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Vertical Restraints from a Principal-Agent Viewpoint

by
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and
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W.P. #395

August 1985

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1. Introduction.

Much of economic theory is concerned with the study of linear prices, in which the buyer pays to the seller an amount proportional to the quantity bought. Vertical relationships between manufacturers and retailers (or wholesalers), however, often do involve more complex contracting arrangements, broadly named "vertical restraints". These range from simple non-linear prices -- for instance, the imposition of a franchise fee -- to instruments that restrict intrabrand- or interbrand-competition, such as exclusive territories and exclusive dealing.

The natural theoretical framework to study these restraints is the principal-agent one. Indeed, we would argue that this area is one of the most important fields to be covered by the principal-agent paradigm. First, such contracts are somewhat more explicit than in a number of other areas of application of the paradigm, so that data can be obtained more easily. Second, vertical restraints are important business strategy instruments; and (because of this, together with their observability) they are the object of many policy interventions (antitrust suits). Industrial organization theorists have long recognized this, as we will see below.

To balance the title of this paper, we should mention that principal-agent theory, in its current state, is not a panacea. On the one hand, a number of restraints are connected with the existence of intrabrand or interbrand competition, while most of the existing principal-agent theory is con-

cerned with a competition-free output. On the other hand, potential arbitrage between retailers as well as legal constraints often restrict the set of contracts that a manufacturer can offer to his retailers. Thus, the study of vertical restraints has evolved rather independently of the principal-agent theory (actually, many of the ideas evoked here were suggested before this theory even existed). We will try to explain the difference in emphasis between the theory and its application.

The purpose of this paper is to survey and classify some ideas associated with vertical restraints.[1] We will discuss their rationale (the issue of "private desirability") and mention their social consequences (that of "social desirability"). In section 2, we define the main restraints.

Section 3 looks at what we call "control problems", which is the structure of most contributions on vertical restraints. There, it is assumed that there is nothing stochastic in the environment, which is known before the parties sign the contract. Some actions taken by the involved parties (mainly by the retailer) are not observable (or verifiable in a court). We first identify the externalities (between the producer and the retailer, or between retailers or between producers) associated with linear prices. Which vertical restraints are especially adequate to correct these externalities then follows.

Section 4 discusses the new features associated with uncertainty. There, it is assumed that the parties sign contracts under symmetric

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[1]The paper is not meant to give a comprehensive treatment and list of references, but rather to discuss the methodology and leit-motivs of the literature. For a fairly complete and clear overview of the development of the theory of and evidence on vertical restraints, see Caves [1984]. See also Blair and Kaserman [1983]'s comprehensive treatment.

information, but that, after signing, the retailers have superior information about the "environment" (retail cost or local demand). It is noticed that vertical restraints may not be privately desirable (i.e., not specified by the contracts). And, it is shown that, even if they are privately desirable, they may not be socially desirable. We explain this by the link between uncertainty and the consumer price's average level and flexibility to demand and cost shocks.

Section 5 concludes with a few remarks about the case in which the parties have asymmetric information when signing contracts, which has received little attention in the context of vertical restraints.

2. Linear prices vs. vertical restraints.

Let us first start with a basic framework and notation. We will later enrich the model (and the notation).

a) Basic Framework: There is a single supplier, called a manufacturer. He produces an intermediate good at constant unit cost c, is the only producer of this good, and sells it to a single retailer. The retailer resells the product and, to simplify, has no retailing cost (we will introduce a constant unit retail cost γ when we discuss uncertainty). Formally the retailer, after signing the contract, has a monopoly on a technology that transforms one unit of intermediate good into one unit of final good. p denotes the wholesale (intermediate) price and q the consumer (final) price. x denotes the quantity bought by the retailer; it also denotes the final consumption, if the retailer does not throw any intermediate good away. The downward sloping demand function is denoted $x = D(q)$ (we will later assume that demand also depends on a promotional effort e exerted by the retailer: $x = D(q,e)$).

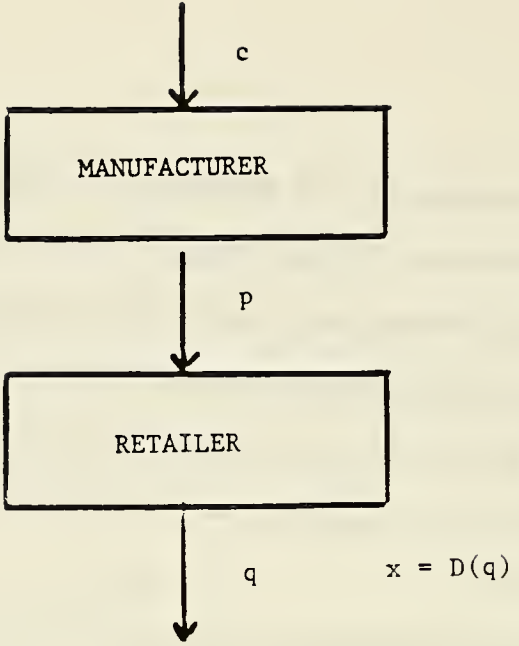

Figure 1

Let us now define some of the most common contracting forms between manufacturers and retailers:

A linear price is a contract specifying only a payment $T(x) = px$ from the retailer to the manufacturer. x is the retailer's choice.

A franchise fee A gives rise to the simplest example of a non-linear price (or payment function). The retailer then pays $T(x) = A + px$. See below for a discussion of more general non-linear prices and of their relevance here.

Resale price maintenance (RPM) is a provision in the contract dictating the choice of the final price q to the retailer. Variants of this restraint are the imposition of a price ceiling: $q \leq \bar{q}$, or of a price floor: $q \geq \underline{q}$ (RPM is thus a price ceiling plus a price floor, such that $\underline{q} = \bar{q}$).

Quantity fixing specifies the amount x to be bought by the retailer. Variants of this restraints are quantity forcing: $x \geq \underline{x}$ and quantity rationing: $x \leq \bar{x}$. Note that, if demand is known and depends on the final price

only, and if the retailer cannot throw the good away, quantity forcing is equivalent to a price ceiling and quantity rationing to a price floor (and quantity fixing to RPM).

Before enlarging the model and defining further common vertical restraints, let us pause and discuss why the theory has focused on such primitive restraints and when these restraints can be imposed. The most obvious cause of the focus is that these restraints are simple and commonly used. But also they may not be as primitive as they look in the environments in which they have been studied.

Consider first a control environment, i.e., a deterministic environment (see section 3 for more details). The manufacturer's concern is to ensure that the retailer picks the "right actions" (for instance, final price or promotional effort). The retailer's decision is, in general, dictated by the marginal price at which he pays the intermediate good. But, in a control environment, the amount of intermediate good consumed and thus, its marginal price can be foreseen perfectly. Then there is no loss in adopting a two-part tariff, i.e., a franchise fee plus a fixed marginal price (at least if the retailer's objective function is concave); so there is no point considering more complex non-linear prices. This vindicates the focus on franchise fees in the contributions discussed in section 3.

This justification of two-part tariffs does not hold in a stochastic environment. As is well-known in both adverse selection[2] and moral hazard[3]

[2]See, e.g., Baron-Myerson [1982], Sappington [1982] and Laffont-Tirole [1984] in regulatory contexts.

[3]See, e.g., Holmström [1979], Shavell [1979] and Grossman-Hart [1983].

theories, a constant marginal price in general is not desirable. So the manufacturer may wish to use more complex non-linear prices. However, arbitrage may prevent him from doing so. If there are several retailers (e.g., in different markets or geographical areas), the latter may "bootleg" and prevent a total price discrimination. While it is easy to control the quantity bought directly by the retailer, it is much harder to observe the quantity he actually sells. The conventional result is that, with lots of arbitraging buyers, the upstream unit can only charge linear prices. In the present context, however, the manufacturer can usually observe whether the retailer carries his product, and thus can demand the payment of a franchise fee (as long as courts confirm this right). Thus, two-part tariffs can be used despite arbitrage.

