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The role of exclusive territories in producers' competition

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This article shows how vertical restraints, which affect intrabrand competition, can and will be used for reducing interbrand competition. Exclusive territories alter the perceived demand curve, making each producer believe he faces a less elastic demand curve, inducing an increase in the equilibrium price and producers' profits, even in the absence of franchise fees for recapturing retailers' rents. We analyze this strategic effect in a model that specifies the full range of feasible vertical contracts; thus we endogenize both whether exclusive contracts are employed and, if employed, the contract terms. Equilibria involve exclusive territories (with or without franchise fees), resulting in higher prices and profits but lower consumer surplus and total welfare.

1. Introduction

■ Although vertical restraints have traditionally been viewed with some suspicion—as trade practices that serve to restrain trade—in recent years they have been looked upon with considerably greater favor. Economists, using the two polar models of perfect competition and pure monopoly, have argued that such restraints will be employed if and only if they provide a more efficient way for producers to distribute their goods to consumers. For instance, a producer might give a distributor the exclusive right to sell his product within a territory (a vertical restraint called exclusive territories) because retailers provide "public goods" such as product information, and with many retailers within a territory, there will be an undersupply of such public goods—from the perspective of the firm. This has led to the view that these vertical restraints should be per se legal. (See Posner, 1981.)

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These analyses are flawed in two critical ways. First, they ignore one of the central reasons that firms do not distribute goods themselves: retailers and wholesalers have specialized information. This gives rise to problems of adverse selection and moral hazard, and in this context, contracts that maximize the profits of the producer do not necessarily maximize the welfare of the consumer.[1] Second, in most markets there is some competition among producers (so that the pure-monopoly model is not relevant), but not perfect competition: firms do not face a horizontal demand curve for their products. In imperfectly competitive environments, a central concern of firms is to decrease the effectiveness of (interbrand) competition—an issue that simply does not arise in either of the polar models, where the degree of interbrand competition is assumed given.[2]

Our central objective is to show how vertical restraints, which affect intrabrand competition, can and will be used as an effective mechanism for reducing interbrand competition and increasing producer profits. We show how exclusive territories alter the perceived demand curve, making each producer believe he faces a less elastic demand curve, thereby inducing an increase of the equilibrium price. The use of exclusive territories may increase producers' profits, even if the producers cannot charge franchise fees and so cannot recapture from retailers the monopoly rents they earn from their exclusive territory. We show that "double marginalization" effects can be overcome by the strategic effect on producers' competition.[3] With franchise fees, the double marginalization problem does not impose any loss on the producers' profits; then not only are profits increased, they can be increased even more by adding successive layers to the distribution chain.

We provide here a model in which we can clearly specify the full range of feasible contracts between producers and retailers. In this context it will be a dominant strategy for firms to have exclusive territories with franchise fees, even though, under certain conditions, profits are higher without franchise fees than with. This result itself may seem somewhat surprising: producers seem paradoxically better off if they cannot capture the rents that their distributors earn, simply as a result of the grant of an exclusive territory. This comes from the fact that if a producer cannot use a franchise, rivals will follow a different pricing strategy, and the equilibrium prices will, accordingly, differ; they may be higher without franchise fees than with, and this may offset the loss of profits from the failure to capture the distributors' rents.

The article is organized as follows. In Section 2 we show how the presence of exclusive territories can serve to facilitate collusion among a fixed set of producers raising market price and joint profits. The fact that exclusive territories increase the joint profits of the firms in the industry does not imply, of course, that in the absence of tacit or explicit collusion, exclusive territories will characterize market equilibrium. Section 3 tackles this issue. In Section 4 we address methodological issues, and Section 5 concludes with a discussion of the policy implications and of avenues for future research.

[1] Private and social objectives may in particular diverge on the level of effort and/or insurance. See, for instance, Rey and Tirole (1986b), Mathewson and Winter (1984, 1986), and Caillaud and Rey (1987) for an analysis of adverse selection and moral hazard problems; Rey and Tirole (1986a) provide an introduction to this literature on vertical control.

[2] Throughout the article, interbrand competition or producers' competition will refer to competition between firms producing substitute goods, while intrabrand competition will refer to (retail) competition between the distributors of a given good.

[3] Earlier proponents of the legalization of exclusive territories have argued that there must be significant public-good aspects of distribution to justify a producer's granting an exclusive territory, since in the absence of such efficiency benefits, producers are harmed by "double marginalization" because retailers, with limited competition, will charge a greater markup over the wholesale price, meaning that the producer is hurt by the reduced sales. Our analysis clearly provides a less optimistic explanation.

2. Exclusive territories as a device to reduce competition

■ We consider a model where manufacturers produce imperfect substitutes and distribute them via retail networks. We compare two situations. In the first, there is perfect competition among retailers. In the second, each retailer has an exclusive territory. This obviously reduces intrabrand competition, but it may reduce interbrand competition as well.

Let us describe the model. There are two manufacturers, each producing a single good at the same constant marginal cost c. The two products are assumed to be imperfect substitutes. These manufacturers distribute their products via retailers who have no retail costs. The final demand for good i depends on retail prices q_1 and q_2 and is given by $D^i(q_1, q_2)$.

We initially formalize the competition as a two-stage game. In the first stage, given vertical arrangements previously agreed upon, manufacturers simultaneously propose contracts to their retailers (later on, the choice of vertical arrangements will itself be considered as endogenous). In the second stage the retailers choose their retail prices. We characterize the (subgame) perfect equilibria of this two-stage game.

Of course, the players' strategies, and particularly the contracts proposed by the producers, depend on the information structure of the game. We shall adopt the following assumptions:

Assumption 1. Costs and demand functions are common knowledge; retailers observe all contracts signed by each producer.

Assumption 2. Producers observe the quantity bought by each retailer; they do not observe the quantities sold by the retailers, their profits, or the prices they charge.

Assumption 3. Producers serve many markets, between which transportation costs are negligible.

Assumption 4. Consumers have no search cost; they buy a product at the lowest possible price within the market in which they reside.

These assumptions are quite natural. The asymmetry in information between retailers and producers seems particularly realistic; the difficulties of detecting hidden subsidies is one way of justifying, for instance, the assumption that the "true" retail prices are not observable by producers (see Rey and Tirole (1986b) for an extensive discussion of this assumption).

From Assumption 1, all retailers play the game with complete information. Assumption 2 determines the set of admissible contracts between a producer and his retailers: they can only be based on the quantity bought by the retailers and thus correspond to (possibly nonlinear) tariff schedules. Assumption 3 rules out nonconstant marginal prices, because of retailers' arbitrage. Whether the producers do or do not observe who sells their products, they can impose franchise fees on the retailers. We shall consider the two possible situations (with or without franchise fees).

These informational assumptions complete the description of the game: to recap, in the first stage, producers simultaneously choose their wholesale prices, p_1 and p_2 (plus, where relevant, the franchise fee); in the second stage, the retailers observe both wholesale prices (and fees if any) and choose their retail prices simultaneously.

Letting $\pi_i^r(p_i, q_1, q_2) \equiv (q_i - p_i)D^i(q_1, q_2)$ denote the retail (variable) profits for product i ($i = 1, 2$), we shall assume the following throughout:

(i) For $i = 1, 2$, $\pi (p_i, q_1, q_2)$ is twice continuously differentiable with respect to (p_i, q_1, q_2) and single-peaked with respect to q_i: the reaction function $q_i^a(p_i, q_j)$

$(j = 1, 2, j \neq i)$ is thus continuously differentiable and characterized by the first-order condition $\partial \pi_i^r(p_i, q_1, q_2)/\partial q_i = 0$;

(ii) Products are substitutes: $\partial D^i/\partial q_i \leq 0$ and $\partial D^i/\partial q_j \geq 0$ $(i, j = 1, 2, i \neq j)$;

(iii) Demand functions are symmetric: $\forall p_1, p_2 \in \mathbf{R}_+, D^1(p_1, p_2) = D^2(p_2, p_1)$.

