Chapter 6: Vertical restraints and vertical mergers

(PRELIMINARY VERSION: Comments welcome!)

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1 Vertical restraints and vertical mergers

1.1 What are vertical restraints?

In most markets, producers do not sell directly their goods, but reach final customers through intermediaries, wholesalers, and retailers. Further, in many cases production of the final good undertakes several stages, from raw material, to intermediate good, to final product. Very often, firms at different stages of the vertical process do not simply rely on spot market transactions, but engage in contracts of various types that are signed in order to reduce transaction costs, guarantee stability of supplies, and better coordinate actions. These agreements and contractual provisions between vertically related firms are called *vertical restraints*. This chapter analyses the welfare effects of vertical restraints as well as of vertical mergers, that is mergers between vertically related firms.[1]

To gain some initial insight on the topic, consider the classical example of the vertical relationship between a manufacturer and a retailer which distributes its products.[2] In general, both the manufacturer and the retailer will have to decide on different actions, and what is an optimal action for one, is not necessarily optimal for the other. As a result, a party can try to use contracts and clauses so as to restrain the choice of the other and induce an outcome which is more favourable to itself. (Or, put it otherwise, each party's actions creates an externality on the other. Vertical contracts might be used to try and control for these externalities.)

For instance, the manufacturer would like the retailer to make a lot of effort in marketing its products (such as advertise its products, put them in evidence on shelves, employ specialised personnel who assist potential customers, offer post-sale assistance and so on), but the latter might have a lower incentive to do so, as effort and services are costly to provide. The manufacturer might then decide to use contractual provisions (that is, vertical restraints) in order to induce higher marketing effort from its retailer. To continue the example, it might assign an exclusive area of competence to the retailer so that it would fully appropriate the benefits of the services provided (if other retailers carry the same brand within the same region, there is a free-riding problem that further reduces the amount of services provided); or it might use a non-linear contract such that the retailer would have a discount if it buys a large number of units, in order to encourage its sales effort; or it might simply impose the retailer to sell a minimum number of units of the good, which again would increase its effort; or it might convince the retailer not to carry competing brands, to stimulate its

[1] It is worth noting that while from an economic point of view it makes sense to deal with vertical restraints and vertical mergers together (both are used to solve problems of vertical coordination), anti-trust laws resort to different provisions to deal with them. In the EU, for instance, vertical restraints might be the object of article 81 (agreements between firms) or article 82 (if the firm using them is dominant), whereas vertical mergers are covered by the Merger Regulation.

[2] The vertical relationship might take place between manufacturer and retailer(s), or between upstream and downstream firm(s), or between producer and distributor(s). Despite the different labels, the relationship is of the same nature.

sales efforts of the own brands; or it might simply take over the retailer so as to make coordination of actions easier. The objective of this chapter will be to identify when these vertical restraints (and vertical mergers) should be expected to show positive or negative effects on welfare.

As the simple example above indicates, there are several types of vertical restraints.[3] Some of the most common examples are the following.

- *Non linear pricing.* (Also called *franchise fee* (henceforth, FF) or t*wo-part tariff* contracts.) The simplest possible relationship between two agents is that one buys from the other on the basis of a "linear pricing" rule, that is, the total payment is proportional to the number of units involved in the transaction. Whether one buys one unit or one hundred units, the unit price would be the same.[4] A simple vertical restraint is then "non-linear pricing", a contract which specifies a fixed amount independent of the number of units bought (the "franchise fee") plus a variable component. For instance, to sell a given clothes producer's brand, a shop might have to pay $1,000$ euro per year plus 10 euro for each T-shirt it buys. The effect of such a contract is that the unit cost effectively paid by the shop decreases with the number of units bought from the same producer.[5] The effect is to encourage the retailer to buy more units.

- *Quantity discounts.* Quantity discounts or *progressive rebates* have the same effect as non linear pricing contracts, as the larger the quantity bought the cheaper the transaction on average.

- *Resale price maintenance (RPM).* The manufacturer might have different perceptions from the retailer as to which price final customers should be charged for the product. As a consequence, the former might want to affect the price decisions of the latter. In its most extreme form, RPM simply consists of the price at which the retailer should sell the product. But it might also be a recommended price, or it might establish either a minimum resale price (price floor) or a maximum resale price (price ceiling).

- *Quantity fixing.* The manufacturer might want to specify the number of units that the retailer should buy. Again, this might also take different forms, such as quantity forcing (the retailer cannot buy less than a certain amount) or quantity rationing (it cannot buy more than a certain amount).

[3] Tie-in sales (or tying), when they involve vertically related products, are also vertical restraints. However, they will be considered in chapter 7 because tying might concern independent goods as well. Furthermore, some clauses that prevent a distributor from selling a product outside its home territory are also vertical restraints. But since such clauses allow a manufacturer to do price discrimination (also dealt with in chapter 7), they are not analysed here.

[4] *Royalties* are also another possible instrument used by the manufacturer, who receives a payment that is proportional to the *sales* of the downstream firm. As such, royalties are used only if downstream sales can be observed (and verified).

[5] For instance, if the shop buys one T-shirt only, its average cost is 1010 euro, but if it buys 100 T-shirts, the average cost is only $(1000 + 10 \times 100)/100 = 20$.

- *Exclusivity clauses*. Manufacturer and retailer might also sign exclusivity agreements. For instance, an *exclusive territory* (ET) clause would imply that there is only one retailer who can sell a certain brand within a certain geographical area (or to a certain type of customers). *Exclusive dealing* is when a retailer agrees to carry only the brand of a certain manufacturer. *Selective distribution* clauses consist of clauses which allow only a certain type of retailers - usually specified in objective terms - to carry a manufacturer's brand. For instance, a luxury good producer might want to provide its product only to high street retailers and not to supermarkets or discount stores, fearing that the latter might undermine the quality or luxury image associated with its product.

It is important to notice that in any given market - due to the nature of the transactions, or due to institutional constraints - some of these vertical restraints might be effective whereas others might not be. For instance, RPM makes sense only insofar as the effective price paid by final customers can be observed by the manufacturer. For mass products (say, the T-shirts of our example above) this might be the case; but in other circumstances there might be a bargaining process between the retailer and the final buyer whose outcome might be difficult to observe. If discounts on prices cannot be observed by the manufacturer, RPM loses its power as a restraint, and a manufacturer might want to rely on other restraints to achieve a certain objective. For instance, quantity fixing might be a substitute to RPM.

Arbitrage (buying where the price is cheap to resell where the price is high) might also be a force which diminishes the effectiveness of some restraints. If consumers have lower search and transport costs (with respect to the value of a good), it is unlikely that exclusive territorial clauses would be effective. If retailers could arbitrage, also non-linear pricing or quantity discounts might lose effectiveness, as one retailer could buy a large number of units and then resell some of them to retailers who plan to sell low quantities. These restraints are therefore more effective when the manufacturer can also observe retailers' sales.[6]

Most of the clauses above are to some extent substitutable with others. This implies that it would be largely useless, for instance, to outlaw a certain type of clauses while allowing others that achieve the same objectives.

Vertical integration (or vertical mergers) In some circumstances, manufacturers might find it difficult to use clauses that induce the behaviour they want from the retailers. In such a case, they could also resort to vertical integration, i.e., they could simply merge with (or take over) the retailers. They would then belong to the same firm, so that their objectives should be more easily reconciled.[7] It is important to keep in mind that vertical mergers are

[6] Different restraints might also have a different legal status. For instance, RPM is per se illegal in some countries and discouraged in others, obliging producers to resort to other clauses to affect the distributors of their products.

[7] Even within the same firm there might well be problems to achieve the actions or effort levels that maximise joint profits. Indeed, the problem of giving the right incentives to em-

often an alternative to vertical restraints. It would be inconsistent to adopt a very firm stance against vertical restraints if mergers are not subject to a strict control.

1.2 Plan of the chapter

Section 2 analyses the effect of vertical restraints when they affect *intra-brand* competition, that is the relationship between firms which produce and distribute the same brand, abstracting from the effect on competing brand producers or distributors. In this case, vertical restraints and vertical mergers allow firms at different stages of the vertical process to control for externalities and this is typically as beneficial for the firms as for consumers. In some circumstances, vertical restraints might improve coordination in the vertical chain but adversely affect consumer surplus and total welfare. However, I shall argue that as long as intra-brand competition is concerned, the presumption is that such restraints are welfare improving.

Section 3 looks at the effects of vertical restraints upon *inter-brand* competition. By affecting the actions taken by a producer and its retailer(s) (i.e., the vertical chain of a given brand), vertical restraints also generally affect the market interactions between this vertical chain and other vertical chains (i.e., producers and distributors of other brands). When the vertical restraints are adopted to solve the coordination problems within the same chain, consideration of inter-brand competition does not probably affect their evaluation. For instance, if a producer uses vertical restraints to solve the double marginalisation problem or free riding in the provision of services, these should increase market competition, since they will tend to make the brand more competitive vis-à-vis rivals (through lower prices and higher sales effort). However, it is possible that vertical restraints might be adopted not so much to increase efficiency of the vertical chain but to reduce competition with other vertical chains.

Section 4 pursues further the topic and shows that both vertical restraints and vertical mergers might have anti-competitive effects, by foreclosing competition. For instance, an incumbent firm might use exclusive contracts to pre-empt efficient entry into an industry; and a merger might allow a vertically integrated firm to foreclose an input to its downstream rivals, thereby reducing their competitiveness and possibly forcing them to exit the industry.

Section 5 argues that one should balance efficiency and anti-competitive effects of vertical restraints and vertical mergers when assessing them. The same type of vertical restraint might be used with a different purpose, that is it might be used to improve coordination within the chain (which usually has a welfare improving effect) or with the aim of affecting competition with the other chains (whose effect might be to lower welfare). This has two implications.

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ployees would still be there. However, I assume for simplicity that agency problems are more easily solved within the same firm than between firms or independent agents. This leaves out - because beyond the scope of this work - the recent contributions in the literature on the theory of the firm, which study which transactions and tasks are better performed within a firm (hierarchical structure) than in the market.

First, one cannot say that a given type of restraint is always good or always bad: it depends on what is the motive behind it. For instance, RPM might improve intra-brand efficiency, but it might also affect interbrand competition and favour collusion by increasing observability of firms' behaviour. This means that one cannot simply outlaw certain restraints and permit others. In legal terms, this means that economic analysis suggests a *rule of reason* rather than a *per se rule* of prohibition of certain restraints. Second, in the real world both motives might coexist to some degree, or in any case it might not be clear at first sight which one is dominant. Often, only an elaborate analysis might shed light on whether efficiency considerations or anticompetitive ones prevail.

This would not be a satisfactory conclusion though. Saying that there is no clear rule on vertical restraints, and that they should all be analysed on a case-to-case basis would amount to disaster. Given the pervasiveness of vertical agreements between firms, competition agencies would collapse because they should devote most of their resources to look into such cases, as has happened to the EC at the beginning of its history and - to a minor degree - until the new rules on vertical agreements. Fortunately, there is a more helpful policy conclusion which can be derived from the analysis of vertical restraints. Since the only vertical restraints that raise welfare concerns are those adopted by firms which enjoy enough market power, the main policy conclusion is that only the vertical clauses adopted by firms enjoying large market power are worth investigating, and on them a rule of reason approach should be used.

2 Intra-brand competition

In this section I review the main welfare effects of vertical restraints when they affect competition between retailers that sell the same product or brand. The situation we consider here is one where a manufacturer (a monopolist for simplicity) sells through one or more retailers. Section 2.1 shows that if both a manufacturer and its retailer have market power, both charge a positive mark-up, resulting in too high market prices for the vertical chain (the so-called *double marginalisation* problem). If vertical restraints were used, or vertical integration occurred, prices would decrease and both producer surplus and welfare would increase. Section 2.2 illustrates instead the free riding problem in the provision of services by the retailers. If several retailers distributed the same brand, they might be unable to appropriate the effort made to market the brand (to the advantage of competing retailers) and, anticipating this, they would make less effort than would be optimal for the manufacturer. By using appropriate restraints, incentives for retailers to provide effort and services might be restored. Again, if consumers value such services, vertical restraints are likely to increase both producer and consumer surplus. Section 2.3 will study the case where several externalities co-exist. Section 2.4 will look at other efficiency motives for vertical restraints (in order not to fragment the analysis, I shall also consider restraints used when there is inter-brand competition). Section 2.5 shows that when contracts are unobservable, vertical restraints or a vertical merger might be used by a manufacturer to commit itself to sell at high prices. Else, it would be tempted to renegotiate its offer to the retailers, ending up with lower prices than it would like to charge.

2.1 Double marginalisation

The best known example of externalities affecting vertically separated firms is given by the *double marginalisation* problem, first identified by Spengler (1950).[8] Suppose that a manufacturer relies on a retailer for selling to final customers, and that the former sells to the latter according to a constant unit price (linear pricing). Suppose also, for simplicity, that the retailer does not have any costs other than the wholesale price.[9] Figure 6.1 illustrates the structure of the market.

INSERT Figure 6.1. Double marginalisation

Both firms want to maximise their profit and in order to do so they both choose the monopolistic mark-up (margin) over their own cost: the upstream firm chooses the wholesale price w given its cost c, and the downstream firm as a result will choose p given its own cost, namely the wholesale price w (which is higher than c because the upstream firm has a margin). The result, however, of both firms adding their margin is that they end up with consumers paying too high a price (buying too few units) with respect to what would be optimal from their joint point of view, that is from the point of view of the vertical chain (the sum of the profits made by the upstream and downstream firm).

If the two firms are instead under the same management, the final price p would be chosen so as to add only a mark-up over the cost c. Vertical integration - that is the merger among the two firms - is efficient since it allows them to coordinate on the optimal outcome, or to "internalise" (control for) the externality that they impose on each other. The result after the correction for this externality is that not only firms but also consumers gain from the vertical merger.

If vertical integration is not possible, different types of vertical restraints might be used to control for this externality. Since the problem results in too high a market price (or too low sales), an obvious possibility to solve the problem is resale price maintenance. The manufacturer could simply impose the resale price on the retailer, or establish a price ceiling. Of course, resale price maintenance is effective if the final price is observable.

Alternatively, quantity forcing would have the same outcome, as this would oblige the retailer to increase sales to the level which is optimal for the integrated structure.

Yet another possibility to restore the vertically integrated outcome is for the manufacturer to use non-linear pricing (a fixed component F plus a variable

[8] But Cournot (1838) had already pointed out a similar effect when firms are selling complementary products, a case which formally is similar to that of vertically related firms.

[9] The reader can easily check that the argument also holds if the retailer has an additional distribution cost.

component w for each unit bought) in order to make the retailer the "residual claimant" of all the profit generated in the market. By setting the variable component identical to the manufacturer's own cost, $w = c$, the retailer would effectively behave in the same way as a vertically integrated firm, and would choose the optimal final price. The retailer would then make the maximum profit. However, part of or all such profit can be appropriated by the manufacturer through the franchise fee F. In general, the distribution of the profit depends on the relative bargaining power of the two firms. If it is the manufacturer who has all the bargaining power (or if there are many possible retailers who would compete for the right to sell the manufacturer's product, and they would outbid each other until the winning bid F absorbs all the expected profit), the manufacturer can make exactly the same profit as if it owned the retailer.

However, notice that vertical restraints are not equivalent if there exists some uncertainty in the market (either on the level of final demand, or on the costs of distributing the product) and if the retailer is risk averse. In these circumstances a non-linear contract $F + cq$, by making the retailer the residual claimant of all the profit generated by the vertical chain, would ensure that the retailer reacts to demand or cost shocks in the same way as a vertically integrated firm. However, it would expose the retailer to a high risk, since his profit would not be protected against such shocks. If the retailer is risk-averse, in order to insure him the manufacturer will have to guarantee him some minimum profit.

RPM gives perfect insurance under demand uncertainty, since the final price is guaranteed independently of the level of demand. However, RPM fares very badly under cost uncertainty, as a shock on the distribution cost will greatly affect the retailer's profit margin, since the price cannot be adjusted so as to cover high costs.

As a result, with a risk averse retailer, RPM is better under demand uncertainty, non-linear pricing under cost uncertainty. (For a formal treatment, see section 2.1.2.)

Conclusions Although it is convenient to refer to the case where there exists a monopoly both upstream and downstream, the issue of double marginalisation arises whenever some market power exists at both levels. This vertical externality pushes prices *above* what would be optimal for the vertical structure.

We have seen that a vertical merger, resale price maintenance, quantity fixing and non-linear pricing are instruments which control for this externality and therefore also result in higher welfare.

An upstream firm might also resort to another way to avoid the double marginalisation problem, namely tackling the problem at its root and eliminating market power at the downstream level. Indeed, in this particular case, the fiercer competition among the downstream firms selling the manufacturer's brand the lower the mark-up they set on top of the upstream firm mark-up and in turn the weaker the externality.[10] Note therefore that here by *reducing*

[10] In the limit, if intra-brand competition led to final prices equal to wholesale price, $p = w$

competition downstream, for instance by assigning *exclusive territories* to retailers, that effectively give them a monopoly in a certain geographic area or for a certain type of customers, the double marginalisation problem is aggravated, and welfare is reduced.

2.1.1 Double marginalisation*

Suppose there is one upstream firm U that manufactures a certain product, for which it is a monopolist. Suppose also that it cannot sell the good directly, but has to rely on a downstream firm D - the retailer - that buys the product from U and resells it to the final consumers. (Exercises 2 and 1 deal with the cases of n retailers.) Assume that the manufacturer has all the bargaining power, that is that it makes a take-it-or-leave-it offer to the retailer (although the main result would not change if we assumed a different distribution of the bargaining power).

Consumers' demand is given by $q = a - p$, where $a > 0$ is a parameter, q is quantity demanded and p is the final price charged to consumers.

The manufacturer has a unit production cost $c < a$, and the retailer's unit cost is given by the sum of the wholesale price w that it (possibly) has to pay to the manufacturer for a unit of the product and a unit cost of retail that is taken equal to zero for simplicity. I also assume that all agents have perfect information.

I analyse two different cases. First, upstream and downstream do not engage in any vertical contracts and the upstream firm sells to the retailer by using a simple linear price structure, that is, by fixing w. Then, upstream and downstream firms are integrated. I will show that there are several sets of vertical restraints that allow the upstream firm to reproduce the vertically integrated outcome.

Separation and linear pricing The game being played is as follows. First, the upstream firm chooses the wholesale price w at which it sells to the downstream firm. Then, the downstream firm chooses the final price p at which it sells to consumers.

As usual, we first have to look for the solution of the downstream firm first. Its problem is to choose p in order to maximise its profit given the wholesale price w:

$$\max_p \Pi_D = (p - w)(a - p) \tag{1}$$

By taking the first derivative and equaling it to zero ($\partial \Pi_D / \partial p = 0$), we obtain price, quantity and profit as a function of the wholesale price: $p = (a + w)/2; q = (a - w)/2; \Pi_D = (a - w)^2/4$.

(this would happen for instance if at least two undifferentiated retailers competed in prices), the upstream firm would be able to set the wholesale price equal to the optimal price under vertical integration, thereby restoring the efficient outcome.

