Oligopoly price discrimination and resale price maintenance

Yongmin Chen*

Oligopoly price discrimination in the retail market prevents a manufacturer from inducing optimal retail margins through any wholesale price. This motivates the manufacturer to impose resale price maintenance. In a model of third-degree price discrimination by rival retailers, a retail price ceiling (or floor) enables the manufacturer to restore the first best. Imposing a fixed retail price is generally not optimal because the manufacturer wants to eliminate price discrimination based on consumers’ abilities to switch retailers, not based on consumers’ valuations. Under resale price maintenance, welfare may either increase or decrease, and it may increase even when total output is reduced.

1. Introduction

Why would a manufacturer want to limit the flexibility of retailers in setting retail prices? This question has long intrigued economists. If retailers are able to set prices optimally to maximize their profits in the retail market, this would seem to be beneficial to the manufacturer who may share at least part of the increased profits through transfer payments. Nevertheless, firms have used resale price maintenance in many markets, including those for clothing, gasoline, beer, milk, pharmaceuticals, books, appliances, bread, automobiles, watches, china, television sets, and many more (Ippolito, 1991). The traditional explanation of resale price maintenance is that it prevents retailers from “free riding” in providing services (Telser, 1960). The free riding arises, for instance, when one retailer demonstrates how to use a product while another retailer, without providing the service, nevertheless sells to a customer who has learned about the product from the other retailer. It has been suggested that the service interpretation can be fairly broad, including maintaining a product’s quality.

* University of Colorado at Boulder; yongmin.chen@colorado.edu.

This is a substantially revised version of an article circulated previously under the title “Vertical Restraint on Price Negotiations.” I have benefited enormously from the comments and suggestions of Kathy Spier, two referees, and Editor Glenn Ellison. I also thank Esther Gal-Or, Tom Holmes, Rob Porter, Bob Rosenthal, Ron Smith, Ruqu Wang, and colleagues at the University of Colorado at Boulder for helpful discussions and comments. I am solely responsible for errors or opinions expressed.
reputation (Marvel and McCafferty, 1984). Another well-known explanation is achieving price collusion. More recently, Deneckere, Marvel, and Peck (1996) have formalized the idea that resale price maintenance may be used to respond optimally to demand uncertainty and to encourage retailers to hold inventories. Explicit or implicit in these arguments is the belief that resale price maintenance is used because, from the point of view of the manufacturer, there would otherwise be “too much” price competition among retailers.

This article offers a new and particularly simple explanation of resale price maintenance (RPM). I demonstrate that retail competition itself need not be a reason for RPM; rather, it is what I call the margin distortion caused by oligopoly price discrimination in the retail market that makes RPM desirable. Price discrimination is widely observed in retail markets with oligopoly competition. It is common, for example, for rival retailers to hold sales periodically, to offer discounts to a particular group of consumers, to charge different prices to new and “old” customers, and to offer the product bundled with a “bad” (such as a coupon) or a “good” (such as some additional service). These are all well-known forms of third-degree price discrimination. By explaining RPM in terms of oligopoly price discrimination in the retail market, I avoid many of the assumptions that are needed in the existing theories of RPM and thus make the theory applicable to a fairly broad range of markets.

I study a simple model in which a manufacturer sells a product through several retailers who are at different locations and compete as oligopolists. Consumers can be separated into what I call “local shoppers” and “comparison shoppers.” The local shoppers purchase only from a local retailer, while the comparison shoppers always purchase from the retailer with the lowest price. This is a convenient way of capturing the idea that consumers may have different costs of time or of gathering price information, or that consumers may have different levels of loyalty in a repeated-purchase context. Sellers are assumed to be able to separate these two groups because, say, consumers shopping on weekdays are mostly local shoppers whereas consumers shopping on weekends are mostly comparison shoppers. Without resale price maintenance, retailers will charge different prices for these two groups of consumers, even when all consumers have valuations that are random draws from a common distribution. This makes it impossible for the manufacturer to set a wholesale price that would induce the retail prices (or retail margins) that maximize the joint profits of the manufacturer and retailers. When both groups of consumers have the same valuation distribution, any of the three forms of RPM—a price floor, a price ceiling, or a fixed price—would restore the first best for the manufacturer. If, on the other hand, local shoppers have valuations that are on average higher than those of comparison shoppers, as we may expect since people with higher time costs are likely to be willing to pay more, then either a floor or a ceiling price would be optimal for the manufacturer, but a fixed price need not be. The key idea here is that there can be two kinds of price discrimination in oligopoly markets: one based on consumers’ willingness to switch sellers or shop around (i.e., consumers’ cross-elasticities regarding different retailers) and another based on consumers’ valuations for the product. The optimal implementation of RPM

---

1 Recent studies have found this explanation implausible (Marvel, 1994).
2 Dana and Spier (1998), however, have shown that there is a simple solution to such problems through revenue sharing. Other articles on RPM include Bolton and Bonanno (1988), Gal-Or (1991), Katz (1989), Mathewson and Winter (1984), Perry and Groff (1985), Rey and Tirole (1986), Romano (1994), and Winter (1993).
by the manufacturer will aim to eliminate the effect of the first kind of price discrimination but retain the effect of the second kind.\footnote{Note that price discrimination based on cross-elasticities is the crucial feature that differentiates oligopoly price discrimination from monopoly price discrimination.}