In the absence of any vertical restriction, pure intrabrand price competition leads the retailers to charge zero markups; given the wholesale prices p_1 and p_2, in the second stage the retail prices will be $q_1 = p_1$ and $q_2 = p_2$. (This in turn implies that franchise fees, even if available, must be equal to zero.) In other words, the retail price of a product is completely responsive to any change of the corresponding wholesale price. At the first stage, the anticipated producer i's profit, π_i, is therefore just a function of wholesale prices:

$$\pi_i(p_1, p_2) = (p_i - c)D^i(p_1, p_2), \qquad i = 1, 2. \tag{1}$$

The (symmetric) equilibrium, if it exists, is thus characterized by the first-order condition

$$p_1 = p_2 = p^c: \qquad (p^c - c)/p^c = 1/\epsilon_1(p^c, p^c), \tag{2}$$

where $\epsilon_1 \equiv -\partial \log D^1(q_1, q_2)/\partial \log q_1$ denotes the direct price elasticity of demand (the superscript c refers to retail "competition"). This situation is formally identical to the situation where producers fix the consumers' price and therefore compete directly against each other: in both cases, the equilibrium markup is inversely proportional to the (direct) elasticity of the final demand, ϵ_1: $(q^c - c)/q^c = 1/\epsilon_1(q^c, q^c)$.

As a benchmark, let us denote by q^m the monopoly price, which maximizes total (joint) profits. Assuming that the total profit function is single peaked, this profit is maximized for

$$q_1 = q_2 = q^m: \qquad (q^m - c)/q^m = 1/E(q^m), \tag{3}$$

where E is the elasticity of the "big DD curve," in the familiar terminology of Chamberlinian monopolistic competition theory—the demand curve generated by a simultaneous decrease in both prices—i.e., $E(q) \equiv \epsilon_1(q, q) + \epsilon_2(q, q)$, where

$$\epsilon_2 \equiv -\partial \log D^1(q_1, q_2)/\partial \log q_2$$

denotes the cross price elasticity of demand.

The price associated with competitive retailers is below the monopoly price ($\epsilon_2 < 0$), and the more the two goods are substitutes, the bigger the gap is between these two prices. We now show that vertical restrictions can be used to fill this gap. We suppose that at the beginning of the game, producers have assigned (symmetric) exclusive territories to their retailers, so that each retailer has a monopoly position over some fixed fraction of the final demand for his product.[4] These territorial agreements are supposed to be common knowledge. Note that assigning exclusive territories supposes that producers can observe which consumers are served by a retailer, but it does not exclude the possibility of arbitrage among retailers, so that, as before, only linear or two-part tariffs are available.

[4] Firms sometimes allow several retailers within a geographical territory, but one may be restricted in the set of customers that it can approach, e.g., there may be one department store, one firm that may receive mail orders, one that may engage in door-to-door solicitations, etc.

Given the producers' prices p_1 and p_2, at the second stage the equilibrium retail prices, $(q_i^r(p_1, p_2))_{i=1,2}$, are functions of the two producers' prices and characterized by

$$q_i^r = q_i^a(p_i, q_j^r), \qquad i, j = 1, 2 \quad \text{and} \quad i \neq j. \tag{4}$$

Note that franchise fees would alter the retailers' decisions about whether to distribute a product, but not these response functions, if the retailers agree to sell the product. Also, from the symmetry of the demand functions, these response functions are symmetric too: $\forall p_1, p_2 \in \mathbf{R}_+, q_1^r(p_1, p_2) = q_2^r(p_2, p_1)$.

□ **Exclusive territories without franchise fees.** If franchise fees are not available, the introduction of exclusive territories generates double marginalization problems and at given producer prices leads to higher retail prices and lower sales. The producers may, however, benefit from the introduction of exclusive territories, if it tends to increase the prices they receive.

In the first stage, producer i's profit is now

$$\pi_i(p_1, p_2) = (p_i - c)D^i\Big(q_1^r(p_1, p_2), q_2^r(p_1, p_2)\Big), \qquad i = 1, 2. \tag{5}$$

In equilibrium, with $p_1 = p_2 = p^e$ and $q_1 = q_2 = q^e$ (the superscript e standing for "exclusive territories"), first-order conditions take the simple form

$$(p^e - c)/p^e = 1/\tilde{\epsilon}(p^e), \tag{6}$$

where

$$\tilde{\epsilon}(p) \equiv m_1(p, p)\epsilon_1(q, q) + m_2(p, p)\epsilon_2(q, q),$$

with

$$q = q_1^r(p, p), m_1(p_1, p_2) \equiv \partial \log q_1^r(p_1, p_2)/\partial \log p_1,$$

the own elasticity of retail price response to a change in producer's price, and

$$m_2(p_1, p_2) = \partial \log q_1^r(p_1, p_2)/\partial \log p_2,$$

the cross elasticity of retail price response to a change in (the other) producer's price.

The equilibrium markup thus is altered from the standard one by two effects. First, the direct effect of a price increase on the reduction in demand is altered by the transmission channel between the wholesale price and the retail price. Normally, we might expect that competitive pressures result in the elasticity m_1 being positive but less than one: retail firms that find that their costs have increased, while their competitors' costs have not changed, do not simply pass on the cost increase with the usual markup, but rather absorb some of the cost increase themselves. Second, there is an indirect effect: if retail prices are strategic complements, we would expect m_2 to be positive: the rival's retailers, now facing a higher price, find it optimal to increase their prices, which tends to reduce the producer's perceived loss in sales.

More precisely, we can state the following.

Lemma 1. If the retail price equilibrium is stable,[5] then $\forall p \in \mathbf{R}_+$, $m_1(p, p) > \|m_2(p, p)\|$. If, moreover, the retail prices are strategic complements,[6] then

$$\forall p \in \mathbf{R}_+,\ 0 < m_2(p, p) < m_1(p, p).$$

If, moreover, the demand elasticity ϵ_1 does not decrease when both retail prices increase at the same rate, i.e., if $\epsilon(q) \equiv \epsilon_1(q, q)$ does not decrease with q, then

$$\forall p \in \mathbf{R}_+,\ m_1(p, p) \leq 1.$$

Proof. See the Appendix.

When the conditions of Lemma 1 are satisfied, the two effects described above tend to decrease the elasticity perceived by the producers. The assumptions are quite reasonable. The last one in particular states roughly that when prices are "high," the demand for the good responds more drastically to an increase of 1% in its price; this assumption will in particular be satisfied if second derivatives of the demand are not too large in absolute value.[7] Under this assumption, however, another indirect effect tends to increase the elasticity of the demand perceived by the producers: the elasticity ϵ_1 has to be evaluated not at producers' prices, but at retail prices, which are higher. We can nonetheless establish the following:

Proposition 1. (i) If the retail equilibrium is stable, then $q^e > q^c$.

(ii) If, in addition, producers' profit functions are single peaked with respect to their own prices, then $p^e > p^c \equiv q^c$ so long as $m_1^e \epsilon_1^e + m_2^e \epsilon_2^e < \epsilon_1^c$. In particular, $p^e > p^c$ when

(iia) demand functions are linear with respect to prices (by continuity, this remains valid if second derivatives are not too large, since the characterization of the equilibrium prices does not involve higher-order derivatives), or

(iib) the retail prices are strategic complements, $\epsilon(q)$ does not decrease with q, and the goods are close substitutes, or

(iic) the retail prices are strategic complements, $\epsilon(q)$ does not increase with q, and for any p, $m_1(p, p)$ is lower than one.

Proof. (i) Clearly, wholesale prices are always higher than the unit cost c (choosing $p < c$ is a strictly dominated strategy, and increasing p slightly above c generates positive profits as long as the market is viable, i.e., as long as $D^i(c, c)$ is positive). The conclusion follows from $m_1 + m_2 > 0$ (Lemma 1), using the fact that $q^e = q_1^r(p^e, p^e)$ and $q^c = q_1^r(c, c)$.

(ii) If producers' profit functions are single peaked, the above first-order conditions characterize the equilibrium.

(iia) if demand is linear, computations show $p^e > q^c$. The analysis of the linear model is presented in the Appendix.