The manufacturer anticipates perfectly the decision of the retailer. In particular, it knows the quantity it will order from it as a function of the wholesale price (for any given w, the retailer will not be willing to buy more units of the products than those that it will find optimal to sell to final consumers). Therefore, its problem is to choose w to maximise its own profit:

$$\max_{w} \Pi_U = (w-c)\frac{a-w}{2}. \tag{2}$$

From the first-order condition ($\partial\Pi_U/\partial p = 0$) and after re-arranging one finds the solution as: $w = (a+c)/2$. Replacing the equilibrium wholesale price into the downstream solutions one finds the equilibrium final price and profits obtained by the upstream and downstream firms, as well as the sum of the profits made by the vertical chain.

$$\begin{aligned} p^{sep} &= \frac{3a+c}{4}; \quad \Pi_U^{sep} = \frac{(a-c)^2}{8}; \quad \Pi_D^{sep} = \frac{(a-c)^2}{16}; && (3) \\ PS^{sep} &= \Pi_U^{sep} + \Pi_D^{sep} = \frac{3\,(a-c)^2}{16}. && (4) \end{aligned}$$

Vertical integration (vertical merger) Suppose now that the upstream and downstream firms are integrated in a unique company, for instance because of a vertical merger. This implies that the manufacturer can now sell directly to consumers. Its problem will now be the standard problem of a monopolist, as follows:

$$\max_{p} \Pi_{vi} = (p-c)(a-p). \tag{5}$$

The solution is easily obtained from the first-order condition $\partial\Pi_{vi}/\partial p = 0$:

$$p^{vi} = \frac{a+c}{2}; \quad q^{vi} = \frac{a-c}{2}; \quad PS^{vi} = \Pi^{vi} = \frac{(a-c)^2}{4}. \tag{6}$$

Comparison The vertical merger case is unambiguously better for society.

- Prices are lower under a vertically integrated structure than under the separated one, as $p^{vi} < p^{sep}$ (recall that $a > c$, else the market would not exist). Since vertical integration determines a price decrease (and an increase in the quantity sold to final consumers), consumer surplus improves due to the vertical merger.
- The profit created by the vertical structure is also higher under vertical integration, as $PS^{vi} > PS^{sep}$. In turn, this means that the manufacturer can always pay to the retailer at least the profit Π_D^{sep} the latter makes

under the separated structure, to convince it to take part in the merger (or otherwise, the retailer can give the manufacturer at least its outside opportunity payoff, that is the profit Π_U^{sep} it would make under vertical separation). Both firms stand then to gain from the merging of the two vertical stages.

- Since both consumer surplus and producer surplus increase, total welfare unambiguously rises from vertical integration.

Vertical restraints Assume now that a vertical merger - for whatever reason - is not possible. It is still possible for the upstream firm to remove the double marginalisation externality by using different vertical restraints, as follows.

- *Resale price maintenance (RPM).* Double marginalisation results in too high final prices. *Imposing the retail price* $p = p^{vi} = (a + c)/2$ on the downstream firm will maximise the surplus of the vertical structure. The way in which the upstream and downstream firms share the surplus will then be determined by the wholesale price w. If it is the upstream firm to have all the bargaining power, then it will fix $w = p^{vi} = (a + c)/2$ and will get all the producer surplus. More generally, the higher w (with $w \in [c, p^{vi}]$) the higher the share of the surplus going to the upstream firm. Identical outcome would be achieved if the upstream firm sets a *price ceiling* $\overline{p} = p^{vi} = (a + c)/2$. This obliges the downstream firm to sell at a price $p \leq \overline{p}$. For any wholesale price $w \in [c, p^{vi}]$ the downstream firm would then choose precisely $p = \overline{p}$ (and again the actual w determines the division of the surplus).

- *Quantity fixing (QF).* The mirror image of too high a price is that there is too little a quantity sold to final consumers. Therefore, the upstream firm can restore efficiency also by obliging the retailer to buy the number of units $q^{vi} = (a - c)/2$, or equivalently by imposing quantity forcing, that is establishing that the retailer should buy at least $q \geq \overline{q} = q^{vi}$. The retailer would then choose precisely the efficient output $q = q^{vi}$. As in the previous case, the level of the wholesale price determines the distribution of the producer surplus. If the upstream firm has all the bargaining power, it will choose $w = p^{vi}$ and appropriate all the profit of the vertical structure.

- *Franchise fee (FF).* The upstream firm can make the downstream firm the residual claimant of all the profit generated in the market by setting the non-linear price scheme $F + wq$, and fixing $w = c$. The downstream firm's maximisation problem is given by:

$$\max_p \Pi_D^{ff} = (p - c)(a - p) - F. \tag{7}$$

  Clearly, the solution of this problem is given by the vertical integration price $p^{vi} = (a + c)/2$ and quantity $q^{vi} = (a - c)/2$, as the fixed fee does not affect the first order condition. The distribution of the profit (equal to the vertically integrated profit) will then be determined by the amount of the fee F, as the downstream and upstream firm will respectively get $\Pi_D^{ff} = (a-c)^2/4 - F$ and $\Pi_U^{ff} = F$. If the upstream firm has all the bargaining power, then $F = (a-c)^2/4$ and it appropriates all the profit generated by the vertical structure.

2.1.2 Double marginalisation with retailers' risk aversion**

The following example, adapted from Rey and Tirole (1986), illustrates the different risk-insurance properties of vertical restraints when there exist asymmetric information and risk aversion of retailers.

Consider an extension of the double monopoly model above. A risk-neutral manufacturer has a unit cost c and its retailer is infinitely risk-averse and has a unit distribution cost γ. Demand is $q = a - p$. There exist both demand uncertainty $a \in [\underline{a}, \overline{a}]$ and distribution cost uncertainty $\gamma \in \left[\underline{\gamma}, \overline{\gamma}\right]$, with $\underline{a} > c + \overline{\gamma}$, realisations of a and γ being independent. The game is as follows. First, when both market demand a and distribution costs γ are unknown to everybody, the manufacturer makes a take-it-or-leave-it-offer to the retailer, in the form of a non-linear contract $(F + wq)$. Second, a and γ are observed by the retailer (but not by the manufacturer). Third, the retailer chooses p.

We want to (i) find the optimal contract under non-linear pricing (FF) and resale price maintenance (RPM). (ii) show that under demand uncertainty $\pi_{RPM} > \pi_{FF}$ and $W_{RPM} > W_{FF}$; (iii) show that under cost uncertainty $\pi_{FF} > \pi_{RPM}$ and $W_{FF} > W_{RPM}$.

I prove these results as follows.

(i.a) FF. The retailer maximises $\pi_r = (a-p)(p-w-\gamma)$. It is easy to check that $p = (a+w+\gamma)/2$, $\pi_r = (a-w-\gamma)^2/4$. Since the retailer is infinitely risk-averse, the franchise fee F must guarantee him non-negative profits even in the worst state of nature. Therefore, it must be $F_{FF} = (\underline{a} - w - \overline{\gamma})^2/4$. The manufacturer's problem will be to choose w to maximise $E\left[(a-(a+w+\gamma)/2)(w-c)\right] + (\underline{a} - w - \overline{\gamma})^2/4$. The solutions are: $w_{FF} = c + (a^e - \underline{a}) + (\overline{\gamma} - \gamma^e)$, $p_{FF} = \left[a + c + \gamma + (a^e - \underline{a}) + (\overline{\gamma} - \gamma^e)\right]/2$, $\pi_{FF} = (\underline{a} - c - \overline{\gamma})^2/4 + \left[(a^e - \underline{a}) + (\overline{\gamma} - \gamma^e)\right]^2/4$, $W_{FF} = 3(\underline{a} - c - \overline{\gamma})^2/8 + \left[(a^e - \underline{a}) + (\overline{\gamma} - \gamma^e)\right]^2/4 + var(a)/8 + var(\gamma)/8$.

(i.b) RPM. The retailer charges the imposed price p and has profit equal to $\pi_u = (a-p)(p-w-\gamma)$. Given infinite risk aversion, $F = (\underline{a} - p)(p - w - \overline{\gamma})$.

The manufacturer will choose p and w to maximise $(\underline{a} - p)(p - w - \overline{\gamma}) + E\left[(a-p)(w-c)\right]$, subject to $p \geq w + \overline{\gamma}$. It can be checked that π_u is increasing in w. Hence, the manufacturer will choose the maximum w compatible with the constraint: $w = p - \overline{\gamma}$. The problem becomes then $\max_p E\left[(a-p)(p-\overline{\gamma}-c)\right]$, whose solution is given by $p_{RPM} = (a^e + c + \overline{\gamma})/2$. By substitution, $w_{RPM} = (a^e + c - \overline{\gamma})/2$, $F_{RPM} = 0$, $\pi_{RPM} = (a^e - c - \overline{\gamma})^2/4$, $W_{RPM} = 3(a^e - c - \overline{\gamma})^2/8 + var(a)/2$.

(ii) Consider demand uncertainty only ($\overline{\gamma} = \underline{\gamma} = \gamma^e$). Then $\pi_{FF} < \pi_{RPM}$ if: $(\underline{a} - c - \overline{\gamma})^2/4 + \left[(a^e - \underline{a})\right]^2/4 < (a^e - c - \overline{\gamma})^2/4$. This inequality can be rewritten as: $(a^e - \underline{a})(c + \overline{\gamma} - \underline{a}) < 0$, which is always true since by assumption $a^e > \underline{a}$ and $\underline{a} > c + \overline{\gamma}$. It can also be checked that $W_{FF} < W_{RPM}$.

(iii) Under cost uncertainty $(E(a) = \underline{a} = \overline{a})$, $\pi_{FF} > \pi_{RPM}$ since $(\underline{a} - c - \overline{\gamma})^2/4 + [(\overline{\gamma} - \gamma^e)]^2/4 > (a^e - c - \overline{\gamma})^2/4$. One can also check that $W_{FF} > W_{RPM}$.

A variant of this example with competing retailers, is considered in exercise 3.

2.2 Horizontal externality: Free riding in the provision of services

Besides the vertical externalities between a manufacturer and the retailers that carry its products there often exist horizontal externalities among retailers that determine an inefficient outcome from the point of view of the vertical structure as a whole. Figure 6.2 illustrates the structure of the market with more retailers.

INSERT Figure 6.2. Horizontal externality

An example of such externalities concern the level (and quality) of services provided by retailers. If such services cannot be perfectly appropriated by one retailer (that is, if there are spillovers which benefit other retailers carrying the same brand) then services become a public good on which the retailers will free ride, thus determining an underprovision which reduces the manufacturer's profit. Again, vertical integration as well as certain vertical restraints might help the manufacturer solve this externality problem.

To capture the main reasoning behind the argument (first proposed by Telser (1960)), consider the following example. Imagine that in a city there are several shops which sell a given product, say a brand of dishwashers. (To concentrate on the issue at hand, also suppose that this is the only brand sold in this city, although it is not necessary.) There are many activities that these shops might carry out to increase consumers' appeal for the product. Think for instance of hiring shop assistants who answer potential customers' questions, illustrate the characteristics of the product to them and so on. These are all activities which might make the potential client more willing to buy the brand, but not necessarily at the shop where he gets the information. Or think of some sort of advertising that might attract customers to the brand but not to the shop that does the advertising.

Suppose also that some of the competing retailers are located very close to each other, and it is not too costly, relative to the value of the good, for the consumer to do a little search before a purchase.

In these circumstances, each shop will think twice before investing a great deal of effort to sell the brand. This is because another shop nearby would have an incentive to avoid the cost of this effort, just free ride on the provision of services and offer a better price. A consumer would first visit the shop which offers additional services, get there all information he needs, but will then buy at the shop which offers the same product at the best price. Of course, a shop will anticipate this and will refrain from offering services having a public good characteristic. In the limit, if services given by retailers just contribute to the brand but cannot be appropriated by the shop itself, and if the shops are close enough, no service at all will be provided. This will be suboptimal for the producer, given that its brand will not be supported by shop services, but also for consumers, who do not receive information they highly value.

Vertical restraints might restore incentives for the retailers to invest in services. For instance, suppose that the producer divides the city in different areas, and appoints an exclusive distributor in each area (exclusive territories). This would reduce the possibility of consumers to visit several shops (it is more costly to shop around in different areas) and therefore reduces the risk that a retailer will be undercut by a free riding competing shop. Hence, each retailer will have a higher incentive to offer brand supporting services. Another possibility is for the producer to maintain all the shops in the city, but fix the resale price, or impose a price floor, to avoid the problem of undercutting and to allow the retailers to recoup (part of) the investment.[11]

Vertical integration would also solve the problem: if the producer owned the shops, it would take into account the externality that each of them imposes on the other, and would prevent its shop managers from undercutting each other and reducing the level of services they provide.

To sum up, vertical restraints and vertical integration avoid or reduce the free riding problem to the benefit of both producer and consumer surplus. (For a formal treatment of this argument, see section 2.2.1.)

Of course, in general there will also be many sales activities which can be appropriated by the shop, for instance credit to consumers, or post-sales service provided by the store, or physical appearance of the shop itself (some consumers do prefer to buy in shops which are located in high streets, or whose premises are nicer looking). In all these cases, the free riding problem will not arise. In reality, services of different types will probably coexist, and although the extreme case where no service at all is provided is unlikely to rise, the free riding problem will probably affect to some degree the shops' investment decisions.

An example of welfare-reducing vertical restraints (too much effort) We have just seen that vertical integration and vertical restraints might improve welfare by raising the level of effort and services provided by retailers. It is conceivable, though, that vertical restraints internalise the horizontal externality and lead to too high effort. In other words, they might increase profits, but result in lower consumer surplus and welfare. Technical section 2.2.2 constructs a simple example where vertical integration (and vertical restraints) would reduce welfare: a (vertically integrated) monopolist would increase effort to attract marginal consumers to the detriment of infra-marginal consumers who do not value extra effort.[12] Losses for the latter group might outweigh increased producer surplus.

[11] Of course, if the services provided by the retailers are observable and verifiable, there is a simpler solution to the problem, which is to fix contractually the level of services. This might be the case, for instance, with advertising or certain types of after-sales services.

[12] See Scherer and Ross (1990: 541-548) for a similar argument.

The example illustrates that there is no reason to expect that the control of the existing externalities by means of vertical restraints or vertical mergers will always show a coincidence between the interest of the firms and the interest of consumers. However, it is worth noting that the example needs some special assumptions to show that welfare might reduce. Further, and more importantly, an extension of the example shows that welfare decreases only insofar as no competition exists. If infra-marginal consumers (those who do not value extra effort) have the possibility to buy from firms supplying a standard quality of the product (i.e., a product which does not incorporate extra services), vertical integration will not reduce welfare. This introduces a crucial point on which I will return later: one should worry about vertical restraints only when adopted by firms which enjoy large market power.

2.2.1 A model of underprovision of services*

Consider a situation where there is an upstream firm U (the manufacturer) and two downstream firms D_1 and D_2 which have to decide on the level of effort (services) they want to provide to sell U's product and then compete in prices.

Assume that services increase the perceived quality of the brand but cannot be appropriated by the retailer that provides them. The perceived quality of the brand is given by $u = \overline{u} + e$, where the effort level is $e = e_1 + e_2$, that is the sum of the effort (service) provided by the two retailers. In the absence of any effort, $u = \overline{u}$ which is the basic level of quality perceived by the consumers. As for each retailer's cost, we assume that $C(q, e_i) = wq + \mu e_i^2/2$, with $\mu > 1$. Note that here I assume that the cost of services is fixed, that is independent of the number of units sold, rather than variable. This would correspond for instance to the case where "service" is advertising outlays.[13]

Consumers' demand is given by $q = (v + e) - p$, that is, it increases by e for any additional service above the standard quality.

The fact that downstream firms compete in prices avoids double marginalisation and will make the free-riding problem the only externality of this simple model. This is because retailers are not able to differentiate themselves (by assumption) through the use of the services they provide, and therefore retailers are perceived as perfect substitutes by consumers.

I look first at the case where there is separation between the upstream and the downstream firms and then at the case where there is vertical integration. Finally, I shall see which vertical restraints allow the upstream firm to restore the vertical integration solution.

Separation If the two retailers are competing in prices, the only equilibrium in the retailers' game is the one where $p_1 = p_2 = w$ and $e_1 = e_2 = 0$. The reason is as follows. Since there is a complete externality in the provision of services, a retailer does not manage to differentiate itself from the other no

[13] Instead, services such as pre-sale assistance would probably correspond to variable costs of service provision, as each unit sold (each potential customer showing up at the shop) requires higher cost or effort. See exercise 4 for the case of variable cost of effort.

matter how much service it gives to consumers. Therefore, Bertrand competition implies that prices equal marginal cost (i.e, the wholesale price w). But since the retailers make zero profit they will never be able to cover their (fixed) cost of quality provision. No equilibrium with $e > 0$ can then be sustained.[14]

The upstream firm correctly anticipates that the final price $p = w$ and that final demand will be $q = v - w$. Its programme is then $\max_w \Pi_u = (w-c)(v-w)$, which is solved by $w = (v+c)/2$. At the separated equilibrium, therefore, producer surplus, consumer surplus and welfare are respectively given by:

$$PS_s = \Pi_u = \frac{(v-c)^2}{4}; CS_s = \frac{(v-c)^2}{8}; W_s = \frac{3(v-c)^2}{8}. \tag{8}$$

Vertical integration Consider now the case where the upstream firm and the two retailers are integrated, for instance because the former takes over the retailers.[15] The programme of the vertically integrated firm is:

$$\max_{p,e_1,e_2} \Pi_{vi} = (p-c)(v+e_1+e_2-p) - \mu\frac{e_1^2}{2} - \mu\frac{e_2^2}{2}. \tag{9}$$

Solving the system of the three first-order conditions:

$$\begin{cases} \frac{\partial \Pi_{vi}}{\partial e_i} = p - c - \mu e_i = 0, \quad (i = 1, 2) \\ \frac{\partial \Pi_{vi}}{\partial p} = v + e_1 + e_2 - 2p + c = 0, \end{cases} \tag{10}$$

one obtains the following solutions: $e_1 = e_2 = e_{vi} = (v-c)/\left[2(\mu-1)\right]$; $p_{vi} = \left[\mu(v+c) - 2c\right]/\left[2(\mu-1)\right]$. Each retailer will sell $q_{vi} = \mu(v-c)\left[4(\mu-1)\right]$. By substitution, one then obtains producer surplus, consumer surplus and welfare as follows.

$$PS_{vi} = \Pi_{vi} = \frac{\mu(v-c)^2}{4(\mu-1)}; CS_{vi} = \frac{\mu^2(v-c)^2}{8(\mu-1)^2}; W_{vi} = \frac{\mu(3\mu-2)(v-c)^2}{8(\mu-1)^2}. \tag{11}$$

Vertical integration is again more efficient, as $W_{vi} > W_s$ amounts to the inequality $(4\mu-3)(v-c)^2/\left[8(1-\mu)^2\right] > 0$.

In this example, vertical integration allows to control for the horizontal externality which exists among retailers and which determines an underprovision of services relative to what would be optimal for the integrated structure.

[14] One can see the same result by contradiction. Because of fixed cost of services, $e > 0$ would require $p > w$. But then an undercutting firm would get all of demand. Hence, this cannot be an equilibrium.

[15] It turns out that it is optimal for the vertically integrated structure to have both retailers selling the good. This is because we have assumed a convex cost of services provision: to produce a given level of services, costs are lower if provision is split among the two retailers rather than concentrated in one.

Vertical restraints In this case the problem under a separated structure is one of free riding among retailers, who are pushed to undercut each other thereby losing incentives to provide services. To restore incentives the manufacturer has to relax competition downstream. A non-linear contract would not solve the problem, unless it is accompanied by some measures which reduce competition.