This brings us to the following trivial, but important, point: the set of vertical restraints that can be used in practice, depends on the informational environment, i.e., on what can be observed and enforced by the manufacturer (if the enforcement mechanism is associated with the legal system, court must also be able to verify the manufacturer's information). So, for instance, RPM is not doable if the retailer can give hidden discounts to his customers.[4] Similarly, quantity fixing is somewhat meaningless in an environment in which the retailers arbitrage. The vertical restraints

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[4]Discounts may also affect non-monetary (less observable) dimensions of exchange between retailer and customers. Also, even if discounts can be observed by the manufacturer, such price control may be prohibitively costly. Suppose that one of the retailers' roles is to analyze customers so as to price discriminate between them (the manufacturer knowing only the distribution of tastes in the population of customers). A full control of the retailer's pricing policy then requires knowing ex-post the <u>whole</u> distribution of prices that he charged, which is very costly for the manufacturer and the court to assess (in other words, the latter cannot save on monitoring costs by inspecting randomly).

literature, like most of the Principal-Agent one, assumes that relevant variables can be monitored at zero or infinite cost. The zero-one nature of enforceability is a convenient, but extreme assumption.

b) Intrabrand competition.

Let us now introduce the possibility of competition between several retailers on the same market. The new type of restraint that can be used by the manufacturer is exclusive territories, which divides the final market between the retailers (a similar restraint is a limit on the density of retailers):

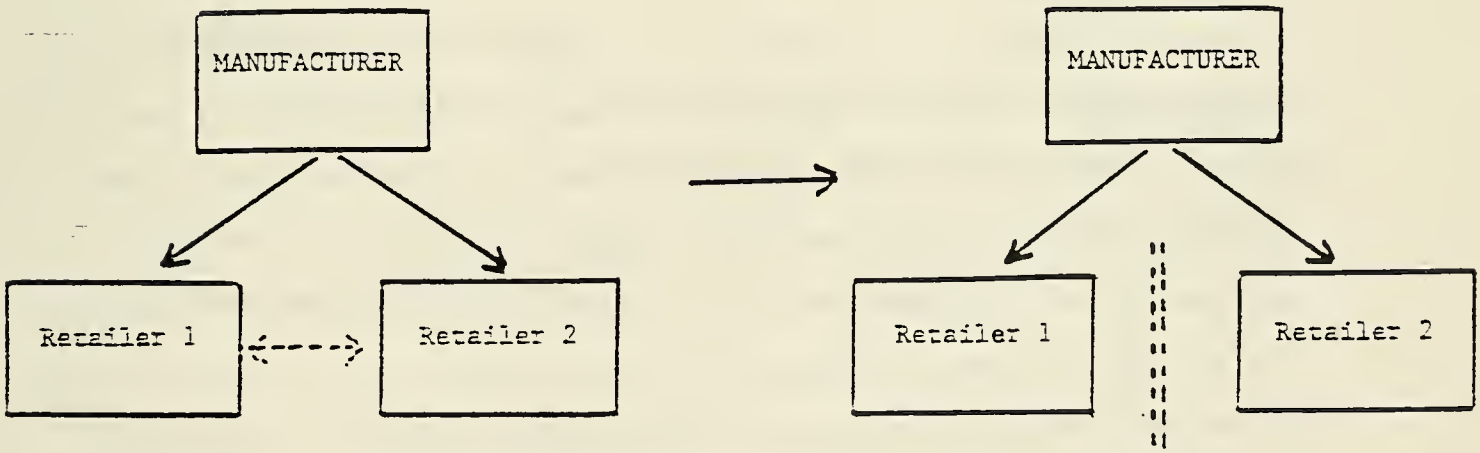

Figure 2: Exclusive territories.

Territories can be understood in a spatial sense, but also more broadly in a market segmentation sense (for instance, public vs. private markets). Needless to say, the informational requirement for such a restraint to be feasible is strong. For example, in the spatial interpretation of the model, the manufacturer must be able to trace customers and to prove (in case of cheating) that the retailer was aware of their origin (or, if he was not, that it was cheap for him to obtain this information). Thus, exclusive territories are more commonly used when the downstream units are wholesalers. Let us, however, note that the allocation of a retail monopoly situation (in an isolated territory) serves the purpose of exclusive territories. A similar remark can be made about refusals to deal.

c) Several inputs.

Let us assume that the downstream unit uses several inputs to produce the final good. Here, the downstream unit can be a manufacturer. It can also be a retailer who sells complementary products to the customer. A new restraint specific to this feature is a tie-in, in which one of the input suppliers forces the downstream unit to purchase the other inputs from him (to be precise we should distinguish between "bundling", which fixes the quantities of other inputs per unit of manufacturer input, and "requirements contracting", in which the manufacturer simply requires that the retailer buys the other inputs from him. The distinction matters under uncertainty).

All intermediate products are thus tied. In particular, he can charge prices for the other inputs that differ from their market prices.

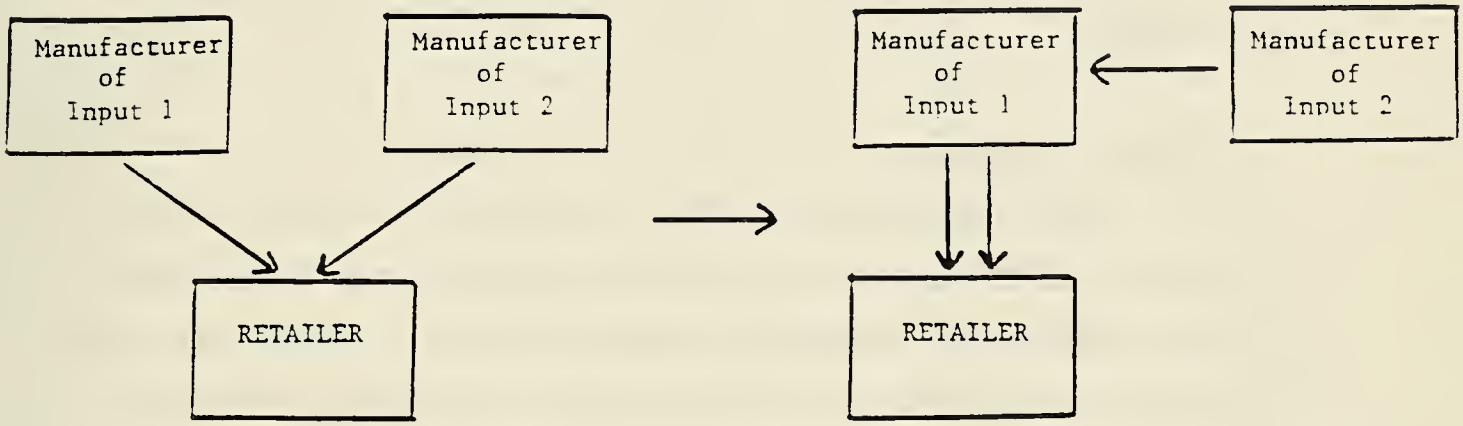

Figure 3: Tie-in.

d) Interbrand competition.

The retailer may sell goods that are close substitutes to the one supplied by the manufacturer. The latter may then impose exclusive dealing on the retailer, which prevents him from selling goods that directly compete with the manufacturer's product.[5]

This certainly does not exhaust the list of possible contractual provisions, which depends on the environment. For instance, if the manufacturer is in charge of national advertising for the product, the contract may include a provision concerning such expenses; etc....

Let us conclude this presentation by saying a few words about the (always changing) legal status of these restraints in the U.S. Roughly, fran-

[5]Another (and very different) degree of freedom concerning interbrand competition is the length of contracts, or the level of penalties for breach of contract (on this, see Aghion-Bolton [1985]).

chise fees are legal; indeed, we may reserve the term "vertical restraint" for other restraints. RPM is currently illegal while exclusive territories after having been forbidden are now subject to the rule of reason. Tie-ins are illegal.