(iib) if $\epsilon(q)$ does not decrease with q, then a sufficient condition for $p^e > p^c$ is

[5] We shall say that the retail price equilibrium is stable if for any pair of wholesale prices (p_1, p_2) and any retail price q, the sequence $(q_n)_{n \in N}$ defined by $q_0 = q$ and $q_{n+1} = q_1^a(p_1, q_2^a(p_2, q_n))$ converges toward $q_1^r(p_1, p_2)$.

[6] That is, an increase in one retailer's price gives the other retailer incentives to increase its own price (see Bulow, Geanakoplos, and Klemperer, 1985).

[7] More precisely, the assumption is satisfied if the demand for one good is not too convex with respect to the price of this good and/or if an increase of one price does not greatly increase the slope of the demand for the other good.

$$\tilde{\epsilon}(p) < \epsilon(p). \tag{7}$$

To show that (7) is a sufficient condition, suppose $p^e \leq p^c$. Using the monotonicity of ϵ and first-order conditions (2) and (6), we have

$$\epsilon(p^e) \leq \epsilon(p^c) \leq \tilde{\epsilon}(p^e), \tag{8}$$

in contradiction with (7). We now need to study when condition (7) is satisfied. Under the conditions of Lemma 1, for any p,

$$m_1(p, p)\epsilon_1(p, p) + m_2(p, p)\epsilon_2(p, p)$$

is lower than $\epsilon_1(p, p)$. It thus remains to check that the elasticities do not vary too much when jumping from p to $q_1^r(p, p)$. This is likely to be the case when the goods are close substitutes, since then retail prices are close to wholesale prices. In the Appendix we derive analytic expressions for $\tilde{\epsilon}(p)$ and show that it is indeed lower than $\epsilon(p)$ when the goods are close substitutes, i.e., when ϵ_1 is high.

(iic) if retail prices are strategic complements, $m_2 > 0$ and ϵ_2 is nonzero; if moreover $m_1 \leq 1$ and $\epsilon(q)$ does not increase with q, then

$$\begin{aligned}(p^e - c)/p^e &= 1/\left(m_1\epsilon_1(q^e, q^e)\right) + m_2\epsilon_2\left(q^e, q^e\right)\Big) \\ &> 1/\epsilon(q^e) \\ &> 1/\epsilon(p^e). \end{aligned} \tag{9}$$

Q.E.D.

Proposition 1 stresses that exclusive territories are an effective device for raising not only retail prices, but also equilibrium wholesale prices, provided that the demand elasticity does not increase too much when both prices increase, or that the second demand derivatives are not too large in absolute value, or that the two goods are close substitutes. The intuition is simple. A producer would like his rival to match price increases, so that as he increases his own price, the rival does not get any price advantage. In general, it will not be in the self-interest of the rival to do this. In the standard Bertrand-Nash equilibrium, a producer considers the consequences of changing his price assuming his rival does not alter his own price. At the equilibrium, each producer charges the same price but would like a coordinated price increase. Here, as in the usual Nash equilibrium, the rival producer does not change his price, but this implies that the rival's retailers will. In other words, by restructuring the competitive interactions between retailers, one obtains a situation where indeed one's rivals (retailers) increase their prices when one producer (and his retailers) increase prices. This leads to a lower perceived elasticity of demand, and hence to higher prices.

This increase in equilibrium prices does not assure that profits are higher, since though margins are higher, double marginalization means that sales are lower. (Also, there may be some overshooting: prices could rise above monopoly prices—see the linear example in the Appendix.) It is easy to see, however, that if ϵ_1 is large, exclusive territories are likely to increase profits since then, double marginalization problems are small. Thus it is precisely in cases where the differentiated products are close substitutes that exclusive territories may be effective.[8] (If the demand is linear, producers' profits are higher with exclusive territories if the goods are close substitutes, and they are higher with competitive retailers if they are only imperfect substitutes. See, for instance, McGuire and Staelin (1983), who analyzes the related role of intermediaries in a linear-demand model, and the discussion of the linear case in the Appendix.)

In other circumstances, exclusive territories can clearly decrease the producers' profits. If, for instance, the demand is multiplicatively separable in the two prices (i.e., $D^1(q_1, q_2) = D(q_1)d(q_2)$), an increase in one producer's price does not induce an increase in the price of the other good ($m_2 = 0$), and thus double marginalization problems are likely to dominate. In the limiting case of constant elasticity ($D(q) = q^{-\epsilon}$), equilibrium wholesale prices are the same with and without exclusive territories, but retail prices are higher and sales are lower in the former case: exclusive territories thus work in that case against the interests of both consumers and producers.

Alternative organizations of the retail sector have, of course, different implications both for the magnitude of retail margins and for the magnitude of rivals' responses to price increases (and hence the perceived elasticity of demand). In a previous version of this article, we studied the impact of the design of exclusive territories in a spatial differentiation model with linear demands. We compared three situations: competitive retailers (retailers face strong intrabrand competition for each product), brand exclusive retailers (each retail outlet sells only one brand and for each brand there is only one outlet in a given territory), and common exclusive retailers (each outlet sells both brands and for each product there is still only one outlet in any given territory). As expected, the elasticity of producers' perceived demand is lower with brand retailers than with competitive retailers. Moreover, this elasticity is lower with brand exclusive retailers than with common exclusive retailers (a common retailer realizes that increases in sales from lowering the price of one brand are partly at the expense of reduced sales of other brands); double marginalization may be higher in the latter case (because of the lower level of competition). Hence producers unambiguously prefer some competition among retailers (brand exclusive retailers) to no competition (common exclusive retailers), but they prefer the limited competition afforded by exclusive territories to perfect competition.

□ **Exclusive territories and franchise fees.** We show that when producers can require franchise fees, in most plausible cases they are better off with exclusive territories: they do not lose profits as a result of double marginalization and, so long as retailers' prices tend to respond positively to each other (i.e., retail prices are strategic complements), perceived elasticities of demand are lower and equilibrium prices are higher.

Anticipating the retail price equilibrium, the maximal sum of franchise fees received by producer i, F_i, is given by

$$F_i(p_1, p_2) = \left(q_i^r(p_1, p_2) - p_i\right)D^i\left(q_1^r(p_1, p_2), q_2^r(p_1, p_2)\right). \tag{10}$$

Producer i's profits are thus now given by

$$\pi_i(p_1, p_2) = \left(q_i^r(p_1, p_2) - c\right)D^i\left(q_1^r(p_1, p_2), q_2^r(p_1, p_2)\right). \tag{11}$$

Remember that since the franchise fee should be viewed as a fixed cost, it has no

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[8] In one recent case, exclusive territories employed by two major beer producers were claimed to be restraints on trade; the above line of reasoning stresses that the defense claim that the market was competitive, because each beer had close substitutes, is clearly not depositive.

effect on the retailer equilibrium and hence none on the price functions $q_i^r(p_1, p_2)$. First-order conditions yield in equilibrium, with $p_1 = p_2 = p^f$ and $q_1 = q_2 = q^f$ (the superscript f refers to the use of franchise fees),

$$(q^f - c)/q^f = 1/\left[\epsilon_1(q^f, q^f) + \epsilon_2(q^f, q^f)m_2(p^f, p^f)/m_1(p^f, p^f)\right]. \quad (12)$$

It follows that

Proposition 2. If producers' profit functions are single peaked, then under the conditions of Lemma 1, $q^c < q^f$. If, moreover, $E(q)$ does not decrease with respect to q, then $q^c < q^f < q^m$. If, moreover, $\pi(q) \equiv \pi_1(q, q) + \pi_2(q, q)$ is concave with respect to q, then profits are higher with exclusive territories and franchise fees than with competitive retailing.

