them a unit discount computed on that price. The use of a Recommended (Suggested) Retail Price (RRP) is often observed in markets like, for example, gasoline, cars, medicines, books, magazines, clothing and beer. In some industries (e.g. medicines, books and magazines) this may become an accepted Resale Price Maintenance (RPM), because retailers, having received a satisfactory unit discount, agree to leave the price set by the manufacturer unchanged. The amount of the retailers' discount is however variable from industry to industry, and depends on their buyer power in dealing with manufacturers.

Retail price restrictions imposed by manufacturers have traditionally been considered harmful for society by antitrust authorities and, consequently, forbidden. In recent years, however, the prevailing antitrust doctrine has changed, modifying its negative attitude towards some forms of price restrictions. Maximum RPM, for instance, is now permitted by both the European Commission and the American antitrust authorities<sup>1</sup> in the belief that it prevents price-making retailers from increasing the retail price.<sup>2</sup> Other weaker forms of price restrictions, like RRP, are also permitted. Hence, both Maximum RPM and RRP are now available options.

Some interesting yet unanswered questions immediately arise: which of

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<sup>1</sup>American antitrust authorities have been wavering throughout last century in assessment of vertical price restrictions and on the necessary conditions to prove their illegality. See Comanor [1985] and Mathewson–Winter [1998] for more details on this issue.

<sup>2</sup>Minimum and plain RPM are instead still forbidden in most countries.

these two available vertical price restrictions prevail in equilibrium? Under what conditions? Which of them should be preferred from a welfare point of view? In other words, how important is to insure the retailer the freedom to set the retail price?<sup>3</sup>

Bork [1978] and Posner [1976] argued that vertical restraints, inclusive of price restrictions, are pro-competitive, because the aim of the manufacturer in managing them is to increase sales, which also make consumers happier. But when buyers (i.e. retailers) do have market power—for instance because it is difficult to replace them—this argument does not apply, given that it can be costly to convince them to accept a vertical restraint which may well make their profit lower. It then becomes important to investigate how the desire of the manufacturer to affect the retail price interacts with the retailer’s buyer power.

Our aim in this paper is precisely to look at this question. We see two channels for the retailer to exert her buyer power: (1) the determination of the unit discount and (2) the ability of changing the retail price suggested by the manufacturer (i.e. RRP *vs* RPM). When the second channel of buyer power is considered, the manufacturer might indeed use the retailer’s discount

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<sup>3</sup>It is to be noted, however, that according to the prevailing antitrust doctrine it is crucial—to assess *who* should set the retail price—to understand the true nature of the retailer’s activity: when the retailer is a mere agent of the manufacturer, she is not entitled to set the retail price and the manufacturer should. This occurs when the retailer is not the owner of the good for sale and does not bear any entrepreneurial risk (for instance, when she does not hold an inventory and/or an investment risk). In this case vertical price restrictions are not an issue. On the contrary they become a hot issue when the retailer acts as a firm.

as an instrument to buy her willingness to control the retail price, but this could be costly.

The traditional literature on RPM has not dealt with these questions: rather, it has concentrated its efforts in investigating whether RPM, alone or jointly with other vertical restraints (e.g. franchise fees, exclusive territories, quantity forcing), may replicate the vertical integration solution, thus correcting a variety of horizontal and/or vertical externalities.<sup>4</sup> Other contributions have highlighted the so-called *cartel hypothesis*, i.e. RPM might be a device to implement some forms of coordination either between manufacturers (Jullien–Rey [2003]) or among retailers (Shaffer [1991], Wang [2004]).

Literature has focused on Minimum RPM, the most controversial case, leaving the study of Maximum RPM rather neglected. Moreover, it has seldom taken into consideration manufacturers' recommended retail prices (Rosenkranz [2003] is one of the very few papers)<sup>5</sup> and has never brought into the picture the role of buyer power in choosing a vertical price restriction (the contribution of Klein–Murphy [1988] and Perry–Besanko [1991] are partial exceptions).<sup>6</sup> Retailers have usually been regarded as agents with

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<sup>4</sup>In this line of research we can mention Mathewson–Winter [1983, 1984], Dixit [1983], Perry–Groff [1985], Perry–Porter [1990], and Bolton–Bonanno [1988]. The common point they make is that RPM alone is not able to achieve the vertical integration solution but the latter can be obtained if RPM is adopted *together with* other vertical restraints.

<sup>5</sup>She considers, unlike our perspective, a model where the manufacturer advertises a recommended price and consumers react to it by reducing (increasing) their willingness to pay if the retailer charges a price higher (lower) than the recommended one. We believe that this situation can be applied to very few markets, since consumers are rarely informed about the manufacturer's recommended price.

<sup>6</sup>Klein–Murphy consider another source of retailer's buyer power: free riding. Retail-

no buyer power (e.g. Tirole [1988]), on the grounds that they can be easily replaced by the manufacturers, while this assumption is clearly violated in some important industries (e.g. food, gasoline, cars and books), where the retailer instead controls important tangible or intangible assets in the vertical channel.

We show that a retailer's buyer power does matter in determining the equilibrium vertical price restriction, consequently with important effect on consumers surplus, channel profit and welfare. Only when a retailer's buyer power is small, can RRP be an equilibrium solution. When instead a retailer's buyer power is high, Maximum RPM occurs. It may seem counter-intuitive that the retailer chooses to give away the retail price control when she has a (relatively) high buyer power, and instead to keep control over it when her buyer power is small. It would seem natural that the retailer uses her buyer power to increase the predetermined unit discount, which, in turn, increases her profit margin. When the discount grants her a sufficiently high profit margin, she no longer needs to control the retail price.

Looking at welfare, we show that, in equilibrium, RRP is dominated by Maximum RPM. When RRP prevails, it gives rise to a welfare loss due to both double marginalization and a positive (although small) discount. When Maximum RPM prevails, double marginalization is eliminated, but retailers' free riding occurs when the manufacturer imposes on retailers, against the threat of contract termination, certain standards of retailing in order to maintain a high quality level. If consumers cannot recognize whether these standards have been followed by an individual retailer before the purchase, the latter has an incentive not to comply and so enjoy a higher margin by cutting her costs. They show that granting remuneration to retailers may induce them not to undertake this free riding approach.

the distortion due to the unit discount increases. If buyer power is very high, the unit discount raises so much that the benefit of the double mark-up elimination is almost wiped out. The best situation for society is when the manufacturer and the retailer countervail their bargaining power when dealing with each other. Under these circumstances, Maximum RPM occurs in equilibrium, giving the benefit of eliminating double marginalization but without conceding a too high unit discount to the retailer. In this situation both the manufacturer and the retailer increase their profits in comparison with those arising with RRP. Galbraith's countervailing power hypothesis is thus at work in this model.

Our study is a second best analysis in that although vertical integration and fixed fees would be more efficient than linear pricing and unit discounts, they are not observed in the cited industries. Perhaps this is due to high fixed costs for vertical integration (which then becomes unattractive), and to moral hazard problems in splitting the channel profit through fixed fees.

The paper proceeds as follows. In Section 2 we present the model. In Section 3 we study the retail price determination. In Section 4 we analyze the setting of the recommended retail price by the manufacturer, while in Section 5 we characterize the optimal vertical price restriction under various degrees of retailer's buyer power, also looking at its effect on profits and welfare. Concluding comments are included in Section 6. Some analytical details provided in the Appendices end the paper.