Price discrimination in oligopoly markets has been studied by several authors in recent years (e.g., Borenstein, 1985; Holmes, 1989; and Winter, 1997). Because of the work of these authors, it is now a well-known principle that price discrimination based on cross-elasticities will be against the collective interest of firms in a market.\footnote{Other recent contributions on this subject include Chen (1997) and Corts (1998).} As Winter (1997) has shown, this can explain the collective agreements retailers sometimes make to limit the discounts they offer a class of customers. In contrast, the present article examines a vertical solution to the problem arising from price discrimination based on cross-elasticities. While these two approaches share some similar motivation, the effects of oligopoly price discrimination may depend in important ways on whether or not the oligopolists are retailers of a manufacturer. In particular, in the existing studies where the oligopolists are modelled as producers, price discrimination may lower prices for all consumers, because more competition for the price-sensitive segment of the consumer population can also intensify competition for other consumers. But this cannot happen in the present article because the marginal cost of the retailers is determined endogenously by the manufacturer. Since sellers of many consumer goods are indeed only retailers for manufacturers, the framework I develop here could also be useful in understanding price discrimination in oligopoly markets.\footnote{This article is also related to the literature on comparing selling mechanisms, such as Chen and Rosenthal (1996), Spier (1990), Wang (1993), and Wernerfelt (1994). All these studies, however, are concerned only with possible transactions between seller(s) and buyers that have no vertical relations on the sellers’ side.}

As I shall discuss in more detail in Section 5, the theory of RPM developed in this article has interesting applications. In particular, it can explain the use of RPM for many “simple” goods, such as gasoline, that is otherwise troublesome for the existing theories. It can also explain why manufacturers may want to impose retail price ceilings, to which the existing theories do not apply.\footnote{An exception is Perry and Porter (1990), who suggest that maximum RPM can be used to prevent excessive service competition.} Since manufacturers have used maximum resale price maintenance in a variety of markets, and since this use has generated a large amount of legal and policy debate, an understanding of the motives for this practice is important.\footnote{Among the 203 reported cases of RPM between 1976 and 1982, for instance, about a third are cases involving maximum RPM allegations (Ippolito, 1991).}

The rest of the article is organized as follows. An example is presented in Section 2 to illustrate why a manufacturer would strictly benefit from RPM when there is oligopoly price discrimination in the retail market. The example also makes it clear that more or less competition in the retail market per se need not be a reason for RPM. Section 3 analyzes a model that generalizes the example in a stylized way. In addition to showing why the manufacturer would want RPM, it shows how the manufacturer can optimally implement RPM. Section 4 studies the effects of RPM on consumers and on welfare. The welfare effect of RPM is shown to be ambiguous in general, and an upper and a lower bound for the welfare effect is provided. Interestingly, RPM may increase welfare even if it reduces total output. Section 5 discusses how the theory developed in this article can be applied to understanding the motives for RPM in
practice and how the model can be extended to explain additional empirical observations.

2. An illustrative example

A manufacturer, denoted $M$, sells a product through two retailers, denoted 1 and 2. The retailers are located at two different areas. There is a continuum of consumers of measure 1 at each area. Each consumer desires at most one unit of the product with valuation $u$, which is the realization of a random variable distributed uniformly on $[0, 1]$. There are two types of consumers: local shoppers (type A) and comparison shoppers (type B). When they make purchases, a local shopper always buys from the local retailer, while a comparison shopper always buys from the retailer with the lowest price. The retailers are able to tell whether a consumer is of type A or type B, although a consumer’s $u$ is her private information. It is commonly known that the portion of type-A consumers at each area is $a \in [0, 1]$. Both the production cost of $M$ and the selling cost of the retailers are normalized to be zero.

One possible interpretation of such a retail market is that portion $a$ of the consumers have sufficiently high transportation costs while the rest of the consumers have zero transportation cost. The hypothesized consumer behavior can also be consistent with a model where only type-A consumers incur a cost to gather price information (a positive search cost). Retailers are able to separate these two types because, say, customers shopping on weekdays are local shoppers while customers shopping on weekends are comparison shoppers; local shoppers will not bother to collect coupons but comparison shoppers will; or, at a gasoline station, local shoppers will only ask for full service while comparison shoppers have no trouble using self service.

The optimal retail price, $p^0$, which maximizes the joint profits of $M$ and retailers, should solve

$$\max_{p} \{ p (1 - p) \}.$$ 

That is, $p^0 = \frac{1}{2}$ for both types of consumers. The highest profit $M$ can potentially obtain is thus

$$R^0 = 2 \left( \frac{1}{2} \left( 1 - \frac{1}{2} \right) \right) = \frac{1}{2}.$$ 

$p^0$ and $R^0$ will be referred to as the first-best retail price and profit for $M$. Assume that $M$ can always make take-it-or-leave-it contract offers that are in the form of two-part tariffs: $\{ w, T \}$, where $w$ is a wholesale price and $T$ is a transfer payment to $M$ (franchise fee).

Assume for the moment that $M$ cannot impose vertical restraint on retailers about resale prices. Suppose first that $a = 1$. In this case, each retailer is a monopoly in his local area and there is no effective competition between the retailers. $M$ can achieve the first best by offering each retailer $\{ w, T \} = \{ 0, \frac{1}{4} \}$, inducing each retailer to set the retail price at $p^0$, earning a monopoly profit that is paid to $M$ through $T$.

---

8 I am grateful to Kathy Spier for suggesting this example to me in her discussion of an earlier version of this article under the title “Vertical Restraint on Price Negotiations” at the 1998 Winter Meetings of the Econometric Society.