Proof. If the retail equilibrium is stable and retail prices are strategic complements, then from Lemma 1, $0 < m_2 < m_1$. If producers' profit functions are single peaked, first-order conditions (1.20) characterize the equilibrium wholesale prices, and we thus have

$$\begin{aligned} 1/E(q^f) &= 1/\left[\epsilon_1(q^f, q^f) + \epsilon_2(q^f, q^f)\right] \\ &> 1/\left[\epsilon_1(q^f, q^f) + \epsilon_2(q^f, q^f)m_2(p^f, p^f)/m_1(p^f, p^f)\right] \\ &= (q^f - c)/q^f \qquad (13) \\ &> 1/\epsilon_1(q^f, q^f) \\ &= 1\epsilon(q^f). \end{aligned}$$

If $\epsilon(q)$ does not decrease with respect to q, then the last above inequality implies $q^c < q^f$. If this was not the case, one would have

$$(q^f - c)/q^f > 1/\epsilon(q^f) > 1/\epsilon(q^c) = (q^c - c)/q^c,$$

a contradiction. Similarly, it can be shown that the first inequality in (13), together with the monotonicity of $E(q)$, implies $q^f < q^m$. *Q.E.D.*

The same argument can be used to establish that profits are increased with successive layers of distribution, provided that the assumptions on the strategic complementarity of prices and on the demand elasticity are preserved at successive levels. That is, producers' profits can again be increased if producers do not deliver the goods directly to retailers but sell the good to wholesalers (under an exclusive contract), who then sell to retailers (under exclusive contracts). In the limit, as the number of disitribution layers is increased, profits may approach those of the collusive outcome (ignoring, of course, the costs associated with operating each of these distribution layers); this is the case, for instance, for linear demand functions.[9]

This analysis again shows that vertical restraints may be used in order to decrease effective competition among producers. Retailers play the role of "black boxes" that

[9] If the demand for good i is $D^i(q_1, q_2) = d - \alpha q_i + \beta q_j$ $(0 < \beta < \alpha)$ and (without loss of generality, rescaling prices if necessary) $c = 0$, the markup between the monopoly price and the equilibrium price, $(q^m - q^c)/q^c$, is divided by more than two when adding an extra layer; in particular,

$$(q^m - q^f)/q^f = \left(\alpha/(2\alpha + \beta)\right)(q^m - q^c)/q^c.$$

serve as "response machines" and enable the producers to act in a way that facilitates (implicit) collusion; vertical restraints constitute a tool that may help in improving the performance of these response machines.

We should emphasize that in this model, in the absence of imperfect competition at the upper level, there is no motivation for using exclusive territories: a monopoly producer or perfectly competitive producers would achieve the integrated optimum by dealing with competitive retailers. This stresses the importance of the nature of competition at the producer level for analyzing the role of vertical restraints.

Proposition 2 also stresses that the effect on equilibrium prices is likely to be higher when franchise fees are not available. The basic intuition is that, though retailers' response functions are the same whether fees are or are not allowed, producers' reaction functions induce higher prices when fees are not available: producer i's profit is equal to the product of the "perceived" demand, which is the same whether fees are allowed or not, and the markup, which is $(q_i^r(p_1, p_2) - c)$ if franchise fees are allowed but only $(p_i - c)$ if they are not allowed. As a consequence, producer i's reaction function $p_i^r(p_j)$ $(j = 1, 2, j \neq i)$ is "higher" when franchise fees are not allowed, leading to higher equilibrium wholesale prices and also, thus, to higher equilibrium retail prices. This suggests that when double marginalization problems are not too important, producers prefer the situation in which franchise fees are not available.[10]

The next section addresses more precisely the issue of the producers' choice of the contractual type of arrangement. (Similar arguments can be used to explain why contracts that provide for exclusive dealings may increase profits. Assume there are two firms, one of which has a small fraction of the market. Assume there are scale economies in distribution (within any locale). Then, the manufacturer of the commodity with the larger market can raise his rival's costs by forcing the rival to establish his own distribution network, rather than using the established retailer. At the higher marginal cost of distribution, the equilibrium price that will emerge in the market will be higher, and hence the large producer's profits will be higher.[11] If there are economies of scope, e.g., between distributing the product in one market and in another, or between distributing one product and another, then the provisions for exclusive territories may interact with exclusive dealing provisions. A new retailer cannot attempt to lower costs by selling both products.)

3. Equilibrium marketing arrangements

■ So far, we have compared market equilibria associated with different contractual territorial arrangements. However, whether these territorial agreements will be signed is itself a question the theory should address—in particular, the fact that the profits of one or even all of the producers are higher or lower when assigning exclusive territories does not necessarily imply that such contracts will be signed.

The natural way to tackle this issue is to introduce in the previous model a first stage in which producers choose whether to sign a territorial agreement with retailers. We shall thus now consider a three-stage game. In the first stage, producers choose their contractual type of agreement. We shall suppose that they have three options: option C—sell to a very large number of competitive (intrabrand) retailers; option E—

[10] This is true for linear demand functions, as computations show. It can also be seen very clearly in the case of multiplicative demand functions introduced earlier, where $m_2 = 0$: then the equilibrium with exclusive territories and franchise fees coincides with the equilibrium with competitive retailers, while the equilibrium with exclusive territories and no franchise fees may in some cases entail higher profits when double marginalization problems are not too important.

[11] Note that this argument holds even if the two commodities are "almost" perfect substitutes, so long as it takes time for the new commodity to replace the established commodity in the marketplace.

assign exclusive territories to their retailers, without requiring any franchise fees; and option F—assign exclusive territories and require franchise fees. In the second stage, producers choose their wholesale tariffs: a wholesale price plus (if authorized by the contractual form chosen in the first state) a franchise fee. In the third stage, retailers choose their retail prices.

The assumption here is that producers can commit themselves in the first stage to assign exclusive territories and, for instance, to require no franchise fee, and that this first choice is publicly observed and known by the other producers and the retailers at the beginning of the second stage. We shall look for the (subgame) perfect equilibria of this game. This extra layer in the game and the associated commitment enable the producers to choose among different retailers' reaction functions. Table 1 gives, for each possible choice of marketing arrangements, the producers' profits as functions of their wholesale prices (with $q_i^a \equiv q_i^a(p_i, q_j)$, for $i, j = 1, 2$ and $i \neq j$).

We can establish the following result:

Proposition 3. (i) If retail prices are strategic complements and profit functions are quasi-concave, then (F, F) dominates (C, C) and: (a) (C, C) cannot be an equilibrium; (b) if (C, C) dominates (E, E), (E, E) cannot be an equilibrium.[12]

(ii) F may be a dominant strategy and (F, F) the unique equilibrium, even though the producers would be better off with (E, E).

Proof. (i) The first part is in Proposition 2; we prove here (ia) and (ib).

(ia) We show that, starting from (C, C) producer 1 is better off by playing F. In subgame (C, C), producer i's best response to his rival's price is $p_i = q_i^a(c, p_j)$ $(i, j = 1, 2, i \neq j)$. In subgame (F, C), producer 1's best response is to set $p_1 = c$, which induces his retailers to choose $q_1 = q_1^a(c, p_2)$ and gives him the same profit as in subgame (C, C) given his rival's price. But setting $p_1 = c$, producer 2's marginal profit in subgame (F, C) is

$$(p_2 - c)D_2^2\Big(q_1^a(c, p_2), p_2\Big) + D^2\Big(q_1^a(c, p_2), p_2\Big) + (p_2 - c)D_1^2\Big(q_1^a(c, p_2), p_2\Big)(\partial q_1^a/\partial q_2)(c, p_2). \tag{14}$$

The last term of this marginal profit is positive if retail prices are strategic complements and the first two terms are zero for $p_2 = p^e$ $(= q_i^a(c, p^e), i = 1, 2)$. Therefore, if the profit function is quasi-concave, producer 2's equilibrium price is higher in subgame (F, C) than in subgame (C, C), which concludes the argument.

(ib) We show that producer 2 prefers (E, C) to (C, C), which by assumption he prefers to (E, E): producer 2 would hence deviate from (E, E), e.g., by playing C.