## 2 The model

We consider a successive monopoly where a manufacturer sells his product to a single retailer. For the sake of simplicity, let us assume that each unit of the goods bought by the retailer is sold to consumers and that the retailer does not incur any distribution costs. Her marginal cost is thus equal to the wholesale price of the goods. The manufacturer produces with constant unit costs, which is, without loss of generality, normalized to zero.

We define  $\bar{p}$  as the recommended retail price (RRP) set by the manufacturer and  $s$  as the unit discount granted to the retailer and computed on the recommended price. Hence the wholesale price can be defined as  $w(\bar{p}, s) = \bar{p} - s$ . The retail price is  $p$ , so the retailer's profit margin is  $p - \bar{p} + s$ . If  $p = \bar{p}$ , the recommended retail price is confirmed by the retailer and her profit margin is only equal to  $s$ . If instead  $p > \bar{p}$ , the retailer's profit margin rises and overpricing takes place (i.e. double marginalization arises). So the retailer has two ways to increase her profit margin: (1) overpricing, (2) an increase in  $s$ . She can exert her buyer power through both factors. The presence of a strictly positive unit discount  $s$  therefore introduces a wedge between the recommended retail price  $\bar{p}$  and the wholesale price  $w$ . Indeed, when  $s = 0$ ,  $\bar{p}$  represents both the retail price recommended by the manufacturer and the wholesale price, but this is no longer true when  $s > 0$ .

The retailer, in contrast with the assumption in literature, has some bargaining power in determining  $s$ , and remains free not to accept the recommended price  $\bar{p}$  and to change it.<sup>7</sup> Hence the manufacturer, in order to see

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<sup>7</sup>It follows that the wholesale price is not set by the manufacturer alone, but, as the difference between the recommended price (decided by the manufacturer) and the discount

that  $\bar{p}$  is confirmed by the retailer, might have an incentive to design  $s$  so that the recommended price is accepted afterwards by the retailer. We model this by giving the retailer, having observed  $s$ , the opportunity to choose between two different contracts: (1) a contract where the manufacturer recommends a retail price (i.e.  $\bar{p}$ ) but leaves the retailer free to change it, referred to here as RRP; (2) a contract where the manufacturer recommends  $\bar{p}$  and the retailer accepts it, committing herself not to modify it. This second price restriction is referred to here as accepted Maximum RPM and labeled RPM.<sup>8</sup>

The whole situation can be formally described as a complete information four-stage game, with the following timing:

- at  $t = 1$  (the *discount* stage) the retailer's unit discount  $s$  is set;
- at  $t = 2$  (the *retail price regime* stage) the retailer, knowing  $s$ , decides between RRP and RPM;
- at  $t = 3$  (the *recommended retail price* stage), the manufacturer, knowing  $s$  and the retail price regime, chooses the recommended price  $\bar{p}$ , which will be equal to the actual retail price  $p$  only under RPM; under RRP  $p$  remains to be set;
- at  $t = 4$  (the *retail price* stage), the retailer sets the retail price  $p$  only under RRP (under RPM,  $p = \bar{p}$ ).

The determination of  $s$  at  $t = 1$  depends crucially on buyer power. With the aim of studying different degrees of buyer power, we focus on the fol-

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(which is subject to buyer power), it is partly decided by the retailer as well.

<sup>8</sup>We distinguish it from the conventional Maximum RPM where the retail price can be imposed by the manufacturer on his retailers at no cost.

lowing alternatives: (1)  $s$  is determined as a solution of an asymmetric Nash bargaining problem (Game 1); (2) we attribute the power of setting  $s$ , respectively to the manufacturer (Game 2) and to the retailer (Game 3). As already explained fixed fees and vertical integration are not available.

We look for the subgame perfect equilibria of these games, applying, as usual, backward induction. For this reason we start the analysis, in the next section, from the last stage.

### 3 Retail Price Determination

The retailer's decision at  $t = 2$  clearly affects what happens in the last stage. We need then to distinguish between the two possible cases: (a) the retailer chooses RRP (i.e. she keeps control of the retail price), (b) the retailer selects RPM (i.e. she gives up retail price control). The former case is considered first.

#### 3.1 RRP

If the retailer keeps control on the retail price, her profit can be written as follows:

$$\pi_R^{RRP} = [p - (\bar{p} - s)]y(p) \quad (1)$$

where  $y(p)$  represents the downward sloping demand function of final consumers ( $y' < 0$ ). As mentioned before and as clear from (1), the retailer has two channels to increase her profit margin: (1) an increase in  $s$ ; (2) an increase in  $p$  above the recommended price  $\bar{p}$  (what we call overpricing). If the retailer decides to reduce the retail price below the level recommended

by the manufacturer (underpricing), she suffers a reduction in profit margin, which can only be compensated with a significant sales increase.<sup>9</sup>

The retailer chooses  $p$  at  $t = 4$  in order to maximize (1). The first order condition of this profit maximization can be written as follows:

$$\frac{d\pi_R^{RRP}}{dp} = y(p) + (p - \bar{p} + s)y'(p) = 0 \quad (2)$$

Totally differentiating (2), we obtain:

$$y'(p)dp + y'(p)[ds + dp - d\bar{p}] + (p - \bar{p} + s)y''(p)dp = 0 \quad (3)$$

From the second order condition we know that:  $G = 2y' + (p - \bar{p} + s)y'' < 0$ . Using  $G$  in (3), we have:  $Gdp = y'(p)(d\bar{p} - ds)$ , and so

$$dp = \frac{y'(p)}{G}d\bar{p} - \frac{y'(p)}{G}ds \quad (4)$$

which gives the following implicit function:

$$p = \phi(\bar{p}, s) \quad (5)$$

where, from (4), we have:

$$\frac{\partial\phi(\bar{p}, s)}{\partial\bar{p}} = \frac{y'}{G} > 0 \quad \text{and} \quad \frac{\partial\phi(\bar{p}, s)}{\partial s} = -\frac{y'}{G} < 0$$

It is then obvious that:

$$\frac{\partial\phi(\bar{p}, s)}{\partial\bar{p}} = -\frac{\partial\phi(\bar{p}, s)}{\partial s} \quad (6)$$

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<sup>9</sup>Underpricing is subject to a lower bound provided by the non-negativity constraint on profits,  $\pi_R \geq 0$ , which implies that  $p \geq \bar{p} - s$ .

The impact of a unit variation of  $\bar{p}$  on  $p$  is exactly equal to that of a unit variation of  $s$  on  $p$ , with the opposite sign. Equation (6), from Euler's Theorem, also implies that:  $\frac{\partial^2 \phi}{\partial \bar{p} \partial s} = -\frac{\partial^2 \phi}{\partial s^2}$  and  $\frac{\partial^2 \phi}{\partial s \partial \bar{p}} = -\frac{\partial^2 \phi}{\partial \bar{p}^2}$ ; in turn,  $\frac{\partial G}{\partial \bar{p}} = -\frac{\partial G}{\partial s}$  and then  $\frac{\partial^2 \phi}{\partial \bar{p} \partial s} = \frac{\partial^2 \phi}{\partial s \partial \bar{p}}$ , as shown in Appendix A. Let us now analyze what happens in stage 4 if the retailer chooses RPM at  $t = 2$ .