3. Control environments.

By "control environment", we mean a situation in which the contract between the manufacturer and the retailer is signed when all the relevant information about the environment is known and public. So there is no exogenous uncertainty. While the principal-agent literature has focused on situations with uncertainty, most of the papers on vertical restraints deal with control environments. There are good reasons for this; models that are usually studied in the principal-agent literature are often so simple that the control problem (described below) is trivial.[6] To the contrary, the study of mildly complex control environments with vertical restraints has yielded interesting insights for business strategy. The study of control environments can furthermore be considered as a first step in the study of more complex problems (in which uncertainty plays a role). It thus becomes important to master the control issues.

The problem considered in the control literature is the following. A number of (possibly dependent) variables must be chosen by the vertical structure: quantity purchased by the retailer, consumer price, effort, retail location, wholesale price, franchise fee, etc. ... But only a subset of these variables can be observed and be used in the contract. These variables

[6]For instance, the observable variable is output, and the unobservable variable is effort. If the production function is deterministic, effort is easily controlled -- for instance, through a minimum output level requirement.

are called instruments. Next, we define targets. To this purpose, let us call aggregate profit the sum of the manufacturer's and the retailer's profits. The targets form another subset of choice variables, which are those directly affecting the aggregate profit. Promotional effort and the retail price are targets. The franchise fee and the wholesale price are not, because they do not directly affect the aggregate profit.[7] The control problem consists in knowing how to use the instruments to reach, or come close to, the desired values of the targets (see the remark below for a discussion of what is meant by "desired"). The literature actually often looks at when there are "enough" instruments to obtain the maximum aggregate profit or vertically integrated profit, i.e., the aggregate profit that would obtain if all choice variables were costlessly observable and specified in the contract. Mathewson-Winter [1982, 1984] then say that the set of instruments is sufficient.

• Remark on franchise fees: If the manufacturer can impose a franchise fee on the retailer, in the absence of uncertainty, only a "constrained-efficient contract" is signed. A constrained efficient contract is a contract that maximizes the aggregate profit subject to the incentive constraints (decentralization of actions) (see below for the double marginalization example, in which, because of the absence of a franchise fee, gains from trade between the manufacturer and the retailer are not realized). This property also holds if the manufacturer and the retailer bargain over the contract, i.e., bargaining affects only the level of lump-sum payment (fran-

[7] They directly only affect "internal" transfers. They may indirectly affect targets through incentives, but this is irrelevant to the present classification.

chise fee). Below we will assume that the manufacturer chooses the contract. This makes sense if there exists a competitive supply of potential retailers.

Franchise fees often have no incentive effects, although they do when the manufacturer cannot impose the number of retailers (it then has an effect on entry and is an instrument). Even though we may use the word in other circumstances, we will mainly define "targets" for situations in which a franchise fee is imposed (the basis for the definition of optimal targets is then the aggregate profit).[8]

Our "control environment" is similar to Tinbergen [1952]'s economic policy problem. Tinbergen studied how policy instruments could be used to reach macroeconomic targets.

Considering control environments has two trivial, but important consequences. First, risk aversion plays no role, as everything can be foreseen when signing the contract.[9] Second, in a control environment, restraints that are feasible, costless to enforce, and considered in a), b), c) are always privately desirable.[10] The proof is obvious. For any contract, the two parties can foresee the actions that

[8]In the absence of a franchise fee, the basis for optimal targets is the manufacturer's profit if the latter imposes the contract.

[9]Risk aversion may play a role even in the absence of exogenous uncertainty, because the players in the post-contract game, if any, (e.g., between two competing retailers; or between the retailer and the manufacturer when both choose effort levels) may choose mixed strategies. In the contributions described below, this phenomenon, however, does not occur.

[10]Exclusive dealing may not be privately desirable, for instance, because the fixed cost of having one's own network of retailers may be prohibitive, or because of consumer search (in the spirit of Stahl [1980]).

they will choose. Fixing them in advance, when feasible, can do no harm to the vertical structure[11] (note that this holds even if the set of instruments is not sufficient).

Let us now see how these concepts apply to various environments. For each environment, we start with the choice of actions by a vertically integrated structure, then define the externality associated with linear prices, and lastly, give various restraints that can be used to correct the externality (contingent on being feasible and effective, of course).

a) Basic structure.

We first study the one manufacturer-one retailer structure considered above.

a1) Let us begin with a classic issue: double marginalization (Spengler [1950]). The vertical structure's only target is the consumer price. The vertically integrated quantity x^m and final price q^m are determined by: $x^m = D(q^m)$ and q^m maximizes $\{(q-c)D(q)\}$.

Consider the decentralized structure and the retailer's choice of the consumer price under a linear wholesale price: $T(x) = px$. The retailer maximizes $\{(q-p)D(q)\}$. To make a profit, the manufacturer charges $p>c$, which implies that the consumer price chosen by the retailer satisfies $q>q^m$.[12] Because of two successive marginalizations, the consumer price exceeds the

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[11] In asymmetric cases (for instance, in the case of intrabrand competition with asymmetric retailers), the restraints may be retailer-contingent (e.g., RPM specifies different consumer prices for different retailers). But this does not affect the general proposition.

[12] $(q^m-c)D(q^m) \geq (q-c)D(q)$ and $(q-p)D(q) \geq (q^m-p)D(q^m)$ imply that $(p-c)\left(D(q^m)-D(q)\right) \geq 0$ and therefore, $q \geq q^m$. The strict inequality is obtained if the monopoly price is unique.

vertically integrated price. The externality comes from the fact that the retailer does not take the manufacturer's marginal profit $\{(p-c)D'(q)\}$ into account.

To keep the consumer price (target) down to q^m, the manufacturer may use:

• a franchise fee: the manufacturer can avoid a distortion at the wholesale level by charging p=c and recovering the retailer's profit by using a franchise fee $(A = (q^m-c)D(q^m))$. The retailer is then the "residual claimant for the aggregate profit". The marginal cost he faces (c) is the true marginal cost of the vertical structure. Thus, he takes the "right decision". This is, indeed, a very general principle: in a basic control environment in which all non controllable actions are taken by the retailer, making the latter the residual claimant maximizes aggregate profit and is optimal. Thus, the franchise fee and the wholesale price are sufficient instruments. This simple result also applies in the examples considered in a2) and a3). It also holds under uncertainty if the retailer is risk neutral (see section 4).

• or RPM: fixing the retail price at q^m clearly solves the double marginalization problem. Actually, a price ceiling $(q \leq q^m)$ -- or equivalently quantity forcing $(x \geq x^m)$ -- suffices. To recover the retailer's profit without using a franchise fee, the manufacturer can charge a wholesale price $p=q^m$.

a2) Let us introduce a promotional effort e exerted by the retailer. The effort costs him a monetary equivalent $\phi(e)$ per unit of output, and is not observed by the manufacturer. The demand function is $x = D(q,e)$. e can be thought of as a pre-sales service.

The vertically integrated consumer price q^m and effort e^m maximize $\{(q-c-\phi(e))D(q,e)\}$.

Under linear pricing, the manufacturer charges a wholesale price $p>c$. Thus, for any consumer price q, the retailer's profit margin $(q-p)$ is smaller than the vertical structure's profit margin $(q-c)$. Hence, the retailer's incentive to exert effort is too small. This externality generalizes the double marginalization one. Here, the retailer also does not take into account the extra profit for the manufacturer associated with an increase in effort $\left((p-c)\frac{\partial D}{\partial e}\right)$.

To encourage more effort and obtain the vertically integrated profit, the vertical structure can make the retailer a residual claimant ($p=c$, $A = \max_{q,e}\{(q-c-\phi(e))D(q,e)\}$), as noted above. Notice that, in this particular case, adding one target (effort) does not require more instruments. Quantity forcing is also a sufficient instrument: It suffices that the manufacturer chooses $p=q^m - \phi(e^m)$ and $\underline{x}=x^m$ (the retailer obtains a zero profit by charging q^m and exerting effort e^m, and the manufacturer's profit is the monopoly profit. See Mathewson-Winter (1984)).