Let us denote by $\tilde{p}_i$ and $\tilde{\pi}_i$ producer i's equilibrium price and profit in subgame (E, C). We have:

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[12] In the following, "(A, B)"—where A, B = C, E, or F—represents the equilibrium achieved in the subgame where the first producer has chosen marketing arrangement A and the second producer has chosen arrangement B. (A, B) is said to "dominate" (A′, B′) if both producers prefer (A, B) to (A′, B′).

$$\begin{aligned}\tilde{\pi}_2 &= (\tilde{p}_2 - c)D^2\Big(q_1^a(\tilde{p}_1, \tilde{p}_2), \tilde{p}_2\Big) \\ &\geq (p^e - c)D^2\Big(q_1^a(\tilde{p}_1, p^e), p^e\Big) \\ &\geq (p^e - c)D^2\Big(q_1^a(c, p^e), p^e\Big) \\ &\geq (p^e - c)D^2(p^e, p^e) \\ &= \pi^e,\end{aligned} \tag{15}$$

where the first inequality uses the fact that $\tilde{p}_2$ is producer 2's best response to p_2 in subgame (E, C), the second inequality uses $\tilde{p}_1 \geq c$ (which is obviously satisfied, since in subgame (E, C) producer 1's profit is of the form $(p_1 - c)D^1$), and π^e denotes producer 2's profit in subgame (C, C).

(ii) We exhibit such a case using a linear example, in which the demand functions are given by $D^i(q_1, q_2) = d - \alpha q_i + \beta q_j$, with $\alpha \geq \beta > 0$. In this case, which we present in more detail in the Appendix, the only relevant parameter for our purpose is $b \equiv \beta/\alpha$, an indicator of the substitutability of the two goods: in all subgames, equilibrium profits are of the form $f(b)\cdot\Pi$, where $\Pi = [d - (\alpha - \beta)c]^2/\alpha$. Producers always prefer (F, F) to (C, C), and they also prefer (F, F) to (E, E) when b is small ($b \in [0, \tilde{b}]$, where $\tilde{b} \approx .8$), but (E, E) to (F, F) otherwise ($b \in [\tilde{b}, 1]$); however, F is always a dominant strategy (for any b in [0, 1]) and even a strictly dominant strategy for $b > 0$—in which case (F, F) is the unique equilibrium. *Q.E.D.*

Proposition 3 stresses that exclusive territories necessarily emerge from the noncooperative choices of vertical arrangements. Moreover, firms may require franchise fees, even in cases where they would prefer not to if they could cooperatively agree to dispense with them; there may thus exist a standard prisoner's dilemma problem, in which each producer would like his rival to use a fee, since this would yield higher prices, but in which each of them, given his rival's strategy, unilaterally prefers to impose such a franchise fee and recover his retailers' profits.

4. Methodological discussion

■ This article has had two major objectives. First, we have sought to develop a general methodology for the analysis of market equilibrium in which goods are sold not directly by producers, but through intermediaries. It is our belief—supported by the present analysis—that retailers and wholesalers are important, and that their

TABLE 1

	Player 2		
Player 1	C	E	F
C	$(p_1 - c)D^1(p_1, p_2)$ $(p_2 - c)D^2(p_1, p_2)$	$(p_1 - c)D^1(p_1, q_2^a)$ $(p_2 - c)D^2(p_1, q_2^a)$	$(p_1 - c)D^1(p_1, q_2^a)$ $(q_2^a - c)D^2(p_1, q_2^a)$
E	$(p_1 - c)D^1(q_1^a, p_2)$ $(p_2 - c)D^2(q_1^a, p_2)$	$(p_1 - c)D^1(q_1^r, q_2^r)$ $(p_2 - c)D^2(q_1^r, q_2^r)$	$(p_1 - c)D^1(q_1^r, q_2^r)$ $(q_2^r - c)D^2(q_1^r, q_2^r)$
F	$(q_1^a - c)D^1(q_1^a, p_2)$ $(p_2 - c)D^2(q_1^q, p_2)$	$(q_1^r - c)D^1(q_1^r, q_2^r)$ $(p_2 - c)D^2(q_1^r, q_2^r)$	$(q_1^r - c)D^1(q_1^r, q_2^r)$ $(q_2^r - c)D^2(q_1^r, q_2^r)$

presence significantly modifies the market equilibrium. The second objective of this article has been to investigate in detail one particular aspect of retail/producer relationships, the use of exclusive territories. We now make some comments on these two points, before concluding with some remarks on the implications of this analysis for antitrust policy.

□ **General remarks.** Our analysis modelled the market equilibrium as a three-stage game, with the rules of the game (the contractual form) being chosen in the first, the wholesale price in the second, and the retail price in the third. We showed that (a) the perfect Nash equilibrium (and, in particular, the Nash equilibrium choice of the contractual form) may not be joint profit maximizing, but (b) retail structure provides, in effect, a way for the producer to commit himself (or more accurately, his retail outlet) to increase prices in response to a price increase of his rival and to decrease prices in response to entry. Both of these responses are anticompetitive, leading to higher consumer prices.

This result is an example of a more general result. Assume we have two firms with a vector of decision variables, say $\{x, y\}$, with profits a function of the levels chosen by both firms:

$$\pi^i = \pi^i(x_1, y_1, x_2, y_2). \tag{16}$$

Then, clearly, by choosing an adequate time structure (for instance, choose the x's first, and then the y's given the x's), one induces certain responses that facilitate cooperative behavior.

The problem presented to the modeller is choosing a "reasonable" set of structures to investigate. Assume for example that one of the firms can create an artificial machine that has the following property: if the rival takes jointly cooperative action, then the machine will too; but if the rival does not, the machine engages in ruthless behavior. Such a machine will clearly support cooperative behavior, but the artificiality of the construct makes this "solution" unpersuasive. (See Katz (1991) for a general discussion of the possibility of supporting collusion in this way; this problem has been investigated by Fershtman and Judd (1987a, 1987b) in a rivalrous agency framework and by Bernheim and Whinston (1986) in a common agency framework.)

We have investigated here the natural structures associated with retailing.[13] We have shown that even in the absence of any technological advantages, retailing structures have a distinct advantage in facilitating collusion—even a succession of distribution layers can successively raise profits.

□ **Quantity forcing contracts.** Some care needs to be taken in modelling the feasible contracts between retailers and wholesalers. We have been quite explicit about the informational assumptions underlying our game theoretic analysis; in particular, we have assumed that the producer cannot observe the price charged by the retailer, and therefore cannot specify the price that the retailer charges. We believe that, in many contexts, this is a plausible assumption. Giving the producer the power to specify the price would seem to give him more power and thus would be to his advantage, but in fact this limits the possibility of delegation; if contracts can specify prices, then it is

[13] Several other studies have noted the possible use of delegation as a form of commitment. Stiglitz (1986), for instance, showed that franchisees could be used to deter entry more effectively. The opportunity of "delegation," mentioned in Vickers (1985), has been further analyzed by Bonanno and Vickers (1988), while Bernheim and Whinston (1985) focus on collusion through common agents.

as if the producers are competing directly against each other, and exclusive territories would be ineffective.

Under our informational assumptions, producers also could not make the price they charged depend on the quantity sold. Allowing this may increase the ability of exclusive territories to facilitate collusive outcomes. This can be seen most forcefully in the context where the two producers produce identical products. In that case, if the manufacturers deal with perfectly competitive retailers, all firms get zero profit. Suppose now that the manufacturers can agree in assigning the same exclusive territories to each retailer. In this case, each retailer is now in monopolistic position, in some territory, in the trading of the two goods; they will therefore obtain some positive profit at the new equilibrium. In exchange for their positive profits, the manufacturers can require positive sales of their products (i.e., the retailers effectively commit themselves to sell some quantity of each product to consumers, even if the two manufacturers' prices are different). In that case, the manufacturers perceive a less elastic demand, and at the new price equilibrium, they also achieve positive profits. (Note that the quantity forcing requirement need not be used at the actual equilibrium.) Producers thus have strong incentives to assign exclusive territories to retailers, rather than directly compete against each other. Of course, the simple framework we considered is a very extreme one, but the analysis could be generalized to cases where retailers are not perfect Bertrand competitors in the absence of exclusive territories, so long as assigning exclusive territories does increase retail profits. Note, also, that quantity forcing requirements quite often accompany exclusivity agreements.

□ **Timing and observability.** We have analyzed market equilibrium within a game theory framework, with particular assumptions about the sequence of moves and the set of admissible strategies. It is always reasonable to ask the question, "How well do our assumptions capture what actually occurs in the market, and are our results robust?"