© RAND 1999.
Suppose next that $\alpha = 0$. In this case, all the consumers are comparison shoppers, and Bertrand competition between the retailers implies that both will charge $w$. But again $M$ can achieve the first best by offering each retailer $\{w, T\} = \{p^0, 0\}$, resulting in a resale price $p^0$.

Now suppose $0 < \alpha < 1$. Then, given any $\{w, T\}$ that is accepted by the retailers, a retailer will charge $(1 + w)/2$ to a type-A customer and $w$ to a type-B customer in the retail-market equilibrium. Each retailer’s profit, excluding $T$, will be

$$\pi_i = \alpha(1 - w)/2.$$  

By setting $T = \alpha((1 - w)/2)^2$, $M$’s profit is

$$R = 2 \left\{ w \left[ \frac{1 - w}{2} + (1 - \alpha)(1 - w) \right] + \alpha \left( \frac{1 - w^*}{2} \right)^2 \right\},$$

which is maximized when $w = w^*$, where $w^*$ solves the first-order condition

$$\alpha \frac{1 - w^*}{2} + (1 - \alpha)(1 - w^*) - \frac{\alpha}{2} w^* - (1 - \alpha) w^* - \alpha \left( \frac{1 - w^*}{2} \right) = 0.$$  

Or $w^* = [2(1 - \alpha)]/[4 - 3\alpha]$. Thus, type-A customers will be charged

$$(6 - 5\alpha)/[2(4 - 3\alpha)] > \frac{1}{2}$$

and type-B customers will be charged $[2(1 - \alpha)]/[4 - 3\alpha] < \frac{1}{2}$. The average price in the market will be

$$\frac{6 - 5\alpha}{2(4 - 3\alpha)} + (1 - \alpha) \frac{2(1 - \alpha)}{4 - 3\alpha} = \frac{1 + 4 - 2\alpha - \alpha^2}{2} > \frac{1}{2},$$

In this case, the highest profit achievable by $M$ is

$$R^* = \frac{1 (2 - \alpha)^2}{2 4 - 3\alpha},$$

which is less than $\frac{1}{2}$ for $0 < \alpha < 1$, is decreasing in $\alpha$ for $\alpha \in [0, \frac{2}{3})$, and is increasing in $\alpha$ for $\alpha \in (\frac{2}{3}, 1)$.\(^9\)

It is not difficult to see why $R^* < R^0$ for $0 < \alpha < 1$. From the manufacturer’s point of view, it is optimal if the retail price is $p^0$. When firms in the retail market are unable to practice price discrimination (either $\alpha = 0$ or $\alpha = 1$), a proper choice of $w$ will enable the manufacturer to induce $p^0$ on the retail market and then obtain $R^0$ through a proper choice of the transfer payment. When $0 < \alpha < 1$, the duopoly retailers will engage in price discrimination in the retail market, charging a higher price for the local shoppers but a lower price for the comparison shoppers. It then becomes impossible for the manufacturer to use any wholesale price to induce a single retail market price equal to $p^0$. This creates the margin distortion that reduces the manufacturer’s profit.

If $M$ can impose resale price maintenance, then any of the following contracts will restore the first best for $M$ when $0 < \alpha < 1$: $\{w, T\} = \{p^0, 0\}$ together with a

\(^9\)To be complete, one should allow $M$ the option to sell through only one retailer. This will not change my result, however, assuming that with one retailer the local shoppers of the remote area will not make purchases. The highest profit $M$ can achieve with only one retail is, $\frac{1}{4} + \frac{1}{4}(1 - \alpha)$, which is lower than $R^*$. © RAND 1999.
fixed retail price $p^0$ that is imposed on both retailers; \( \{w, T\} = \{0, \frac{1}{4}\} \) together with a floor price \( p = p^0 \) such that no retailer is allowed to price below \( p^0 \); and \( \{w, T\} = \{p^0, 0\} \) together with a ceiling price \( \bar{p} = p^0 \) such that no retailer is allowed to price above \( p^0 \).\(^{10}\)

The conventional wisdom is that a manufacturer may want to impose resale price maintenance because there is “too much” price competition among the retailers. A key point I hope to illustrate in this simple example is that more competition in the retail market itself need not be a reason for using RPM; rather, it is the margin distortion caused by oligopoly price discrimination in the retail market that makes RPM desirable for the manufacturer.

Since without RPM the price for type-A consumers is higher but the price for type-B consumers is lower, RPM clearly makes the former better off and the latter worse off.\(^{11}\) While in general the welfare effect of RPM is not always positive, as we shall see later, it is always positive in this example. This is because welfare, measured as the sum of aggregate consumer and producer surpluses, is

\[
S = 2 \left[ \int_{\frac{1}{2}}^{1} (u - 0) \, du \right] = 1 - \left( \frac{1}{2} \right)^2 = \frac{3}{4}
\]

under RPM; welfare without RPM is

\[
S = 2 \left[ \alpha \int_{\frac{1}{(2(1-\alpha))/3\alpha]}^{1} (u - 0) \, du + (1 - \alpha) \int_{\frac{1}{(2(1-\alpha))/3\alpha]}^{1} (u - 0) \, du \right] = \frac{3(2 - \alpha)^2}{4(4 - 3\alpha)} < \frac{3}{4}.
\]

In the next section I analyze a model that extends the example here in three ways: (i) the consumers’ valuation distribution takes more general forms; (ii) the local shoppers and the comparison shoppers can have different valuation distributions; and (iii) there can be any number of oligopoly retailers. These extensions serve to confirm that the motivation for RPM illustrated by the example exists in a more general context. Furthermore, extension (ii) makes it clear that what the manufacturer desires to prevent is the price discrimination in the retail market that is based on consumers’ differences in cross-elasticities but not that based on consumers’ differences in valuations. This suggests that a manufacturer may desire a particular form of vertical restraint in implementing RPM.