### 3.2 RPM

If the retailer has given up control of  $p$  at  $t = 2$ , the manufacturer obviously finds it profitable to charge  $p^{RPM} = \bar{p}^{RPM}$ , and, consequently, the retailer's profit is now:  $\pi_R^{RPM} = sy$ , with  $y(\bar{p}^{RPM})$ , as clear by substituting  $p^{RPM} = \bar{p}^{RPM}$  in (1).

## 4 The retail price recommended by the manufacturer

Having solved the last subgame, we are now in a position to look at what happens at  $t = 3$ , where the manufacturer sets the recommended retail price. His profit can be defined as follows:

$$\pi_M = w(\bar{p}, s)y(p) = (\bar{p} - s)y(p) \quad (7)$$

From the previous section, we know that, under RRP,  $p^{RRP} = \phi(\bar{p}^{RRP}, s)$  (see equation (5)); if instead RPM is adopted, we have  $p^{RPM} = \bar{p}^{RPM}$ . The two cases will be analysed separately.

#### 4.1 RRP

In this case the manufacturer's profit is given by  $\pi_M^{RRP} = (\bar{p} - s)y[\phi(\bar{p}, s)]$ .

He maximizes  $\pi_M^{RRP}$  by choosing  $\bar{p}$ . The first order condition is as follows:

$$\frac{d\pi_M^{RRP}}{d\bar{p}} = y + (\bar{p} - s)y' \frac{\partial \phi}{\partial \bar{p}} = 0 \quad (8)$$

The total differential of (8) is:

$$\begin{aligned} y' \left[ \frac{\partial \phi}{\partial \bar{p}} d\bar{p} + \frac{\partial \phi}{\partial s} ds \right] + y' \frac{\partial \phi}{\partial \bar{p}} (d\bar{p} - ds) + (\bar{p} - s) \frac{\partial \phi}{\partial \bar{p}} y'' \left[ \frac{\partial \phi}{\partial \bar{p}} d\bar{p} + \frac{\partial \phi}{\partial s} ds \right] + \\ + (\bar{p} - s)y' \left[ \frac{\partial^2 \phi}{\partial \bar{p}^2} d\bar{p} + \frac{\partial^2 \phi}{\partial \bar{p} \partial s} ds \right] = 0 \quad (9) \end{aligned}$$

From the second order condition we know that:

$$F = 2y' \frac{\partial \phi}{\partial \bar{p}} + (\bar{p} - s) \left[ y'' \left( \frac{\partial \phi}{\partial \bar{p}} \right)^2 + y' \frac{\partial^2 \phi}{\partial \bar{p}^2} \right] < 0 \quad (10)$$

Thus, using  $F$  in (9), we get:

$$F d\bar{p} + \left[ y' \frac{\partial \phi}{\partial s} - y' \frac{\partial \phi}{\partial \bar{p}} + (\bar{p} - s) \frac{\partial \phi}{\partial \bar{p}} y'' \frac{\partial \phi}{\partial s} + (\bar{p} - s)y' \frac{\partial^2 \phi}{\partial \bar{p} \partial s} \right] ds = 0$$

But since  $\frac{\partial \phi}{\partial s} = -\frac{\partial \phi}{\partial \bar{p}}$  and  $\frac{\partial^2 \phi}{\partial \bar{p} \partial s} = \frac{\partial^2 \phi}{\partial s \partial \bar{p}} = -\frac{\partial^2 \phi}{\partial \bar{p}^2}$ , then

$$F d\bar{p} + \left\{ -2y' \frac{\partial \phi}{\partial \bar{p}} - (\bar{p} - s) \left[ y'' \left( \frac{\partial \phi}{\partial \bar{p}} \right)^2 + y' \frac{\partial^2 \phi}{\partial \bar{p}^2} \right] \right\} ds = 0 \quad (11)$$

Since the term in curly brackets in (11) is equal to  $-F$  (as it emerges from (10)), it follows that:

$$\frac{d\bar{p}^{RRP}}{ds} = 1 \quad (12)$$

This implies that  $\bar{p}^{RRP} = \kappa + s$ , where  $\kappa$  is a strictly positive constant. Substituting (12) in (4) we have  $dp^{RRP} = 0$ , i.e.  $p^{RRP}$  is independent of  $s$ . The following Lemma has therefore been proved.

**Lemma 1** *Under RRP, the retail price is independent of  $s$ . Hence consumer surplus is unaffected by  $s$ .*

Lemma 1 points out that if the retailer asks for a higher  $s$ , the manufacturer compensates this loss by increasing  $\bar{p}$  by the same amount, in such a way as to keep the wholesale price constant. This in turn leaves the retail price unchanged.

#### 4.1.1 Underpricing vs overpricing

Combining the two FOCs' (2) and (8), after some easy algebraic manipulations, we get an expression which identifies when overpricing and, respectively, underpricing prevail. We have the following result:

**Lemma 2** *Under RRP we observe underpricing whenever  $s > \kappa \frac{\partial \phi}{\partial \bar{p}}$ . Overpricing occurs when  $s < \kappa \frac{\partial \phi}{\partial \bar{p}}$ . The retailer confirms  $\bar{p}$  if  $s = \kappa \frac{\partial \phi}{\partial \bar{p}}$ .*

*Proof:* See Appendix B.

It follows from Lemma 2 that when  $s = 0$ , since  $\frac{\partial \phi}{\partial \bar{p}} > 0$ , it must be that  $p^{RRP} > \bar{p}^{RRP}$ : the retailer applies overpricing to get a positive profit, giving rise to the well known double marginalization problem. But when  $s > 0$ , overpricing is not always the retailer's best pricing strategy. Underpricing or overpricing may both prevail according to the value of  $s$ .

It is interesting to understand why the retailer might choose underpricing. As shown in Lemma 2 underpricing may arise when  $s$  is high. In this case the manufacturer, to compensate his high marginal cost due to a high  $s$ , selects a high  $\bar{p}$ , to keep his profit margin constant. But the retailer, who already benefits from a high unit margin due to a high  $s$ , prefers to reduce the retail price and her profit margin to increase demand.

#### 4.1.2 The effect on profit and welfare

The effect of  $s$  on the retailer's, manufacturer's and industry's profit under RRP is now considered. Regarding the retailer's profit, it is easy to see that, with  $p^{RRP}$  independent of  $s$ , and since  $\bar{p}^{RRP} - s = \kappa$ , then from (1) it follows that  $\pi_R^{RRP}$  is also independent of  $s$ . For the manufacturer's profit, from (7), by the same argument, it is shown that  $\pi_M^{RRP}$  is independent of  $s$ . Hence, under RRP, the channel profit, defined as  $\pi_M^{RRP} + \pi_R^{RRP}$ , also does not depend on  $s$ . Since both consumer surplus (Lemma 1) and channel profit are not affected by  $s$ , it follows that social welfare (defined *à la Marshall* as the sum of consumer surplus and channel profit) is also independent of  $s$ , as stated in the following Lemma.

**Lemma 3** *Under RRP the unit discount  $s$  does not affect firms' profits, consumer surplus and social welfare. Only the recommended retail price increases with  $s$ .*

According to Lemma 3, under RRP, buyer power has no relevant effect on  $s$ .