We believe that the most important assumption of our analysis, that retail prices are set after the producer prices are set, is plausible. Retailers do not have long-term contractual arrangements with their customers, and they typically adjust their prices quickly in response to changed market conditions and, in particular, to changed costs of the goods they purchase.[14]

Another important assumption, which we believe is also reasonable, is that producers choose the contractual types of arrangements before they fix their prices. We could, however, consider alternative assumptions. For instance, in a previous version of this article we analyzed the case where producers simultaneously choose their marketing arrangements (exclusive territories or pure competition) and their tariffs (franchise fees and wholesale prices). Then, given any (pure) rival's strategy, each producer is indifferent with regard to assigning exclusive territories—and charging a franchise fee equal to his retailers' profits—or not. This leads to a multiplicity of equilibria, including four pure-strategy equilibria. In the first one, both producers choose "competition" and charge $p = p^c$. In two other equilibria, one producer acts as a Stackelberg leader and the other one follows: for instance, producer 1 chooses "competition" and the Stackelberg leader price (which maximizes $(q_1 - c)D^1(q_1, q_2^a(c, q_1)))$, while the other one chooses "exclusive territories" and charges $p = c$ (which indeed leads to $q_2 = q_2^a(c, q_1)$). In the last equilibrium, both producers choose "exclusive territories" and charge $p = p^f$. It can be shown, however, that the equilibrium where both producers employ exclusive territories dominates (from the producers' point of view) the

[14] There may be some lag, e.g., when the goods are sold out of inventory, but this is unimportant for our purposes.

equilibria where they do not. Exclusive territory assignments are thus likely to appear even with this alternative structure of timing.

More questionable may be our assumption that wholesale tariffs are observed by the rival's retailers. However, this assumption, which simplifies the analysis, is not necessary for our purposes.

Consider, for example, the same three-stage game as before, but in which wholesale prices—and fees, when available—are private information. Then the rival's retail price does not respond to a change in one's wholesale price. Nonetheless, assigning exclusive territories—without franchise fees—may still reduce competition between producers. More precisely, the options C and F are formally identical in this modified game. If in the first stage of the game producer 1, say, chooses C, then in the second stage he will set his wholesale price p_1 so as to maximize $(p_1 - c)D^1(p_1, q_2)$, where q_2 is the retail price he expects for product 2; that is, he will choose $p_1 = q_1^a(c, q_2)$. If instead he chooses F in the first stage, then he will choose p_1 so as to maximize $(q_1^a(p_1, q_2) - c)D^1(q_1^a(p_1, q_2), q_2)$, that is, he will choose $p_1 = c$, leading to $q_1 = q_1^a(c, q_2)$, as when he chooses C in the first stage. But if producer 1 chooses E in the first stage, he then sets p_1 so as to maximize $(p_1 - c)D^1(q_1^a(p_1, q_2), q_2)$, leading to $p_1 > c$ and to $q_1 > q_1^a(c, q_2)$. Thus, choosing E instead of C leads to higher prices. If both producers choose C, the equilibrium price $q^c = p^c$ is the same as in Section 3. If both producers choose E, the equilibrium prices p^e and q^e are such that $q^e = q_1^a(p^e, q^e)$ and p^e maximizes $(p_1 - c)D^1(q_1^a(p_1, q^e), q^e)$. The wholesale price p^e can again be higher than the equilibrium price q^c and, if double marginalization problems are not too important, producers' profits can be higher than in case (C, C). The analysis of the linear case provided in the Appendix exhibits such an example, and also shows that (E, E) can be a marketing equilibrium when it is preferred to (C, C) (that is, producers may not want to deviate from (E, E) to, say, (C, E)). Therefore, if producers can commit themselves not to use franchise fees and make this commitment known to their rivals[15] or, alternatively, if franchise fees are not available for institutional or other exogenous reasons, then assigning exclusive territories has real effects on producers' competition even if wholesale prices are not publicly observable.

5. Conclusion

■ This article has a simple point: the effects of vertical restraints, such as exclusive territories, may in the two polar cases of pure competition and monopoly be markedly different from that in markets—virtually all markets—in which there is imperfect competition; for such markets, vertical restraints may be a device for reducing the degree of competition, and thus raising prices and profits. In contrast, in the two polar cases (monopoly and pure competition), the degree of competition is, by assumption, fixed. In addition, of course, such vertical restraints may be efficiency enhancing as they arguably must be in competitive markets; and, as in pure monopolies, they may also be used as devices to facilitate discrimination. (Under the Robinson-Patman Act, producers in the United States cannot engage in price discrimination. However, retailers or wholesalers in different markets can charge different markups, reflecting the degree of competition in those markets; and if there are franchise fees, the producer can recapture these profits, achieving exactly the same results he could have received with price discrimination. For this to be effective, there cannot be arbitrage, and this requires exclusive territories. Our objective has been to focus on the role of exclusive territories in reducing the effective degree of competition among firms. We have not explored

[15] In France, producers are required to publish their "general conditions": rules for quantity discounts, fees, royalties, etc. Even though precise tariffs are not public—since the application of the rules depends on unobserved variables—whether franchise fees are being used or not is public information.

the other roles of exclusive territories, e.g., in generating rents that are an important part of providing incentives for maintaining reputation. In Rey and Stiglitz (1987, 1988) we discuss this and other aspects of exclusive territories. We show, for instance, that equilibrium may entail exclusive territories with excessive advertising, so that exclusive territories actually lower producer profits. Also, exclusive territories may be used to deter entry: an independent retailer who has an exclusive territory is likely to have a tougher response to entry, since he does not take into account the effect of a decrease of his own price upon the producer's profits in other territories.)

The multiplicity of objectives that vertical restraints may serve poses a problem for antitrust policy. Certainly, a policy of per se legality as proposed by Posner (1981) seems inappropriate. The possibility of efficiency-enhancing effects may make one cautious about a policy of per se illegality. If a *rule of reason* standard is proposed, one still needs to ask what the *presumption* should be. Where should the burden of proof lie?

In our perusal of the literature on efficiency-enhancing effects we have been impressed with the almost total reliance on theoretical arguments showing the possibility of such effects, and the paucity of cases providing persuasive evidence of their importance. While we have focused on the theoretical arguments establishing the ability of such restraints to reduce competition, an examination of the relevant formulae reveals that even with products that are close, but imperfect, substitutes, exclusive territories can have significant effects on prices and profits. These effects are so significant that not only do retailers benefit from the lack of competition, but producers gain, even in the absence of the franchise fees with which they might capture the retailer profit.

It should be emphasized that we have analyzed in detail only one of the channels by which vertical restraints may serve to reduce competition. Other, more traditional, mechanisms may operate. We have noted that if the two producers use a common agent in any locale, joint profits can clearly be enhanced. Though in many markets there may be more than one agent (retailer or wholesaler), the limited number of such agents competing against each other, as a result of exclusive territories, may enable them to engage in forms of tacit collusion, which in more competitive markets would not be feasible.

These considerations suggest a policy in which vertical restraints should be considered presumptively illegal, unless there can be shown to be significant efficiency-enhancing effects (a) that could not be obtained (at reasonable cost) in other ways,[16] without the ensuing anticompetitive effects, and (b) that outweigh any anticompetitive effects.

The implementation of such a policy will not be easy. In the imperfectly competitive environments we are concerned with here, even the Posner test of the presence of "efficiency-enhancing" effects—a shift in the demand curve—may not be appropriate. The demand curve may shift out, yet welfare may be decreased.

Moreover, firms have the ability to work around any simple rules that might be established. Restraints in the use of exclusive territories lead firms to devise "areas of primary responsibility," which have much the same effect. But they impose a burden on antitrust prosecutors to show that this is the case, a burden that at the very least increases the cost of antitrust enforcement.