Exclusive territories and franchise fee Suppose each retailer receives a territory or exclusive competence for a certain type of customers, plus a non-linear contract of the type $T = wq + F$, with $w = c$. For simplicity, assume that each retailer can sell to half of the total number of consumers. However, we keep the assumption that the overall perceived level of quality of the good sold by each retailer is determined by the sum of the retailers' efforts. Then each retailer will face the following problem:

$$\max_{p_i, e_i} \Pi_{et} = (p_i - c)\frac{(v + e_1 + e_2 - p_i)}{2} - \mu\frac{e_i^2}{2} - F. \tag{12}$$

The first-order conditions are:

$$\begin{cases} \frac{\partial \Pi_{et}}{\partial e_i} = \frac{p_i - c}{2} - \mu e_i = 0, \\ \frac{\partial \Pi_{et}}{\partial p_i} = v + e_i + e_j - 2p_i + c = 0, \quad (i = 1, 2; i \neq j). \end{cases} \tag{13}$$

Note that given the level of effort the price chosen will be equivalent to the vertically integrated solution ($\partial\Pi_{et}/\partial p_i = 0$ is the same as for the vertically integrated monopolist). However, effort is not optimal since marginal profit from effort is reduced with respect to the situation where there is full internalisation of the effort externality. Each retailer knows that its effort will increase sales in a market which is half the size of the one of a vertically integrated monopolist. Therefore, exclusive territories improve the incentives to provide services and make the manufacturer closer to the optimum, but do not restore the first best.

Giving exclusivity for the whole market to only one retailer does not restore the first best either, since effort will be provided by only one retailer rather than two (there are diseconomies of scale from effort provision). The only retailer will choose p and e to maximise the following function:

$$\max_{p_1, e_1} \Pi_{et_1} = (p_1 - c)(v + e_1 - p_1) - \mu\frac{e_1^2}{2} - F. \tag{14}$$

The first order conditions will be:

$$\begin{cases} \frac{\partial \Pi_{et_1}}{\partial e_i} = (p_1 - c) - \mu e_1 = 0, \\ \frac{\partial \Pi_{et_1}}{\partial p_i} = v + e_1 - 2p_1 + c = 0, \quad (i = 1, 2; i \neq j). \end{cases} \tag{15}$$

At equilibrium, the retailer will provide lower effort than at the first best. To sum up, exclusive territories do improve the externality problem and increase the provision of effort but do not restore the first-best.[16]

Resale price maintenance and franchise fee Another possible type of vertical restraints that can be used to give more incentives to produce services is resale price maintenance combined with a non-linear contract ($w < c; F$). If the manufacturer fixes the price $p = p_{vi}$ at which the retailers can sell, then the retailers will not price so aggressively that incentives to provide effort will be eliminated (as it occurred in the Bertrand case).

Each retailer will face the following problem:

$$\max_{e_i} \Pi_{rpm} = (p_{vi} - w)\frac{(v + e_1 + e_2 - p_{vi})}{2} - \mu\frac{e_i^2}{2} - F. \quad (16)$$

The first-order conditions for effort is:

$$\frac{\partial \Pi_{et}}{\partial e_i} = \frac{p_{vi} - w}{2} - \mu e_i = 0. \quad (i = 1, 2; i \neq j) \quad (17)$$

In order for a retailer to choose the optimal level of effort, the following condition must be satisfied:

$$e_i = \frac{p_{vi} - w}{2\mu} = e_{vi} = \frac{v - c}{2(\mu - 1)}; \quad (18)$$

hence, the wholesale price must be: $w_{rpm} = p_{vi} - \mu(v - c)/(\mu - 1)$. By replacing the expression of p_{vi} one obtains:

$$w_{rpm} = \frac{3\mu c - 2c - \mu v}{2(\mu - 1)} < c. \quad (19)$$

Note that if $w = c$, resale price maintenance would not reproduce the vertically integrated level of effort. This is because each retailer - when choosing its effort level - takes into account only the marginal impact of effort on its own profit rather than for both retailers. Since each retailer knows it will sell to only half the market (the product is undifferentiated and the prices are fixed by the manufacturer) it will have insufficient incentives. RPM alone does not restore the first best: the retailers must be given additional incentives to make effort, and this can be achieved by the upstream monopolist selling them the input at a wholesale price below its own marginal cost.

Note that the contract which specifies the retail price at the level p_{vi} and the wholesale price w_{rpm} induces the same level of price and effort as the vertically

[16] If the two retailers were managed by one firm only, then giving an exclusive territory contract to this firm would restore the vertically integrated solution.

integrated structure. Therefore, the total profit generated under this contract are the same as under vertical integration. The franchise fee F can then be used to redistribute the profit from the retailers to the manufacturer. If $F = \Pi_{vi}/2+(c-w)q_{vi}$, the manufacturer will exactly replicate the profit made under vertical integration.

Resale price maintenance and quantity forcing Resale price maintenance can also be used in combination with another instrument, that is quantity forcing. To ensure that a retailer is selling at the optimal price, the manufacturer would set the retail price at the level $p = p_{vi}$. However, RPM alone would obviously not suffice to restore the vertically integrated solution, as we have seen above. The retailers would make insufficient effort and sell too few units of the good. As an alternative to the (w_{rpm}, F) contract specified above, the manufacturer could simply impose a minimum level of sales (quantity forcing), equal to q_{vi}. This would push the retailer to make the optimal effort level. Since price is fixed and optimal effort is determined by quantity forcing, the vertically integrated outcome would be reproduced. The manufacturer could then choose the wholesale price - which given RPM and QF does not modify the retailers' incentives - as the channel to redistribute rents away from the retailers.

More formally, the arguments just presented can be seen as follows.

Given RPM that imposes $p = p_{vi}$, and given quantity forcing, the problem of each retailer i becomes:

$$\max_{e_i} \Pi = \frac{(p_{vi} - w)(v + e_i + e_j - p_{vi})}{2} - \mu \frac{e_i^2}{2}, \quad s.to: \frac{v + e_i + e_j - p_{vi}}{2} \geq q_{vi}. \tag{20}$$

We know that unconstrained maximisation would lead the retailer to insufficient effort. Therefore, its problem is solved by the minimum effort level e_i which satisfies the constraint. At the symmetric solution, effort is therefore given by $(2q_{vi}+p_{vi}-v)/2$, which is nothing else than e_{vi}. Since this contract already implements the optimal p_{vi} and e_{vi}, the wholesale price becomes incentive-neutral. The manufacturer can then use it to appropriate the rents. To do so, it should choose w so as to leave retailers with zero net profit. The optimal $\widehat{w}$ solves then the following condition: $(p_{vi} - \widehat{w})(v + 2e_{vi} - p_{vi})/2 - \mu e_{vi}^2/2 = 0$, whence $\widehat{w} = (v + c)/2$. The total profit made by the manufacturer is then given by $\Pi = (\widehat{w} - c)q_{vi}$, which after substitution becomes equal to Π_{vi}.

Conclusions In this particular example, where the overall level of services is determined by the sum of the levels provided by each retailer, and where the cost of providing services falls upon fixed costs, a vertical merger will enhance welfare with respect to a situation where competing retailers do not provide enough effort. Vertical restraints such as exclusive territories and resale price maintenance also increase welfare in that they reduce competition among retailers and in doing so they restore their incentives to provide services. However, exclusive territories combined with a franchise fee are not able to reproduce the vertically integrated outcome, whereas RPM combined either with a non-linear contract ($w < c, F$) or with quantity forcing, does restore the vertically integrated outcome.[17]

2.2.2 Vertical integration might reduce welfare*: An example

Consider a market with two types of consumers. Those with a high willingness to pay, θ_h, do not care about extra effort or services. Those with a low willingness to pay do care about extra effort or services and have therefore a valuation $\theta_l + e$ for the good, with $\theta_h > \theta_l$. Normalise the population of consumers to 1 and assume that the shares of high and low types are respectively λ and $1 - \lambda$. Assume also that price discrimination is not possible, and that two independent and undifferentiated retailers would compete in prices. Like in section 2.2.1 above, assume $e = e_1 + e_2$, and $C(q, e_i) = wq + \mu e_i^2/2$ (there are fixed costs of quality improvement). Assume also that $\mu > 1/(\theta_h - \theta_l)$ (which guarantees that the low types will never have the highest willingness to pay in the market).

Separation Under separation, for the usual undercutting and free-riding arguments discussed above, no effort will be provided at equilibrium ($e = 0, p = w$). The manufacturer will then choose the wholesale price w so as to maximise profit. If it sells to high types only, it will fix $w = \theta_h$. If it wants to sell to both types, it will choose $w = \theta_l$. Let us assume that it is convenient for the manufacturer to sell to both types. This amounts to imposing that $\lambda(\theta_h - c) \leq \lambda(\theta_l - c) + (1 - \lambda)(\theta_l - c) = (\theta_l - c)$, which becomes: $\lambda \leq (\theta_l - c)/(\theta_h - c)$.

Under this assumption, the manufacturer extracts all the consumer surplus of the low types, while the high types have a surplus. As a result, overall consumer surplus is $CS_s = \lambda(\theta_h - \theta_l)$, total profit is $\pi_s = \theta_l - c$ and welfare is $W_s = \theta_l - c + \lambda(\theta_h - \theta_l)$.

Vertical integration (with two retailers) Under vertical integration (or vertical restraints which reproduce the vertically integrated outcome), the monopolist will still choose price as to extract all the surplus of the low types, but this is now increased by the effort level. The problem of the vertically integrated monopolist will therefore be:

$$\max_{e_1, e_2} \pi_{vi} = \theta_l + e_1 + e_2 - c - \mu\frac{e_1^2}{2} - \mu\frac{e_2^2}{2}, \tag{21}$$

which has the solution $e_1 = e_2 = 1/\mu$. (Note that $\theta_h > \theta_l + e$ under the assumption made above on μ). At this equilibrium, $\pi_{vi} = \theta_l + 1/\mu - c > \pi_s$ and $CS_{vi} = \lambda(\theta_h - \theta_l - 2/\mu) < CS_s$. Total welfare decreases under vertical

[17] In this model there are two externalities. The first consists of too strong competition, which eliminates incentives to exert effort. The second is the spillover in effort. Therefore, a necessary condition for the manufacturer to achieve the first best is to have two instruments.

integration if $W_{vi} = \theta_l + 1/\mu - c + \lambda(\theta_h - \theta_l - 2/\mu) < W_s$, which amounts to $\lambda > 1/2$.

In this example, effort is provided by the monopolist to increase the willingness to pay of the marginal consumers (whose surplus is then fully extracted by the monopolist), which increases profit but decreases the surplus of the inframarginal types. If there are many of the latter ($\lambda > 1/2 \geq (\theta_l - c)/(\theta_h - c)$), their loss outweighs the profit rise and determines a welfare loss. Note in particular that the restriction $\lambda \leq (\theta_l - c)/(\theta_h - c)$ should also be satisfied. Therefore, an interval where welfare decreases exists only if $\theta_l \geq (\theta_h + c)/2$.

Competition reduces the danger of vertical restraints Let us slightly reinterpret the previous example in the following way. High types are willing to pay up to θ_h for a good of basic quality u but do not value any quality increase (or additional service). Low types value additional services and are willing to pay $\theta_l + e$ for a good of quality $u + e$.

There exist $n + 1$ goods. A good of basic quality u is produced by n (for simplicity vertically integrated) firms which do not offer any additional service. Another manufacturer can instead provide a higher quality $u+e$, with $e = e_1+e_2$, provided that its two retailers have the incentives to do so. If higher quality (or additional effort/services) is provided, it can be recognised by consumers. In other words, quality spillovers might happen between retailers of the same product but not across products (think of advertising for one particular brand).

Separation For the usual reason, if there are two retailers competing a la Bertrand no additional effort will be provided: at equilibrium all brands will be of basic quality and $p = c$. No firm makes profit and total welfare will be: $W_s = \lambda(\theta_h - c) + (1 - \lambda)(\theta_l - c)$.

Vertical integration (with two retailers) By vertically integrating, the free riding aspect of effort provision is controlled for, and the manufacturer of the (potentially) high quality good will indeed be able to offer a good of quality $u + e$. Low types will buy this good at a price up to $\theta_l + e$, whereas high types will continue to buy the basic quality brands at the price $p = c$. The problem faced by the vertically integrated monopolist is thus:

$$\max_{e_1,e_2} \pi_{vi} = (1 - \lambda)(\theta_l + e_1 + e_2 - c) - \mu\frac{e_1^2}{2} - \mu\frac{e_2^2}{2}, \tag{22}$$

whose solution is: $e_1 = e_2 = (1 - \lambda)/\mu$. At the equilibrium, $\pi_{vi} = (1 - \lambda)(\theta_l + (1 - \lambda)/\mu - c)$, (all other firms still make zero profit) and $W_{vi} = \lambda(\theta_h - c) + (1 - \lambda)(\theta_l - c) + (1 - \lambda)^2/\mu > W_s$.

Therefore, vertical integration (or vertical restraints) by a monopolist hurts welfare, whereas vertical integration by a firm which faces competition does not. The presence of competing firms reduces the possibility that vertical restraints are used to the detriment of some consumers. While the example constructed here is very specific, this conclusion holds good under more general circumstances.

2.3 A more general treatment*

In the previous sections we have looked separately at the cases where there exist double marginalisation issues (section 2.1) and free riding problems in the provision of distribution services (section 2.2). In general, such problems coexist. Further, there might be other possible distortions created by vertical restraints or vertical integration, such as a reduction in the number of retailers relative to the case where a manufacturer sells via linear contracts. In this section, I will sketch a more general treatment which confirms the main insights from the two previous sections. The subject being inevitably more technical, the reader who is not particularly interested in this robustness analysis can skip this section and go directly to section 2.4.

Combining externalities In section 2.3.1 I present a model where a (monopolistic) manufacturer sells the final good through several (oligopolistic) retailers. Retailers compete against each other for the final consumers, but also have to provide some services of which they can appropriate only a part (that is, there exists some free riding in the provision of services). Such a situation is more general and more realistic than that developed in the previous sections. Different externalities arise there. First, there is the usual double marginalisation problem, which arises whenever firms at successive stages of the production process have some market power, and not only when there are two successive monopolies. This tends to push prices above what is optimal for the chain. Second, there is the horizontal externality consisting of retailers reducing their effort because of free riding (in a measure which is proportional to the degree to which the investment made by one spills over to the rivals). Third, there is another horizontal externality due to the fact that - other things being equal - each retailer will tend to set a lower price than would be optimal for the vertical chain because it does not internalise that a marginal reduction of its own price affects negatively the profit of the other retailers.

The model shows that the first effect prevails over the third one, and that even in this more complicated setting it is true that a vertically separated structure with linear wholesale pricing leads to higher prices and lower effort (i.e., lower services). Therefore, vertical integration and vertical restraints which restore the vertically integrated outcome will reduce prices, increase effort and ultimately increase both producer and consumer surplus. The model also emphasises that different vertical restraints (or combinations among them) can be used so as to alleviate the coordination problem within the chain and thus get closer (or achieve) the same outcome as the optimal vertically integrated outcome. In other words, different types of restraints are often substitutes for each other, and a firm's preference for one over the others might be due to specific reasons (for instance, if final price is not observable, enforcement of RPM is impossible; if territorial or different customers' areas are difficult to draw, or if arbitrage among such areas is easy, ET might lose some of its appeal, and so on). There is a priori no reason to treat such restraints in a different way from the legal point of view.

Competition policy should recognise the degree of substitutability which exists among different vertical clauses in many circumstances. It would be useless to use a per se prohibition of, say, exclusive territorial clauses while permitting, say, resale price maintenance clauses which allow firms to reproduce a very similar outcome. (And vice versa: permitting ET but outlawing RPM.) Or it would be useless to outlaw resale price maintenance practices while having a lax merger control which would not stop vertical mergers: if not able to use RPM, a firm can still implement the same outcome by merging with retailers. (And, again vice versa: forbidding mergers but permitting vertical restraints.)

Vertical integration and variety: endogenous number of retailers Sofar, we have just discussed cases where one manufacturer sells through a *given* number of retailers, which in turn have to decide on price and investment levels. The hypothesis that the number of retailers is exogenous is restrictive, though. While an independent retailer would open an outlet if its own profit (net of fixed cost of entry) is positive, a vertically integrated firm will introduce a new outlet only if this gives greater profit (net of fixed cost) than without it. The former condition is less strong than the latter. A vertically integrated firm would not open a new outlet if its profits come from stealing business to other existing outlets, whereas an independent retailer would not consider externalities on competing retailers. The result is that there will be fewer outlets under vertical integration.

The existence of fewer outlets reduces consumer surplus (as long as consumers have a preference for variety, or their search cost increases with distance traveled to the closest shop) but does not necessarily decrease welfare, since more outlets also imply higher fixed costs. In many circumstances, competition generates excess of variety (or excess entry), and when this occurs vertical integration will improve welfare by reducing duplications.[18] Further, even if the impact on welfare of fewer varieties were negative, this effect should still be compared with the positive effects of vertical integration we have already discussed in the previous sections. For instance, vertical integration takes care of the double marginalisation problem, and this reduces prices to the benefit of consumers; and it increases incentives to effort, which again is efficient.

Section 2.3.2 illustrates the issue within a simple formal model where a vertically integrated manufacturer decides on how many outlets to have and at which price to sell in each outlet. It shows that vertical integration has the two main effects mentioned above: it decreases prices (good for welfare) but it also decreases variety (bad for welfare). It is a priori impossible to say which effect dominates, the answer depending mainly on the specific form that

[18] Not surprisingly, the literature shows that there is a relationship between the conditions under which vertical integration increases welfare and under which competition entails too much entry relative to the first best. See for instance Kühn and Vives (1999).

consumers' preferences take, as the following brief summary shows. However, under plausible assumptions it is likely that vertical integration increases rather than reduces welfare.

A few papers have studied the welfare impact of vertical integration when the number of retailers is endogenous. Mathewson and Winter (1983) find that vertical integration increases welfare. (The model I present in section 2.3.2 shares some of the features of Mathewson and Winter, and arrives at the same result.)

Perry and Groff (1985) study a model where monopolistic competition with a CES (constant elasticity of substitution) demand function is assumed for the downstream retailers. In their model, integration does reduce final price, but this effect is outweighed by the lower variety existing under integration.

Kühn and Vives (1999) look at the impact of vertical integration of a supplier into a monopolistically competitive downstream industry for a more general family of demand functions. They confirm that the two main effects of integration are: (1) eliminate the problem of double marginalisation, thus leading to lower final prices; (2) reduce variety (which might be welfare improving if there is elimination of excess variety).

They find that vertical integration is welfare improving when there is "increasing preference for variety", defined as a situation where "at low levels of total consumption a consumer cares less about variety increases (relative to total output increases) than at high consumption levels",[19] and they show that this property is obtained under relatively mild assumptions on preferences. Their analysis suggests that under plausible assumptions on preferences vertical integration increases welfare.

2.3.1 Horizontal and vertical externalities: A model*

In this section I propose a simple model where externalities of different nature coexist, and study the sets of vertical restraints that lead to an outcome equivalent to vertical integration.

This section is inspired by Mathewson and Winter (1984) who use a spatial model of product differentiation.[20] I have chosen to recast their analysis within the non-spatial model of differentiation which is already familiar to the readers of this book (see chapter 5). Despite some differences, the main features of their analysis are preserved.

Consider an upstream manufacturer which must sell its good through a network of n retailers that, because of location or other characteristics, sell a good which is perceived by final consumers as differentiated, according to the following direct demand functions:

[19] Under Perry and Groff's CES model, there is no increasing preference for variety, and welfare is decreased by vertical mergers.

