Discussion Paper No. 017

Vertical Control of Cournot Wholesalers in Spatial Competition: Exclusive Territories? or Maximum Retail Price Stipulations?

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March, 2004

21COE
Interfaces for Advanced Economic Analysis
Kyoto University

February 2004

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Abstract

In this paper, we use a spatial competition model developed by Pal (1998) to analyze producer imposed retail price ceilings and producer assigned exclusive geographic sales territories. Two wholesale distributors are presumed to each have a single collection point respectively from which they supply retail outlets at many locations. Each wholesaler chooses the quantity to ship to each outlet and the retail prices attain market clearing levels. Given that the costs of shipping depend on distance, this system results in a kind of waste in that the products are not shipped exclusively from the nearest collection point. As pointed out by Matsumura (2003) this wasteful cross-hauling can be prevented if the manufacturer assigns exclusive geographic territories to the distributors. But the costs of administering an exclusive territory system may well outweigh any savings in shipping costs. In this instance a manufacturer stipulated price ceiling may be the preferred alternative. By controlling not only the manufacturer price but also the retail price at each location, the manufacturer can deter wasteful cross-hauling and expand the overall channel profit, while also conferring enlarged consumer surplus. JEL classification: D43, L13, L42. Key words: Spatial quantity competition, location choice, manufacturer assigned exclusive geographic territories, manufacturer stipulated maximum retail prices

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1. Introduction

Where the independent wholesale distributors of a branded product are Cournot rivals, a kind of wasteful cross-hauling can arise in which more than one of the wholesalers–and not only the nearest and least cost wholesaler–supply the same retail location. If this sort of "reciprocal dumping" adds significantly to logistic costs, the manufacturer may well intervene to correct the situation and see that each retail location is supplied only by the nearest wholesaler. The manufacturer could do this by assigning each wholesaler an exclusive sales territory, and then imposing vertical restraints to counteract the successive monopoly distortions. Such is the basic logic of Matsumura (2003). We extend the argument by showing that the manufacturer can achieve nearly the same result without explicitly assigning exclusive wholesale territories merely by stipulating maximum retail prices.

There are many examples in Japan in which manufacturers stipulate resale prices. This is known as the tate-ne (lit. "set-price") system. There are very few instances of Japanese manufacturers assigning exclusive wholesale territories. In our algebraic example the two regimes achieve nearly the same allocation, but there are ways in which an exclusive territory system would be more costly to administer than the tate-ne system.

The thrust of our argument is that the ubiquity of manufacturer stipulated resale prices in Japan and elsewhere may be simply to economize on transport costs. In these cases, manufacturer stipulated resale price regimes are not only profitable for the manufacturer but also expand output, lower prices and enhance consumer surplus. This example of welfare enhancing resale price maintenance thus joins others including the Spengler (1950) control of successive monopoly argument, Telser (1960) promotion of special services argument, and Flath and Nariu (1989; 2000) deterrence of revenue corroding price discounts under uncertain demand argument.

2. The Model

Our basic set-up matches that of Matsumura (2003) in which Cournot rivals first choose their own spatial locations, and then choose the quantities to ship to each final demand location. A couple of authors had already analyzed this situation. Specifically, Anderson and Neven (1991) showed that in the linear spatial model the Cournot rivals locate close together. But Pal (1998) showed that in the circular spatial model the Cournot rivals locate as far apart as possible. We, like Matsumura (2003), follow the Pal, circular city approach.