3. The model and its analysis

- The model. Manufacturer \( M \) produces a product at constant marginal cost \( c \geq 0 \). \( M \) sells the product through \( n \geq 2 \) retailers, denoted as \( i = 1, 2, \ldots, n \). The retailers’ selling costs are normalized to be zero. There are \( n \) different areas, and one retailer is located at each area. There is a continuum of consumers of measure 1 at each area. Portion \( \alpha \) of the consumer population at each area are local shoppers (type-A consumers), while the rest are comparison shoppers (type-B consumers), defined as in the earlier example. Each consumer has valuation \( u \) for one unit of the product but has zero valuation for additional units, where \( u \) is the realization of a random

\(^{10}\) Still another possible restraint is to require retailers to charge the same prices to all customers. It is not optimal here, since the only retail market equilibrium will then be in mixed strategies. However, should there be some continuous transportation costs so that a pure-strategy equilibrium would exist, a uniform-price restraint could also restore the first best in this example.

\(^{11}\) Note, however, that the average price in the market is lower under RPM in this example.
variable \( U \) with Pr(\( U < u \)) = \( F(u) \) and Pr(\( U < u \)) = \( G(u) \) on \([0, \bar{u}]\) for type-A and type-B consumers, respectively, where \( c < \bar{u} < \infty \). Note that \( F(u) \) and \( G(u) \) are the usual cumulative distribution functions if they are continuous on \([0, \bar{u}]\). A consumer’s \( u \) is her private information, but whether she is type A or type B is known by the retailers.

Define

\[
p_f(w) = \arg \max_p \{(p - w)[1 - F(p)]\},
\]

\[
p_g(w) = \arg \max_p \{(p - w)[1 - G(p)]\}.
\]

Assume that \( p_f(w) \) and \( p_g(w) \) exist uniquely for any \( w \in [0, \bar{u}] \). Let \( p_f^0 = p_f(c) \) and \( p_g^0 = p_g(c) \). Assume \( c < p_f^0 < \bar{u} \), \( c < p_g^0 < \bar{u} \), and for any \( p > p_f(p_f^0) \),

\[
(p_f(p_f^0) - c)[1 - F(p_f(p_f^0))] \geq (p - c)[1 - F(p)].
\]

One can verify that the above assumptions will all be satisfied if \( F \) and \( G \) are continuous with respective density functions \( f(u) \) and \( g(u) \) on \([0, \bar{u}]\), and 
\[
(d/dp)[[1 - F(p)]/f(p)] \leq 0 \quad \text{and} \quad (d/dp)[[1 - G(p)]/g(p)] \leq 0
\]
for \( p \in [0, \bar{u}] \). Note that the monotonic (inverse) hazard rate assumption is satisfied by many familiar continuous distributions. My model, however, allows more general distributions, including distributions that are not continuous.

I also assume that \( p_f^0 \leq p_g^0 \). The idea is that the comparison shoppers are more likely to have lower valuations than the local shoppers, and thus the monopoly price tends to be lower for the former than for the latter. For any \( w_1 > w_2 \),

\[
(p_f(w_1) - w_1)[1 - F(p_f(w_1))] \geq (p_f(w_2) - w_1)[1 - F(p_f(w_2))],
\]

\[
(p_f(w_2) - w_2)[1 - F(p_f(w_2))] \geq (p_f(w_1) - w_2)[1 - F(p_f(w_1))].
\]

Adding the two inequalities above and simplifying, we have \( p_f(w_1) \geq p_f(w_2) \) for any \( w_1 > w_2 \). Thus both \( p_f(w) \) and \( p_g(w) \) are weakly increasing in \( w \). To avoid trivial situations, assume \( p_f(p_f^0) > p_f(c) = p_f^0 \).

As a benchmark, if each retailer sets prices that maximize the joint profits of \( M \) and retailers, then each retailer should set \( p_f^0 = p_f(c) \) for type-A consumers and \( p_g^0 = p_g(c) \) for type-B consumers. The highest total profit \( M \) can potentially obtain is

\[
R^0 = n[a[p_f(c) - c][1 - F(p_f(c))] + (1 - a)[p_g(c) - c][1 - G(p_g(c))]],
\]

or

\[
r^0 = a[p_f(c) - c][1 - F(p_f(c))] + (1 - a)[p_g(c) - c][1 - G(p_g(c))]
\]

per area (per retailer). I shall refer to this benchmark as the first best for \( M \).

---

12 We assume that a consumer will buy the product if her \( u \) is higher than or equal to the price she is charged. If \( F(u) \) or \( G(u) \) is not continuous, then under our definition of \( F \) and \( G \), \( 1 - F(u) \) or \( 1 - G(u) \) will be upper semicontinuous.

© RAND 1999.