[20] In their model, an upstream manufacturer's product is sold by retailers that are located around a circle. Consumers are also located around the circle but do not know of the existence of the product unless reached by advertising messages sent by the retailers (the manufacturer cannot advertise).

$$q_i = \frac{1}{n}\left[v + e_i + \alpha \sum_{k \neq i}^{n} e_k - p_i\,(1+\gamma) + \frac{\gamma}{n}\sum_{j=1}^{n} p_j\right], \tag{23}$$

where $\gamma \in [0, \infty)$ is the parameter of substitutability between the different products (i.e., an inverse measure of differentiation). Note that retailers' effort increases the willingness to pay of consumers, and that there exists a free riding effect in the provision of effort, since effort made by a retailer spills over to rival retailers in a proportion which is determined by the parameter $\alpha \in [0, 1]$. When $\alpha = 0$, each retailer fully appropriates its effort; when $\alpha = 1$, its effort increases by the same amount both its demand and that of all its rivals. Note also that for $\gamma \to \infty$ and $\alpha = 1$, the model is equivalent to that analysed in section 2.2.1. Similar to that model, I assume that $C_i(q_i, e_i) = wq_i + \mu e_i^2/2$, with $\mu > 1$. Each retailer's profit is given by $\pi_i = (p_i - w)q_i(p_i, p_j, e_i, e_j) - \mu e_i^2/2$.

Vertical separation and linear pricing Under vertical separation, retailers maximise individual profit. The first order conditions $d\pi_i/dp_i = 0$ and $d\pi_i/de_i = 0$ of the maximisation problem can be written, after taking derivatives and imposing symmetry, as:

$$\begin{cases} v + e\,(1 + \alpha\,(n-1)) - p\,(2 + \gamma - \gamma/n) + w\,(1 + \gamma - \gamma/n) = 0 \\ \frac{(p-w)}{n} - \mu e = 0 \end{cases} \tag{24}$$

Since we want to focus on the vertical restraints which allow to reproduce the vertically integrated outcome and will not for the moment analyse their welfare impact, we do not need to find the closed form solutions and we can work with the first-order conditions only.

Vertical integration Consider now the case where the upstream monopolist owns all the retailers. In this case, each outlet will take into full account the externalities that it is imposing on the others, since effort levels and prices will be chosen to maximise $\Pi = \sum_{i=1}^{n} \pi_i$. By taking derivatives $d\Pi/dp_i = 0$ and $d\Pi/de_i = 0$ and imposing symmetry one obtains the following FOCs:

$$\begin{cases} v + e\,(1 + \alpha\,(n-1)) - 2p + c = 0 \\ \frac{(p-c)}{n}\,(1 + \alpha\,(n-1)) - \mu e = 0 \end{cases} \tag{25}$$

Note that $w = c$ since the manufacturer is now vertically integrated with all the retailers.

Externalities The comparison between (24) and (25) allows to identify the different externalities at play, and understand why under vertical separation and linear pricing a sub-optimal outcome arises for the manufacturer. Let us start by comparing the price decisions. It is convenient to rewrite these FOCs as $p^S(e) = (v + e(1 + \alpha(n-1)) + w(1 + \gamma - \gamma/n)) / (2 + \gamma - \gamma/n)$ and $p^I(e) = (v + e(1 + \alpha(n-1)) + c)/2$.

There are two distinct externalities at work, which push the price into opposite directions, for given effort levels. First, under separation there is the usual vertical externality: under separation, the double marginalisation problem arises, leading to $w > c$, which tends to increase the price p^S above p^I. Second, there is now a horizontal pecuniary externality, in that independent retailers would compete too much with each other, imposing a negative price externality upon each other. This can be seen by the fact that for p^S the denominator is divided by $2+\gamma-\gamma/n$, whereas for p^I it is divided only by 2. Note that this horizontal externality increases with the degree of competition, being highest when $\gamma \to \infty$ and lowest when $\gamma = 0$. In the latter case, retailers are selling products which are perceived as independent, and the only externality left is the vertical one. The final net effect is a priori ambiguous. However, it turns out that in standard models the vertical externality effect dominates the pecuniary horizontal externality effect.[21]

To analyse the incentives to make effort under the two vertical structures, write now the first derivatives with respect to effort as a function of (given) prices, as follows: $e^S(p) = (p-w)/(n\mu)$ and $e^I(p) = (p-c)(1 + \alpha(n-1))/(n\mu)$.

Here again there are two externalities at play, but they both have a negative effect on the provision of effort under the separated vertical structure. First, the vertical externality, by increasing the marginal cost of retailers ($w > c$), reduces its marginal profit from investing in effort. Second, there is a horizontal externality, determined by the spillover, which is internalised under the vertically integrated structure and increases the effort made in that case. Therefore, $e^I > e^S$.

To sum up, in this model it is possible that vertical integration reduces welfare, but only if *all* the following conditions hold: (1) vertical integration leads to higher prices, (2) this effect outweighs the positive effect due to the rise in effort under integration, and (3) the resulting loss in consumer surplus is higher than the positive effect on producer surplus created by the internalisation of the various externalities.

Welfare analysis In this particular model, welfare turns out to be higher under vertical integration, because both consumer and producer surplus are higher than under separation.

To prove it, first we have to find the equilibrium price and effort under *vertical separation*. To do so, let us find the optimal wholesale price w charged by the manufacturer. By solving the system (**??**) one obtains:

$$p^S = \frac{(v-w)\mu n}{2\mu n - 1 - \alpha(n-1) + \gamma\mu(n-1)} + w; \quad e^S = \frac{(v-w)}{2\mu n - 1 - \alpha(n-1) + \gamma\mu(n-1)}. \tag{26}$$

[21] See also Kühn and Vives (1999). Note that in the model I present here prices might be higher under vertical integration because of higher effort (which in turn increases the willingness to pay of consumers).

The total output sold by the manufacturer will then be:

$$Q^S = nq^S = \frac{(v-w)\mu\left(\gamma(n-1)+n\right)}{2\mu n - 1 - \alpha(n-1) + \gamma\mu(n-1)}. \tag{27}$$

The manufacturer's profit is given by $\pi^u = (w-c)Q^S$. By substituting and maximising with respect to w, it is immediate to see that the optimal wholesale price is given by: $w^* = (v+c)/2$. We can now replace this value into p^S and e^S to find the equilibrium final price and effort under vertical separation as:

$$p^{S*} = \frac{1}{2}\left(v + c + \frac{(v-c)\mu n}{2\mu n - 1 - \alpha(n-1) + \gamma\mu(n-1)}\right); \quad e^{S*} = \frac{1}{2}\frac{(v-c)}{2\mu n - 1 - \alpha(n-1) + \gamma\mu(n-1)}. \tag{28}$$

Next, notice that the consumer surplus with our demand function is given by $CS = \left(v + e(1+\alpha(n-1)) - p\right)^2/(2n)$. Therefore, we can now obtain the consumer surplus under vertical separation by substituting in this expression the equilibrium values above. We obtain:

$$CS^S = \frac{(v-c)^2\mu^2\left(\gamma(n-1)+n\right)^2}{8n\left(2\mu n - 1 - \alpha(n-1) + \gamma\mu(n-1)\right)^2}. \tag{29}$$

Now, we have to derive the equilibrium values for the case of *vertical integration*. By solving the system (25) one obtains:

$$p^{VI*} = \frac{(v+c)\mu n - c\left(1+\alpha\left(n-1\right)\right)^2}{2\mu n - \left(1+\alpha\left(n-1\right)\right)^2}; \quad e^{VI*} = \frac{(v-c)\left(1+\alpha\left(n-1\right)\right)}{2\mu n - \left(1+\alpha\left(n-1\right)\right)^2}; \tag{30}$$

Substituting these values in the expression of the consumer surplus gives:

$$CS^{VI} = \frac{(v-c)^2\mu^2 n}{2\left(2\mu n - \left(1+\alpha\left(n-1\right)\right)^2\right)^2}. \tag{31}$$

We can now compare the consumer surplus under vertical integration and separation. First of all, note that $\partial CS^S/\partial\gamma > 0$. Therefore, CS^S is bounded above by $\lim_{\gamma\to\infty} CS^S = (v-c)^2/(8n)$. Next, note that $\partial CS^{VI}/\partial\alpha > 0$ and $\partial CS^{VI}/\partial\mu < 0$. Hence, CS^{VI} is bounded *below* by $\lim_{\mu\to\infty} CS^{VI}(\alpha = 0) = (v-c)^2/(8n)$. In other words: $CS^{VI} \geq (v-c)^2/(8n) \geq CS^S$. Consumers are always better off under vertical integration. Since vertical integration allows to control for the existing externalities, it improves the profit of the vertical chain too. Hence, welfare is higher under vertical integration than under vertical separation.

Vertical restraints that restore the vertically integrated solution Let us find the vertical restraints that allow an upstream monopolist to restore the vertically integrated outcome. As in Mathewson and Winter (1984), let us study first the case where there exist no advertising spillovers ($\alpha = 0$), which gives a useful benchmark, and then the case where advertising spillovers exist ($\alpha > 0$).[22]

No advertising spillovers ($\alpha = 0$).

Exclusive territories (ET).

- $ET + FF(w = c)$. It is easy to see that exclusive territories can be used to restore the vertically integrated outcome if $\alpha = 0$. Exclusive territories imply that each of the retailers behaves as a local monopolist (as if, therefore, $\gamma = 0$). This eliminates the horizontal pecuniary externality, as the pressure to lower prices caused by competition is eliminated. Given that the advertising externality does not exist by assumption, the only other externality is given by the vertical one. But we know that the double marginalisation problem is easily solved by using a non linear contract $(w = c, F)$. Therefore, ET combined with a price scheme $F + cq$ restores the VI outcome. (Indeed, for $\alpha = 0$, $\gamma = 0$, and $w = c$, one can check that the FOCs under vertical separation coincide with those under vertical integration.)

- $ET + QF$. Under exclusive territories, there is an alternative way to solve the double marginalisation problem, which is to impose a minimum sale on retailers. Quantity forcing pushes the retailer to increase its output and therefore reduces price. It is enough therefore to impose $q \geq q^I$, where q^I is the optimal output under VI. The manufacturer can then use the wholesale price to redistribute profit away from the retailers.

Resale Price Maintenance (RPM).

- $RPM + FF(w = c)$. If there is no advertising spillover, the optimal price can be implemented simply by imposing it on retailers via RPM: $p = p^I$, p^I being the optimal price under VI (it is not clear a priori whether this should be a price floor or a price ceiling). However, to induce the optimal effort it is also necessary to guarantee the right profit margin to retailers.

[22] Although it is convenient to study the case $\alpha = 0$ for a fixed number of firms, the reader should note that in my model the optimal vertically integrated structure when advertising spillovers are low or nil is such that there exists only one retailer. This is because industry demand does not increase with the number of retailers and because - even under integration - the marginal profit of effort for any retailer which sells to the $(1/n) - th$ part of the market is reduced with respect to a unique retailer, unless spillovers are large enough. It can be showed that a necessary condition for a vertically integrated manufacturer to keep all n retailers is $\alpha > 1/(1 + n)$. If $\alpha = 1$, gross profit of the vertical structure always increases with n. (Obviously, if each retailer has to bear an entry fixed cost, then this would reduce the optimal number of outlets.)

This is done by selling to them at a wholesale price $w = c$. A franchise fee can then be used to redistribute the profit.

- *RPM+QF*. As an alternative to the non-linear pricing scheme, RPM can be used in combination with quantity forcing. After imposing the price, if $w > c$ the retailer would not have the incentive to make the optimal effort. But the upstream monopolist can also impose a minimum quantity to the retailer. Each retailer's profit is given by $\pi = (p^I - w)q_i(p^I, e_i, e_j) - \mu e_i^2/2$, subject to $q_i(p^I, e_i, e_j) \geq q^I$. The unconstrained maximum would lead the retailer to make too low an effort: to meet the quantity forcing clause, each retailer will make enough effort to produce the vertical integration output. Given that price is imposed at p^I, this will induce the optimal effort e^I. At this point, the optimal effort and price are implemented and the industry outcome reproduces the vertically integrated structure. Since the wholesale price w does not modify the retailers' choices, w can be used to redistribute rents from the retailers to the manufacturer.

Advertising spillovers ($\alpha > 0$). When there is an advertising spillover (more generally, a horizontal externality on top of the pecuniary one), exclusive territories clauses are not able to restore the vertically integrated outcome. An exclusive territory combined with a non-linear pricing scheme solves the pecuniary externality (too much market competition relative to the optimum) and the double marginalisation problem, but downstream monopolists do not internalise the advertising spillover and would still advertise too little relative to the vertically integrated outcome. Nevertheless, resale price maintenance turns out to implement the vertically integrated outcome, if combined with other restraints, as we show next.

Resale Price Maintenance (RPM).

- *RPM+FF*$(w < c)$. Once imposed upon retailers the optimal price p^I, it is easy to see from the FOCs under vertical separation that the retailers would still do too little effort if $\alpha > 0$ and $w = c$: $e^S = (p^I - w)/(n\mu) < e^I = (p^I - c)(1 + \alpha(n-1))/(n\mu)$. To induce the optimal effort, it is therefore necessary for the manufacturer to sell the product to retailers at a wholesale price lower than its own marginal cost, $w < c$. More precisely, the wholesale price $\widehat{w}$ inducing the optimal level of effort will solve the equality $(p^I - \widehat{w}) = (p^I - c)(1 + \alpha(n-1))$. A franchise fee can then be used to redistribute the profit.

- *RPM+QF*. RPM can also be used in combination with quantity forcing, in the same way as for $\alpha = 0$. By imposing the price p^I and a minimum quantity q^I to retailers, they will be induced to make the optimal effort e^I to produce the vertical integration output. As the optimal effort and price are chosen, the industry outcome reproduces the vertically integrated structure. Since the wholesale price w is made incentive-neutral by RPM and QF, it does not modify the retailers' choices: it can then be used by the manufacturer to appropriate the retailers' rents.

2.3.2 Vertical integration and variety**

Within the same model I now want to endogenise the number of retailers. After imposing symmetry, profit of a vertically integrated firm can be written as:

$$\pi^{vi} = (p - c)\left(v + e\left(1 + \alpha\left(n - 1\right)\right) - p\right) - nf \tag{32}$$

whereas the profit of an independent retailer is.

$$\pi^{vs} = (p - w)\frac{1}{n}\left(v + e\left(1 + \alpha\left(n - 1\right)\right) - p\right) - f. \tag{33}$$

To determine endogenously the number of retailers operating at equilibrium, consider that under vertical integration entry occurs to the point that maximises π^{vi}, whereas under vertical separation it occurs to the point that makes $\pi^{vs} = 0$ (the standard free entry condition, under the assumption that n is continuous).

The conditions which determine the number of retailers at equilibrium are therefore:

$$\frac{\partial \pi^{vi}}{\partial n} = (p - c)\alpha e - f = 0, \tag{34}$$

and

$$\pi^{vs} = (p - w)\frac{1}{n}\left(v + e\left(1 + \alpha\left(n - 1\right)\right) - p\right) - f = 0. \tag{35}$$

There are two different effects at work. First, a vertically integrated firm internalises the fact that the output produced by an additional variety decreases the output sold by the existing varieties. Note however that in this particular model we deal with a special case, as industry demand does not increase with the varieties available, so that the only reason to increase n is when this affects significantly the total output through the advertising spillover. In fact, if α is low enough, or if the cost of effort is very large (leading to a very low equilibrium value of e), the vertically integrated monopolist will have only one retailer. More generally, one should expect that consumers have a preference for variety and that an additional variety would increase total demand (see exercise 5). However, the case analysed here provides a useful benchmark case in that a vertically integrated monopolist does not have an incentive to increase the number of outlets to attract new demand. Second, the profit margin of an additional outlet is higher under vertical integration because of the double marginalisation effect. One should expect this latter externality - which ceteris paribus would raise the number of varieties under vertical integration - to be outweighed by the former, so that more varieties are produced under a decentralised structure than under a centralised one.

To be able to study the welfare impact of vertical restraints in the model, abstract now for simplicity from effort considerations (i.e., from the advertising spillovers), so that the intercept is given by v alone. (Think for instance of the marginal cost of effort μ as tending to infinity, so that retailers will choose to make effort $e = 0$.)[23]

We know that a priori it is not clear whether the final price is higher or lower under vertical integration, since there are two distinct forces at work. First, under separation and linear pricing the horizontal pecuniary externality leads to lower prices *given* the wholesale price; second, under separation and linear pricing the vertical externality leads to higher wholesale prices which in turn pushes prices upward. To see which force is dominant we have to find the wholesale price chosen by the upstream manufacturer. It turns out that under vertical integration prices are always smaller. Let us see why.

Under *vertical integration* the price can be easily obtained by replacing $e = 0$ in equation (**??**). One obtains $p^I = (v + c)/2$.

Under *vertical separation* and linear pricing, we have to find the optimal wholesale price w charged by the manufacturer. By replacing $e = 0$ into equation (**??**) one obtains $p^S = (v + w(1 + \gamma - \gamma/n))/(2 + \gamma - \gamma/n)$. The total output sold by the manufacturer will then be: $Q^S = nq^S = (v - w)(1 + \gamma - \gamma/n)/(2 + \gamma - \gamma/n)$. The manufacturer's profit is given by $\pi^u = (w - c)Q^S$. By substituing and maximising with respect to w, one finds the optimal wholesale price as: $w^* = (v + c)/2$. By replacing this value into p^S one finds the final price as: $p^* = (v(3 + \gamma - \gamma/n) + c(1 + \gamma - \gamma/n)) / (2(2 + \gamma - \gamma/n))$.

We can now compare the final prices under the two vertical structures. It is easy to see that $p^* \geq p^I$. Indeed, p^* decreases with the substitutability parameter γ, but $\lim_{\gamma \to \infty} p^* = (v + c)/2 = p^I$. Even when at its minimum, p^* is therefore higher than p^I.[24]

In this model, vertical integration will never reduce welfare. Independently of the number of retailers n, we have $p^* \geq p^I$: prices are always lower under vertical integration. Further, recall that in this model industry demand does not rise with the number of retailers. Therefore, $p^* \geq p^I$ implies $q^* \leq q^I$, irrespective of the number of retailers operating at equilibrium. Therefore, vertical integration leads to lower prices because it internalises the double marginalisation problem.

A second source of welfare improvement comes from the elimination of duplications. Separation results in a larger number of outlets and higher fixed costs which do not really add to consumers' utility as quantity demanded does not increase with the variety supplied. This is a very specific feature of the model. However, the reader can check in exercise 5 that in a similar model, but where preferences exhibit love for variety, the impact of vertical integration on welfare

[23] Note that in this case the optimal number of retailers under vertical integration is one.

[24] Note that for $\gamma = 0$, $p^I < p^* = (3v + c)/4$, which is the same expression we found when discussing the double marginalisation issue.

is still positive. (Remember, though, that this is not always true: it is possible to devise models where the effect of reduced variety outweighs the effect of lower prices.)

2.4 Other efficiency reasons for vertical restraints and vertical mergers

We have focused sofar on two efficiency motives behind vertical restraints, namely double marginalisation and externalities in the provision of retailers' services for a given brand. These are possibly among the best known (and more easily formalised and explained), but by no means the only sources of efficiency of vertical restraints and vertical mergers. Writing an exhaustive list of such efficiency reasons is beyond the scope of this work, but it is important to give an idea of how widespread they are. In what follows, I underline some of them. Note that I do not restrict the analysis to intra-brand competition, but consider also efficiency motives that are at play when a manufacturer competes with rival brands.