To recap the framework of Matsumura (2003), assume that the final demand for a branded product is the same at each retail outlet along the perimeter of a circle with unit circumference and is linear as follows

(1) $p = a - Q$,

where p is the retail price at the location (i.e. the delivered price), and "a" is a scale parameter (and the vertical intercept of the demand curve). We shall presume that there is a monopoly producer of the good and to keep matters simple let the marginal cost of production be zero. Let there be two independent distributors of the product (i=1,2). And suppose further that each of the distributors has a single collection point somewhere on the perimeter of the circle, from which it ships the good to retail outlets also located on the perimeter of the circle, for sale to the final demanders. To keep matters simple we will assume that the arrangements between each distributor and the retail outlets bring about the same allocation as would vertical integration between the distributor and retailers. This might entail vertical restraints of some sort or another which we will not attempt to specify precisely. We presume that the retail outlets are numerous and equidistant from one another. That is the retail outlets are uniformly dense on the perimeter of the circle. The cost of shipping the good from collection point to retail outlet is t per unit of distance. We presume that the demand is sufficiently large in relation to shipping costs that $a \geq 2t$. We also assume that consumers' transport costs are prohibitively great[1]

Under the set of conditions just described we posit a three-stage game. First, the manufacturer chooses a shipping price r and a franchise fee F to be paid by each distributor, and may also assign exclusive territories to distributors or stipulate a maximum retail price. Then, the two distributors, given the shipping price and franchise fee, each simultaneously and independently choose a location for their collection points x_i (i=1,2). Then, in the third and final stage the distributors each independently choose shipping quantities and allocate their respective shipments across the retail outlets; the retail prices at each outlet adjust to market-clearing levels and the product is sold to the final demanders.

Within this basic set-up we discuss three alternative regimes. In the first the manufacturer controls only his own shipping price r and franchise fee F. In the second regime the manufacturer controls the shipping price r and franchise fee F and also assigns an exclusive geographic territory

[1]Under this assumption the market demand at each location is independent of the demand at any other location.

to each distributor. These two regimes were analyzed by Matsumura (2003). To these we add a third regime in which the manufacturer controls the shipping price r and franchise fee F and also imposes a retail price ceiling, but does not assign exclusive territories.

3. Cournot Quantity Competition versus Exclusive Territories

Matsumura (2003) characterized the equilibria under the regime in which the manufacturer sets the shipping price and distributors engage in Cournot quantity competition at each retail location, and compared that with the regime in which the manufacturer assigns each distributor an exclusive geographic territory. Under the latter regime the manufacturer in fact attains a first-best for itself, achieving the same allocation as that of a vertically integrated monopoly. But under the Cournot regime such an outcome is not attained. In particular, the Cournot regime deviates from that of the vertically integrated monopoly in that goods are shipped from both distributors to at least some retail outlets, even though the transport costs are lower for the one that is nearer. A vertically integrated monopoly would direct that each retail outlet is supplied only by the nearer distributor. Assigning each distributor an exclusive geographic territory achieves virtually the same pattern, avoiding wasteful cross-hauling. And (assuming constant unit costs), two-part pricing is (in the language of Mathewson and Winter (1984)) a sufficient instrument for the manufacturer to induce efficient quantity choices by the distributors and fully appropriate the producer surplus.

We reprise the main results of Matsumura (2003) in the first two columns of Table 1. And we next proceed to analyse an additional regime in which the monopoly manufacturer stipulates maximum resale prices.

4 Price ceiling

Under the regime of manufacturer stipulated maximum retail prices, we envision a three stage game. In the first stage the manufacturer chooses its shipping price r and also stipulates a maximum retail price $p^U<a$.[2] Then in the second stage each distributor chooses a collection point, and in the third and final stage each chooses its shipment quantities. In the event that the price ceiling is binding for both distributors at any location we shall assume that they just meet the demand and divide sales equally.

Proceeding recursively we begin by considering the last stage. In the event that the manufacturer imposes a binding price ceiling on sales at a retail location it must be that the Cournot price lies above the ceiling:

$$(5) \qquad p^C = (a + 2r + t/2)/ 3 \; > \; p^U = r+m$$

where $m=p^U-r$ is the retail price-cost margin if the ceiling is binding. If the manufacturer stipulated price ceiling is not binding then we suppose that the price is the result of Cournot-Nash choice of sales quantities by the two distributors and, as under the regime analyzed in section 2, the implied equilibrium retail price would not then depend on the location.