Remark on bilateral effort: Suppose that the manufacturer also chooses some level of effort (one can think of brand advertising, for example), at total monetary cost $\phi(E)$. Demand can be written $x = D(q,e,E)$, and increases with the two levels of effort. Let (q^m, e^m, E^m) maximize $\{(q-c-\phi(e))D(q,e,E) - \phi(E)\}$. If E can be contracted for, no new problem arises. If E cannot be observed and q and e are chosen by the retailer (simultaneously with the manufacturer's choice of E), the two-part tariff that makes the retailer a residual claimant is no longer sufficient. The absence of manufacturer's profit margin leads to a minimal level of effort E (zero, say).

The moral hazard problems associated with the choice of e and E can be solved through two-part tariffs if both are residual claimants, i.e., if the retailer's profit margin is equal to $(q-c-\phi(e))$, and the manufacturer's one

is equal to $(q^m-c-\phi(e^m))$, where q^m and e^m are the vertically integrated price and the retailing effort. But this is feasible only if there exists a third party who plays the role of a "marginal source", paying the manufacturer $\{(q^m-\phi(e^m))x\}$, while the retailer pays the source $\{A+cx\}$, where $A \equiv (q^m-c-\phi(e^m))D(q^m, e^m, E^m)$.[13] This solution may be hard to implement as, first, side transfers of good x may be hard to observe for the source, and second, and more generally, there is scope for a coalition between the manufacturer and the retailer (the vertical structure's profit margin becomes $((q-c-\phi(e))+(q^m-c-\phi(e^m)))$ and thus exceeds the one without source. Thus, a coalition between a manufacturer and a retailer leads to "too much" output and to a negative profit for the source).

a3) As a last example, let us take a model with several inputs, which resembles much the previous two cases. Suppose that the retailer uses two inputs, the manufacturer's good and another intermediate good produced competitively at cost (and sold at price) c'. Aside from the final price, the downstream unit (retailer) must choose inputs x and x' to produce output $y = f(x,x')$. The demand function is $y = D(q)$ (we here distinguish the quantity of the intermediate good and that of the final good). The two inputs are substitutes in the production function. The vertical structure's maximum profit is given by: $\max_{x,x'} \{D^{-1}(f(x,x'))f(x,x')-cx-c'x'\}$. Let x^m and x'^m denote the solution.

Under linear pricing, again the manufacturer chooses a wholesale price $p>c$. So the relative price of inputs for the retailer $\{p/c'\}$ exceeds the true relative price $\{c/c'\}$ for the vertical structure. The retailer thus substitutes towards the other input, and consumes too little of the manufacturer's intermediate good.

[13] On moral hazard in teams and the role of third parties, see Holmstrom [1982].

To reach the maximum aggregate profit, the retailer again can be made the residual claimant ($p=c$, $A=D^{-1}(f(x^m,x'^m))f(x^m,x'^m)-cx^m-c'x'^m$). Alternatively, the manufacturer can impose a tie-in, together with RPM. The tie-in allows the manufacturer to impose the true relative price of inputs $p/p' = c/c'$, by charging a price p' for the substitute in excess of its market price c' (a royalty on output is another means of avoiding input price distortion). Subject to this condition on relative prices, and adding RPM: $q=q^m$, p and p' can be chosen so that, i) the vertically integrated profit is realized and, ii) the retailer makes no profit, at least if the production function f exhibits constant returns to scale. For further details, see Burstein [1960], Schmalensee [1973], Blair-Kaserman [1978] and Winter (1985). Note that, for instance, Blair and Kaserman's presentation has no RPM, because perfect competition at the downstream level eliminates the second marginalization.

Remark on welfare aspects: These three textbook cases all have the following in common: under a linear price, the manufacturer's wholesale price exceeds his marginal cost. Hence, the externality associated with the retailer's decisions goes towards too low a level of effort or of a consumption of the intermediate good and too high a consumer price. Thus, instruments that correct the externality also benefit the consumer.

b) Intrabrand competition.

b1) Let us begin with the simplest case of intrabrand competition. The number of retailers is exogenously given, say two. The retailers cover the same market; they may or may not be differentiated. With non-differentiated retailers, the consumer chooses the lowest price or the best price-service

combination. With differentiated retailers other attributes (such as location) matter, and the demand for a retailer's product is not perfectly elastic. We will assume that the retailers are Bertrand-Nash competitors, in order to highlight the competitive aspects of the situation. Forms of (possibly non-cooperative) collusion between the retailers would to some extent bring us back to the one-retailer case. Similarly, we will for the moment ignore exclusive territories, which also tend to lead to the one-retailer case.

Let us assume that the retailers are not differentiated. Under linear pricing, if the manufacturer charges p, Bertrand competition between the retailers avoids the second marginalization, so q=p. Thus, by charging the linear price $T(x) = q^m x$, the manufacturer obtains the vertically integrated profit (while either RPM or a franchise fee would be needed under exclusive territories). If retailers are differentiated, there exists a second marginalization, and RPM then can be used to remedy this.

Let us next consider the case in which the retailers <u>compete through services</u> (efforts) as well. And let us first assume that the service cost is proportional to the number of customers actually served. Let $\phi(e)$ denote this unit service cost. This level of service is a choice variable for each retailer. Consumers consume the product of only one retailer. Let $S(q,e)$ denote the consumer's net surplus at price q and retail service e (note that $\frac{\partial S}{\partial q} = -D(q,e)$). Retailers are not differentiated. The exposition here follows Caillaud-Rey (unpublished notes).

The vertically integrated profit is obtained by maximizing $\{(q-c-\phi(e))D(q,e)\}$ over q and e. Note in particular that, as usual, the choice of effort is dictated by its influence on the <u>demand</u> function.

Under a linear price $T(x)=px$, Bertrand competition leads to the maximization of the consumer's net <u>surplus</u> $S(q,e)$ under the zero-profit constraint

$q = p+\phi(e)$ (consumer price equals wholesale price plus unit service cost). Even though retailers are non-differentiated, the vertically integrated profit cannot be reached with a linear price. It is still true that for a given level of effort, the manufacturer can, by a judicious choice of p, lead to the vertically integrated consumer price q^m without leaving a surplus to the retailers. The problem comes from the choice of effort. Competitive retailers choose effort with the consumer's surplus in mind, while, for the vertical structure, only the effect of effort on consumer demand matters. Note that introducing a franchise fee does not solve this problem (actually, only a zero franchise fee is feasible under Bertrand competition).

The manufacturer can use a competition-reducing restraint to obtain the vertically integrated profit. One example of such a restraint has already been mentioned: exclusive territories (together with a franchise fee, which allows to avoid double marginalization). Another example is RPM: the choice of q and p fixes the service level $\phi(e) = q-p$ under Bertrand competition. Hence, it suffices to impose $q = q^m$ and to pick the wholesale price $p = q^m-\phi(e^m)$.[14]

Thus, we conclude that the manufacturer may want to prevent competition to avoid effort distortion. Also, the two competition-reducing restraints (exclusive territories and RPM) are good substitutes here (as we will see in section 4, this is not always the case). Let us, however, already note a difference between the two restraints: exclusive territories isolate retailers from other forms of competition than price, contrary to RPM.

Let us now examine the new features associated with externalities in effort. Mathewson and Winter [1982,1984] consider a model in which each

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[14]Quantity forcing as well is sufficient: imposing $x > D(q^m,e^m)$ together with a wholesale price $p = q^m-\phi(e^m)$ induces the retailers to choose the right effort and price (i.e., the ones that maximize aggregate profit).

retailer spends money to increase demand (advertising, say). But this effort cannot be fully appropriated. A fraction of a retailer's expenses turns out to be a spillover on other retailers, i.e., it increases their demand. In order for the retailers to internalize this "horizontal externality", the wholesale price must be lowered somewhat. For instance, if exclusive territories can be granted (together with a franchise fee), the wholesale price must fall under c, i.e., the intermediate good must be marginally subsidized.