Quality certification In the same spirit as the free-riding argument, Marvel and McCafferty (1984) suggest that some retailers provide customers with a quality certification service. By stocking some products, these retailers implicitly guarantee for the quality of the products in the eyes of customers. It does not really matter for the argument whether any kind of quality certification really happens or if consumers just assume that by being stocked by a certain fancy shop the product must be good. What matters for the argument is that such certification activity involves some costs (again, this might simply be due to the fact that a shop is located in a posh district and exhibits marble walls and smart assistants) and presents a public good characteristic: other shops might benefit from such activities and - given they can afford a lower price because they do not engage in them - can attract consumers away from the certified product. This argument might justify restraints such as RPM (if the certifying shop cannot be undercut, there is no reason why the consumer should get the product elsewhere after having observed that the product is stocked there) and *selective distribution*. In the latter case, only a certain type of shops, showing some particular characteristics, is entitled to sell the product. For instance, a manufacturer of luxury goods might want to sell only through shops which have some characteristics, such as being located in a high street, being specialised, having dedicated personnel, having particular amenities and so on. As a consequence, it might refuse to supply the product to discount stores or supermarkets. Although one might wonder about the use of the word "efficiency" to label such restraints, one should also recognise that not allowing a manufacturer to protect the image of the good in this way might be harmful not only to it but also to consumers who do value the luxury features of the good. It is conceivable that - prohibiting such marketing strategy - the luxury image collapsed and consumers will not be ready to pay for the product any longer. In turn, it might simply disappear and, strange as it may sound, the utility of all those who would have been prepared to pay for such a luxury good would diminish.[25] It should be noted, though, that like for the free riding argument above the quality certification story holds only insofar as the retailers are not able to appropriate the services they provide. For instance, a supermarket chain which invests heavily into controlling that food products have really been produced via a fully biological process should be able to limit the spillover of its quality certification (biological labelling) investment. It is also unclear to which extent shops which provide quality certification through investing in luxury premises are not able to appropriate their investment. On the one hand, if items on sale there involve small amounts of money, it is unlikely that consumers would first go there to check what is on offer and then take the car and go to search if it is in a discount store for the purchase. On the other hand, the rumour that a certain item is sold in a certain type of shops or other might run fast, possibly ruining the luxury image as the free riding argument suggests. In conclusion, the free riding and the quality certification arguments are sensible stories in theory but they do not necessary apply for all products. Only the analysis of the industry and the market can tell to which extent they apply to a given set of products.

Free riding among producers Although restrictive by definition in that they oblige a retailer not to carry products of competing producers, exclusive contracts might be efficient. For instance, they can stimulate the investments into retailers' services made by a producer, such as technical support, promotion, training, equipment, financing. To the extent that such investments favour not a particular brand but the retail outlet in general, other producers would also benefit from them. This gives rise to a free riding problem that may be solved by resorting to exclusive dealers (i.e., retailers cannot stock products from competing brands), as the next section 2.4 formally shows. Exclusive dealing might also push a retailer to sell a brand more aggressively than if it devoted its marketing effort among different brands, thereby raising competition.[26]

Restraints which remove opportunistic behaviour and promote specific investments The existence of long term contracts between a manufacturer and a retailer (or, *a fortiori*, their integration) might also have positive effects on the specific investments that both parties have to make in their relationships. There are many investments which lose most of their value outside a particular relationship, because they are tailored and dedicated to a particular partner (think for instance of a firm which devises its machinery to work

[25] Recall that the quality of the good is the quality as it is perceived by consumers, rather than the extrinsic quality of the product itself. Advertising - for instance - is another way through which a manufacturer can increase the image of its product, and most consumers are indeed happier to pay a premium for highly advertised products rather than purchasing similar products which are cheaper and not advertised. (Think of cigarettes, colas, detergents and most of mass consumer products...) This implies that the utility of such consumers decrease if the former products disappeared from the market, or if advertising were forbidden!

[26] However, we shall see in sections 2.5 and 4 that such clauses are not without drawbacks and must be carefully evaluated.

with a particular intermediate good or input, or to a franchisee that devotes important investments to carry and promote a particular brand). In such cases, the danger that the relationship is broken or discontinued will generally lead to an underinvestment problem. If a distributor fears that his promotion effort to establish a brand's image might next year benefit another shop located in the same area and carrying the same brand, he will think twice before investing heavily in such an activity. Likewise, a producer will be deterred from investing in assets which might improve a distributor's performance if the latter is likely to switch to other brands. To avoid such opportunistic behaviour (a firm getting out of the relationship after the partner has made specific investments into it) clauses such as exclusive territories and exclusive dealing are helpful. By reducing or eliminating the underinvestment problem, they increase efficiency. Of course, the same holds for vertical mergers. In this case, the interests of the manufacturer and of the retailer are aligned, and they will coordinate so as to attain the same objective.

Exclusive dealing avoids free riding on manufacturers' investment* In this section, I formalise one of the efficiency rationales behind exclusive dealing. This is based on the idea that manufacturers often provide their retailers with services and investments which promote sales of the manufacturer's brand. In some circumstances, however, since such services and investments benefit the retailer, they might also promote sales of competing brands sold by the same retailer. This externality reduces the appropriability of the investment. Exclusive dealing (ED), obliging the retailer to carry only one brand, might then be adopted as a clause by the manufacturer, in order to avoid such an externality. Exclusive dealing might then increase the incentive to invest in such services, which in turn is generally welfare improving.

The following model, a variation of Besanko and Perry (1993) formalises this idea and shows that a ban on exclusive dealing would reduce consumer surplus and welfare.

Two manufacturers produce two differentiated goods at constant unit cost (that I equal to zero for simplicity). Each manufacturer can invest in an activity which reduces the cost of the retailer carrying its brand. The level of the investment is denoted by e_i and its cost is $(\mu/2)e_i^2$. There exists a possible spillover of such an investment, so that a retailer carrying both brands benefits from the effective investment $\widehat{e}_i = e_i + \alpha e_j$ when it sells brand i, where $\alpha \in [0, 1]$ is the externality parameter (for $\alpha = 0$, there is no spillover, whereas for $\alpha = 1$ the externality is maximal, as it equally benefits the rival manufacturer and the manufacturer who is investing). A retailer that has agreed on an exclusive dealing contract will have its cost reduced only by $\widehat{e}_i = e_i$. I assume that demand for each product is given by the (usual) following demand function:

$$q_i = \frac{1}{2}\left[v - p_i\,(1+\gamma) + \frac{\gamma}{2}(p_i + p_j)\right]. \tag{36}$$

I also assume that there are a large number of retailers in the market that compete in prices and provide undifferentiated services (or, which is equivalent, that are perfectly competitive).[27] Each retailer's cost of selling brand i is given by $d + w_i - \widehat{e}_i$, where w_i is the wholesale price charged by manufacturer i, d is the distribution cost.[28]

The timing of the game is as follows. First, manufacturers make simultaneously investment and wholesale price decisions. Then, retailers choose prices. Our objective is to compare the equilibrium solutions of this game under two alternative contractual situations, one where retailers operate under ED, and one where there is no exclusive dealing (NED), i.e., retailers can sell both brands. Besanko and Perry (1993) analyse the full game, where manufacturers decide at a pre-stage of the game where to choose ED or NED, but this involves having at least three firms (with two firms, if one choose ED the other is de facto also obliged to rely on an exclusive retailer) and complicates the calculations.[29]

Solution of the game At the last stage of the game, retailers would set prices equal to their marginal costs: $p_i = d + w_i - \widehat{e}_i$. Consider first the case where there is no exclusive dealing arrangement (NED). Replacing equilibrium prices one obtains the quantities as a function of wholesale prices and investment levels. At the previous stage, manufacturers $\max_{w_i,e_i} \pi_i = w_i q_i(e_i, e_j, w_i, w_j) - (\mu/2)e_i^2$. By taking the FOCs $\partial\pi_i/\partial e_i = 0$, $\partial\pi_i/\partial w_i = 0$, imposing symmetry and solving the system, one obtains the equilibrium solutions as:

$$w_i^{NED} = \frac{4\mu(v-d)}{2\mu(4+\gamma) - (1+\alpha)(2+\gamma(1-\alpha))}; \tag{37}$$

$$e_i^{NED} = \frac{(2+\gamma(1-\alpha))(v-d)}{2\mu(4+\gamma) - (1+\alpha)(2+\gamma(1-\alpha))}. \tag{38}$$

By substitution, the other equilibrium values can be obtained. In particular:

[27] This assumption is made to avoid foreclosure issues and to bring forward in a neater way the efficiency effect of exclusive dealing. Since there are several retailers selling one same brand, strategic delegation issues (see section 3.1.1) are also avoided.

[28] I also impose two conditions on parameters in order to obtain positive values at equilibrium: $\mu > (1+\alpha)(2+\gamma(1-\alpha))/2(4+\gamma)$. In addition, d has to be large enough.

[29] Please refer to their article for the full game. Notice, however, that I choose a different formalisation of the externality, and this modifies considerably the results. In particular, in my version of the model manufacturers have a collective preference for ED, whereas in Besanko and Perry it depends on the values of the externality and substitutability parameters. Their function is $\widehat{e}_i = \lambda e_i + (1-\lambda)e_j$, and it is such that the externality not only benefits the other firms but also reduces the own marginal profit from investing. (A priori, I do not see any reason to prefer one formalisation over the other, and my choice was determined only by the fact that calculations turn out to be simpler.) All the results are qualitatively similar, except for the fact that in Besanko and Perry ED is not always collectively preferred by the manufacturers. In their game, a prisoner's dilemma might arise, in that ED might be chosen at equilibrium but the manufacturers would prefer to be under NED.

$$p_i^{NED} = \frac{2d(2+\gamma)\mu + v(4\mu - (1+\alpha)(2+\gamma(1-\alpha)))}{2\mu(4+\gamma) - (1+\alpha)(2+\gamma(1-\alpha))}; \tag{39}$$

$$\pi_i^{NED} = \frac{\mu\left[4\gamma(2\mu - 1 + \alpha) + 16\mu - \gamma^2(1-\alpha)^2 - 4\right](v-d)^2}{\left[2\mu(4+\gamma) - (1+\alpha)(2+\gamma(1-\alpha))\right]^2}. \tag{40}$$

From these values, it is now easy to compute the equilibrium solutions for the case where retailers are engaged by ED agreements. Indeed, it is enough to impose $\alpha = 0$ to solve the ED case:

$$w_i^{ED} = \frac{4\mu(v-d)}{2\mu(4+\gamma) - (2+\gamma)}; e_i^{ED} = \frac{(2+\gamma)(v-d)}{2\mu(4+\gamma) - (2+\gamma)}, \tag{41}$$

$$p_i^{ED} = \frac{2d(2+\gamma)\mu + v(4\mu - (2+\gamma))}{2\mu(4+\gamma) - (2+\gamma)}; \tag{42}$$

$$\pi_i^{ED} = \frac{\mu\left[4\gamma(2\mu - 1 + 16\mu - \gamma^2 - 4\right](v-d)^2}{\left[2\mu(4+\gamma) - (2+\gamma)\right]^2}. \tag{43}$$

It is now easy to check that under exclusive dealing (ED): (i) investment levels are higher. This is due to the increased appropriability of the investment. In turn, this reduces the cost of distributing the brand; (ii) wholesale prices are higher. This is because lower distribution costs shift outwards the marginal revenue function of the firm, which can then increase wholesale prices; (iii) the retail price is lower (due to the dominant effect of the reduction in costs); (iv) manufacturers' profits are higher (retailers' profits are always nil due to the Bertrand competition assumption); (v) finally, welfare is higher than under NED, since profits are higher and consumers are better off.

In this model, therefore, exclusive dealing has a welfare improving effect, and banning it would decrease both consumer surplus and manufacturers' profits.[30]

2.5 Vertical restraints, vertical mergers, and the commitment problem

Vertical restraints and vertical mergers can have an adverse effect on welfare when they help a manufacturer (more generally, an upstream firm) to keep prices high, whereas without them it would not be able to commit to high prices. To understand why such a commitment problem arises, consider the following example. Suppose a manufacturer has a very successful brand of clothes which is well known everywhere, but that has not been sold yet in a given region. Suppose also that there is little demand uncertainty, so that total expected

[30] As indicated above, the result that profits are always higher under ED is sensitive to the specification of the externality function. However, the conclusion that ED leads to higher welfare is robust to alternative specifications. See Besanko and Perry (1993).

profit from selling these products would be π, and there is agreement on this estimate. There exist several possible franchisees ready to sell the brand. If the producer promised to give exclusivity for the region sales to one franchisee (and its promise were believed), competitive bidding would lead the winning bidder to offer π to the manufacturer. However, once it has sold the franchise, the producer has an incentive to renege on its exclusivity promise and engage in opportunistic behaviour. It could now offer a second franchise (and promise there would be no more than two) and, if its promise were believed, it would obtain up to an additional $\pi/2$ from a second franchisee (note that the first franchisee would have a loss equal to $\pi/2$) . Once cashed in the second franchise, it could then renege again on the promise, and offer a third licence. And so on, and so forth.

Of course, the potential franchisees would anticipate all this, and if the manufacturer were unable to commit to give one franchise contract only, nobody would accept to buy the license. Everyone knows that the manufacturer has an incentive to renege on the promise, which will entail a loss for them. In other words, the manufacturer needs to find a way to commit itself in a credible way not to add new franchises in the market. Otherwise, it would be unable to obtain the profit π that its product could fetch.

Whenever this problem arises, a firm will not be able to appropriate the market power it potentially has. In this example, for instance, the clothes producer could potentially have a monopoly profit, but the presence of a large number of potential franchisees together with the lack of commitment power might result in the buyers accepting to buy the franchise only for a very low price, and the producer earning very little profit, rather than the monopoly profit.[31]

The same commitment problem arises in more general circumstances, whenever a firm has an input (or product) and can sell it to more than one buyer (or more than one retailer): it might have an incentive to privately renegotiate the terms of the contract with some buyers after having signed with all of them. Equivalently, if the contracts were not publicly observable, it might have an incentive to agree on better terms with one or more buyers after some have already signed a contract.

To further illustrate the point, consider the following example. Suppose that there are two retailers selling the same homogenous product in the same town. If they both pay the wholesale price w, the retailers sell a quantity Q at price p and they each make profits $\pi/2$. A possible (non-linear) contract the manufacturer of the good can offer its two retailers is that they buy each at a price w if they make a fixed payment $\pi/2$. (Each retailer would make zero profit and would accept this contract if not anticipating opportunistic behaviour by

[31] The first paper which studied the commitment problem in the context of vertical relationships is Hart and Tirole (1990). Subsequent contributions are due to O'Brien and Shaffer (1992) and McAfee and Schwartz (1993), and, more recently, Chemla (1995). Rey and Tirole (1996) analyse the incentive to foreclose access by the owner of an essential facility (or an input produced by a monopolist) and the related policy issues. It is the main reference for those who would like to understand better these issues.

the monopolist.) After the contracts have been signed, however, the monopolist might go to one of the two retailers and offer him the product at a slightly lower unit price than w. This would allow this retailer to get a competitive advantage and increase its market share (possibly, it could get the whole market), making $\pi' > \pi/2$ under the new contract. It would therefore be willing to pay up to π' for the new terms. At the expenses of the other retailer, who still has to pay $\pi/2$, the manufacturer would therefore obtain after renegotiation an additional profit $\pi' - \pi/2$. Of course, however, the temptation to renegotiate the contract will be anticipated by each retailer, who would then be unwilling to enter a contract with the manufacturer unless a very low fixed payment is set. Again, the monopolist would be unable to exploit its potential market power, being hurt by its lack of commitment, i.e., by the temptation to change the terms with the retailers.

The reader will have noticed the close similarity with the problem of the durable good monopolist (see chapter 2). There as well, it was the impossibility to commit to a certain action (the future price) which prevented the monopolist from exercising market power. Like the durable good monopolist, though, an upstream producer also has the possibility to solve the commitment problem so as to exploit its market power. Vertical restraints (other than simple non-linear contracts) and vertical mergers are among such instruments, as I explain below. Before doing so, however, it is worth noting that the commitment problem arises only for an upstream firm which needs wholesalers or retailers to sell the product to final customers, not for a downstream retailer who sells directly to final customers. Suppose that the structure of the market is reversed relative to the one described above, so that there is a monopolistic downstream firm which can buy (substitutable) inputs from two or more upstream suppliers. The retailer does not have any incentive to renegotiate the supply contract with the upstream firms, since it controls the final market price itself. This means that - if it was possible to design the structure of the industry - it would be preferable to have competition at the level of the interaction with consumers.[32]

Vertical mergers A natural solution for the manufacturer to commit to high prices is to merge with one of the downstream firms.[33] If it did so, it would internalise the profit made by its downstream affiliate, and therefore would not have any incentive to offer better terms to other downstream firms, since this would diminish the profit made by its affiliate, and therefore by itself.

[32] For instance, if there was a distributor which enjoys monopoly power, it would make sense to allow final consumers to buy directly from producers and let producers buy access from the distributor. This policy, known as "common carrier" policy, effectively turns the downstream firms upstream and vice versa. See Rey and Tirole (1996) for a discussion and some examples, mostly from the telecommunications and energy sectors. Although fascinating, I do not dwell on this topic since it is more an issue of regulation rather than competition, as it entails redesigning the structure of the industry.

[33] Obviously, complete vertical integration, that is, taking over all the downstream firms would also solve the commitment problem. But this is not only unnecessary - as the same outcome could be established with just one merger - but also very unlikely to be approved by the antitrust authorities.

Foreclosure of the rival downstream firms would then be likely to arise, as the upstream unit would not have incentive to supply the input to the rival retailers. Indeed, to restore monopoly power it might be optimal to supply the affiliate only and avoid making the inputs available to rivals. It can be showed, however, that a vertical merger would not always result in complete foreclosure of rival downstream firms. If there were other substitute (but inferior) inputs, the upstream firm would prefer to supply itself the downstream rivals, rather than letting them be supplied by an upstream competitor. (See section 2.5.1.)

It is interesting to note that in the absence of competing upstream suppliers a vertical merger would be maximally detrimental, because it would lead to complete foreclosure of downstream rivals and would determine a price rise up to the monopoly level. When (less efficient) upstream suppliers exist, however, a vertical merger will increase prices but not to the same extent: the retailers' threat of switching to alternative suppliers limits the exercise of market power of the vertically integrated more efficient firm. Again, vertical restraints might be welfare detrimental but their adverse effect would be limited by the presence of competing suppliers of the input. This can be interpreted by saying that the larger the upstream market power the more attention should be devoted to vertical practices.

Exclusive territories Since the problem of the producer comes from the presence of several buyers, an obvious way to restore market power is to credibly restrict itself to supply the product (or input) to one such buyer only in each market area.[34] If a contract establishing that there is only one buyer which can sell the product within a certain specified area is legal, then the manufacturer's problem is solved. In the region protected by the exclusivity clause, competition among the potential retailers will bring them to pay up to the monopoly price to have the opportunity to be the only dealer selling the good. This will allow the manufacturer to restore all its monopoly profit. The counterpart of this is that exclusive territory harms welfare: consumers will pay the monopoly price rather than the lower price that would have arisen without the exclusivity clause. The usual allocative inefficiency occurs, as the higher producer surplus does not outweigh the lower consumer surplus.