Furthermore, neither distributor i will make any sales at a retail location x for which its retail margin m is less than the unit cost of shipping the good from its collection point at x_i. That is it will make no sales if: $t \bullet dist(x,x_i) > m$. Define then $z_U=m/t$, an upper bound on the distance that a good

[2]If $p^U \geq a$, then the price ceiling is not binding. Notice that we presume the price ceiling p^U is the same at every location. If it could do so, the manufacturer would in general set a different ceiling at each location, but we assume this is infeasible.

will be shipped from collection point to retail outlet.

There are three possible configurations of distributor i's sales at any location x. First, it might be a monopolist for which the manufacturer stipulated price ceiling is ***not*** binding. Second, it might be a monopolist for which the price ceiling ***is*** binding. And third, it might be in a duopolistic equilibrium with the other distributor. Specifically, for any retail outlet located at an x such that $z=\text{dist}(x,x_i)\leq z_U$ ***and*** $\text{dist}(x,x_j)>z_U$, the distributor i is a monopolist, and it either sets the monopoly price $p^M=(a+r+tz)/2$, or charges the manufacturer stipulated price ceiling p^U, whichever of the two is lower. In the case in which $p^M< p^U$, the price ceiling is not binding and it sets the monopoly price. Its profit from sales at the outlet located at z is

$$(6) \qquad y^M(r,z) = (a-r-tz)^2/\,4$$

Alternatively, if $p^M>p^U$ and the price ceiling is binding, then its profit from sales at location z become

$$(7) \qquad y^U(r,z) = (p^U-r-tz)(a-p^U) = (m-tz)(a-m-r)$$

In the remaining instances for which the distributors find themselves in a duopolistic situation, that is for locations x such that $z=\text{dist}(x,x_i)\leq z_U$ ***or*** $\text{dist}(x,x_j)\leq z_U$, the equations (5) clearly establish that the price ceiling is binding. Accordingly, the quantity demanded at each such location is $Q=a-p^U=a-m-r$, and the two distributors, as per our assumption, each supply half of this.[3] The resulting

[3]Under a binding manufacturer stipulated price ceiling, if both distributors independently choose quantities then multiple Nash equilibria are possible. We sidestep these analytic difficulties

profit of each from sales at such a location are thus

$$(8) \qquad y^D(r,z) = (m\text{-}tz)(a\text{-}m\text{-}r)/\ 2$$

Now define boundary locations z_{MU} where the manufacturer stipulated price ceiling is just binding. We have (from $p^M = (a+r+tz)/2 = r+m = p^U$) that $z_{MU} = (r+2m\text{-}a)/t$. The following are some useful observations:

$$z_{MU} = (r+2m\text{-}a)/t < m/t = z_U \Leftrightarrow r+2m\text{-}a < m \Leftrightarrow r+m\text{-}a < 0 \Leftrightarrow p^U = r+m < a$$

From this and from $p^U = r+m < a$, it follows that $z_{MU} < z_U$.

Next we turn attention to the second stage, the distributors' choices of locations for their collection points. Here notice that from equations (6) - (7) each distributor's profit is a monotonically decreasing function of z. Furthermore for given values of r and z we have that

$$y^M(r,z) \geq y^U(r,z) \geq y^D(r,z)\ ,$$

from which it follows that each distributor's profit is a single-peaked function of the location of its collection point. Furthermore, as the collection points lie closer to one another the region of duopoly expands and the region of monopoly is constricted, with consequent erosion of the distributors'

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by arbitrarily imposing the simple assumption that the two distributors share the quantity demanded equally.

profit. For this reason they each seek to place their respective collection points as far from that of the rival as possible. More precisely, without loss of generality, let the collection point of distributor 2 be placed at the location x_2=½, and let that of distributor 1 lie at the location x_1 such that, $0 \leq x_1 \leq ½$. There are then two cases to consider. In the first case, m<t/4, to obtain monopoly profit the distributor 1 locates its collection point so that: $½ - 2z_U < x_1 < ½ + 2z_U$. In the second case, m≥t/4, the distributor 1 locates its collection point at x_1=0.