Although this article has focused on exclusive territories, it raises more general methodological issues. We have shown that the behavior of markets cannot be

[16] Brewers speak, for example, of the freshness of the beer, while automobile mechanics invoke security, etc. In the former case, however, it could be possible to put the date of production upon beer bottles. In the second one, mechanics' effort seems (at least imperfectly) verifiable *ex post*. The recent example of airline deregulation showed that competition does not always lower security expenses.

ascertained by simply looking at producers, their technology, and market demand curves. While there appear to be few significant economies of scale in bottling soft drinks, the market is far from competitive. It is highly concentrated, and the leading firms enjoy what appear to be monopoly profits. The same is true in many other industries, including beer. It is common lore that monopoly profits and market power in these industries arise from the arrangements by which the goods are marketed. We have seen precisely how a multiple-tier system—producers selling to wholesalers selling to retailers, with exclusive territories—reduces the effective degree of competition, raising prices and profits. We have also seen how pricing behavior and the effective degree of competition depends on whether there are franchise fees. When producers' sales are mediated through wholesale and retail intermediaries, the demand curve they face is not the same as that derived in the standard theory of consumer behavior. We have seen how the elasticity of the demand is reduced. In general, even the shape of the demand curve may be altered—much of the complexity of the analysis of this article derives from this observation. By the same token, it implies that unless econometric studies include the prices of all relevant products in the market, the estimated elasticities may well be biased estimates of the elasticity of the consumers' demand curve. Also, focusing on the elasticity of consumer demand—a function of retail prices—may not suffice for the study of producers' (wholesale) pricing behavior. The theory of market structure with marketing poses a rich research agenda for the future.

Appendix

■ In this Appendix, we first derive the retail Nash (price) equilibrium, and prove Lemma 1. We then present the effect of exclusive territories on manufacturers' prices in the case of linear demand functions.

Retail Nash equilibrium. Some general preliminaries are useful before proving Lemma 1. Recall that $D^i(q_1, q_2)$ denotes the final demand for good i ($i = 1, 2$), that the two goods are substitutes, $D^1_2 \geq 0$, $D^2_1 \geq 0$, and that we assume symmetry, $D^1(q_1, q_2) = D^2(q_2, q_1)$. Given the wholesale prices p_1 and p_2, the retail prices q_1, q_2 are defined as the Nash equilibrium prices of the retail game, where retailer i's profit is given by

$$\pi^r_i(p_i, q_1, q_2) = (q_i - p_i)D^i(q_1, q_2). \tag{A1}$$

If the demand functions are not too convex, retailer 1's and 2's answers to their rival's price, $q^a_1(p_1, q_2)$ and $q^a_2(p_2, q_1)$, are characterized by the following first-order conditions respectively (dropping the arguments in the response functions and using subscripts to indicate partial derivatives of the demand functions):

$$(q^a_1 - p_1)D^1_1(q^a_1, q_2) + D^1(q^a_1, q_2) = 0 \quad \text{and} \quad (q^a_2 - p_2)D^2_2(q_1, q^a_2) + D^2(q_1, q^a_2) = 0. \tag{A2}$$

The second-order condition for retailer 1's profit function, for instance, yields (using first-order conditions):

$$(q^a_1 - p_1)D^1_{11}(q^a_1, q_2) + 2D^1_1(q^a_1, q_2) \leq 0$$

$$\Leftrightarrow \quad -D^1(q^a_1, q_2)D^1_{11}(q^a_1, q_2)/D^1_1(q^a_1, q_2) + 2D^1_1(q^a_1, q_2) \leq 0$$

$$\Leftrightarrow \quad q_1D^1_{11}(q^a_1, q_2)/D^1_1(q^a_1, q_2) + 2\epsilon_1(q^a_1, q_2) \geq 0$$

$$\Leftrightarrow \quad \rho_1(q^a_1, q_2) + \epsilon_1(q^a_1, q_2) - 1 \geq 0, \tag{A3}$$

where $\rho_1 \equiv \partial \log \epsilon_1(q_1, q_2)/\partial \log q_1$ denotes the direct elasticity of the demand elasticity. The retail prices are strategic complements if q^a_1 increases with respect to q_2 and vice versa. For retailer 1, for instance, this is equivalent to (using first-order conditions)

$$\partial^2\pi_1^r(p_1, q_1, q_2)/\partial q_1\partial q_2 \geq 0$$

$$\Leftrightarrow \quad (q_1^a - p_1)D_{12}^1(q_1^a, q_2) + D_2^1(q_1^a, q_2) \geq 0$$

$$\Leftrightarrow \quad -D^1(q_1^a, q_2)D_{12}^1(q_1^a, q_2)/D_1^1(q_1^a, q_2) + D_2^1(q_1^a, q_2) \geq 0$$

$$\Leftrightarrow \quad \rho_2(q_1^a, q_2) \leq 0, \tag{A4}$$

where $\rho_2 \equiv \partial \log \epsilon_1(q_1, q_2)/\partial \log q_2$ denotes the cross elasticity of the demand elasticity. The retail price response functions, $q_1^r(p_1, p_2)$ and $q_2^r(p_1, p_2)$, are then defined by

$$q_1^r(p_1, p_2) = q_1^a\big(p_1, q_2^r(p_1, p_2)\big) \text{and} \quad q_2^r(p_1, p_2) = q_2^a\big(p_2, q_1^r(p_1, p_2)\big). \tag{A5}$$

From the symmetry of the demand functions, the price response functions are also symmetric: $q_1^r(p_1, p_2) = q_2^r(p_2, p_1)$. Given this symmetry, the retail equilibrium is stable if and only if (using (A3) and (A5))

$$\|\partial q_1^a(p_1, q_2)/\partial q_2\| < 1$$

$$\Leftrightarrow \quad \|\rho_2(q_1, q_2)\| < \rho_1(q_1, q_2) + \epsilon_1(q_1, q_2) - 1, \tag{A6}$$

where prices are evaluated at their equilibrium levels. We can now prove Lemma 1.

Proof of Lemma 1. We introduce some more bits of notation: ϵ_j^i will denote the elasticity of demand for good i with respect to the price of good j ($\epsilon_j^i(q_1, q_2) = \partial \log D^i(q_1, q_2)/\partial \log q_j$, and thus $\epsilon_j = \epsilon_j^1$), ρ_j^i will denote the elasticity of the direct elasticity of good i with respect to the price of good j

$$(\rho_j^i(q_1, q_2) = \partial \log \epsilon i_i(q_1, q_2)/\partial \log q_j, \qquad \text{and thus } \rho_j = \rho_j^1),$$

and m_j^i will denote the elasticity of retailer i's retail equilibrium price with respect to p_j

$$(m_j^i(p_1, p_2) = \partial \log q_i^r(p_1, p_2)/\partial \log p_j, \qquad \text{and thus } m_j = m_j^1).$$

The first-order condition for retail equilibrium price q_i can be written

$$\big(q_i^r(p_1, p_2) - p_i\big)/q_i^r(p_1, p_2) = 1/\epsilon_i^i\big[q_1^r(p_1, p_2), q_2^r(p_1, p_2)\big]. \tag{A7}$$

Taking the log-derivative of this equation with respect to p_j leads, after some rearrangements, to the following (where the Kronecker index, δ_j^i, is equal to one if $i = j$ and to zero otherwise, the ϵ's and the ρ's are evaluated at (p_1, p_2), and the m's are evaluated at $(q_1^r(p_1, p_2), q_2^r(p_1, p_2))$):

$$(m_j^i - \delta_j^i)(\epsilon_i^i - 1) = -(\rho_1^i \cdot m_j^1 + \rho_2^i \cdot m_j^2). \tag{A8}$$

Considering (A8) at the (symmetric) producers' equilibrium prices gives

$$m_1 = (\rho_1 + \epsilon_1 - 1)(\epsilon_1 - 1)/\big[(\rho_1 + \epsilon_1 - 1)^2 - (\rho_2)^2\big] \tag{A9}$$

$$m_2 = -\rho_2(\epsilon_1 - 1)/\big[(\rho_1 + \epsilon_1 - 1)^2 - (\rho_2)^2\big]. \tag{A10}$$

From the above, retail equilibrium stability implies that the denominator is positive in the above equations, and first-order conditions imply that ϵ_1 is higher than one. From second-order conditions, the numerator is positive in (A9) and thus, again using retail equilibrium stability, higher than the numerator in (A10). We thus have $m_1 > \|m_2\|$.