The effect of such a contract is therefore to foreclose access to the product to all retailers apart from one. Note also that if competing upstream suppliers existed, the welfare impact of an exclusive dealing clause is more adverse than under a vertical merger. Indeed, if a less efficient supplier of the input existed, under a vertical merger the upstream firm of the vertically integrated firm would end up supplying the downstream rivals as well (since they would obtain the input anyhow, it would be better to provide them with it rather than letting them be served by the upstream rival). But if the efficient upstream firm signs an

[34] Similarly to the durable good monopolist case, reputation might also help the monopolist. If a stream of inputs were brought to the market by the monopolist over time, there is a repeated game played between a manufacturer and a retailer. Even in the absence of an explicit exclusive clause, the manufacturer might have an incentive to build for itself the reputation to deal with only one retailer at a time.

exclusive deal, it will be prevented from serving other retailers. As a result, they will be supplied by the less efficient upstream firm, thereby adding a productive efficiency loss to the allocative inefficiency.

Resale price maintenance Since the problem of the monopolist is to guarantee that there is no renegotiation which leads to higher output or lower prices, the commitment problem is solved if the monopolist commits to industry-wide prices.[35] Consider for instance RPM clauses such as those still legal in many European countries, for products like books and pharmaceuticals. The producer prints the final market price on the product itself, and RPM can be enforced in courts. Retailers cannot sell at a discount price (they can be taken to court if they did), and this clearly takes away any incentive for the producer to secretly cut prices to retailers: a price cut would not increase final sales, it would only worsen the distribution of the profit between itself and the retailer that gets a discount.[36]

Most favoured nation clause and anti-discrimination laws Suppose that the manufacturer was able to credibly commit to and enforce a clause stating that whenever it offers a price discount to one retailer, all other retailers are also entitled to it. This would remove any temptation to renege on a previously signed contract with some retailers. (Consider for instance the franchise example at the beginning of this section. If after having signed a contract with one franchisee for a price of π, the manufacturer sold a franchise to a second retailer for the price of $\pi/2$, under MFN it would have to reimburse the first retailer of $\pi/2$. Clearly, there would be no point in reneging on the promise and offering the franchise to a second retailer.)

One problem with MFN is clearly the observability of price discounts and therefore the enforceability of such a clause. (If a retailer could not observe a discount made to another, how could MFN be applied?) Since the commitment problem arises in situations where contracts are not observable, it would seem that the same circumstances also make it difficult to use MFN clauses. However, suppose that the producer had to pay a heavy penalty if it was caught offering better terms to some buyers than others. Then, it is likely that it would refrain from renegotiating its price offers, and this would be equivalent to enforcement of the MFN clause. This is precisely what happens under the current EU competition law. Both the Commission and the European Court of Justice consider as an abuse of a dominant position the practice of a firm endowed with market power of discriminating among buyers. As in the *Michelin* case, firms

[35] O'Brien and Shaffer (1992), in a model with differentiated goods and price competition, show that (bilateral) retail-level price ceilings accompanied by wholesale pricing at the same level can also restore monopoly power.

[36] In the US, industry-wide resale price floor was established thanks to state laws (so-called "non-signer" laws) according to which all retailers should abide to the RPM contract offered by the manufacturer as long as at least one retailer had signed such a contract. See O'Brien and Shaffer (1992: 306), who also offer some anecdotal evidence showing that RPM had been used in the US to solve the commitment problem.

will be heavily fined if they were to offer different terms of supply to different buyers,[37] and suppliers should abide to the principle of "transparent pricing": they cannot offer secret price discounts to buyers. Whatever the reason why the Commission and the ECJ introduced and enforce this rule, it is clear that it helps the provider of an input solve its commitment problem. Contrary to what they expect, the "transparency rule" will help firms endowed with market power to keep prices high, to the detriment of welfare.

Conclusions This section has showed a case where vertical restraints and vertical mergers might be welfare detrimental. If contracts between an upstream monopolist and downstream retailers are not publicly observable, the monopolist is hurt by its temptation to renegotiate supply terms (which will be anticipated by the retailers, unwilling to accept high input prices). It suffers therefore from the same commitment problem as a durable good monopolist. A merger with a downstream firm, or vertical clauses such as exclusive territories and resale price maintenance might solve the monopolist's commitment problem and help it exercise its monopoly power, to the detriment of overall welfare.

Note that the magnitude of the damage created by the vertical restraints identified above (or by a vertical merger) depends on the upstream firm being a monopolist or not. If there are competing suppliers, even if less efficient, the harm done by such practices is diminished. This suggests again that it is worth monitoring such practices only when they are undertaken by firms enjoying enough market power.

Another important policy conclusion, perhaps of even more practical relevance, is that laws that impose "transparency" in the prices and contracts between vertically related firms, or that oblige upstream firms not to discriminate among buyers, are misled. Rather than fostering price competition, they provide upstream firms with an efficient and credible commitment not to secretly undercut prices to buyers, thereby allowing them to enforce high prices. The EU competition rules are a case in point, and they should be revised.

2.5.1 Vertical restraints and the commitment problem*

Suppose there exists an upstream manufacturer, M, which sells a product to two retailers, R_1 and R_2. The manufacturer has a constant production cost c, and the retailers' only variable cost is given by the wholesale price they have to pay to the supplier of the input. (For simplicity, we restrict attention to contracts where they are offered the input at a unit cost c.) The two retailers produce a homogenous good and compete in quantities.[38] Final demand is given by $p = 1 - Q$, where $Q = q_1 + q_2$ is the total output. The manufacturer has all

[37] This does not mean that a firm cannot engage in any form of price discrimination. It is perfectly legitimate for a firm to offer prices based on the quantities bought by the buyers. What is not legitimate is to offer different conditions for similar contracts, or the same number of units bought.

[38] Price competition with differentiated goods gives rise to some complications, but the qualitative results are the same. See O'Brien and Shaffer (1992) and Rey and Vergé (2001) for the analysis with price competition. See also exercises 7 and **??**.

the bargaining power and makes take-it-or-leave-it offers to the retailers. The game is as follows. First, M offers each retailer a contract (F_i, q_i), where F_i is a fixed fee and q_i the number of units that the retailer wants to buy. Then, each retailer orders q_i units of the product and pays F_i. Finally, each retailer will bring q_i to the market and the market will clear.

Let me make two remarks about this game. First, note that I focus on non-linear contracts only. This is because when there is market power downstream we know that linear contracts are not optimal, in that they do not reproduce the vertically integrated outcome.[39] Second, note that I assume that retailers pay for the input *before* they go to the final market. If they agreed on a contract but they paid for the input only *after* they go to the final market, then the upstream firm would not have any incentive to renegotiate. (See exercise 7.)

Observable contracts: A benchmark As a benchmark case, it is easy to check that the vertically integrated outcome is given by $Q^{vi} = (1-c)/2$, $p^{vi} = (1+c)/2$, $\pi^{vi} = (1-c)^2/4$.[40] The same outcome can be obtained if contracts offered by M were observed by each retailer (and could not be renegotiated). In this case, the manufacturer would offer each of them a contract (F, q) whereby $F_i = (1-c)^2/8$ if the retailer buys $q_i = (1-c)/4$ units, and $F_i = \infty$ for any other quantity.

Unobservable contracts The vertically integrated outcome cannot be restored under unobservability. To see why, suppose that retailer R_1 has accepted M's offer (F, q) as above. The manufacturer's profit, if it is able to appropriate R_2's profit through a fixed fee, is: $\pi' = (1 - (1-c)/4 - q_2 - c)q_2 + (1-c)^2/8$. By setting $d\pi'/dq_2 = 0$, one obtains $q_2' = 3(1-c)/8 > q_1 = q^{vi}$. This is the output that M would offer to the second retailer. Since retailer 2's output is higher, the market price will fall below p^{vi}. As a result, firm 1 will make a profit $3(1-c)^2/32 < (1-c)^2/8 = F$. Therefore, the contract offer (F, q) cannot be an equilibrium, since each retailer would anticipate that if it signed such a contract, the manufacturer would have an incentive to offer larger output to the rival, which in turn would create losses for it.[41]

We know then that the contract which restores the vertically integrated outcome cannot be an equilibrium. We still have to determine what the equilibrium is. To do so, given unobservability, we have to make assumptions on the beliefs

[39] As emphasised by O'Brien and Shaffer (1992), this literature is to show that non-linear contracts are not able either to restore the vertically integrated outcome when the upstream firm makes unobservable offers.

[40] This follows from the standard monopoly problem, which is to set Q so as to maximise $\pi = (1-Q-c)Q$. The result is immediately obtained from $d\pi/dQ = 0$. Owning both retailers, the fully vertically integrated firm is indifferent as to how to distribute output among them, as long as $Q^{vi} = (1-c)/2$.

[41] Note that if M did not have all the bargaining power, the same reasoning would still hold. The sum of the profit of M and R_2 after R_1 has signed the contract (F, q) would still be $\pi' = (1 - (1-c)/4 - q_2 - c)q_2$, leading to the same choice of output (F will be used to distribute profit, and it will depend on the relative bargaining power of M and R_2).

that a retailer has about the offer that will be received by the other retailer. Following Hart and Tirole (1990), O'Brien and Shaffer (1992) and Rey and Tirole (1996) assume "passive beliefs" (also called market-by-market conjectures): if a retailer receives an unexpected offer from the manufacturer, it does not revise its belief about the offer received by the rival. We look for the Perfect Bayesian Equilibrium of this game, which requires each agent to choose its best action given the action of the other agents and given its beliefs.

If retailer R_1 expects that R_2 is offered to buy q_2, how much is R_1 willing to buy and at which price? Its expected market profit would be: $\pi_1 = (1 - q_1 - q_2 - c)q_1$. Profit maximisation would lead it to buy $q_1 = (1 - q_2 - c)/2$ units, and pay up to $\pi_1 = (1 - q_2 - c)^2/4$. Symmetrically, the other retailer would buy $q_2 = (1 - q_1 - c)/2$ units. Note that $q_i = (1 - q_j - c)/2 = r_i(j)$, which is the usual reaction function under quantity competition. The only equilibrium is where both firms are on their reaction function, and it is given by the Cournot output $q^C = (1 - c)/3$ and both retailers will be ready to pay up to $(1 - c)^2/9$. Clearly, the manufacturer will make less profit than under the vertically integrated (or observable contracts) outcome, as $2(1-c)^2/9 < (1-c)^2/4$. It can be showed that the larger the number of retailers, the lower the profit that the manufacturer can make (the commitment problem is aggravated). See exercise 6.

How to restore market power

- Vertical mergers. Suppose there is a merger between M and R_1. Then, offering $q = (1 - c)/4$ to both the affiliate and the independent retailer R_2 cannot be an equilibrium, as R_2 would correctly anticipate that M has an incentive to increase the output of its affiliate. On the other hand, $q = (1 - c)/3$, that is the Cournot contract, cannot be an equilibrium because the chain $M - R_1$ can obtain higher profit simply by foreclosing access to the input to retailer R_2. Indeed, by setting $q_1 = (1 - c)/2$ and $q_2 = 0$, the vertically integrated profit can be obtained.

- Exclusive territories. With just one retailer downstream, market power can be exercised as the commitment problem does not arise. As long as the exclusivity clause is enforceable in courts, a retailer who is offered exclusivity and to buy $(1 - c)/2$ units for a price up to $(1 - c)^2/4$ will accept the contract, which then restores the vertically integrated solution.

- Industry-wide RPM (price floor). If an industry-wide price floor $p \geq p^{vi} = (1 + c)/2$ is enforceable, then the commitment problem is solved. Each retailer would be offered to buy $q = (1 - c)/4$ and firm M would have no incentive to behave in an opportunistic way. Suppose R_1 has already signed the contract. If M offered a larger quantity to R_2, the total profit to be made is $\pi^* = ((1 + c)/2 - c)q_2$ for $q_2 \leq (1 - c)/4$.[42] Therefore, $q_2 \geq (1 - c)/4$ gives M the highest profit compatible with the price floor.

[42] The price floor is satisfied whenever $p = 1 - (1 - c)/4 - q_2 \geq p^{vi}$. By replacing one obtains the condition $q_2 \leq (1 - c)/4$. Higher output for R_2 would violate the RPM condition.

- Most-favoured nation (MFN) clause (or most-favoured customer clause). Suppose each retailer is offered a contract together with a MFN clause,[43] that states that if a price discount (or a better price) is given to one retailer, then all other retailers will also receive the same better offer. (This is also the definition of symmetric beliefs.) This means that whenever a retailer is offered to buy q units of the input, it will expect its rival also to buy q. Therefore, its expected profit is $\pi = (1 - q - q - c)q$, and it will be ready to buy $q^{vi} = (1 - c)/4$ units and pay up to $(1 - c)^2/8$. The manufacturer is able to restore its best outcome.

Vertical mergers and exclusive dealing when a substitute input exists.[44] Suppose now that M is not the only supplier: there also exists a less efficient supplier of the product, S, whose cost is $s > c$, with S not being too inefficient: we assume $s \in (c, (1 + c)/2]$. Look first at what happens when there is *vertical separation*. Since M will end up supplying both retailers, the solution will be the same as for the case without substitute inputs: both retailers will be offered and will order $q^C = (1-c)/3$. The market price will be $p^C = (1+2c)/3$. However, note that a retailer will not be willing to pay a fee up to the Cournot profit $(1 - c)^2/9$ to the manufacturer M. By accepting that fee, it would have a zero payoff. Given that R_i accepts the contract, R_j would have an incentive to deviate and switch to the substitute good S. This deviation would give R_j a profit $\pi_j = (1 - q_j - q^C - s)q_j$. By choosing the optimising quantity $q' = (2 + c - 3s)/6$, retailer R_j would make $\pi' = (2 + c - 3s)^2/36$. Therefore, each retailer will be ready to accept the contract only if it has to pay up to π', and the manufacturer can make $2(\pi^C - \pi')$.

Suppose now that there is a vertical merger between M and, say, R_1. To understand what the equilibrium will be, consider first the case where R_2 decided to be supplied by S. This corresponds to the Cournot equilibrium with asymmetric costs, c and s. Quantities are $q_1^* = (1-2c+s)/3$, $q_2^* = (1-2s+c)/3$. Profits are $\pi_1^* = (1-2c+s)^2/9$, $\pi_2^* = (1-2s+c)^2/9$. Therefore, the independent retailer could always threaten to switch to S if it is not offered q_2^* units. The best thing that M can do is then to offer precisely the same conditions as S to the second retailer, that is q_2^* units at a unit price s. The vertical chain will then make a profit $\pi = \pi_1^* + (s - c)q_2^*$.

Note that under the vertical merger, the final price will be $p = (1+c+s)/3$. Hence, the price increase the consumer will have to bear relative to the situation of vertical separation is $p - p^C = (s - c)/3$. In other words, the larger the efficiency gap between the upstream firms, the larger the welfare loss which will result from the vertical merger. The competition of alternative suppliers reduces the risk of vertical mergers.

One can also note that although foreclosure is not complete if an alternative supplier exists, still the independent retailer is worse off under the vertical

[43] See the discussion in the text for the conditions under which a MFN clause could be meaningful.

[44] See Hart and Tirole (1990), and Rey and Tirole (1996).

merger, as $\pi' = (2 + c - 3s)^2/36 > (1 - 2s + c)^2/9$ for $s > c$.

2.6 Conclusions

This section has showed that vertical mergers and vertical restraints that affect intra-brand competition only are mostly efficiency-enhancing. They allow firms to control for externalities that affect the vertical relationship with other firms, thereby increasing profits of the vertical chain, as well as, in most cases, consumer surplus. The analysis has also unveiled cases (notably when they might lead to the overprovision of services - see section 2.2 - and when they help a manufacturer solve a commitment problem - see section 2.5) where vertical restraints and vertical mergers might reduce welfare. However, such cases do not appear as general, and, more importantly, their adverse effects shrink when there is competition in the market.

The main conclusion of this section is therefore that vertical restraints which affect intra-brand competition do not raise much preoccupation; certainly, they are not worth investigating when firms that adopt them do not have high market power.

Another important implication of the analysis carried out here is that vertical restraints are often substitutable - at least to some extent - with each other. Accordingly, differential treatment of vertical restraints (for instance, allowing ones and forbidding others) does not appear to be justified in general terms.

However, these conclusions are still provisional, since I have so far given little consideration to the effect of vertical restraints on inter-brand competition. It is to this topic that I turn next.

3 Inter-brand competition

In the previous section I focused on the case where only one upstream manufacturer could use vertical contracts, so inter-brand competition was not an issue. However, by modifying the choices (investment, price and so on) made by a vertical chain (i.e., the manufacturer of a brand and its distributors), vertical restraints will generally have an impact on the competition between this vertical chain and competing ones. I now analyse the effect of vertical restraints (and mergers) when several manufacturers sell through retailers. Section 3.1 shows that vertical restraints can be used strategically so as to relax competition between retailers and ultimately between manufacturers; section 3.2 shows that they might favour collusive agreements; section 4 shows that they might be used to deter entry. Therefore, economic analysis certainly demonstrates that vertical clauses are by no means always beneficial (contrary to what the Chicago school used to claim). Nevertheless, I will be far from suggesting that vertical restraints (or some of them) are always bad. First, I will point out the conditions under which such restraints are harmful. Second, I will recall that one has always to weigh the possible negative effects upon inter-brand competition with the likely efficiency gains of vertical restraints illustrated in the previous section. Again, the main conclusion will be that one should worry about vertical restraints only when they involve firms endowed with large market power.

3.1 Strategic effects of vertical restraints

There is a large literature that analyses the strategic rationale behind vertical restraints under imperfect competition. The main insight comes from principal-agent models, which emphasise how a principal in certain circumstances has an incentive to delegate a decision to an agent, who is more likely to perform a certain action than the principal is, if provided with appropriate incentives. Suppose for instance that there are two entrepreneurs in a market. Each of them would like to keep prices high, but the usual market forces would lead them to undercut each other, resulting in low prices. It would not be credible if one of them simply promised to the other that he would keep high prices and would not undercut. Each of them knows that the other will behave so as to maximise profits, and this implies that prices will be low, no matter how many promises are made. However, suppose now that one of the two entrepreneurs hired a manager, delegated to her all price and market decisions and gave her a compensation which gives her a premium if the price she charged on the market is high enough. If this contract is observable by the rival, it makes it credible that the firm's manager will keep prices high and this pushes the rival to increase prices as well. What centralisation of decisions could not do, delegation might be able to. This is a principle which is well established in game theory and which has had many applications in different fields.[45]

Gal-Or (19xx-CHECK), Vickers (1985), Bonanno and Vickers (1988), Rey and Stiglitz (1988, 1995) are among the papers which have applied this principle on vertical restraints.[46] They study strategic effects of vertical restraints when there are competing vertical chains, as illustrated by Figure 6.3.

INSERT Figure 6.3. Competing vertical chains

The main idea is that a manufacturer (the principal) might want to make its retailer a "softer" competitor in the final market, so as to lead - through the strategic effect mentioned earlier - to higher final prices and higher retailers' profits. The benefit from higher prices would then be recovered by the principal via a franchise fee.[47,48]

[45] See for instance Fershtman and Judd (1987) and Sklivas (1987) for an analysis of contracts in oligopoly between owners and managers. The strategic trade policy literature also moves from the same principle. The principal (a country's government) offers subsidies (or imposes taxes) to domestic firms so as to make credible their more aggressive (or softer) behaviour in international markets. In most applications of the delegation principle, policy implications are ambiguous (as we shall see also below). Depending on the nature of market interactions, the principal gives very different incentives to its agent. This in turn determines different welfare effects.

[46] See Irmen (1998) for a review of this literature.

[47] In some circumstances, even without franchise fee the manufacturer will gain from vertical restraints. See for instance Rey and Stiglitz (1995).