Finally, we consider the first stage in which the manufacturer chooses the shipping price and retail price ceiling. Here notice, first, that if m>t/2, the two distributors both sell at every location. Second, if the collection point of distributor 1 lies in the region (0,½), then based on the analysis of section 2, the profit maximizing retail price p*(x) lies in the interval [a/2, a/2+t/4]. Therefore, the profit maximizing manufacturer stipulated price ceiling must also lie in this same interval. That is to say,

(9) $$p^*(0) = a/2 \leq p^U \leq a/2 + t/8 = p^*(¼)$$

Here we propose the following

Lemma: If $a/2 \leq p^U \leq a/2+t/8$ and $m \leq t/2$, then $p^M \geq p^U$.

Proof: $r = p^U - m \geq a/2 - m \qquad (p^U \geq a/2)$

$\geq t - m \qquad (a \geq 2t)$

$\geq t - t/2 = t/2 \qquad (m \leq t/2)$,

from which

$p^M(x) \geq p^M(0) = (a+r)/2 \geq a/2 + t/4 \geq pU$

Q.E.D.

From the Lemma it is clear that it is profitable for the manufacturer to stipulate a maximum retail price that is binding at every retail location. First if m≤¼, then, at any location, at most only one of the two distributors can sell at the ceiling price p^U. Furthermore, if $m < t/4$ then there will exist locations not served by either distributor. The manufacturer again imposes a franchise fee to appropriate the distributors' profit. The manufacturer's profit attains

(10) $\quad = 4 \int_0^{(pU-r)/t} (p^U - tx)(a - p^U)\, dx$

The manufacturer's profit is thus an increasing function of the retail margin m. The manufacturer raises the retail margin until just the point that all the retail outlets are served, in other words to m=¼. Then the manufacturer's profit becomes

(11) $\quad = 4\int_0^{1/4}(p^U\text{-}tx)(a\text{-}p^U)\,dx \;=\; (a\text{-}p^U)(8a\text{-}t)/\,8$

From the profit maximizing condition ($d\;\;/dp^U = 0$), we have that

(12) $\quad p^U \;=\; a/2 + t/16$

The implied profit maximizing manufacturer shipping price becomes: r= a/2 - 3t/16.

In the remaining instances $\frac{1}{4} \leq m \leq \frac{1}{2}$, at least some of the retail locations are served by both distributors. The manufacturer's profit becomes

(13) $\quad =4\;\left(\int_0^{1/2\,-\,m/t}(p^U\text{-}tx)(a\text{-}p^U)\,dx \;+\; \int_{1/2\,-\,m/t}^{1/4}(p^U\text{-}\;t/2)(a\text{-}p^U)\,dx\;\right)$

Notice that in this instance wasteful cross-hauling is present. That is, some retail outlets are not supplied exclusively by shipments from only the nearer of the two collection points. For this reason there is a marginal benefit to the manufacturer from lowering the retail margin and thereby shrinking the region served by both distributors. Accordingly, the manufacturer again sets the margin at m=¼. The manufacturer profit attains the form of equation (11). The price ceiling becomes p^U=a/2+t/16, and the manufacturer shipping price becomes r=a/2-3t/16. The manufacturer profit, consumer surplus, and social surplus are:

$^U = (8a\text{-}t)^2/\,256$

$CS^U = (8a\text{-}t)^2/ 512$

$SS^U = 3(8a\text{-}t)^2/ 512$

5 Conclusion: Comparison of regimes, and empirical implications

Equilibria under the three regimes –the two analyzed by Matsumura (2003): Cournot competition and exclusive territories, and the one analyzed here: manufacturer stipulated price ceiling– are depicted in Table 1. The location of collection points of the two distributors are the same under all regimes. The other outcomes depend on the parameters. As depicted in Figure 1, the retail prices are highest under the Cournot regime, and near to the distributors' collection points are lowest under exclusive territories, while farthest from the collection points are lowest under the price ceiling regime. Accordingly, the consumer surplus at each location also depends upon both the regime and distance from collection point. Where retail price is lower, the consumer surplus is greater. Near a collection point, consumer surplus is highest under the exclusive territory regime. Far from the collection points, consumer surplus is highest under the price ceiling regime. Consumer surplus is lowest at all locations under the Cournot regime. Furthermore, producer profit, overall consumer surplus and social surplus are all highest under the exclusive territory regime, and lowest under the Cournot regime. Here notice that given that $a \geq 2t$,

$$({}^{T} - {}^{U})/ {}^{T} = (t^2/768)/((48a^2\text{-}12at+t^2)/192) = t^2/4(36a^2+12a(a\text{-}t)+t^2)$$

$$\leq t^2/4(144+24+1)t^2 = 1/756 < 0.002$$

From this it follows that by stipulating maximum retail prices the manufacturer can obtain nearly as great a profit as under the exclusive territory regime–which attains the same gross profit as vertical integration, a first-best. Consequently, where the costs of administering and enforcing an exclusive territory system are large, the manufacturer may well decide to stipulate maximum retail prices instead. Resale price maintenance that is for this reason– elimination of wasteful cross-hauling by wholesalers– is welfare-enhancing. Our explanation thus joins other examples of welfare enhancing resale price maintenance. These include the Spengler (1950) example of manufacturer stipulated retail price to counter the distorting effect of successive monopoly, the Telser (1960) example of RPM to promote retailer provision of special services, and the Flath and Nariu (1989, 2000) example of RPM to prevent revenue corroding price discounts when demand is uncertain.

Finally, we end by considering the empirical relevance of our explanation for manufacturer stipulated maximum retail prices. In 1960's Japan, distribution transactions in many product lines were carried out not under an exclusive territory regime but rather under the so-called tate-ne (lit. "set price") system in which the manufacturer stipulates all resale prices. The tate-ne system very much resembles the manufacturer stipulated price ceiling regime analyzed here. In the model of this paper we presumed that arrangements between wholesale distributor and retailers were analytically equivalent to their vertical integration. Operationally, this might mean that the wholesaler fully appropriates the profit of the retailer by levying a flat-fee. But under a tate-ne system in which the manufacturer stipulates the retail price, such a flat-fee (paid to the wholesaler by the retailer) does not arise.

Under the tate-ne system the manufacturer determines not only the quantity to ship to each wholesaler but also stipulates for each wholesaler and each retailer the shipping price p^R, the wholesale price p^U and retail price p^U. Then each wholesaler determines the quantities to ship to each retailer q^U=a-p^U. Because the wholesale price and retail price are equal the retailers realize no profit and the wholesaler collects no franchise fee. Each wholesaler does realize a profit,[4] which the manufacturer appropriates by levying a franchise fee and attaining for itself the profit ^{U}. This is exactly the same outcome as that of the manufacturer stipulated price ceiling in our earlier discussion. In other words the allocation under the tate-ne system is exactly as under the manufacturer stipulated maximum retail price regime with wholesaler and retailers effectively vertically integrated with one another.

Notice in this instance, that is under the tate-ne regime as just described, that for any retailers farther from the wholesale collection point than a distance of 1/4, the unit cost of transport is actually higher than the wholesale margin (p^U-r^U=t/4). Consequently, neither wholesaler has any incentive to sell in the other's market and wasteful cross hauling is strictly avoided. Nor does either wholesaler collect a franchise fee from the retailers. And further, under the tate-ne system the double margin problem is avoided without reducing the shipping price or wholesale price below the level that would be set by a vertically integrated manufacturer and wholesaler firm. Accordingly, if multiple retailers should occupy nearly the same location there can be no possibility of sales above the "manufacturer suggested retail price", and no necessity to rely upon consumer aversion to such pricing in enforcing the price stipulations.