**Equilibrium without RPM.** Let us first study equilibria of the model without RPM. In this case, $M$ first offers a two-part tariff contract, $\{w, T\}$, to all retailers, and retailers who accept the contract then compete in the retail market. I assume that $n$ and $\alpha$ are such that it is optimal for $M$ to use all retailers. Since the highest profit $M$ can potentially obtain by selling through only $n - 1$ retailers is

$$n(1 - \alpha)[p_g(c) - c][1 - G(p_g(c))] + (n - 1)\alpha[p_f(c) - c][1 - F(p_f(c))],$$

while selling through $n$ retailers $M$ can obtain at least $n\alpha[p_f(c) - c][1 - F(p_f(c))]$ by offering each retailer $\{w, T\} = \{c, \alpha[p_f(c) - c][1 - F(p_f(c))]\}$, a sufficient but not necessary condition under which it is optimal for $M$ to use all $n$ retailers is

$$n(1 - \alpha)[p_g(c) - c][1 - G(p_g(c))] \leq \alpha[p_f(c) - c][1 - F(p_f(c))].$$

Given that all retailers will be active sellers of $M$’s product, it is optimal to offer the same contract to all retailers in equilibrium.\(^1\)

I first characterize the retail market equilibrium, assuming that some $\{w, T\}$ has been accepted by all retailers. Without loss of generality, assume $c \leq w < \bar{w}$. Each retailer’s strategy in the retail market is a pair $(p_g, p_h)$, where $p_g$ and $p_h$ are retailer $i$’s prices for type-A and type-B consumers, respectively. At any Nash equilibrium in the retail market, we must have $p_g = p_g^* = w$ and $p_h = p_h^* = p_f(w)$. Therefore there is a unique Nash equilibrium in the retail market, and each retailer’s profit at the unique Nash equilibrium, excluding $T$, is

$$\pi(w) = \alpha[p_f(w) - w][1 - F(p_f(w))].$$

Now consider the optimal (subgame-perfect Nash equilibrium) choice of $\{w, T\}$ by $M$. $M$ chooses $\{w, T\}$ to maximize profit per retailer:

$$r(w) = (w - c)(\alpha[1 - F(p_f(w))] + (1 - \alpha)[1 - G(w)]) + T,$$

subject to the constraint that $T \leq \pi(w)$ so that each retailer will indeed accept the contract. In the optimum, $T = \pi(w)$, thus

$$r(w) = \alpha[p_f(w) - c][1 - F(p_f(w))] + (1 - \alpha)(w - c)[1 - G(w)]. \quad (5)$$

Now define $w^*$ as any $w$ that maximizes $r(w)$ on $[c, \bar{w}]$. Under our definition of $F(\cdot)$ and $G(\cdot)$, $r(w)$ is upper semicontinuous. Thus $w^*$ exists and the maximum, $r^* = r(w^*)$, will be obtained. Since $r^*$ is unique even if $w^*$ is not, the possible existence of multiple $w^*$ is not essential for the analysis of equilibrium outcomes. In what follows I shall thus assume either that $w^*$ is unique or that $M$ always chooses the smallest $w$ that achieves $r^*$. Let $\pi^* = \pi(w^*)$. We have the following:

**Proposition 1.** Without RPM, the model has a unique subgame-perfect Nash equilibrium. At this equilibrium, $M$ offers $(w^*, \pi^*)$ to each retailer, where $c \leq w^* \leq p_f$ and

\(^{13}\) This is because if in equilibrium two retailers have different contracts, they will have different values of $w$ and the retailer with higher $w$ will only sell to the local shoppers. But then $M$ can (weakly) increase profit by slightly lowering $w$ and increasing $T$ for that retailer.
at least one inequality holds strictly; each retailer charges \( p^*_i = p_i(w^*) \) to type-A customers and \( p^*_g = w^* \) to type-B customers. \( M \)'s equilibrium profit is lower than \( R^0 \).

**Proof.** I only need to show \( c \leq w^* \leq p^*_g \), where at least one inequality holds strictly, and \( r^* < r^0 \). Notice first that \( w^* \geq c \). Next, since \( p_i(w) \) weakly increases in \( w, p_i(w) \geq p_i(p^*_g) \) if \( w > p^*_g \). Thus, if \( w > p^*_g \), we would have

\[
[p_i(w) - c][1 - F(p_i(w))] \leq [p_i(p^*_g) - c][1 - F(p_i(p^*_g))].
\]

Therefore, for any \( w > p^*_g \), we have

\[
r(w) < \alpha[p_i(p^*_g) - c][1 - F(p_i(p^*_g))] + (1 - \alpha)(p^*_g - c)[1 - G(p^*_g)].
\]

Hence \( w^* \leq p^*_g \). Since \( c < p^*_g \), at least one inequality holds strictly for \( c \leq w^* \leq p^*_g \). Therefore

\[
r^* = \alpha[p_i(w^*) - c][1 - F(p_i(w^*))] + (1 - \alpha)(w^* - c)[1 - G(w^*)] < \alpha[p_i(c) - c][1 - F(p_i(c))] + (1 - \alpha)(p^*_g - c)[1 - G(p^*_g)] = r^0.
\]

Q.E.D.

**Equilibrium with RPM.** Now suppose that in addition to offering a two-part tariff, \( M \) can impose a vertical restraint on how resale prices are to be set. Denote the two-part tariff in this case by \( \{w_v, T_v\} \).

First, if \( M \) offers \( \{w_v, T_v\} = \{c, r^0\} \) together with a resale price floor \( p = p^*_g \), the unique retail market equilibrium will be for all sellers to charge type-A customers \( p^*_g \) and type-B customers \( p^*_g \). Each retailer will earn \( r^0 \) in the retail market, which is paid to \( M \) through \( T_v \). The first best for \( M \) is thus restored.