Strategic complementarity implies that $(-\rho_2)$ is positive. With the above, this leads to $0 < m_2 < m_1$. Moreover, m_1 is lower than one if

$$(\rho_1 + \epsilon_1 - 1)(\epsilon_1 - 1) \leq (\rho_1 + \epsilon_1 - 1)^2 - (\rho_2)^2$$

$$\Leftrightarrow \quad (-\rho_2)^2 \leq (\rho_1 + \epsilon_1 - 1)\rho_1. \tag{A11}$$

TABLE A1

Player 1	Player 2: C	Player 2: E	Player 2: F
C	$\frac{1}{(2-\beta)^2}$	$\frac{(4+3\beta)^2(2-\beta^2)}{2(8-5\beta^2)^2}$	$\frac{(2+\beta)^2}{4(4-2\beta^2)}$
	$\frac{1}{(2-\beta)^2}$	$\frac{(4+2\beta-\beta^2)^2}{2(8-5\beta^2)^2}$	$\frac{(4+2\beta-\beta^2)^2}{16(2-\beta^2)^2}$
E	·	$\frac{4+2\beta-2\beta^2-\beta^3}{(2-\beta)(4-\beta-2\beta^2)^2}$	$\frac{(4+\beta-\beta^2)^2(8-6\beta^2+\beta^4)}{(32-32\beta^2+7\beta^4)^2}$
	·	$\frac{4+2\beta-2\beta^2-\beta^3}{(2-\beta)(4-\beta-2\beta^2)^2}$	$\frac{2(2+\beta)^2(2-\beta^2)(4+\beta-2\beta^2)^2}{(32-32\beta^2+7\beta^4)^2}$
F	·	·	$\frac{2(2-\beta^2)}{(4-2\beta-\beta^2)^2}$
	·	·	$\frac{2(2-\beta^2)}{(4-2\beta+\beta^2)^2}$

Given stability (i.e., $\rho_1 + \epsilon_1 - 1 > -\rho_2$), a sufficient condition for (A11) to hold is $\rho_1 + \rho_2 \geq 0$, which amounts to saying that the direct demand elasticity does not decrease when both prices increase (i.e., $\epsilon(q)$ does not decrease with q). *Q.E.D.*

Proof of (iib) of Proposition 1. Using the above formulas, the sufficient condition $\tilde{\epsilon} < \epsilon_1$ can be written as (with $\epsilon_1 \equiv \epsilon_1(q_1^r(p_1, p_2), q_2^r(p_1, p_2))$, $\hat{\epsilon}_1 \equiv \epsilon_1(p, p)$, and $\rho_i \equiv \rho_i(p, p)$)

$$(\epsilon_1 - 1)\big[(\rho_1 + \epsilon_1 - 1)\epsilon_1 - \rho_2\epsilon_2\big] < \hat{\epsilon}_1\big[(\rho_1 + \epsilon_1 - 1)^2 - (\rho_2)^2\big]. \tag{A12}$$

Let ρ be an upper bound of $\rho_1(p, p) + \rho_2(p, p)$ in the relevant range of prices. A sufficient condition for (A12) to be satisfied is

$$(\epsilon_1 - 1)\big[(\rho_1 + \epsilon_1 - 1)\epsilon_1 - \rho_2\epsilon_2\big] < (1 - 1/\epsilon_1)^{\rho}\epsilon_1\big[(\rho_1 + \epsilon_1 - 1)^2 - (\rho_2)^2\big]. \tag{A13}$$

Let the ρ's and ϵ_2 be constant, and let ϵ_1 increase. In the limit, the above condition is satisfied, since it boils down to

$$(1 - 1/\epsilon_1)\big(1 + (\rho_1 - 1)/\epsilon_1\big) < (1 - \rho/\epsilon_1)\big(1 + 2(\rho_1 - 1)/\epsilon_1\big)$$

$$\Leftrightarrow \quad \rho < \rho_1, \tag{A14}$$

and in the limit the bound ρ can be chosen as close as desired from $\rho_1 + \rho_2$ (recall that ρ_2 is negative when retail prices are strategic complements). *Q.E.D.*

Linear demand. We now assume $D^i(q_1, q_2) = d - \alpha q_i + \beta q_j$ ($\alpha \geq \beta \geq 0$). Without loss of generality, we shall posit $c = 0$ and $\alpha = d = 1$ (it suffices to move downward the demand function by an amount of $d - (c + w)$ to "eliminate" c in this linear model, and the parameters α and d can be normalized to one through adequate rescaling of the units used for prices and quantities). In the absence of such normalization, in the following all profits would be multiplied by $[d - (\alpha - \beta)c]^2/\alpha$, and the parameter β should itself be multiplied by α.[17] Tedious computations then lead to the (subgame) equilibrium profits given in Table A1 (which can be completed by symmetry). It can be checked that for any β between zero and one, playing F is always a dominant strategy, and even a strictly dominant one whenever $\beta > 0$. (When $\beta = 0$, C and F are strictly equivalent, and strictly dominate E.)

Simple computations also show that profits are higher in the cell FF than in the cell CC (except when $\beta = 0$, in which case they are equal). Thus the equilibrium (FF) is symmetric, entails exclusive territories (and franchise fees) for both producers, and yields higher profits (and lower consumer surplus and aggregate welfare) than in the absence of vertical restraints.

[17] If there are (constant) unit retail costs, w, they can also be normalized to zero; in the absence of normalization, however, profits should in that case be multiplied by $[d - (\alpha - \beta)(c + w)]^2/\alpha$.

TABLE A2

	Player 2	
Player 1	C	E
C	$\frac{1}{(2-\beta)^2}$	$\frac{(4+3\beta)^2}{(8-3\beta^2)^2}$
	$\frac{1}{(2-\beta)^2}$	$\frac{2(2+\beta)^2}{(8-3\beta^2)^2}$
E	·	$\frac{2}{(4-3\beta)^2}$
	·	$\frac{2}{(4-3\beta)^2}$

The comparison of the profits achieved in EE with those achieved in the other two symmetric situations (CC and FF) show that EE may be preferred by both producers: profits are higher for EE than for CC as soon as $\beta > \beta_c \approx .71$ and higher than for FF as soon as $\beta > \beta_f \approx .81$.

Last, in cells CC, EE, and FF the retail price is respectively equal to

$$q^c = 1/(2-\beta), \quad q^e = 2(3-\beta^2)/(8-6\beta-3\beta^2+2\beta^3), \quad \text{and} \quad q^f = 2/(4-2\beta-\beta^2),$$

whereas the monopoly price is given by $q^m = \frac{1}{2}(1-\beta)$. It can be shown that $q^c < q^f < q^m$ (except for $\beta = 0$, in which case $q^c = q^f < q^m$) and that q^e "overshoots" when β is small: $q^e > q^m$ as long as $\beta < \beta_m \approx .70$.

Let us now assume that wholesale tariffs are not publicly observed. As argued in the text, the two options C and F are identical: choosing C leads producer i to $q_i = p_i = q_i^a(c, q_j)$, where q_j is the retail price that producer i expects for product j, whereas choosing F leads to $p_i = c$ and the same retail price $q_i = q_i^a(c, q_j)$. We therefore focus on the two options C and E.

The price equilibrium associated with CC is the same as before: $q^e = p^e$, such that

$$(q^e - c)/q^e = 1/\epsilon_1(q^e, q^e).$$

For EE, the equilibrium prices, p^e and q^e, are characterized by $q^e = q_1^a(p^e, q^e)$ and

$$p^c = \text{argmax}_p (p-c)D^1\left(q_1^a(p, q^e), q^e\right).$$

If producer 1 chooses C while producer 2 chooses E, equilibrium prices $(p_i, q_i)_{i=1,2}$ are characterized by

$$q_1 = p_1 = q_1^a(c, q_2),\ q_2 = q_2^a(p_2, q_1) \quad \text{and} \quad p_2 = \text{argmax}_p (p-c)D^2\left(q_1, q_2^a(p, q_1)\right).$$

Table A2 gives the corresponding profits. The comparison of these profits shows that EE is preferred to CC by both producers as soon as $\beta > \tilde{\beta} \approx .74$. Moreover, for β very large ($\beta > \tilde{\tilde{\beta}} \approx .99$), producer 1 prefers EE to CE, and thus EE is an equilibrium.

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