## 4.2 RPM

The next analysis is the case where the retailer gives up control of  $p$  to the manufacturer. The latter has the following profit function:

$$\pi_M^{RPM} = (\bar{p} - s)y(\bar{p}) \quad (13)$$

The manufacturer chooses  $\bar{p}$  with the aim of maximizing his profit. The first order condition for this problem is:

$$\frac{d\pi_M^{RPM}}{d\bar{p}} = y(\bar{p}) + (\bar{p} - s)y'(\bar{p}) = 0 \quad (14)$$

Totally differentiating (14), we get:

$$y' d\bar{p} + (\bar{p} - s)y'' d\bar{p} + y'(d\bar{p} - ds) = 0 \quad (15)$$

Since  $F = 2y' + (\bar{p} - s)y'' < 0$  to meet the second order condition, we can get from (15):

$$\frac{d\bar{p}^{RPM}}{ds} = \frac{y'}{F} > 0 \quad (16)$$

which leads to the following implicit function:  $\bar{p}^{RPM} = \varphi(s)$ , with

$$\varphi' = \frac{d\bar{p}^{RPM}}{ds} = \frac{y'}{F} > 0.$$

Under RPM, as well as under RRP, an increase in  $s$  induces an increase in  $\bar{p}$ , but of a different magnitude. With a linear demand this is exactly half of that under RRP.

#### 4.2.1 The effect on profit and welfare

Since  $p^{RPM} = \bar{p}^{RPM}$  and  $\varphi' > 0$ , it emerges that an increase in  $s$  leads to an increase in  $\bar{p}^{RPM}$ . Hence consumer surplus shrinks. Looking at the effect of  $s$  on the retailer's profit, we have  $\pi_R^{RPM} = sy[\varphi(s)]$ , and so, by differentiating it with respect to  $s$ , we get:

$$\frac{d\pi_R^{RPM}}{ds} = y + sy'\varphi' \quad (17)$$

Its sign depends upon  $s$ , being  $y > 0$ ,  $y' < 0$  and  $\varphi' > 0$ . The manufacturer's profit is:  $\pi_M^{RPM} = [\varphi(s) - s]y[\varphi(s)]$ . By differentiating it with respect to  $s$  we get:

$$\frac{d\pi_M^{RPM}}{ds} = (\varphi' - 1)y + (\bar{p}^{RPM} - s)y'\varphi' = (\bar{p} - s)y' < 0. \quad (18)$$

The last step in (18) is obtained by solving (14) for  $y$  and substituting it. Not surprisingly, the lower  $s$  is, the higher  $\pi_M^{RPM}$  is. Channel profit is now considered:  $\pi_M^{RPM} + \pi_R^{RPM} = \varphi(s)y[\varphi(s)]$ ; differentiating it with respect to  $s$ , we get:

$$\frac{d(\pi_M^{RPM} + \pi_R^{RPM})}{ds} = \varphi'(y + y'\varphi) = \varphi'sy' < 0$$

The last step is again obtained by solving (14) for  $y$  and substituting it. Thus an increase in  $s$  reduces the channel profit: the loss to the manufacturer due to an increase in  $s$  is always higher than any gain obtained by the retailer. Since consumer surplus is also decreasing in  $s$ , the following Lemma has been demonstrated.

**Lemma 4** *Under RPM both industry profit and consumer surplus decrease as  $s$  increases. Hence an increase in  $s$  is welfare reducing.*

When the retailer receives a higher unit discount, she may get more profit, but since both the manufacturer and the consumers are hurt by the consequent price increase, the overall effect on welfare is certainly negative, while under RRP it was seen that  $s$  is neutral on welfare. The retailer's unit discount acts as a new distortion which is added to double marginalization.

### 4.3 Comparing the two retail price regimes

Having solved the last two subgames under the two possible retail price regimes, we can compare prices, channel profit, consumer surplus and welfare under RRP and RPM. The results are shown in the following Proposition.

**Proposition 1** *If  $s$  is sufficiently high (low), consumer surplus, channel profit and welfare are lower (higher) under RPM than under RRP, provided that they are all strictly concave.*

*Proof:* See Appendix B.

Proposition 1 shows that when  $s$  is sufficiently high, welfare under RPM is lower than under RRP even if under the former the manufacturer eliminates double marginalization. To see why, consider the following trade-off occurring with RPM: on the one hand, downstream marginalization is eliminated and this makes the vertical channel more efficient; on the other hand, to make RPM acceptable to the retailer, a higher  $s$  has to be paid to the latter. But the higher  $s$  is, the higher  $p$  is. The latter negative effect can well prevail on the former. When this occurs it is preferable that the retailer, not the manufacturer, chooses the retail price. RPM can then be undesirable from a social point of view. It remains to be seen, however, at which level

$s$  will be determined in equilibrium and hence which of the effects prevails. This is the aim of the next section.

## 5 Equilibrium vertical price restrictions and buyer power

The first two stages of the model are now examined, where  $s$  and the retail price regime have to be determined. The aim is to examine the effect of buyer power on the equilibrium vertical price restrictions. As mentioned before, two alternative assumptions are focused on: (1)  $s$  is determined as the solution of an asymmetric Nash bargaining problem (Game 1); (2)  $s$  is set unilaterally by a single firm, which in turn can be either the manufacturer (Game 2) or the retailer (Game 3). The subgame perfect equilibria of these three games are sought. To achieve this goal, however, it is necessary to be more specific about market demand. To obtain closed form solutions of the model, the focus is on the linear case:  $y = a - p$ . Under this assumption the subgames at stages 3–4 yield the outcomes shown in Table 1.<sup>10</sup>

Vertical price restriction	Outcomes							
	$p$	$\bar{p}$	$y$	$\pi_R$	$\pi_M$	$CS$	$\Pi$	$W$
RRP	$\frac{3a}{4}$	$\frac{a}{2} + s$	$\frac{a}{4}$	$\frac{a^2}{16}$	$\frac{a^2}{8}$	$\frac{a^2}{32}$	$\frac{3a^2}{16}$	$\frac{7a^2}{32}$
RPM	$\frac{a+s}{2}$	$\frac{a+s}{2}$	$\frac{a-s}{2}$	$\frac{s(a-s)}{2}$	$\frac{(a-s)^2}{4}$	$\frac{(a-s)^2}{8}$	$\frac{a^2-s^2}{4}$	$\frac{(3a+s)(a-s)}{8}$

Table 1: Outcomes in Stages 3–4

To highlight the role of buyer power, the benchmark is now recalled, where  $s$  is decided by the manufacturer who imposes  $\bar{p}$  on the retailer at no

<sup>10</sup>From Lemma 2 we have that underpricing will occur only if  $s > \frac{a}{4}$ ; for  $s < \frac{a}{4}$  we have overpricing, while for  $s = \frac{a}{4}$  we have an endogenous RPM.

cost (the case with no buyer power). After that, discussion will return to the three games mentioned above.

### 5.1 The benchmark: no buyer power

If at  $t = 1$  the manufacturer sets  $s$  and at  $t = 2$  the retailer cannot refuse to charge the recommended price, then  $p = \bar{p}$  and  $s = 0$ . This implies that  $w = \bar{p} = p$ ,  $p = \frac{a}{2} = y$  and  $\pi_R = 0$ , while  $\pi_M = \frac{a^2}{4} = \pi^{VI}$  ( $VI$  stands for vertical integration). Channel profit coincides with manufacturer's profit and  $W = \frac{3}{8}a^2 = W^{VI}$ . Under these circumstances RPM replicates vertical integration and achieves the first best solution.

### 5.2 The effect of buyer power

In this section it is shown that if instead the retailer has buyer power, i.e. the retailer can affect the unit discount and/or might refuse to confirm the manufacturer's recommended price, the final outcome indeed differs from that of the benchmark. We first explore Game 1, where the retailer and the manufacturer bargain over  $s$ .