[48] Note that the same logic applies to the case where it is the retailer - rather than the

One type of vertical restraint which can be strategically used is a two-part tariff. Imagine that a manufacturer sells through an exclusive dealer. By choosing a high wholesale price, the former will make the latter raise its price in the market (since the wholesale price is the retailer's own cost, it needs to set higher prices to try and keep its mark-up), in turn making rival retailers more willing to raise prices. The effect will be higher profit for the vertical chain (the tariff can be used to appropriate the retailer's profit) but lower welfare.

Another vertical restraint that can relax inter-brand competition is exclusive territories. Consider a situation where a manufacturer sells its brands through a number of retailers (which carry only its brand). By removing intra-brand competition which would decrease the own brand prices in the market, and giving a retailer the power to behave as a brand monopolist, higher retail prices will be set. In turn, this will push rivals' prices up. Again, the brand profit will increase and welfare will be lower. Exclusive territorial clauses help also in the sense that they are visible and not easily renegotiated. (A contract has a commitment value, that is it can affect strategically the rivals' behaviour, if it can be publicly observed and cannot be easily modified.) Since they have a higher degree of commitment and visibility than non-linear contracts (the decision to delegate sales to a retailer can be easily observed, and it is likely to be irreversible in the short run, but the actual contract with the retailers will typically be private), their strategic potential is also higher.[49]

Note, however, that not all vertical restraints exercise these strategic effects. Resale price maintenance for instance cannot be used as a strategic restraint. The crucial idea is to delegate price decisions to the retailers, whereas under RPM it is still the manufacturer which decides on prices. For the same reason, a vertical merger does not raise this concern: no delegation happens there, so that exclusive territories and non-linear pricing would achieve higher profit (and cause lower welfare) than vertical integration.

However, one should note that the result that vertical restraints have strategic effects which harm welfare is not robust with respect to the nature of market competition. In some markets, like the ones I have described sofar, when a firm increases its price the rival would increase its price too, thus making it profitable to have a contract pushing one's retailer to keep prices high. In other markets, however, when a firm reduces its output (that is, increases its price), the rival would increase its output (that is, would reduce its price), thus reducing the first firm's profit. When this is the case, a manufacturer will devise contracts aimed at making its retailer more, rather than less, aggressive in the market. For instance, it would decrease its wholesale price so as to stimulate retailers'

producer - that has the bargaining power. In this case, Shaffer (1991) shows that each retailer can manipulate strategically the wholesale price paid to the producer and recover the higher profit made by the vertical chain through a slotting allowance, that is a negative franchise fee that the producer pays the retailer in order to have access to the latter's shelf space. In what follows, I shall limit myself to the case where the bargaining power is on the producer.

[49] Nevertheless, Katz (1991) shows that unobservable contracts might affect market competition under some circumstances; and Caillaud, Jullien and Picard (???) show that under asymmetric information observable contracts carry commitment value even if they can later be renegotiated.

sales.[50] The overall result will be larger quantities brought to the market by each brand retailer, resulting in lower equilibrium market prices. In such a case, vertical restraints will increase consumer surplus and welfare. Firms do adopt such restraints as they are privately optimal, but firms will turn out to be worse off if all of them choose this strategy. This is therefore a classical example of a prisoner's dilemma. By forbidding the restraints one would favour the firms (and not the consumers).

Another important qualification to the result that vertical restraints might dampen market competition comes from the fact that the strategic effects of restraints would have sizeable effects only when the firm adopting them has some market power.

In conclusion, this literature establishes the point that vertical restraints - through strategic effects - might reduce welfare, but it does not authorise unambiguous policy implications. First, what this literature suggests is that only restraints set up by firms with enough market power might be worth looking at (if there is enough competition upstream, restraints used by one firm are unlikely to have significant effects on prices). Second, I would play down the practical utility of the strategic arguments in a concrete antitrust case. It seems difficult to evaluate to which extent restraints are used for strategic purposes, and evaluate their quantitative impact.

3.1.1 Strategic use of vertical restraints*

This section is articulated in the following parts. First, it shows that non-linear pricing when retailers compete in prices might strategically dampen competition; second, it shows that exclusive territories might have the same effect; third, it shows that the more inter-brand competition in the industry the weaker the negative impact of non-linear pricing; finally, it shows that under quantity competition non-linear pricing would increase rather than decrease welfare, therefore proving that the results are not robust to a change in the mode of market competition.

Two-part tariff with price competition Consider two upstream manufacturers U_1 and U_2 which sell two differentiated products. We assume they are identical and that both production and retail costs are constant and equal to zero. The demand function for the final good i is given by:

$$q_i = \frac{1}{2}\left[v - p_i\left(1+\frac{\gamma}{2}\right) + \frac{\gamma}{2}p_j\right]. \tag{44}$$

This is a demand function I have repeatedly used.[51] Recall that $\gamma \in [0, \infty)$ is the degree of substitution among the products. Market decisions are on prices.

[50] For this reason, manufacturers will not adopt exclusive territories when retailers compete in quantities.

[51] For instance, disregarding effort and imposing $n = 2$, it is identical to equation (23).

Vertical integration Suppose first that the two manufacturers are both vertically integrated. All cost and demand functions are common knowledge. Then the problem is the standard one where each firm chooses price to maximise $\pi_i = p_i q_i(p_i, p_j)$. By taking $d\pi_i(p_i, p_j)/dp_i = 0$ and solving the system one obtains:

$$p^{VI} = \frac{2v}{4+\gamma}; \quad \pi^{VI} = \frac{(2+\gamma)v^2}{(4+\gamma)^2}. \tag{45}$$

Vertical restraints: Two-part tariff Suppose now that instead of selling directly, each manufacturer sells via a retailer. Call D_1 and D_2 respectively the retailer who sells good 1 and the retailer who sells good 2. There are then two competing vertical chains. Assume that the manufacturer chooses the retailer from a large number of potential retailers, and that it has all the bargaining power. In the first stage of the game, manufacturers simultaneously give non-linear pricing contracts $F_i + w_i q_i$ to their retailers. These contracts are perfectly observable and not renegotiable.[52] In the second stage, the retailers simultaneously choose prices p_i, profits realise and fees (if any) are paid to the manufacturers.

At the last stage, each retailer chooses price to maximise $\pi_i^D = (p_i - w_i)q_i(p_i, p_j)$. The first order conditions are given by:

$$d\pi_i/dp_i = \frac{-2(2+\gamma)p_i + \gamma p_j + 2v + (2+\gamma)w_i}{4} = 0 \quad (i, j = 1, 2; i \neq j). \tag{46}$$

By re-arranging the two first order conditions one can write the best reply functions $p_i = R_i(p_j)$ of the retailers. To draw them in the same plane (p_1, p_2), let us write R_1 and R_2 as functions of p_1. One obtains:

$$R_1 \ : \ p_2 = \frac{2(2+\gamma)p_1 - 2v - (2+\gamma)w_1}{\gamma}; \tag{47}$$

$$R_2 \ : \ p_2 = \frac{\gamma p_1 + 2v + (2+\gamma)w_2}{2(2+\gamma)}. \tag{48}$$

Figure 6.4 shows the reaction functions in (p_1, p_2). Note that they are positively sloped, i.e., goods are strategic complements (this comes from the assumption of price competition). In other words, a retailer has an incentive to respond to a price increase of the rival by increasing the price himself. Note also that when the wholesale price w_i increases, the reaction function of retailer

[52] Katz (1991) and Caillaud, Jullien and Picard (???) - as well as Irmen (1998)'s survey - have analysed if vertical restraints affect market outcome when contracts are not observable or they are renegotiable. In particular, it can be showed that a non-linear contract has no precommitment effect, as a producer would maximise profit by selecting $w = c$ and using F to get profit, whereas under linear pricing $w = c$ cannot be optimal because it implies that the producer gets zero profit. Therefore, at the equilibrium $w > c$ and prices are higher.

i shifts away from the origin: for any given price of the rival, retailer i responds with a higher price, that is he is behaving more softly.

INSERT Figure 6.4. Tariffs as strategic device: Strategic complements

The figure captures the intuition behind the manufacturer's incentive to increase the wholesale price. Consider first the case where both manufacturers set $w = c(= 0)$. Point E is then the market equilibrium. If instead a manufacturer charged a wholesale price $w' > c$, the reaction function of its retailer would shift outward so as to result in higher equilibrium prices, benefiting both upstream firms. If both manufacturers choose to raise wholesale prices, the final equilibrium price will correspond to the point E'. As we shall see now, this is precisely what will occur at equilibrium.

By solving the system of FOCs we can now obtain the equilibrium at the price stage of the game:

$$p_i^* = \frac{2(4+3\gamma)v + (2+\gamma)(2w_i(2+\gamma)+\gamma w_j)}{16+16\gamma+3\gamma^2}. \tag{49}$$

One can then derive $q_i^*(w_i, w_j)$ by substitution and $\pi_i^* = (p_i^* - w_i)q_i^* - F_i$. Note that the manufacturer will use the franchise fee so as to appropriate the profit of its retailer. Therefore, the manufacturer profit will be (recall that $c = 0$): $\pi_i^U = (p_i^* - w_i)q_i^* + w_i q_i^* = p_i^* q_i^*$. In the first stage of the game the manufacturer will therefore set w_i so as to maximise:

$$\pi_i^U = \frac{(2+\gamma)\left[2(4+3\gamma)v-(8+8\gamma+\gamma^2)w_i+2w_i(2+\gamma)\right]\left[2(4+3\gamma)v+2(2+\gamma)^2 w_i+\gamma w_j(2+\gamma)\right]}{4(4+\gamma)^2(4+3\gamma)^2} \tag{50}$$

By solving the system $d\pi_i^U/dw_i = 0$ one obtains:

$$w^{FF} = \frac{2v\gamma^2}{(2+\gamma)(16+12\gamma+\gamma^2)}; \quad p^{FF} = \frac{4(2+\gamma)v}{(16+12\gamma+\gamma^2)}; \tag{51}$$

$$\pi^{FF} = \frac{2(2+\gamma)(8+8\gamma+\gamma^2)v^2}{(16+12\gamma+\gamma^2)^2}. \tag{52}$$

Therefore, at the equilibrium both upstream manufacturers set a wholesale price $w > c = 0$ so as to relax competition among retailers (and ultimately among themselves: Rey and Stiglitz show that the vertical restraint makes manufacturers face a perceived demand elasticity which is lower than under vertical integration). As a result both prices and profits are higher than under vertical integration: $p^{FF} > p^{VI}$ and $\pi^{FF} > \pi^{VI}$ (the expressions coincide only when $\gamma \to \infty$).This increased allocative inefficiency determines a decrease in overall welfare.

Exclusive territories Rey and Stiglitz (1988, 1995) show that granting exclusive territories to retailers also helps manufacturers to relax competition. As a benchmark, consider the case where two manufacturers have $m \geq 2$ retailers each. Retailers who carry the same brand sell products which are perceived as homogenous by consumers. Therefore, for the usual Bertrand competition arguments, intrabrand competition leads in retailers charging $p_i = w_i$.

The upstream firm chooses its price to maximise $\pi_i^U = (w_i - c)q_i(w_i, w_j)$. Since $p_i = w_i$, this problem is identical to the problem of the vertically integrated firm we have solved above. By taking $d\pi_i(w_i, w_j)/dw_i = 0$ and solving the system one obtains:

$$w^{VI} = p^{VI} = \frac{2v}{4+\gamma}; \quad \pi^{VI} = \frac{(2+\gamma)v^2}{(4+\gamma)^2}. \tag{53}$$

Suppose now that each retailer is given an exclusive territory by his manufacturer, and this decision is publicly observed. Exclusive territories imply that each retailer has $1/m$ share of the demand for the brand. The game is then as the one analysed in the previous sub-section: first, the manufacturer offers retailers a non linear contract $F_i + w_i q_i$. Then, retailers simultaneously choose prices p_i, profits realise and fees (if any) are paid to the manufacturers.

At the last stage, each retailer chooses price to maximise $\pi_i^D = \frac{1}{m}(p_i - w_i)q_i(p_i, p_j) - F_i$. Since m is only a scale factor, the first order conditions are given by precisely the same expression as (46) above. All the solutions will therefore be as under the case treated above, giving rise to higher prices and profits than under intra-brand competition: $p^{FF} > p^{VI}$ and $\pi^{FF} > \pi^{VI}$.[53]

Note here that at the equilibrium $w > c$, which entails that there is double marginalisation. However, the manufacturers do not lose from this externality. By creating a monopolist (or several monopolists) downstream they strategically exploit the presence of imperfect competition as they manage to relax competition. Rey and Stiglitz (1995) show that by adding more and more layers (for instance, by creating wholesalers and other intermediaries between the production and the retail stage) manufacturers might be able to get the monopoly (i.e. the joint-profit maximising) prices.

Competition reduces the risk that vertical restraints lower welfare Vertical restraints might be used so as to strategically relax competition and induce higher prices only insofar as the firm using them enjoys enough market power. To get some intuition for this, consider the following example, where there is a manufacturer - say the firm selling product 1 - which is selling through a retailer, and offers him a contract $F + wq$, whereas all the other n manufacturers in the industry are vertically integrated. Assume the usual demand function:

[53] The game should be completed by endogenising the decisions to allocate exclusive territories to retailers: we have just discussed what happens when both manufacturers use ET, without proving that ET is indeed an equilibrium choice. See Rey and Stiglitz (1995) for such a proof.

$$q_i = \frac{1}{n}\left[v - p_i\left(1+\gamma\right) + \frac{\gamma}{n}\sum_{j=1}^{n} p_j\right]. \tag{54}$$

From the maximisation of the retailer's profit function, and after imposing symmetry on the $n-1$ vertically integrated firms, one obtains the FOCs:

$$\begin{cases} \frac{-\gamma(n-1)(2p_1-p-w)+n(-2p_1+v+w)}{n^2} = 0, \\ \frac{\gamma(p_1-np)+n(-2p+v)}{n^2} = 0. \end{cases} \tag{55}$$

By drawing the reaction functions of the firms, one can see that they become less elastic as n increases, in the sense that their slope decrease with n. As a result, the manufacturer would need a much bigger increase in the wholesale price to obtain a given price response from the retailer: its action has lower strategic power.

From the solution of the system of FOCs one obtains:

$$p_1 = \frac{n(\gamma^2(n-1)w + 2n(v+w) + \gamma v(2n-1) + \gamma w(3n-2))}{4n^2 + 2\gamma n(3n-2) + \gamma^2(2n^2-3n+1)}; \tag{56}$$

$$p = \frac{2n^2 v + \gamma^2(n-1)w + \gamma n(w + v(2n-1))}{4n^2 + 2\gamma n(3n-2) + \gamma^2(2n^2-3n+1)}. \tag{57}$$

By solving the manufacturer's problem, which is to choose w so as to maximise its profit $\pi^U = (p_1 - w)q_1(p_1, p)$ one obtains:

$$w = \frac{\gamma^2(n-1)(2n+\gamma(2n-1))v}{2(2+\gamma)(\gamma^3(n-1)^3 + 2n^3 + \gamma n^2(5n-4) + \gamma^2 n(3-7n+4n^2))}. \tag{58}$$

Finally, by replacing into the price expresssions:

$$p_1^{ff} = \frac{nv(2n+\gamma(2n-1))}{2(\gamma^2(n-1)^2 + 2n^2 + \gamma n(3n-2))}; p = \frac{v(2n+\gamma(2n-1))}{2(2+\gamma)n^2}. \tag{59}$$

When all firms are vertically integrated, the (Bertrand competition) equilibrium price is given by:[54]

$$p_b = \frac{vn}{2n+\gamma(n-1)} \tag{60}$$

The additional mark-up that a manufacturer is able to command due to vertical restraints is therefore given by:

[54] To find the equilibrium price under vertical integration, just impose $w = 0$ in the FOCs above and solve for p.

$$p_1^{ff} - p_b = \frac{nv\gamma^2(n-1)}{2(\gamma^2(n-1)^2 + 2n^2 + \gamma n(3n-2)(2n+\gamma(n-1))}. \tag{61}$$

It can be checked that $d(p_1^{ff} - p_b)/dn < 0$: the larger the number of firms, the lower the additional mark-up that strategic vertical restraints can give to the manufacturer using them.

The results are not robust: Strategic substitutes The previous results have been obtained by assuming that decisions in the final market were on prices. It turns out that the results obtained are very sensitive to the type of market competition. If instead we assume that market decisions are on quantities - rather than prices - manufacturers still want to delegate their sales to independent retailers, but: first, the contracts they give their retailers make them more - rather than less - aggressive, and as a consequence final prices will be lower and welfare higher. Second, the game where manufacturers decide whether or not they want to delegate decisions is like a prisoner's dilemma: delegation is the dominant strategy, and will be chosen at equilibrium, but manufacturers would like to avoid it. In what follows, we formalise these results.

The model The model is the same as the one analysed above, with two manufacturers who sell differentiated goods either directly (vertical integration) or through independent retailers. To analyse what happens under quantity competition, let us use the inverse demand functions. Inverting the system (44) we obtain:

$$p_i = v - \frac{1}{1+\gamma}\left(2q_i + \gamma q_i + \gamma q_j\right). \tag{62}$$

Vertical integration Firms choose output q_i so as to maximise $\pi_i = (p_i(q_i, q_j) - c)q_i$. By solving the system of first-order conditions $d\pi_i/dq_i = 0$ we obtain the standard Cournot equilibrium:

$$q_{vi} = \frac{(v-c)(1+\gamma)}{4+3\gamma}; \quad \pi_{vi} = \frac{(v-c)^2(1+\gamma)(2+\gamma)}{(4+3\gamma)^2}. \tag{63}$$

Delegation Suppose now that both firms have a downstream retailer, and analyse the game where first each manufacturer gives a non-linear pricing contract $F_i + w_i q_i$ to its retailer and then the retailers compete in quantities (after having observed the contract).

At the last stage of the game, retailer i chooses output q_i so as to maximise $\pi_i^r = (p_i(q_i, q_j) - w_i)q_i$. By taking the first-order conditions $d\pi_i^r/dq_i = 0$ and re-arranging them one obtains the following reaction functions for each firm (to draw them in the plane (q_1, q_2), they are written as functions of q_1):

$$
\begin{aligned}
R_1(q_2) \quad &\leftrightarrow \quad q_2 = \frac{-2(2+\gamma)q_1 + v(1-\gamma) - w_1(1-\gamma)}{\gamma}; &(64)\\
R_2(q_1) \quad &\leftrightarrow \quad q_2 = \frac{-\gamma q_1 + v(1+\gamma) - w_2(1+\gamma)}{2(2+\gamma)}. &(65)
\end{aligned}
$$

It is easy to see that the reaction functions are now negatively sloped, i.e., the goods are strategic substitutes. A firm's increased output would be followed by a rival's decrease in own output (see Figure 6.5).

INSERT Figure 6.5. Tariffs as strategic device: strategic substitutes

The iso-profit functions are not showed in the figure, but it would be easy to check that a shift to the right of the retailer's reaction curve (given the reaction curve of the rival) would change the equilibrium to a point where the retailer has higher profit (at the new point, the retailer would have a higher share of the market). However, figure 6.5 also shows that if both retailers had lower marginal costs, the new equilibrium E' would result in larger quantities sold in the market than at the equilibrium E. The two firms would still have the same share of the market but since they both increase outputs, their profits are lower. The figure therefore anticipates what we are now going to see more formally.