The externality argument has been invoked repeatedly in the case of discount stores (Telser [1960], Mathewson-Winter [1983]). There, it is argued that some (high-price) retailers supply the necessary information about the product to the customers, who then go to low-service, low-price stores. To encourage an adequate provision of effort (here, information) by the retailers, competition must be reduced (eliminated) by imposing either ET or RPM. The idea is to give the retailers a "property right on their services", by protecting them from "unfair competition".

b2) Let us next endogenize the number of retailers and their degree of differentiation. Note that if the manufacturer can control the number of outlets and their characteristics (e.g., location), the problem very much reduces to the one considered in b1). The manufacturer, however, may not be legally allowed to control the location and number of retailers.

As long as a franchise fee belongs to the manfacturer's set of instruments, the number of retailers is determined by the level of this franchise fee plus the zero-profit (free entry) condition for the retailers. Thus, franchise fees are indirect ways of controlling entry (see Dixit [1983] and Mathewson-Winter [1982,1984]). The question of control of characteristics (such as location) has not yet been fully studied, to the best of our know-

ledge. The existing models are usually location models in a homogeneous space (e.g., a circle with a uniform density of consumers). The "principle of maximum differentiation" holds for both competing retailers and a vertically integrated structure. Thus, there is no conflict between the manufacturer and a fixed number of retailers as to the latters' locations. This feature does not hold in general (see Bolton-Bonanno [1985] for a model of vertical (quality) differentiation with such a conflict. See also the above discussion about the choice of effort by retailers). The resolution of the corresponding conflict will depend on the set of available instruments.

• Remark on patent licensing: A product or process innovation by a firm which does not want to use the innovation itself but prefers to license it to other producers gives rise to vertical control problems that are similar to the ones we have encountered. Some interesting recent contributions have looked at the link between patent licensing and downstream competition. Kamien and Tauman [1983] assume that there are several downstream Cournot-Nash competitors. They show that, if the innovation is not drastic (i.e., not too important), it pays the innovator to license the innovation to several firms and to use both a franchise fee and royalties, in order to soften the competition downstream (in our terminology, $p > c$ is desirable to maintain "collusion" between retailers). Gallini-Winter [1985] and Katz-Shapiro [1984] also analyze the strategic aspects of patent licensing by one of the downstream firms itself. We will not review this literature. Some of its features are indeed specific to the patent licensing situation. For instance, as Katz and Shapiro notice, it may be hard for the licensor to monitor the licensee's output; thus after obtaining the technology, the licensee may imitate the innovation and avoid per unit charges. In such a case, a franchise fee is the only instrument available to the licensor. Also, the distinction between horizontal and vertical restraints is somewhat blurred,

as the discussion above indicates (to be complete, we should mention that this distinction is not as clear-cut as our presentation suggests in the manufacturer-retailer relationship -- see remark 3 below).

c) Retail price discrimination.

In this section we give two examples of "textbook" price discrimination through vertical restraints. In both cases we will assume that several non-differentiated Bertrand retailers choose prices. This is intended to avoid the well-known problem of double marginalization and thus simplify the discussion. Also, effort is not a choice variable for the retailers.

c1) The first example is based on the existence of two upstream goods:

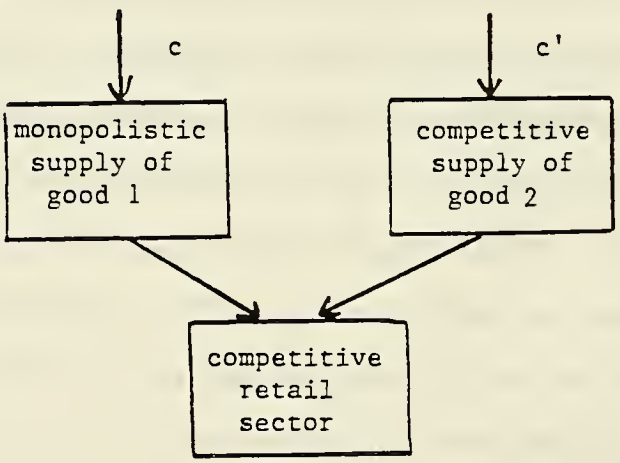

Figure 4

The first upstream good is produced by a monopolist, called the "manufacturer", at cost c per unit. The other upstream good is produced by a competitive sector at price c' per unit. A competitive sector distributes these two goods. For the consumers the two goods are complementary in the following sense: the consumers must first buy one unit of the manufacturer's product (fixed consumption). They then consume several units of the competitive

product (variable consumption). For example, the first good can be a Xerox machine, and the second good paper or ink or maintenance.

Consumers are heterogeneous. The "high demand" ones want to consume a higher number of units of the second good than the "low demand" ones.

Let us first consider what the vertically integrated structure (composed by the three levels) would do. As shown by the theory of price discrimination,[15] it is optimal to charge a price p'>c' for the variable consumption good. This allows to have the high-demand consumers pay a bit more without discouraging the low-demand consumers.

One immediately sees that a tie-in allows the decentralized structure to price-discriminate. It suffices that the manufacturer purchases the second good and forces the downstream retailers to buy it from him at price p'. Thus, we discover a second use for tie-ins: price discrimination (the issue of input substitution considered in a3) does not arise here, since the consumption of the manufacturer's product is inelastic). Note that, as in b), retailers' competition changes the set of instruments required to control the structure. With a single retailer, a franchise fee and a non distortionnary wholesale price (p=c) would be sufficient: the retailer would operate price discrimination himself. The issue, of course, is that perfect competition prevents direct price-discrimination by the retailers.

c2) The second example of price discrimination is based on the existence of two distinct consumer markets with different elasticities of demand (see Perry [1978]). The vertically integrated structure would charge two

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[15]See, e.g., Oi [1971], Schmalensee [1980], Maskin-Riley [1984].

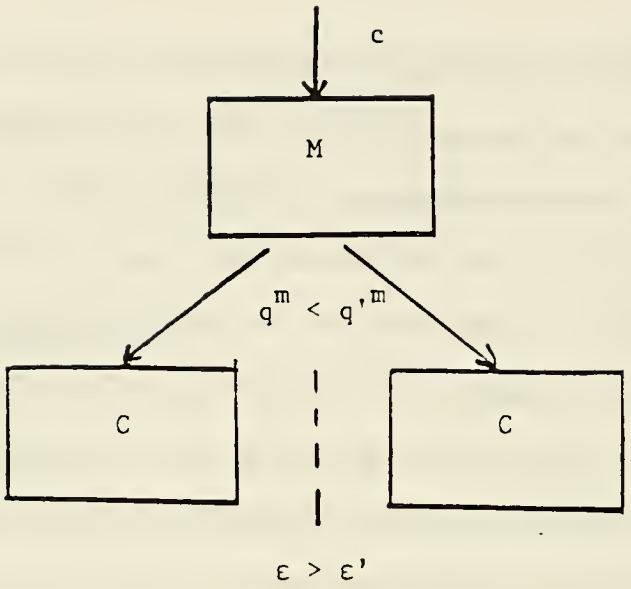

Figure 5

different monopoly prices for the same good. Assuming, for instance, that the elasticity of demand is higher in the first market ($\varepsilon > \varepsilon'$) then $q^m < q'^m$.

In a decentralized structure, the vertically integrated profit can be reached by charging wholesale prices $p = q^m$ or $p' = q'^m$ to retailers serving one market or the other (assuming they are distinct), if the retailers on each market are competitive. However, this policy is not effective if retailers can arbitrage. The high elasticity market retailers will resell the good to the low elasticity market ones. Then some restraint (such as exclusive territories together with a fixed fee) is required to implement price discrimination. Or else the manufacturer can vertically integrate with one high elasticity market retailer so as to internalize transactions at price q^m, and sell at the unique price q'^m on the intermediate good market.

d) Interbrand competition.