Next, if \( M \) offers \( \{w_v, T_v\} = \{p^*_g, \alpha(p^*_g - p^*_g)[1 - F(p^*_g)]\} \) together with a resale price ceiling \( \bar{p} = p^*_g \), the unique retail market equilibrium will be for all sellers to charge type-A customers \( p^*_g \) and type-B customers \( p^*_g \). Each retailer will earn \( \alpha(p^*_g - p^*_g)[1 - F(p^*_g)] \) in the retail market, which is paid to \( M \) through \( T_v \). \( M \)'s profit per retailer is therefore

\[
\alpha(p^*_g - p^*_g)[1 - F(p^*_g)] + (p^*_g - c)\{\alpha[1 - F(p^*_g)] + (1 - \alpha)[1 - G(p^*_g)]\} = r^0.
\]

The first best for \( M \) is again restored.

Finally, if \( M \) imposes a fixed price for each retailer, then, unless \( p^*_g = p^*_g \), \( M \) will not be able to achieve the first best. This is because when \( p^*_g < p^*_g \), the highest profit \( M \) can achieve per retailer by imposing a fixed price on each retailer, say \( p_v, \) is

\[
\max_{p_v} \{\alpha(p_v - c)[1 - F(p_v)] + (1 - \alpha)(p_v - c)[1 - G(p_v)]\} < \alpha(p^*_g - c)[1 - F(p^*_g)] + (1 - \alpha)(p^*_g - c)[1 - G(p^*_g)] = r^0.
\]

I have therefore shown the following:
Proposition 2. With RPM, the profit of $M$ increases. Either a retail price floor or a retail price ceiling optimally implements RPM, resulting in retail prices $p_f^0$ and $p_c^0$ for type-A and type-B consumers, respectively; but imposing a fixed retail price is not optimal for $M$ if $p_f^0 < p_c^0$.

Oligopoly price discrimination in the retail market has two opposite effects on the joint profits of the manufacturer and retailers. In addition to the margin distortion effect, there is also the effect arising when retailers are able to price discriminate among consumers based on their valuation differences. An optimal use of RPM by $M$ will aim to eliminate the former but retain the latter. In the simple model we have here, $M$ is able to achieve this objective perfectly by imposing either a retail price floor or a retail price ceiling.

4. The effects of RPM on consumers and welfare.

We can also gain some insights about how RPM affects consumers and social welfare. From Propositions 1 and 2, we immediately have

Corollary 1. Under RPM, type-A consumers will be (weakly) better off but type-B consumers will be (weakly) worse off.

Thus RPM due to third-degree oligopoly price discrimination in the retail market tends to have opposite effects on different groups of consumers. This is a direct consequence of the effects of third-degree oligopoly price discrimination when the oligopolists are retailers for a manufacturer. In models of third-degree oligopoly price discrimination where the oligopolists are producers, it has been shown that oligopoly price discrimination can sometimes lead to lower prices for all consumers (e.g., Chen, 1997 and Corts, 1998). When the rival sellers are only retailers for a manufacturer, this cannot happen because the manufacturer will adjust the wholesale price to prevent retail prices from being reduced for all consumers.

Welfare without RPM is

$$ S = n \left[ \alpha \int_{p_f^0}^{\pi} (u - c) \, dF(u) + (1 - \alpha) \int_{u^*}^{\pi} (u - c) \, dG(u) \right]. \quad (6) $$

Welfare under RPM is

$$ S_v = n \left[ \alpha \int_{p_f^0}^{\pi} (u - c) \, dF(u) + (1 - \alpha) \int_{p_c^0}^{\pi} (u - c) \, dG(u) \right]. \quad (7) $$

Define

$$ \Delta S = S_v - S, $$

$$ \Delta q_f = 1 - F(p_f^0) - [1 - F(p_f^*)], $$

$$ \Delta q_c = 1 - G(p_c^0) - [1 - G(w^*)]. $$

Then $\Delta q_f$ is the change in output sold to type-A consumers per retailer due to
RPM, and \( \Delta q_s \) is the change in output sold to type-B consumers per retailer due to RPM. Obviously \( \Delta q_f \geq 0 \) and \( \Delta q_s \leq 0 \). We have

\[
\Delta S = n \left[ \alpha \int_{p_f^0}^{p_f^1} (u - c) \, dF(u) - (1 - \alpha) \int_{w^*}^{p_s^0} (u - c) \, dG(u) \right]
\]

\[
\geq n \{ \alpha(p_f^0 - c)[F(p_f^1) - F(p_f^0)] - (1 - \alpha)(p_s^0 - c)[G(p_s^0) - G(w^*)] \}
\]

\[
= n \{ \alpha(p_f^0 - c)[1 - F(p_f^0) - [1 - F(p_f^0)]] \}
\]

\[
+ (1 - \alpha)(p_s^0 - c)[1 - G(p_s^0) - [1 - G(w^*)]] \}
\]

\[
= n[\alpha(p_f^0 - c)\Delta q_f + (1 - \alpha)(p_s^0 - c)\Delta q_s].
\]

On the other hand,

\[
\Delta S = n \left[ \alpha \int_{p_f^0}^{p_f^1} (u - c)f(u) \, du - (1 - \alpha) \int_{w^*}^{p_s^0} (u - c)g(u) \, du \right]
\]

\[
\leq n \{ \alpha(p_f^0 - c)[F(p_f^1) - F(p_f^0)] - (1 - \alpha)(w^* - c)[G(p_s^0) - G(w^*)] \}
\]

\[
= n \{ \alpha(p_f^0 - c)[1 - F(p_f^0) - [1 - F(p_f^0)]] \}
\]

\[
+ (1 - \alpha)(w^* - c)[1 - G(p_s^0) - [1 - G(w^*)]] \}
\]

\[
= n[\alpha(p_f^0 - c)\Delta q_f + (1 - \alpha)(w^* - c)\Delta q_s].
\]