#### 5.2.1 Asymmetric Nash Bargaining on $s$

Suppose that at  $t = 1$  the manufacturer and the retailer solve the following problem:

$$\text{MAX}_{\{s\}} \quad (\pi_R - \pi_R^d)^\beta (\pi_M - \pi_M^d)^{1-\beta} \quad (19)$$

where  $0 < \beta < 1$  represents the degree of buyer power over  $s$ , while  $\pi_j^d$

( $j = R, M$ ) is firm  $j$ 's disagreement profit. If the two parties do not reach an agreement, no trade takes place and hence both firms end up with no profit: so it is plausible to have  $\pi_R^d = \pi_M^d = 0$ . Hence (19) can be written as:

$$\begin{aligned} \text{MAX} \quad & \pi_R^\beta \pi_M^{1-\beta} \\ \{s\} \end{aligned} \quad (20)$$

It should be clear that  $\pi_R$  and  $\pi_M$  crucially depend on the retailer's choice at  $t = 2$ : either RRP or RPM. It is therefore necessary to proceed by backward induction. Stage 3 and 4 have already been solved in the previous sections: the results obtained in the linear case are those reported in Table 1. Stage 1 and 2 still need to be solved. In order to analyze the retailer's decision at  $t = 2$ ,  $I_R$  is defined as an indicator variable equal to 1 if RPM is chosen and 0 if RRP is selected. Clearly RPM will be chosen (i.e.  $I_R = 1$ ) if  $\pi_R^{RPM} \geq \pi_R^{RRP}$ ; this inequality holds if  $s_1 \leq s \leq s_2$ , where

$$s_1 = \frac{a}{2} \left( 1 - \frac{\sqrt{2}}{2} \right) > 0, s_2 = \frac{a}{2} \left( 1 + \frac{\sqrt{2}}{2} \right) > 0, \quad \text{with} \quad s_1 < s_2 \quad (21)$$

The retailer's profit functions under RRP and RPM are drawn in Figure 1, in which it is possible to identify the threshold levels  $s_1$  and  $s_2$ .

It is now possible to examine stage 1 by solving the asymmetric Nash bargaining problem (20). Clearly, if the retailer chooses RRP at  $t = 2$ , both profits are independent of  $s$ , and then, under these circumstances, the bargaining over  $s$  is irrelevant. Firms stick to a profit of  $\pi_R^{RRP} = \frac{a^2}{16}$  and of  $\pi_M^{RRP} = \frac{a^2}{8}$ . If the retailer instead selects RPM at  $t = 2$  a non trivial bargaining problem applies and gives rise to the following maximization problem:

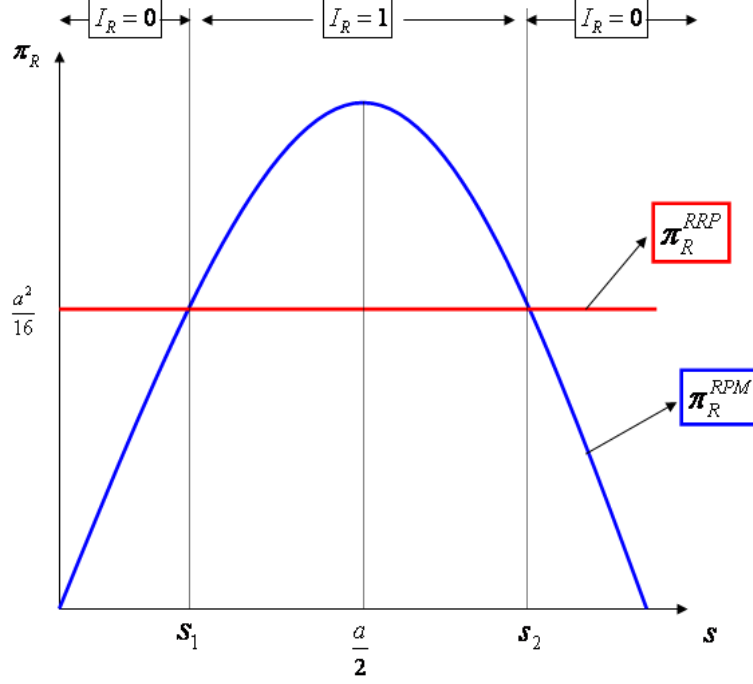


Figure 1: Retailer's profit under RRP and RPM

$$\begin{aligned} \text{MAX}_{\{s\}} \quad & (\pi_R^{RPM})^\beta (\pi_M^{RPM})^{1-\beta} = \left[\frac{s}{2}(a-s)\right]^\beta \left[\frac{(a-s)^2}{4}\right]^{1-\beta} \end{aligned} \quad (22)$$

As it is clear from (22), under RPM  $s$  does affect both profits. The following first order condition can be easily derived:

$$\begin{aligned} \beta \left[\frac{s}{2}(a-s)\right]^{\beta-1} \left[\left(\frac{1}{2}\right)(a-s) - \frac{s}{2}\right] \left[\frac{(a-s)^2}{4}\right]^{1-\beta} + \\ -\frac{1-\beta}{2} \left[\frac{s}{2}(a-s)\right]^\beta \left[\frac{(a-s)^2}{4}\right]^{-\beta} (a-s) = 0 \end{aligned} \quad (23)$$

Solving (23) for  $s$  we get

$$s^{RPM*} = \frac{a\beta}{2} \quad (24)$$

which implies, since  $0 < \beta < 1$ , that  $0 < s^{RPM*} < \frac{a}{2}$ . Now  $s^{RPM}$  can be compared with  $s_1$  and  $s_2$ ; indeed, from Figure 1, if  $s^{RPM} < s_1$  then  $I_R^* = 0$ ,

i.e. the retailer chooses RRP. If  $s_1 \leq s^{RPM} \leq \frac{a}{2}$  then RPM is selected. Since  $s^{RPM*}$  depends upon  $\beta$  (the retailer's buyer power over  $s$ ), and given that  $s_1 = \frac{a}{2}(1 - \frac{\sqrt{2}}{2})$ , we have  $s_1 = s^{RPM*}$  when  $\beta = \beta_0 = 1 - \frac{\sqrt{2}}{2}$ , while  $s^{RPM*} = \frac{a}{2}$  when  $\beta = 1$ . Hence the following Proposition can be stated. pg 22

**Proposition 2** *When a manufacturer and a retailer bargain over  $s$  and the retailer can change  $\bar{p}$ , then RRP is chosen when buyer power is small, i.e.  $0 \leq \beta \leq \beta_0$ . Otherwise (i.e.  $\beta_0 < \beta \leq 1$ ), RPM arises.*

Proposition 2 points out that buyer power on  $s$ , measured by  $\beta$ , affects the nature of the vertical price restriction arising in equilibrium. If buyer power is small, the retailer will get a small  $s$  at  $t = 1$ . For this reason she chooses RRP to enjoy a higher profit by practicing overpricing. Only if buyer power is sufficiently large can RPM arise. In this case the remuneration obtained through  $s$  is satisfactory enough for the retailer to accept losing control over  $p$ . This is because she realizes, on the one hand, that RPM improves the channel efficiency and, ultimately, her surplus; on the other hand, through  $s$  she gets a sufficiently high portion of that surplus. Hence we have a rather counter-intuitive result: downstream marginalization will be eliminated only when buyer power is sufficiently high.