To conclude, let us briefly evoke interbrand competition. As mentioned in section 2, a new restraint which is sometimes used to "restrict" inter-

brand competition is exclusive dealing. A manufacturer, when imposing this restraint, must trade off the potential loss of returns to scale[16] and the efficiency gain for the vertical structure. The latter has been explained in the following way: a multi-brand retailer may take advantage of the manufacturer's advertising expense to attract consumers and induce the latter to buy his competitor's products (which, presumably, do not incur such overall expenses and thus can afford to give a higher profit margin to the retailer). Thus, exclusive dealing is seen as giving the manufacturer a "property right" on his promotional expenses (see Marvel [1982]).

Other vertical restraints may be used to reduce interbrand competition. Rey-Stiglitz [1985] show that, exclusive territories for example, reducing intrabrand competition at the retailers' level, induce a decrease in interbrand competition at the manufacturer's level. The basic idea is that reducing retailers' competition decreases the elasticity of the demand perceived by the manufacturers, whereas in the case of perfectly competitive retailers, the manufacturers directly compete with each other.

It has also been suggested that RPM can help competing manufacturers sustain collusion, by reducing the efficacy of secret wholesale price cuts (Telser [1960], Posner [1977]).

We conclude this section on control problems with three remarks:

Remark 1: Despite the very primitive nature of its models (absence of uncertainty), the control literature has been very successful in deriving

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[16]For instance, selling several brands or products may increase the retailers' employment; and it saves search costs to the consumers.

indications for business strategies and in destroying a number of apparently appealing, but fallacious arguments.[17] It has been very successful (and maybe too successful) in showing that vertical restraints need not hurt the consumer, and a fortiori, need not reduce aggregate welfare.

Remark 2: This survey of the control literature is, of course, an incomplete one, whose only goals are to illustrate the methodology and some basic intuitions. Had we enriched our model further, we would have introduced other types of restraints.[18] And we would have introduced new roles for the the verticals restraints analyzed above.[19]

Remark 3: We have not yet mentioned the link between vertical restraints and collusion between retailers. The simplest example of such a phenomenon involves two competing downstream production units which create a trademark in order to obtain exclusive territories or RPM, and thus, transform a competitive downstream market into a monopolized one. Vertical agreements are then just a veil for horizontal collusion.

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[17]E.g., "RPM and exclusive territories prevent intrabrand competition and thus necessarily raise the consumer price."

[16]For instance, a multiproduct manufacturer can use "block booking", a practice similar to tie-ins, in which advantage is taken of the heterogeneous consumers' cross-preferences for the manufactured goods (Stigler [1963]).

[19]To quote a few arguments (without any judgment as to their relevance): RPM can be used to promote the manufacturer's product image, as well as to avoid loss-leader selling by large retailers. Tie-ins can create cost savings in distribution; they can also be used by the manufacturer to control the quality downstream (or can be seen as a way of obtaining information anout the retailer's services). Exclusive dealing may similarly allow cost savings (because of larger shipments). But, by preventing the exploitation of returns to scale associated with multi-product retailing, it can serve as a barrier to entry. Also, it can increase the manufacturer's product differentiation.

4. Uncertainty and vertical restraints.

a) Introduction.

In this section we analyze some new features associated with uncertainty at the retail level. We distinguish two kinds of uncertainties: on demand and on retail cost. Demand uncertainty arises when the manufacturer's product is new (or has not yet been introduced in a particular market), or when demand fluctuates over time, or else when the competitors' strategy -- and thus the residual demand for the manufacturer's product -- is uncertain. Similarly, the retail cost may depend on local conditions (wages, other input prices) or on technological progress. We will assume that the different parties (retailers and manufacturer) have the same information about the environment when they sign contracts. However, the retailers obtain superior information about demand on their market or about retail cost after they sign the contract and before they take actions that affect the vertical structure's targets. We thus emphasize the adjustment of decisions to the environment through delegation.

The asymmetry of information, of course, is crucial. If the manufacturer ex-post observed the retailers' information, contingent contracts could be signed, that would specify the control solution (defined in section 3) for each state of nature. Under asymmetric information, however, the informed parties' incentive to use their private information to reach their own goals often do result in inefficiencies from the vertical structure's point of view.

The first -- and trivial -- point to be made about uncertain environments is that vertical restraints may not be privately desirable any longer. The simplest example of this is obtained from the basic structure: one manufacturer-one retailer. If the retailer is risk neutral, it is well-known

that the symmetric information aggregate profit and sharing rule can be reached by making the retailer the "residual claimant" for the aggregate profit: a two-part tariff with p=c will do. RPM here would not be redundant (as in section 3), but deletarious to the aggregate structure, because it would destroy the flexibility of the consumer price or the retailer's effort to cost and demand conditions.

b) A simple framework.

We present in this section a simplified version of the model analyzed in Rey-Tirole [1985].

In this model, a manufacturer produces a single product at constant marginal cost c. He supplies a market summarized by a demand function D which, for the sake of simplicity, is supposed to linearly depend on the difference between a demand parameter d and the retail price q:

$$D(d,q) = d-q \ .$$

There are two retailing sites in this market, each of them being occupied by a retailer. The retailers are assumed to be chosen by the manufacturer among a competitive supply of identical candidates. The manufacturer can propose to each retailer the (same) two-part tariff (p,A), where p is the wholesale price and A denotes a franchise fee. (We will only briefly discuss here the different assumptions. An extensive discussion of the (strong) informational requirements that make such contracts indeed optimal can be found in Rey-Tirole [1985]). Each retailer has a constant marginal cost of distribution γ and accepts the two-part tariff as soon as he obtains a non-negative expected utility of his profit.

The manufacturer is assumed to have limited information about the environment; in particular, he can only observe, besides the wholesale price and

the franchise fee, the quantity delivered to each retailer, whether or not this retailer sells his product, and in some cases the retail price and his area of distribution. But he cannot observe the actual quantity sold by a retailer in the market, the demand parameter d or the cost of distribution γ. Note that these assumptions are consistent with the nature of the contracts (two-part tariffs) which are allowed: as the manufacturer cannot observe the quantity effectively sold by a retailer to consumers, non linear pricing is no longer available, as then the retailers could set up a secondary market for the good; the manufacturer can, however, impose a franchise fee as he is informed whether the retailers carry his product or not.

Let us now describe the environmental uncertainty. We only consider now uncertainty which affects in the same way the whole market, i.e., the two retailers. They are, therefore, still identical once the uncertainty is resolved (somewhat similar conclusions hold in the case of independent "idiosyncratic" retailer uncertainty. We focus on market uncertainty because it leads to pure Bertrand competition).

We defined two types of uncertainty:

i) Demand uncertainty: The demand parameter d is assumed to be a random variable with support $[\underline{d},\bar{d}]$, where $\underline{d} > c+\gamma$. We note $d^e \equiv E(d)$ and $\sigma_d^2 \equiv E(d-d^e)^2$.

ii) Retail cost uncertainty: the constant marginal cost of distribution γ is assumed to be a random variable distributed on $[\underline{\gamma},\bar{\gamma}]$, where $d > c+\bar{\gamma}$. Again, $\gamma^e \equiv E(\gamma)$ and $\sigma_\gamma^2 \equiv E((\gamma-\gamma^e)^2)$.

The density distributions of d and γ are independent and known by both

the manufacturer and the retailers. The realization of uncertainty (d and γ) is observed by the retailers after their contracts are signed, but before they make their pricing decisions.