We have thus established a lower and an upper bound for \( \Delta S \), as in the following:

**Proposition 3.** The effect of RPM on welfare satisfies the following condition:

\[
n[\alpha(p_f^0 - c)\Delta q_f + (1 - \alpha)(p_s^0 - c)\Delta q_s] \leq \Delta S \leq n[\alpha(p_f^0 - c)\Delta q_f + (1 - \alpha)(w^* - c)\Delta q_s].
\]

Notice that \((p_f^0 - c) \geq (p_s^0 - c)\) and \(\alpha\Delta q_f + (1 - \alpha)\Delta q_s\) is the change of output per retailer due to RPM. From Proposition 3, it is thus clear that \(\Delta S > 0\) if \(\alpha\Delta q_f + (1 - \alpha)\Delta q_s > 0\). Furthermore, if \(p_f^0 > p_s^0\), then \((p_f^0 - c) > (p_s^0 - c)\), and it is possible that \(\Delta S > 0\) even if \(\alpha\Delta q_f + (1 - \alpha)\Delta q_s < 0\). We thus have

**Corollary 2.** Welfare is higher under RPM if total output is increased; welfare may be higher under RPM even if total output is reduced.

It is perhaps less intuitive why welfare can be higher under RPM even if total output is reduced, but this is because RPM raises output to those consumers with higher expected valuations while it reduces output to those consumers with lower expected valuations.\(^{14}\)

The effect of RPM on welfare turns out to be ambiguous in general. We can make this clear by considering the next example.

---

\(^{14}\)That an increase in output is sufficient for welfare to increase due to the elimination of price discrimination has a simple proof in the case where the manufacturer would not want any price discrimination (see Varian, 1989).

© RAND 1999.
Example. Suppose

\[
F(u) = \begin{cases} 
0 & \text{if } u \leq \frac{3}{5} \\
\frac{1}{2} & \text{if } \frac{3}{5} < u \leq 1 \\
1 & \text{if } 1 < u,
\end{cases}
\]

that is, the local shoppers’ \( u \) has only two possible values: 3/5 and 1, each with prob-
ability 1/2. Assume also \( G(u) = u \) for \( 0 \leq u \leq 1 \) and \( c = 0 \). Then

\[
p_f^0 = \frac{3}{5}, \quad p_g^0 = \frac{1}{2}, \quad p_f(w) = \begin{cases} 
\frac{3}{5} & \text{if } w \leq \frac{1}{5} \\
1 & \text{if } \frac{1}{5} < w \leq 1
\end{cases}
\]

\[
r(w) = \begin{cases} 
\frac{3}{5} + (1 - \alpha)w(1 - w) & \text{if } w \leq \frac{1}{5} \\
\frac{1}{2} + (1 - \alpha)w(1 - w) & \text{if } \frac{1}{5} < w \leq 1
\end{cases}
\]

\[
w^* = \begin{cases} 
\frac{1}{5} & \text{if } \alpha < \frac{9}{19} \\
\frac{1}{2} & \text{if } \frac{9}{19} < \alpha \leq \frac{3}{5}
\end{cases}
\]

\[
p_f^* = \begin{cases} 
\frac{3}{5} & \text{if } \alpha < \frac{9}{19} \\
1 & \text{if } \frac{9}{19} \leq \alpha \leq 1
\end{cases}
\]

\[
r^* = \begin{cases} 
\frac{11}{25} \alpha + \frac{4}{25} & \text{if } \alpha < \frac{9}{19} \\
\frac{1}{4} \alpha + \frac{1}{4} & \text{if } 0 < \alpha < \frac{9}{19}
\end{cases}
\]

Thus, for \( 9/19 \leq \alpha < 1 \),

\[
\Delta S = n \left[ \alpha \int_{3/5}^{1} u \, dF(u) - (1 - \alpha) \int_{1/5}^{1/2} u \, du \right] = -n(1 - \alpha) \frac{21}{200} < 0,
\]

and for \( 0 < \alpha < 9/19 \),

\[
\Delta S = n \left[ \alpha \int_{3/5}^{1} u \, dF(u) - (1 - \alpha) \int_{1/2}^{1} u \, du \right] = n \alpha \frac{3}{10} > 0.
\]

Therefore, there are situations where RPM increases welfare, but there are also situations where the opposite is true.

5. Discussion

- The practice of resale price maintenance has long been a puzzle for economists. Although it has been per se illegal in the United States since the middle 1970s, there
have been continuing legal and policy debates on this issue. In “one of its most im-
portant antitrust decisions in years,” the U.S. Supreme Court recently ruled, in State
Oil Company v. Khan, that imposing a ceiling price on retailers by a manufacturer
(supplier) does not necessarily violate federal antitrust law, overturning the per se illegal
status of maximum price maintenance. Although the existing theories have contributed
to our understanding of RPM, they have not been able to explain RPM for many
“simple” goods. The theory developed in the present article can be particularly useful
in this respect.

Consider the case of gasoline, which is clearly a “simple” good. There is a long
history of litigation with respect to RPM in U.S. gasoline retailing. There is also em-
pirical evidence that competing gasoline retailers practice price discrimination. In par-
ticular, buyers of full-service regular gasoline are less likely to shop around than buyers
of self-service regular gasoline, and there is price discrimination against the former
(Shepard, 1993). Using the terminology of my model, the full-service customers are
local shoppers and the self-service customers are comparison shoppers. My theory
would then predict that from the manufacturer (refiner)’s point of view, without RPM,
prices for the full-service customers tend to be too high and prices for the self-service
customers tend to be too low. The findings by Shepard, in a study of the gasoline
market in eastern Massachusetts for a period in 1987, indicate that this is the case:
prices for full-service customers were higher at leased gasoline stations operated by
independent dealers than at refiner-owned stations where the refiner could legally main-
tain retail prices; but prices for self-service customers were lower at the former than
at the latter.