Figures 2(a) and 2(b) show how  $\pi_R$  and  $\pi_M$  change as functions of  $\beta$  under RPM and RRP. Under RPM, the retailer's profit is, as expected, an increasing function of  $\beta$ . But since  $\pi_R^{RRP} = \frac{a^2}{16}$ , RPM is preferable to RRP only if  $\beta > \beta_0 = 1 - \frac{\sqrt{2}}{2}$  (i.e. moving rightwards from point A in Figure 2(a)).<sup>11</sup>

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<sup>11</sup>Note that by substituting (24) for  $s$  in  $\pi_R^{RPM} = \frac{s}{2}(a - s)$  we get  $\pi_R^{RPM} = \frac{a^2\beta}{8}(2 - \beta)$ .

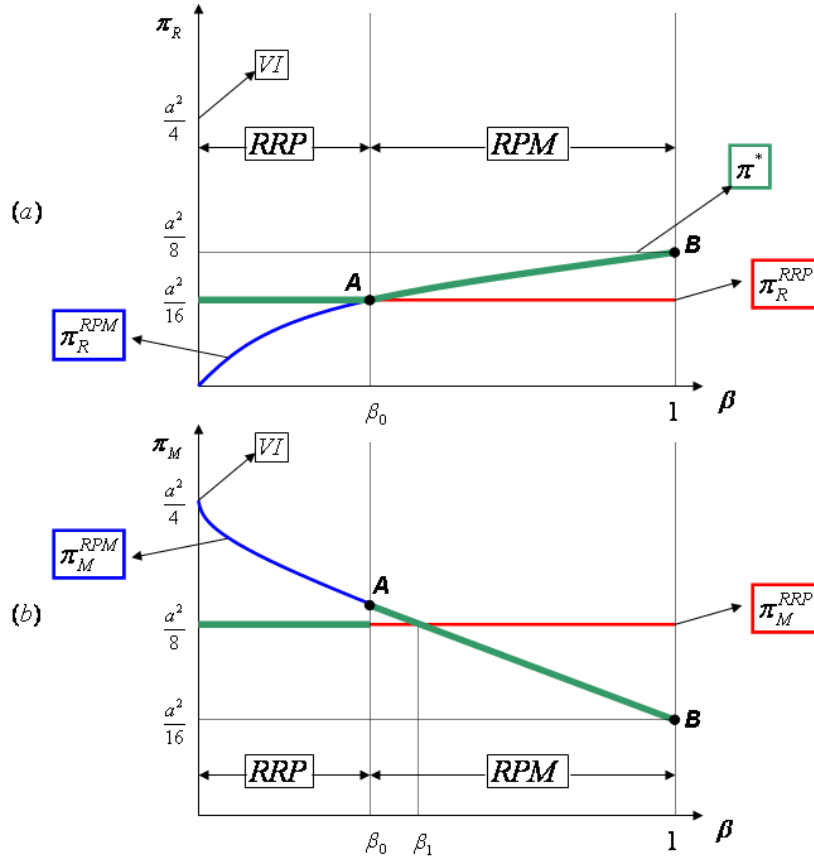


Figure 2: Retailer (a) and manufacturer (b) profits as function of  $\beta$

As for the manufacturer, substituting (24) for  $s$  in  $\pi_M^{RPM} = \frac{(a-s)^2}{4}$  we indeed get:  $\pi_M^{RPM} = \frac{a^2}{16}(2 - \beta)^2$ . At  $\beta = \beta_0$  the manufacturer's profit thus has an upwards jump (to point  $A$  in Figure 2(b)), due to the fact that he induces the retailer to accept the recommended price and so RPM can be implemented. For  $\beta > \beta_0$  the manufacturer's profit is decreasing in  $\beta$ . For  $\beta_0 \leq \beta < \beta_1$  ( $\beta_1 = 2 - \sqrt{2}$ ) the manufacturer implements RPM, through  $s$ , and gets a higher profit than under RRP. When instead the retailer's buyer power is too high, the manufacturer eliminates double marginalization but his profit is lower than under RRP.<sup>12</sup> When buyer power on  $s$  is maximum (i.e.  $\beta \rightarrow 1$ ), the retailer (manufacturer) gets the same profit level that the manufacturer (retailer) obtains when  $\beta = 0$  (point  $B$  in Figure 2(a) and 2(b)).

<sup>12</sup>Note also that for  $\frac{2}{3} \leq \beta < 1$ , the retailer gets a higher profit than the manufacturer.

### 5.2.2 Unilateral setting of $s$

The following analyses deal with cases when, respectively, the manufacturer (Game 2) and the retailer (Game 3) unilaterally sets  $s$ . We start with Game 2, the one with minimum buyer power among the situations investigated. In this case the retailer only retains the power of changing  $\bar{p}$  at  $t = 2$ . This means that the manufacturer cannot reach the vertical integration solution  $VI$  shown in Figure 2(b), because this would be possible only with  $s = 0$ . But in this case  $I_R = 0$ , i.e. RRP would arise and the manufacturer would get a lower profit. Hence the manufacturer may well choose to increase  $s$  with the aim of inducing the retailer to select RPM. This means that he is willing to grant an  $s$  such that  $\pi_M^{RPM} = \frac{1}{4}(a - s)^2 \geq \pi_M^{RRP} = \frac{a^2}{8}$ . The latter holds only if  $s \leq s_3$ , where<sup>13</sup>

$$s_3 = a \left( 1 - \frac{\sqrt{2}}{2} \right) > 0, \quad (25)$$

But since  $\pi_M^{RPM}$  is decreasing in  $s$ , the manufacturer will select the lowest  $s$  such that  $I_R = 1$ , i.e.  $s^* = \text{MIN}[s_1, s_3]$ . Given that  $s_1 < s_3$ , we have that  $s^* = s_1$  (see point  $A$  in Figure 2(b)). The following Proposition has thus been demonstrated.

**Proposition 3** *When a retailer's buyer power consists only in the possibility of changing  $\bar{p}$ , i.e. when the manufacturer sets  $s$ , RPM prevails and  $s^* = s_1$ .*

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<sup>13</sup>The other root is  $s_4 = a \left( 1 + \frac{1}{\sqrt{2}} \right) > s_3$ , which is ruled out because, with  $s$  too high ( $s_4 \gg a$ ), no demand is implied.

The manufacturer sets  $p = \bar{p} = \frac{a}{8} (6 - \sqrt{2})$ , which is lower than the retail price arising under RRP; we then have a Maximum RPM. Moreover  $\pi_M^{RPM} = \frac{a^2}{32} (3 + \sqrt{2}) > \pi_M^{RRP}$  (point *A* shown in Figure 2(b)), with  $\pi_M > \pi_R$ . Notice that while in this game the manufacturer eliminates double marginalization by inducing RPM, with a Nash bargaining game on  $s$  double marginalization may well persist in equilibrium when  $\beta$  is low. Moreover, even in this case the retailer, with buyer power only at  $t = 2$ , is able to extract some rent (while in the benchmark she cannot earn any extra-profit).

Let us now turn to the case where the retailer unilaterally sets  $s$  (Game 3). This is the case of maximum buyer power among the situations analyzed. It is straightforward to show (see Figure 1) that the retailer under these circumstances will set  $s^* = \frac{a}{2}$  at  $t = 1$  and then will choose RPM at  $t = 2$ , in this way achieving her global maximum profit (also see point *B* in Figure 2(a)). Under these circumstances the manufacturer would prefer RRP because the cost of RPM is too high for him, but, given that he has no bargaining power on  $s$ , he has no instrument to implement it. Hence he ends up with point *B* in Figure 2(b). The following result has thus been demonstrated.