The manufacturer is assumed to be risk-neutral, which can be justified if he supplies a large number of statistically-independent markets. Two alternative, polar, assumptions will be made about the retailers' risk-aversion: risk neutrality, in which case they only care about the expected value of their profit, or infinite risk-aversion, in which case they only care, ex-ante, about their profit in the worst possible outcome (this last assumption could also correspond to the case where the retailers learn the realization of uncertainty before signing the contract: if then the manufacturer wants to trade with all possible retailers, he must base his contract on the most unlucky of them. Alternatively one could assume that the retailers may go bankrupt when they realize they will lose money). Many of the results can be extended to general utility functions. The consumers' welfare is measured by the expected value of their surplus, defined by:

$$S(d-q) = \int_q^{+\infty} D(d-p)dp = \frac{1}{2}(d-q)^2 .$$

The social welfare will be taken to be the sum of the ex-ante manufacturers', retailers' and consumers' welfare:

$$W = E(\Pi_M) + \sum_{i=1}^{i=2} V(\Pi_R^i) + E(S),$$

where:

- $\Pi_M = (p-c)D(d-q) + 2A$ represents the manufacturer's profit;
- $\Pi_R^i = (q-p-\gamma)D^i - A$ represents retailer i's ex-post profit (i=1,

2), and D^i the demand he faces. Π_R^i is (ex-ante) a random variable;

- $V(\cdot)$ may be $E(\cdot)$ -- the expected value of the variable $\cdot$ (risk neutrality) --, or $\text{Min}(\cdot)$ -- the minimal value (extreme risk aversion);

- $E(S) = E\{\frac{1}{2}(d-q)^2\}$; the expected surplus is an increasing function of the expected value and the variance of $(d-q)$.

Note that, because there exists ex-ante a competitive supply of retailers, the retailers always obtain their reservation utilities. Thus, we need not take them into account in our welfare comparisons.

We now analyze in this framework the respective advantages and drawbacks of three situations: Pure Competition between retailers, Exclusive Territories assignments and Resale Price Maintenance.

i) Pure competition between retailers: We suppose in that case that retailers act as Bertrand price competitors; hence, the retail price is always equal to the constant total marginal retail cost, that is, the sum of the wholesale price p and the constant marginal cost of distribution γ. This implies that the mark-up is always equal to zero whatever the state of nature and thus, the franchise fee must also equal zero, whether or not the retailers are risk-averse.

ii) Exclusive territories assignments to retailers: We suppose in this case that each retailer enjoys full monopolistic power in a part of the market, say, for example, half of the market -- the exact shares do not matter, unless there is some differentiation between retailers (assigning half of the market to each retailer is then the optimal sharing rule if they are symme-

tric). Hence, the retailer, given the wholesale price p, chooses a retail price which maximizes $\Pi(d,p,\gamma,q) = (q-p-\gamma)(d-q)$. Let us denote by $q^m(d,p,\gamma)$ and $\Pi^m(d,p,\gamma)$ the associated optimal retail price and profit. The maximal franchise fees that can be recovered by the manufacturer are then equal to: $2A = 2V(\Pi^m(d,p,\gamma)/2) = V(\Pi^m(d,p,\gamma))$ given the linearity of the function V.

iii) Resale Price Maintenance: In this case, the contracts proposed by the manufacturer impose, besides the wholesale price and the franchise fee, the retail price q. The retailers then have a very passive role: they only have the choice of accepting or rejecting the contract. Given a wholesale price p and a retail price q, the maximal franchise fee F which can be required from each of the retailers is, if we suppose that half of the consumers go to each retailer when retail prices are equal: $A = \frac{1}{2} V[(q-p-\gamma)(d-q)]$

c) The certainty case.

Before going forward in the analysis of the respective properties of the three above-described situations in the presence of uncertainty, let us first remark that they are all equivalent in the certainty case, in the sense that the manufacturer's optimal choice always induces the same maximal aggregate profit and the same consumer surplus. In the certainty case, the optimal retail price, from the joint profit's maximization point of view, is $q^m(d,c,\gamma)$ and the corresponding "integrated" profit is $\Pi^m(d,c,\gamma)$.

Actually, the three types of contract allow the manufacturer to achieve this optimal integrated profit. In the competitive case, it suffices for him to quote a wholesale price equal to $p = q^m(d,c,\gamma) - \gamma$ and a zero franchise fee; then the retail price is the monopoly one and all the profits go to the manufacturer. In the Exclusive Territories case, he can sell at marginal

cost and impose a franchise fee equal to $\frac{1}{2}\Pi^m(d,c,\gamma)$; the retail price decision is then delegated to the retailer with the "right signal" p=c, and the integrated profit is recovered via the franchise fee (see section 3a)). Lastly, in the Resale Price Maintenance case, the manufacturer can mimic one of the previous two contracts.

Hence, in the absence of uncertainty, vertical restraints induce exactly the same private and social welfares; in particular, the use of franchise fees avoids the double marginalization problem in the case of exclusive territories. In the sense of Mathewson-Winter, two-part tariffs, Exclusive Territories and Resale Price Maintenance are sufficient control mechanisms in the absence of uncertainty. Therefore, the properties which we are going to emphasize now are intimately linked to the uncertainty context. Moreover, as we will see, they depend very much on the nature of uncertainty.

Actually, even when there is some uncertainty, the manufacturer can always implement any desired <u>expected</u> value of retail price or final demand; but problems arise with either the adaptation of these variables to modifications of the environment or the provision of insurance. We analyze in the next section how vertical restraints deal with these problems.

d) <u>The uncertainty case</u>.

We now reintroduce uncertainty about the market (parameter d) and the retail cost (parameter γ). How do such fluctuations affect the agents?

- The consumers, (who, of course, prefer a high expected consumption $(d-q)^e$), for a given expected value of demand $(d-q)^e$, prefer a large variance (the net consumer surplus is convex in consumption). Hence,

they do not want the retail price to adjust to market (d) fluctuations, but want it to fully respond to modifications in retail cost γ.

- The retailers' ex-post profit is $\{(d-q)(q-p-\gamma) - A\}$; minimal variations of this ex-post profit are then obtained for a zero mark-up, which means that the retail price is fully responsive to the retail cost and not at all to the demand fluctuations.

- The manufacturer would like the retail price to adjust to the environment ($q=q^m(d,c,\gamma)$, which responds to a certain extent to both market and retail cost fluctuations) but must also provide insurance to the retailers if they are risk averse. Insurance requires q not too far from $(p+\gamma)$ which is not consistent with $q=q^m(d,c,\gamma)$, as we will see.

What are the properties of vertical restraints with respect to these objectives?

Let us take the competitive situation as a reference. We saw that the retailers' mark-up is in all states of nature equal to zero (perfect insurance of the retailers) so that the retail price fully responds to retail cost fluctuations and not at all to market ones (which is good from the consumers' point of view, but not too good from the manufacturer's one).

Let us now look at Resale Price Maintenance. The retail price, imposed by the manufacturer, responds neither to market nor to retail cost fluctuations. RPM has thus the same properties as Competition in the case of pure market fluctuations, but behaves much worse in the case of retail cost fluc-

tuations: the demand (d-q) does not adjust at all, while the mark-up (q-p-γ) fully responds.

Exclusive Territories assignments have contrasted properties. As in the absence of uncertainty, the manufacturer can here again sell at marginal cost and so implement the optimal monopolistic retail price relative to the environment. On the other hand, it provides little insurance to the retailers and induces a less variable demand $d-q = \frac{1}{2}(d-p-\gamma)$ than in the competitive case (and than RPM when there is only market uncertainty).

These considerations will be helpful in order to better understand the following results.[20]

Proposition 1: Suppose that the retailers have no risk aversion and that there are both market and retail cost uncertainties. Then the manufacturer prefers Exclusive Territories to RPM or Competition, which are equivalent ($\Pi^{ET} > \Pi^{RPM} = \Pi^{C}$). By contrast, from the consumers' and the social welfare's point of view, Competition dominates RPM and ET ($W^{C} > W^{RPM}, W^{ET}$).

Proposition 2: Suppose that the retailers are infinitely risk-averse; then both the consumers and the manufacturer agree on the choice of vertical restraints, which depends on the nature of uncertainty: for pure demand uncertainty, competition is equivalent to RPM, and these two arrangements are preferred to ET. For pure cost uncertainty, competition is preferred to ET, which is preferred to RPM.

Most of these results are quite intuitive in light of the previous discussion.

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[20] See Rey-Tirole [1985] for a formal proof.