Attainment of maximum profit in the exclusive territory system requires that the wholesalers

[4]The wholesaler profit equals the wholesaler's margin times the quantity shipped, minus transport costs.

strictly observe the territorial stipulation. But each will in fact have an economic incentive to sell to retailers in the other's territory, and by levying a franchise fee collect from the retailers a share in their Cournot-equilibrium profit. This behavior by the wholesalers will erode their combined profits and thus lower the franchise fees that the manufacturer is able to impose upon them. To prevent this the manufacturer will have to actively monitor the wholesalers' compliance with the territorial stipulation if it is to attain a first-best outcome for itself. The tate-ne system avoids these difficulties.

Another reason why the tate-ne system became common in Japan during the high growth era (the 1960's) is the following. In that period, along with the proliferation of new products the growth of the Japanese economy broadened the demand for consumer goods generally. Under these conditions, it may not be wise for a producer introducing a new product that initially has small demand but for which it expects to eventually have large demand, to assign inevitably broad exclusive territories to the few wholesalers initially willing to distribute the product. This is because once the demand expands and it becomes profitable for more wholesalers to carry the product, the manufacturer will face the troublesome prospect of revising and renegotiating the original exclusive territory contracts. In contrast, under the tate-ne system the manufacturers were largely able to avoid wasteful cross-hauls while avoiding the costs of administering and enforcing an exclusive territory system.

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Table 1. Comparison of Equilibria

		Cournot	Exclusive Territories; Vertical Integration	Price Ceiling
Location of collection points	x	x_1=0 and x_2=½	x_1=0 and x_2=½	x_1=0 and x_2=½
Sales territories		[0,1] and [0,1]	[¾,¼] and [¼,¾]	[¾,¼] and [¼,¾]
Manufacturer shipping price	r	a/4 - t/16	0	a/2 - 3t/16
Retail price at each location	p(x)	a/2 + t/8	(a + t dist(x,xi))/ 2	a/2 + t/16
Sales quantity at each location	q(x)	a/2 - t/8	(a - t dist(x,xi))/ 2	a/2 - t/16
Profit		$(48a^2 - 24at + 11t^2)/ 192$	$(48a^2 - 12at + t^2)/ 192$	$(8a-t)^2/ 256$
Consumer surplus	CS	$(4a-t)^2/ 128$	$(48a^2-12at+t^2)/ 384$	$(8a-t)^2/ 512$
Social surplus	SS	$(144a^2-72at+25t^2)/ 384$	$(48a^2-12at+t^2)/ 128$	$3(8a-t)^2/ 512$

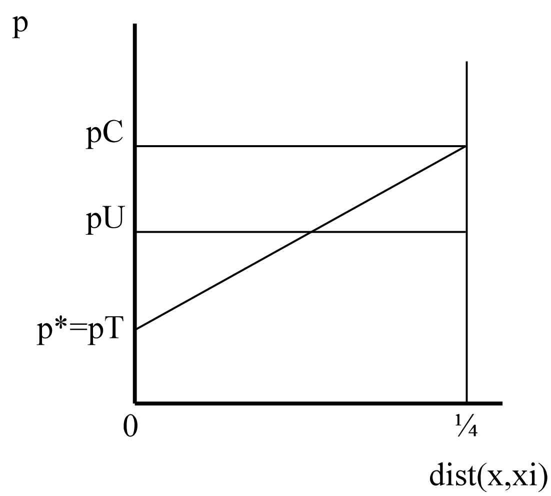

Figure 1. Comparison of retail prices