There is also evidence that gasoline retailers price discriminate based on customers’
choice of gasoline types (e.g., Borenstein, 1991 and Shepard, 1993). For instance,
refiners claim that buyers of regular gasoline are more likely to switch stations in
response to price differentials than are buyers of premium gasoline (Shepard, 1993).
As a simplification, we may consider buyers of regular gasoline as comparison shoppers
and buyers of premium gasoline as local shoppers. Thus a refiner will face the problem
of how to raise the wholesale price of regular gasoline in order to maintain its retail
price but not raise the wholesale price of premium gasoline above the level that would
induce its optimal retail price. Therefore, for lessee-operated stations, the retail prices
for regular and premium gasoline would tend to be too low and too high, respectively,
from the manufacturer’s perspective; empirical evidence indicates that this is indeed
the case (Shepard, 1993). Incidentally, in State Oil Company v. Khan, Khan and his
corporation, who entered into an agreement to lease a gas station and purchase gasoline
from State Oil Company, sued State Oil for price fixing, alleging that if not for the
price constraint imposed by State Oil, Khan would have lowered the price for regular

---

15 See Linda Greenhouse’s article, “High Court Says Price Ceilings and Some ‘Fixing’ Are Allowed,”

16 Note that the difference in the cross-elasticities between the two groups of customers is what would
lead to the margin distortion here. If all customers are comparison shoppers, or all are local shoppers, a
refiner will be able to induce the first best by properly choosing the lease fee and the wholesale price.

17 To the extent that consumers have preference for or loyalty to a particular brand, a gasoline refiner
of a certain brand possesses market power. I abstract from considerations such as competition from other
refiners.

18 Unlike for self- and full-service gasoline, a refiner can set different wholesale prices for regular and
premium gasoline. Thus my model does not apply directly in the latter situation. But it can provide the same
insight if a refiner needs to maintain some minimum difference between the wholesale prices of regular and
premium gasoline.
gasoline and raised the price for premium gasoline (U.S. Supreme Court: State Oil Co. v. Khan, No. 96-871 (1997)).

Except for Perry and Porter (1990), who suggest that maximum RPM may be used to prevent retailers from providing excessive services, the existing theories have not carefully considered the motives for maximum RPM. While the service consideration could well be present for some types of goods, maximum RPM has been used for many “simple” goods for which the argument of prevention of excessive service seems implausible.19 For these goods, my explanation of maximum RPM could be more useful. The actual use of maximum RPM may be wider than what appears according to the legal definition. For instance, manufacturers sometimes attach price labels to their products, indicating the manufacturer’s suggested retail prices. To the extent that retailers can still charge prices lower than what the manufacturer has suggested, this practice is not considered RPM. In fact, retailers often sell products below the manufacturer’s suggested prices, especially when they hold sales. In many situations, what these suggested prices seem to have accomplished is to help a manufacturer commit to some retail price ceilings. If that is true, then my theory may explain why a manufacturer would want to do so.20

Although for convenience I have considered a particularly simple model, the insights of the article can hold in a more general context. Consider, for instance, the following extension of my model: in addition to the n retailers as described, there are two other retailers of a different kind, the “discounters,” located apart from the n retailers, and the area of discounters has measure 1 of consumers who are all comparison shoppers. Then the manufacturer will again face the problem of how to set the wholesale price high enough to maintain the retail prices for the comparison shoppers but avoid too-high prices charged to local shoppers at the n stores. If we call the n retailers “traditional” retailers, then the use of RPM can reduce the average price at the traditional stores but raise the price at the discount stores, because by imposing a minimum retail price, for instance, the manufacturer can now lower its wholesale price, which will result in a lower retail price for the local shoppers. A review of the evidence on the price effects of RPM, or fair trade when such practice was legal, supports my argument. For goods including drugs, soap powders, chips, flakes, cake flour, beauty creams, toothpastes, shave creams, and shampoos, prices fell in traditional stores and rose in discount stores with fair trade. According to Overstreet (1983), “the fall in prices of fair-traded items in traditional stores is not a generally expected result and is not explained” (p. 107). But such effects of RPM are exactly what my explanation would predict.21

While I believe that this article has illustrated an important motive for the use of RPM by manufacturers, it is certainly not true that this motive explains all the uses of RPM. It should be considered as complementary to the existing theories. A careful examination of the economic factors is often needed to determine the effects of RPM

19 In State Oil Company v. Khan, organizations including the National Association of Manufacturers and the Business Roundtable filed briefs urging the Court to overturn a 29-year-old precedent that regarded price ceilings as illegal. This suggests that a broad class of manufacturers wanted to be able to impose maximum RPM.

20 For instance, if the suggested retail price printed on a book practically acts as a ceiling price, rather than preventing excessive service by bookstores, it seems more likely that the ceiling price prevents bookstores from charging too-high prices for “loyal” (local) customers under a wholesale price that has to be high enough to limit “specials” targeted at bargain hunters.

21 Notice that most of the goods mentioned could be considered “simple” goods, and one may wonder, according to the existing theories, why RPM were used on them in the first place.
in a particular situation. This may be especially important now, since the legal status of maximum RPM has been changed in the United States to that of a rule of reason.

References