**Proposition 4** *When the retailer's buyer power is maximum, i.e. the retailer sets  $s$  and can eventually change  $\bar{p}$ , RPM arises in equilibrium and  $s^* = \frac{a}{2}$ .*

Proposition 4 confirms that the retailer is willing to give up the retail price control when she is compensated by a very high  $s$ . In this situation  $\pi_R^{RPM} = \frac{a^2}{8} > \frac{a^2}{16} = \pi_R^{RRP}$ , and  $\pi_R > \pi_M$ . Notice that the channel profit in

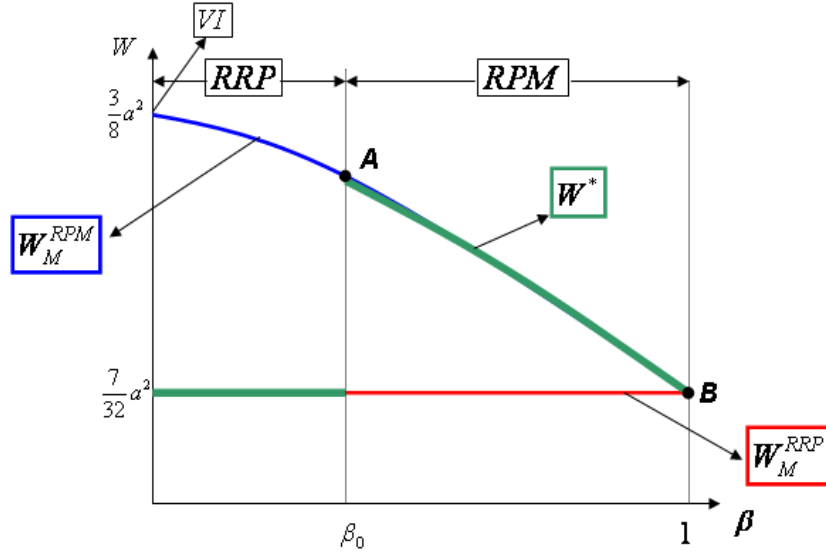


Figure 3: Welfare, buyer power and vertical price restrictions

this case coincides with that under RRP, and is lower than in Game 1 and in Game 2.

### 5.3 Welfare analysis

In this section we compare the welfare properties of the vertical price restrictions arising in equilibrium in the different games analyzed. Figure 3 displays welfare, as a function of  $\beta$ , in Game 1. Substituting (24) for  $s$  in  $W^{RPM} = \frac{1}{8}(3a + s)(a - s)$ , we get  $W^{RPM} = \frac{a^2}{32}(2 - \beta)(6 + \beta)$ . As can easily be shown by substituting the respective solution for  $s$  (i.e.  $s^* = s_1$ ;  $s^* = \frac{a}{2}$ ) in (24), welfare in Game 2 and in Game 3 coincides, respectively, with point  $A$  and point  $B$  in Figure 3.

In Game 1, when  $\beta$  is very small, welfare is also small since RRP prevails. This remains true while  $\beta < \beta_0$  (see Figure 3). When  $\beta \geq \beta_0$ , welfare has an upward jump to point  $A$  due to the implementation of RPM, and becomes a decreasing function of  $\beta$ . It remains higher than that arising under RRP for  $\beta < 1$ . Notice that in Game 1 (when  $\beta = 1$ ) and in Game 3, RRP and

RPM give the same welfare. However, in all the situations analyzed welfare is always lower than that of vertical integration, achieved in the benchmark and given by point *VI* in Figure 3. We have therefore proved the following result.

**Proposition 5** *Welfare depends crucially on buyer power. When  $\beta$  is small (i.e.  $\beta < \beta_0$ ), RRP prevails and welfare is at its lowest level. When  $\beta_0 \leq \beta < 1$ , RPM prevails and welfare is higher than before but decreasing in  $\beta$ . When  $\beta = 1$ , RPM and RRP give the same welfare, which is back to its lowest level.*

Proposition 5 points out that there is a non-monotonic relation between welfare and buyer power. When the latter is positive but small, welfare is low; when buyer power increases sufficiently, RPM is implemented and, consequently, welfare jumps up. But as  $\beta$  increases further, welfare decreases. When  $\beta$  is at its maximum, welfare returns to its minimum. Two factors contribute to explaining this non-monotonic relation: (1) double marginalization (when RRP prevails), (2) the predetermined unit discount given to the retailer, which affects the manufacturer's marginal cost. If buyer power is very small, both these distortions arise in equilibrium: the retailer increases the retail price above the manufacturer's recommended price and also gets a positive, though small, discount. If buyer power is sufficiently high, the first distortion disappears, since the retailer gives up retail price control, but she enjoys a higher unit discount. In this case welfare rises, given the elimination of double marginalization. However, if buyer power continues to grow, the unit discount keeps rising, making this second distortion very large. Welfare

is thus maximal when buyer power is at an intermediate level (point *A* in Figure 3) when the first distortion is eliminated and the second is reasonably low.<sup>14</sup>

## 6 Conclusions

The effect of buyer power on the equilibrium vertical price restriction arising in a successive monopoly has been investigated. It has been demonstrated that a retailer only gives up control of the retail price in exchange for a high unit discount. When the retailer's buyer power is very small or very large, welfare is at its lowest level. In the first case the retailer, receiving only a small unit discount, keeps control over the retail price (RRP prevails) and raises it above the recommended level (overpricing). This implies that double marginalization is not eliminated. In the second case, the unit discount increases so much that, on the one hand, it induces the retailer to give up price control (RPM prevails); on the other hand, it is so large that it leads to very high retail prices. The best situation for society is when the manufacturer and the retailer have a balanced bargaining power: in this case double marginalization is eliminated through an accepted RPM while the unit discount is not particularly high. Hence, in this context, the well known Galbraith's countervailing power hypothesis seems to work.

Our conclusions question the current attitude of antitrust authorities on vertical price restrictions, which looks only at manufacturer's selling power according to a monotonically decreasing relationship: the higher the man-

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<sup>14</sup>The case where  $s$  is so high that RPM leads to a lower welfare than RRP, as shown in Proposition 1, is never an equilibrium outcome in this model specification.

ufacturer's selling power, the worse is the welfare effect of a vertical price restriction.<sup>15</sup> We have also shown that equilibrium recommended prices reduce welfare in comparison with an accepted RPM. This result casts some doubts about the current benevolent attitude of antitrust authorities towards recommended prices.

More research on this topic would certainly be very useful, particularly in studying what happens in more complex vertical structures where competition arises both upstream and downstream.

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<sup>15</sup>For instance the EC block exemptions for vertical agreements state: "The market position of the supplier is the main factor in assessing possible anti-competitive effects of recommended or maximum resale prices. The stronger the supplier's position, the higher the risk that a recommended resale price or a maximum resale price is followed by most or all distributors". EC [2002], p. 26.