Consider first the case of retailers' risk-neutrality: in this case, the manufacturer wants to achieve only two objectives: avoid double marginalization and adapt the market price as well as possible to environment fluctuations. Competition does suppress the second price distortion, and so does RPM in the case of pure market uncertainty; but in each of these two cases, the retail price does not adapt very well to the environmental fluctuations. By contrast, the manufacturer can achieve his two objectives by assigning exclusive territories and selling at marginal cost: By so doing, he fully delegates the pricing decision to the retailers, supplying them with the "good" signal (marginal cost of production), and he can then recover the expected optimal integrated profit via the franchise fees. Hence, ET clearly dominates RPM and Competition from the manufacturer's point of view and permits him to realize the vertically integrated profit.

The consumers, on the other hand, prefer a low expected retail price and a highly variable final demand. It can be shown that in fact ET, RPM and Competition lead to the same expected price;[21] as we already noticed, Competition always induces a more variable demand, and so does RPM in the case of pure market uncertainty. This explains why they may be more socially desirable. Finally, in case of pure retail cost uncertainty, RPM generates a very sticky demand, and therefore is dominated by ET and Competition from the consumers' and the manufacturer's points of view.

Consider now the case of retailers' extreme risk aversion. The manufacturer must now trade-off the two previous objectives with a third one: providing sufficient insurance to his retailers. Obviously, ET assignments do not score very well on this point, as they induce some profit fluctuations at

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[21]This specific result relies on the linear demand function assumption.

the retail level. On the contrary, Competition, as well as RPM in the case of pure market uncertainty, provides perfect insurance to retailers: their profit in the competitive situation is in each state of nature equal to zero, and with RPM, the manufacturer can also force the retailers' mark-up down to zero if he exactly knows the distribution cost (in the case of pure retail cost uncertainty, RPM provides no insurance at all to retailers and hence is still dominated from both manufacturer and consumers' points of view).

What is perhaps less immediately intuitive is the reason why, in the trade-off between efficiency (adaption to environment) and insurance, ET are for example, always dominated by Competition. The basic idea is that when retailers are extremely risk-averse, the manufacturer cannot recover the benefits of price-decision delegation; it suffices, to get the intuition, to notice that the manufacturer can always do better than with ET by restoring competition and charging a wholesale price equal to the ET retail price in the worst state of nature, minus the associated distribution cost: suppose that the wholesale price under ET is p. The maximal franchise fee A which can be required is then characterized by:

$$2A = \underset{(d,q)}{\text{Min}} \{\Pi^m(d,p,\gamma)\} = \Pi^m(\underline{d},p,\bar{\gamma}) = (\underline{d}-\bar{q})(\bar{q}-p-\bar{\gamma}) ,$$

where $\bar{q} = q^m(\underline{d}-p-\bar{\gamma})$. The manufacturer's profit is then:

$$\Pi^{ET} = \underset{(d,\gamma)}{E} \{(d-q^m(d,p,\gamma))(p-c)\} + (\underline{d}-\bar{q})(\bar{q}-p-\bar{\gamma})\}$$

$$< \underset{(d,\gamma)}{E} \{(d-\bar{q})(p-c) + (d-\bar{q})(\bar{q}-p-\bar{\gamma})\}$$

$$= \underset{(d,\gamma)}{E} \{(d-\bar{q})(\bar{q}-c-\bar{\gamma})\} ,$$

which is the manufacturer's profit associated to Competition between retailers at a wholesale price $p = (\bar{q}-\bar{\gamma})$.

Hence, from the manufacturer's point of view, ET are always dominated by Competition and sometimes by RPM. This choice is agreed upon by the consumers for the same reasons as the previous one, plus a new one; because of the insurance motive, the manufacturer is now induced to raise the wholesale price above the marginal cost in the case of ET, in order to lower the retailers' mark-up and thus their profits' fluctuations. Therefore, the expected retail price now is higher under ET.

e) Conclusion.

The simple framework we analyzed shows us that uncertainty about a vertical relationship environment may drastically affect the optimal type of contract they must use.

It appears that vertical restraints such as Resale Price Maintenance or Exclusive Territories assignments are not substitutes and have specific properties which depend on the very nature of uncertainty. It even may be the case that these vertical restraints are not privately desirable: a manufacturer may prefer his retailers to be Bertrand price competitors rather than assigning them exclusive territories or retail price requirements when these retailers acquire some private information.

It also appears that such vertical restraints may be socially undesirable, even if industrial partners want to use them. In the model we just analyzed, competition between retailers was always socially preferred to

exclusive territories and was at least equivalent, from the consumers' and social welfare points of view, to resale price maintenance. Hence the legal implications of such an analysis are involved. Recently, some authors have suggested that vertical restraints, unless they are used to enforce a dealers' cartel, ought to be legal per se. The analysis we discussed in this section clearly does not support this claim, but would rather favor a rule of reason. Of course, such a rule of reason assumes sufficient antitrust authorities' information, which is not always the case: the informational problems we evoked above are likely to be even more important for these authorities. Although our discussion may provide some guidelines for the application of the rule of reason, a lot of work remains to be done in this domain in order to define more precise criterions.

Lastly we should note that, by assuming that the retailers learn information before choosing actions, we emphasized the use of decentralized information to adjust to the environment. Had we assumed that uncertainty occurred after the choice of actions (or were not observed by then), the analysis would have been somewhat closer to that of control environments.

5. Private information at the contracting date.

In section 4, we assumed that the retailers obtained superior information about demand or cost after signing their contracts, and more generally that contracts were signed under symmetric information. But, when signing the contract, the manufacturer may have superior information about aggregate (as opposed to local) demand for his product, say; and the retailer may have superior information about local demand or about his efficiency in distributing the product (private information on the retailer's side is particularly relevant for renegotiated contracts).

There exists a literature on regulation under asymmetric information (see footnote 2). This literature analyzes the basic framework studied in 3a). In the terminology of this paper, the manufacturer offers a contract to a single retailer. The retailer has private information about retail costs usually. The manufacturer tries to induce the retailer to choose the right consumption price or effort without giving him too much money (i.e., the manufacturer trades off the achievement of the vertical structure's targets -- which can be obtained by making the retailer the residual claimant, but which leads to too small a profit for the manufacturer, since the franchise fee cannot discriminate between the potential informations of the retailer -- and the limitation of the retailer's informational rent). This literature has been developed in a regulatory context, and has not yet been extended to include features that are more specific to the manufacturer/retailers relationships.

The manufacturer may also have private information when offering a contract to a retailer, as we noted above. Then the very proposal of the contract reveals information about the manufacturer's state of knowledge. Suppose, for instance, that the manufacturer has private information about the demand a single retailer, say, will face, and that he offers a two-part tariff (franchise fee A plus wholesale price p - the retail price can not be monitored; and furthermore, there is arbitrage). Clearly, the manufacturer would like to convince the retailer that demand is high in order to extract a high franchise fee. A credible way to do so when demand is indeed high is to offer a wholesale price p that exceeds the marginal cost c in exchange for a low franchise fee. The manufacturer thus "proves" that he is more interested in variable profits, thus substantiating his claim that demand is high.[22] Hence, a distortion at the wholesale price level can be imposed even if the

[22]Maskin-Tirole (unpublished notes).

retailer is risk neutral, only for signalling purposes.[23]

6. Conclusion.

Much work remains to be done on pre-contract and post-contract uncertainty to match the well-established and crucial insights of the control literature reviewed in section 3. We have tried to show that the introduction of uncertainty yields important new insights for the theory of vertical restraints, which ought to benefit much from future interaction with the principal-agent approach.

Another topic worth studying concerns the dynamics of manufacturer-retailer contracts. The static analyses mentioned in this paper are not adequate to study issues such as, the appropriation of quasi-rents on investment in specific assets and the renegotiation of contracts. These issues sometimes play an important role, for instance in the decision of attributing territorial protection to retailers.

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[23]Under symmetric information, the manufacturer would make the retailer the residual claimant.

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