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## APPENDIX A

To show that  $\frac{\partial^2 \phi}{\partial \bar{p} \partial s} = \frac{\partial^2 \phi}{\partial s \partial \bar{p}}$ , consider that

$$G = 2y' [\phi(\bar{p}, s)] + [\phi(\bar{p}, s) - \bar{p} + s] y'' [\phi(\bar{p}, s)] \quad (\text{A.1})$$

and so

$$\frac{\partial G}{\partial \bar{p}} = 2y'' \frac{\partial \phi}{\partial \bar{p}} + \left( \frac{\partial \phi}{\partial \bar{p}} - 1 \right) y'' + (p - \bar{p} + s) y''' \frac{\partial \phi}{\partial \bar{p}} \quad (\text{A.2})$$

while

$$\frac{\partial G}{\partial s} = 2y'' \frac{\partial \phi}{\partial s} + \left( \frac{\partial \phi}{\partial s} + 1 \right) y'' + (p - \bar{p} + s) y''' \frac{\partial \phi}{\partial s} \quad (\text{A.3})$$

But since  $\frac{\partial \phi}{\partial s} = -\frac{\partial \phi}{\partial \bar{p}}$ , we can write the latter as

$$\frac{\partial G}{\partial s} = - \left[ 2y'' \frac{\partial \phi}{\partial \bar{p}} + \left( \frac{\partial \phi}{\partial \bar{p}} - 1 \right) y'' + (p - \bar{p} + s) y''' \frac{\partial \phi}{\partial \bar{p}} \right] \quad (\text{A.4})$$

and so:  $\frac{\partial G}{\partial s} = -\frac{\partial G}{\partial \bar{p}}$ . We can now analyze the cross partial derivative of  $\phi(\bar{p}, s)$ . We know that

$$\frac{\partial \phi}{\partial \bar{p}} = \frac{y'[\phi(\bar{p}, s)]}{G(\bar{p}, s)} \quad (\text{A.5})$$

and so

$$\frac{\partial^2 \phi}{\partial \bar{p} \partial s} = \frac{y'' \frac{\partial \phi}{\partial s} G - y' \frac{\partial G}{\partial s}}{G^2} \quad (\text{A.6})$$

and we know that

$$\frac{\partial \phi}{\partial s} = -\frac{y'[\phi(\bar{p}, s)]}{G(\bar{p}, s)}. \quad (\text{A.7})$$

We can then compute

$$\frac{\partial^2 \phi}{\partial s \partial \bar{p}} = \frac{-y'' \frac{\partial \phi}{\partial \bar{p}} G + y' \frac{\partial G}{\partial \bar{p}}}{G^2} \quad (\text{A.8})$$

But

$$\frac{\partial^2 \phi}{\partial \bar{p} \partial s} = \frac{-y'' \frac{\partial \phi}{\partial \bar{p}} G + y' \frac{\partial G}{\partial \bar{p}}}{G^2} = \frac{\partial^2 \phi}{\partial s \partial \bar{p}} \quad (\text{A.9})$$

## APPENDIX B

*Proof of Lemma 2:* Solving (2) for  $y$  and substituting it in (8) we get (since  $\bar{p} = \kappa + s$ ):

$$\frac{p^{RRP}}{\bar{p}^{RRP}} = \left(1 + \frac{\partial \phi}{\partial \bar{p}}\right) \left(\frac{\bar{p}^{RRP} - s}{\bar{p}^{RRP}}\right) = \left(1 + \frac{\partial \phi}{\partial \bar{p}}\right) \left(\frac{\kappa}{\kappa + s}\right) \quad (\text{A.10})$$

It is obvious from (A.10) that, in order to have  $\frac{p^{RRP}}{\bar{p}^{RRP}} < 1$  (underpricing) we need  $\left(1 + \frac{\partial \phi}{\partial \bar{p}}\right) \left(\frac{\kappa}{\kappa + s}\right) < 1$ . But this implies that  $s > \kappa \frac{\partial \phi}{\partial \bar{p}}$ . The same procedure leads, with opposite inequality, to identify when overpricing arises:  $\frac{p^{RRP}}{\bar{p}^{RRP}} > 1$  implies that  $\left(1 + \frac{\partial \phi}{\partial \bar{p}}\right) \left(\frac{\kappa}{\kappa + s}\right) > 1$ , i.e.  $s < \kappa \frac{\partial \phi}{\partial \bar{p}}$ . When  $s = \kappa \frac{\partial \phi}{\partial \bar{p}}$  we have  $p^{RRP} = \bar{p}^{RRP}$  and so an endogenous RPM takes place.  $\square$

*Proof of Proposition 1:* First we evaluate  $\frac{d\pi_R^{RRP}}{dp}$  when  $p = \bar{p}^{RPM}$ . From (2) we get:

$$\left. \frac{d\pi_R^{RRP}}{dp} \right|_{p=\bar{p}^{RPM}} = y + sy' = (2s - \bar{p}^{RPM})y' \quad (\text{A.11})$$

The last step of the above expression is obtained by solving (14) for  $y$  and substituting it. The sign of  $\frac{d\pi_R^{RRP}}{dp} \Big|_{p=\bar{p}^{RPM}}$ , since  $y' < 0$ , depends on the sign of  $(2s - \bar{p}^{RPM})$ . If  $s < \frac{\bar{p}^{RPM}}{2}$  then  $p^{RRP} > p^{RPM} = \bar{p}^{RPM}$ . If  $s = \frac{\bar{p}^{RPM}}{2}$  the two prices coincide (i.e.  $p^{RRP} = p^{RPM} = \bar{p}^{RPM}$ ). If  $s > \frac{\bar{p}^{RPM}}{2}$  then  $p^{RRP} < p^{RPM} = \bar{p}^{RPM}$ . Hence only if  $s$  is sufficiently small will the price under RRP be higher than under RPM. Consequently, consumer surplus under RRP is lower than under RPM. A high  $s$  changes the sign of this comparison.

Second, we analyze channel profit. It is easy to compute that

$$\frac{d(\pi_M^{RRP} + \pi_R^{RRP})}{dp} = y + py'$$

Computing this derivative when  $p = p^{RPM} = \bar{p}^{RPM}$  we find

$$\frac{d(\pi_M^{RRP} + \pi_R^{RRP})}{dp} \Big|_{p=\bar{p}^{RPM}} = y + \bar{p}^{RPM} y' = sy' < 0 \quad (\text{A.12})$$

Note that the last step in (A.12) is obtained by solving (14) for  $y$  and substituting it. It is also possible to compute  $\frac{d(\pi_M^{RRP} + \pi_R^{RRP})}{dp}$  when  $p = p^{RRP}$  (i.e. the price charged by the retailer under the RRP regime). In this case we get

$$\frac{d(\pi_M^{RRP} + \pi_R^{RRP})}{dp} \Big|_{p=p^{RRP}} = y + p^{RRP} y' = (\bar{p}^{RRP} - s)y' < 0 \quad (\text{A.13})$$

This derivative is negative since  $y' < 0$  and  $\bar{p}^{RRP} > s$ . Note that the last step is obtained by solving (2) for  $y$  and substituting it. Since the first order derivative of the channel profit with respect to  $p$  is negative both when  $p = p^{RPM}$  and when  $p = p^{RRP}$ , both prices are too high in comparison with the price that maximizes channel profit, provided that the latter is a strictly

concave function. It follows that, under the two pricing regimes, decreasing  $p$  induces an increase in channel profit. Hence a decrease in  $p$  will lead to an increase in both consumer surplus and channel profit, and, consequently, in welfare. Hence, in order to compare the two pricing regimes from a welfare point of view, it is necessary to identify the regime charging the lower price. But the latter depends upon the sign of (A.11), and so on the level of  $s$ .  $\square$