By solving the FOCs (or - equivalently - finding the intersection point of the reaction functions) one can find the retailers' equilibrium quantities and prices.

$$
\begin{aligned}
q_i \quad &= \quad \frac{(1+\gamma)\left(v(4+\gamma) - 2(2+\gamma)w_i + \gamma w_j\right)}{16+16\gamma+3\gamma^2}; &(66)\\
p_i \quad &= \quad \frac{(8+6\gamma+\gamma^2)v + (8+8\gamma+\gamma^2)w_i + \gamma(2+\gamma)w_j}{16+16\gamma+3\gamma^2}. &(67)
\end{aligned}
$$

At the first stage of the game, the manufacturer chooses w_i to maximise profit. As before, we assume that they have the bargaining power vis-à-vis their retailer, so that they set the franchise fee F_i so as to appropriate all their profit: $F_i = (p_i - w_i)q_i$. Therefore, their problem is: $\max_{w_i} \pi_i^u = (p_i - c)q_i$, where p_i and q_i are given by the expressions above. By taking the first-order conditions and solving the system one finds the equilibrium solutions of the whole game (because of symmetry, manufacturers and retailers will have the same equilibrium variables. We therefore drop the indices i and j):

$$
w_{ff} = c - \frac{\gamma^2 v}{16+20\gamma+5\gamma^2}. \tag{68}
$$

As one can immediately see, the wholesale price is lower than the manufacturer's own production cost: $w < c$. The manufacturer wants to make the retailer more aggressive in the market and therefore it subsidises its purchase of the input so as to make it sell more in the market (of course, subsidisation does not come costly here, since the retailer's profits are appropriated by the manufacturer via the franchise fee). This is precisely the opposite result as with strategic complements (i.e., price competition), where w was optimally set higher than unit cost c.

By substituting, one can find equilibrium quantities and profits as:

$$q_{ff} = \frac{2(1+\gamma)(2+\gamma)(v-c)}{16+20\gamma+5\gamma^2}; \quad \pi_{ff}^u = \frac{2(1+\gamma)(2+\gamma)(8+8\gamma+\gamma^2)(v-c)^2}{(16+20\gamma+5\gamma^2)^2}. \tag{69}$$

When comparing the solutions obtained at the two equilibria, it is easy to see that when firms delegate they sell a higher quantity than under vertical integration ($q_{ff} > q_{vi}$) and they obtain a lower profit ($\pi_{ff}^u < \pi_{vi}$). Here, delegation and vertical restraints increase welfare!

The result according to which at the delegation equilibrium firms earn lower profits begs the question if choosing to delegate output decisions to an independent retailer is indeed an equilibrium (sofar, we have just assumed that both firms delegate). Exercise 8 proves that delegation is a dominant strategy and that the equilibrium where both producers sell through retailers is unique. This is the typical prisoner's dilemma situation, where both firms end up in an equilibrium which is Pareto-inferior: $\pi_{ff}^u < \pi_{vi}$. The manufacturers would be better off if they were not allowed to contract with independent retailers!

3.2 Vertical restraints as collusive devices

It has been pointed out in the literature that there are other circumstances in which vertical restraints might facilitate collusion. In this section, we consider two such arguments. The first shows that resale price maintenance might favour collusion among manufacturers. The second that when two or more manufacturers sell through a common retailer they might be able to reach the collusive outcome.

3.2.1 RPM might facilitate collusion

As seen in chapter 4, resale price maintenance can facilitate collusion among manufacturers because it increases price observability. Absent RPM, when shocks in the retail markets occur, final prices will tend to change, making it more difficult for manufacturers to distinguish changes in retail prices that are caused by different retail conditions from cheating on the cartel. RPM makes collusion more likely by eliminating the retail price variation (see also Jullien and Rey, 2001).

3.2.2 Common agency

If two upstream firms-manufacturers decide to sell their goods in the final market via a common agent (or retailer), this might have anticompetitive effects. In particular, it might give rise to the joint profit maximising prices being charged at equilibrium.[55]

There are two separate circumstances where this can happen. First, imagine that the manufacturers offer a two-part tariff contract to the common retailer and delegate the price decisions to it. In this case, it is obvious that the common agent will pick the collusive prices, given wholesale prices, since the upstream firms effectively give it the mandate to maximise joint profits. Manufacturers would still compete on wholesale prices, but have no incentive to set wholesale prices higher than their own marginal cost. As a result, the retailer behaves exactly as if the manufacturers sold directly to the final market and could maximise joint profits.

More interestingly, however, Bernheim and Whinston (1985) show that the collusive prices can be obtained even if the price choices were not delegated to the common retailer. In their setting, two manufacturers offer a franchise fee contract to a common retailer, but also impose its final price (in other words, RPM is allowed). They show that at the equilibrium both firms choose the collusive price. This is because each manufacturer makes the retailer the residual claimant and uses the franchise fee to recover its profit. At the moment of setting the final resale price, each manufacturer takes into account that the final profit of the retailer depends not only on the sales of the manufacturer's product itself, but also on the sales of the rival's product. This way, when a manufacturer chooses its price so as to maximise the retailer's profit it takes into account the externality that the price decision has on the component of the retailer's profit that comes from the sales of the rival product: this is precisely the same as when the two products were sold by the same cartel (i.e., under joint profit maximisation).[56]

Common retailer and RPM help collusion** I present here a very simplified version of Bernheim and Whinston (1985)'s model, to illustrate their main result. Assume that there are two upstream producers, 1 and 2, which sell their products via a common retailer, R. To simplify the issue, assume that both products have to be sold, otherwise there is a market failure and zero profits are made by all firms.[57] Assume also that the retailer has no bargaining power, for instance because it is selected among a population of very many potential retailers who would compete fiercely to be the chosen retailer. For simplicity, the

[55] In the literature, this is summarised by saying that common agency facilitates collusion (but interestingly, the collusive price arises even though a one shot game is played).

[56] In Rey and Vergé (2001) there is both upstream and downstream competition, each downstream firm acting as a common retailer to both upstream firms. Under this "double common agency" structure, collusive profits arise as the unique equilibrium of a game where first upstream firms make take-it-or-leave-it offers (in the form of franchise fee contracts) to each common retailer, each retailer sets its effort level and then competes in the final product market by selling at the prices set by the manufacturers. Unfortunately, the model hinges on the ability of the manufacturers to extract all the retailer's rents, and when the retailers are endowed with some bargaining power, the model becomes too complicated.

[57] This way, we do not have to study some deviations and the associated asymmetric cases where the retailer accepts only one manufacturer's offer. Bernheim and Whinston show that the same results are obtained relaxing this assumption.

retailer has no cost other than the wholesale price and the producers have the same marginal cost c. Finally, consumer demand is given by $q_i = a - bp_i + \gamma p_j$.

Consider the following game. First, each producer $i = A, B$ simultaneously makes take-it-or-leave-it offers to R in the form of a non-linear contract $F_i + w_i q_i$. These contracts are publicly observable (they might also fix the retail price if resale price maintenance (RPM) is allowed). Second, the retailer accepts or rejects the offers. Third, if both offers have been accepted, the retailer fixes resale prices (or simply sells at the price imposed by the producer under RPM), demand and profits are realised, and franchise fees are paid. If one or both offers are rejected, no sale occurs and all firms get zero payoffs.

No RPM (price choices delegated to the common retailer) Before analysing Bernheim and Whinston's game, let us look at what happens if the common retailer was in charge of price decisions. At the last stage of the game, if both offers have been accepted (and therefore for given w_i and F_i), the retailer chooses final prices p_A, p_B so as to maximise: $\pi_R = (p_A - w_A)(a - bp_A + \gamma p_B) + (p_B - w_B)(a - bp_B + \gamma p_A)$. From the FOCs $\partial \pi_R / \partial p_i = 0$, one obtains $p_i = [a + w_i(b - \gamma)] \,/\, [2(b - \gamma)]$, and $q_i(w_i, w_j) = (a - bw_i + \gamma w_j)/2$.

In the first stage, the programme of a producer i will therefore be to choose its contract offer to maximise its profit given the contract of the competing producer, and taking into account the participation constraint of the retailer:

$$\max_{w_i, F_i} \pi_i = (w_i - c)q_i(w_i, w_j) + F_i, \; s.to: \sum_{\substack{i=1,2;\\ i \neq j}} [(p_i(w_i) - w_i)q_i(w_i, w_j) - F_i] \geq 0. \tag{70}$$

Since at equilibrium the retailer will make no profit, the retailer's constraint must be binding:

$$F_i = (p_i(w_i) - w_i)q_i(w_i, w_j) + (p_j(w_j) - w_j)q_j(w_i, w_j) - F_j. \tag{71}$$

Therefore, producer i's programme can be rewritten as:

$$\max_{w_i} \pi_i = (p_i(w_i) - c)q_i(w_i, w_j) + (p_j(w_j) - w_j)q_j(w_i, w_j) - F_j. \tag{72}$$

By substituting the equilibrium values of the last stage of the game, this becomes:

$$\max_{w_i} \pi_i = \left(\tfrac{a + w_i(b-\gamma)}{2(b-\gamma)} - c \right) \tfrac{a - bw_i + \gamma w_j}{2} + \left(\tfrac{a + w_j(b-\gamma)}{2(b-\gamma)} - w_j \right) \tfrac{a - bw_j + \gamma w_i}{2} - F_j. \tag{73}$$

By taking $\partial \pi_i / \partial w_i = 0$ and simplifying, one can check that the symmetric equilibrium is given by $w_i = w_j = c$. In turn, this implies that the final resale price is $p_i = p_j = a/[2(b-\gamma)] + c/2$, which corresponds to the joint profit maximising price, i.e., the price that the two manufacturers would set if they could sell directly and openly colluded. Indeed, by labeling π_m the joint profits, one has: $\pi_m = (p_A - c)(a - bp_A + \gamma p_B) + (p_B - c)(a - bp_B + \gamma p_A)$. From $\partial\pi_m/\partial w_i = 0$ it is straightforward to check that $p_m = a/[2(b-\gamma)] + c/2$.

RPM and common agency If they can impose resale prices, the manufacturers have an additional strategic variable, that is p_i. Their problem is now given by:

$$\max_{w_i, F_i, p_i} \pi_i = (w_i - c)q_i(p_i, p_j) + F_i,\ s.to: \sum_{\substack{i=1,2;\\ i\neq j}} [(p_i - w_i)q_i(p_i, p_j) - F_i] \geq 0. \tag{74}$$

At equilibrium, the retailer's constraint is binding:

$$F_i = (p_i - w_i)q_i(p_i, p_j) + (p_j - w_j)q_j(p_i, p_j) - F_j. \tag{75}$$

Therefore, producer i's programme can be rewritten as:

$$\max_{w_i, p_i} \pi_i = (p_i - c)q_i(p_i, p_j) + (p_j - w_j)q_j(p_i, p_j) - F_j. \tag{76}$$

After substituting the specific functional form assumed for demand, this becomes:

$$\max_{w_i, p_i} \pi_i = (p_i - c)(a - bp_i + \gamma p_j) + (p_j - w_j)(a - bp_j + \gamma p_i) - F_j. \tag{77}$$

By solving $\partial\pi_i/\partial p_i = 0$ one obtains the optimal price: $p_i = (a + c - \gamma w_j)/[2(b-\gamma)]$. Note that the equilibrium wholesale prices here are not determined, as π_i is not a function of w_i. However, given a pair of wholesale prices (w_i, w_j), the equilibrium (final) prices decrease in the wholesale prices. More importantly, if the wholesale prices equal the manufacturers' marginal costs ($w_i = w_j = c$), then $p_i = p_j = p_m = a/[2(b-\gamma)] + c/2$. In other words, a continuum of prices can arise as the equilibrium of the game, and the collusive price is one of these equilibria.

Note also that the collusive equilibrium would become unique under many selection criteria (for instance, Pareto dominance), as well as in a natural situation where retailers are asked to make some effort in order to sell the good. Exercise 9 shows that this is the case.

4 Anti-competitive effects: leverage and foreclosure

One of the most passionate and intriguing debates in the field of antitrust is whether a firm could use anticompetitive practices to protect and reinforce the market power it has in one market or to extend it to other markets. This is an issue which will be discussed at length in chapter 7 (on monopolisation and abuse of dominance), but it is appropriate to deal with it here, as some of the possible anticompetitive practices under consideration consist of vertical restraints.

It has been suggested, for instance, that exclusive dealing might allow a firm enjoying a dominant position to deter entry into the market, by foreclosing a crucial input (the distribution network) or by making it more difficult or expensive for the entrant to obtain such input. It has also been suggested that a vertical merger might have similar effects: if an upstream firm that has a dominant position takes over one of many downstream sellers, it might stop supplying the competitors of its downstream subsidiary, or supplying them at a higher price which puts them at a disadvantage.

We shall see in this section that - despite the appeal that such arguments might have at first sight - it is far from being the general case that a dominant firm will have the incentive to engage in such practices. In fact, it is only very recently that economic theory has managed to provide formal examples of situations where that could happen.

In what follows, I deal separately with the possible anticompetitive effects of exclusive contracts and vertical mergers. In both cases, I will first recall the "Chicago school" arguments which stressed the little plausibility of foreclosure effects, then I analyse recent ("post-Chicago") models where foreclosure effects might indeed arise. Finally, I will assess the practical value of these theories, pointing out that the anticompetitive motivations highlighted by them should be contrasted with possible efficiency effects that exclusive dealing or vertical mergers might have.

4.1 Anticompetitive effects: Exclusive dealing

The concern that a dominant firm might use exclusive contracts to damage actual or potential competitors is an old one. However, economic theory has often reacted skeptically to the possibility that exclusive contracts might lead to foreclosure. More particularly, since the 50's the so-called Chicago school has emphasised the efficiency effects of such contracts and played down the plausibility of the foreclosure arguments. Posner (1976) and Bork (1978) summarise the "Chicago" arguments on the issue. They point out that for an exclusive contract between an incumbent seller and a buyer (or distributor) to be signed, the latter should receive a benefit from it. Instead, the argument goes, a rational buyer would not be willing to accept a contract which obliges her to buy from an inefficient incumbent if a more efficient competitor is willing to enter the industry.

Suppose for instance there is an incumbent monopolist, a potential entrant (more efficient than the incumbent) and only one buyer in a certain industry. By accepting an exclusive dealing contract, a buyer would commit to buy from a monopolist even if entry occurs. This rules out entry, and the buyer will end up paying the monopoly price for the good. By rejecting the contract offer, instead, the buyer would trigger entry and benefit from a lower price. Sure enough, the incumbent might offer a compensation to the buyer to persuade her to accept exclusivity. However, the incumbent is willing to pay a compensation no higher than its monopoly profit, whereas the buyer - by accepting the exclusive contract - would lose all the consumer surplus that arises by buying at lower prices (namely, with constant marginal cost, the profit of the incumbent plus the deadweight loss). Section 4.1.1 formalises this argument.

Figure 6.6 illustrates it. Suppose the incumbent has unit cost c_I and would make a profit π^m if it enjoyed a monopoly, corresponding to the area $p^m ADc_I$. The entrant has cost $c_E < c_I$: if it entered, it could set a price just slightly below c_I and get all the market for itself. Therefore, price if entry occurs would be (slightly lower than) c_I. The buyer would get a surplus CS^m, corresponding to the area θAp^m, under monopoly, and a surplus CS^e equal to the area θBc_I, if entry occurs. Therefore, to be persuaded to deal exclusively with the incumbent, the buyer should receive an offer t higher than the gain it makes if entry occurs, $CS^e - CS^m$. This is equivalent to the area $p^m ABc_I$. However, it is clear that the incumbent could never make such a high offer, since its profit $\pi^m < CS^e - CS^m$.

INSERT Figure 6.6. The "Chicago School" critique to foreclosure

The implication of this argument is not that exclusive contracts will never be observed, but rather that - if they exist - it is because they entail some efficiency gains, but since these gains are beneficial for both the firm which uses such contracts and for consumers, there should be no reason why antitrust authorities should intervene and forbid such contracts.

Post-chicago models The argument above, which is still valid, emphasises that it is less likely than it might appear at first sight that a firm engages in exclusive contracts with a view to monopolising the market (and that pro-competitive effects are often behind such contracts). However, recent theoretical contributions do offer examples of circumstances under which exclusive contracts will lead to anticompetitive effects.

The main insight behind the recent models of exclusion can be understood by refering to the same example used above. In that example, the incumbent is not able to make an offer large enough to persuade the buyer to accept an exclusive deal. However, there are circumstances under which this is possible, and these circumstances refer to the existence of externalities with respect to the relationship between the incumbent and the buyer who is considering the exclusive deal. For instance, imagine that by excluding the entrant the incumbent makes not only the monopoly profit in the market under consideration, but also manages to increase profit on another market (for instance because the potential entrant cannot enjoy economies of scope by producing in two markets). In this case, the incumbent, by excluding the entrant, would make π^m plus some additional profit from another market: it could now be possible to make an offer high enough to induce the buyer to accept the exclusive deal.

Most of the recent works that show that an incumbent might use exclusive deals to foreclose entry rely on different externalities that explain why foreclosure might be profitable. Such works include Aghion and Bolton (1987), Rasmusen et al (1991), Segal and Whinston (2000a) and Bernheim and Whinston (1998).[58]

Aghion and Bolton (1987) illustrate how an incumbent and a buyer might agree on a partially exclusive contract which might prevent entry of a more efficient competitor. In their model, the buyer can be released from the exclusivity relationship by paying a penalty to the incumbent. Effectively, what happens in their setting is that incumbent and buyer agree on a contract which enables them to extract some of the rent the entrant would have in case of entry (the area $c_I B E c_E$ in figure 6.6 above). Exclusion does not always occur, but when it does it is anticompetitive. Section 4.1.1 shows the argument more formally.

Rasmusen et al (1991) and Segal and Whinston (2000a) show another circumstance where exclusive dealing might deter entry. If there are many buyers in the market that cannot coordinate their purchases, and if a potential entrant needs to secure a certain number of them to cover its fixed costs, then an incumbent might exploit the lack of coordination among buyers to deter entry. At the moment of accepting an exclusivity offer from the incumbent, each buyer does not take into account that by doing so it imposes an externality on the other buyers. In other words, if all the others accept the exclusive dealing offer from the incumbent, one of them has no incentive alone to reject the exclusivity contract from the incumbent, as a "free" buyer alone would not be able to trigger entry by addressing the entrant (as the entrant would need several buyers to cover its fixed cost of entry).

To illustrate the model refer to figure 6.6 above, but with two identical buyers rather than one. Each buyer is described by the demand function $\theta\theta'$. The incumbent makes each of them an offer in exchange for an exclusive deal,

[58] There is also another literature that considers the anti-competitive potential of exclusive dealing through *raising rivals' costs* strategies. In Comanor and Frech (1984), exclusive dealing contracts between a dominant manufacturer (which enjoys a product differentiation advantage) and established retailers forecloses access of a rival firm to those retailers and obliges it to use a less efficient distribution channel. However, Schwartz (1987) shows that the model used by Comanor and Frech is not carefully formulated. By carrying out the correct analysis, he proves the opposite results: exclusive dealing might arise, but would lead to lower, rather than higher, prices for consumers. Mathewson and Winter (1987) also reformulate Comanor and Frech's model (by making different modeling assumptions on product differentiation) and show that exclusive dealing need not be anti-competitive even if it leads to the exclusion of rivals. These works show that: first, exclusionary effects might be accounted for by theory, but tend to arise in models which require particular assumptions and settings. Second, that even when exclusion does arise, it might lead to welfare improvement.

they accept or reject the offer, and then a more efficient entrant decides on entry (but it covers fixed cost only if it sells to both buyers). When the incumbent negotiates the deal with a buyer, it can offer it twice its profit, since by getting an exclusive buyer it would get monopoly profit on two markets. Provided that $2\pi^m > CS^e - CS^m$ (not a strong assumption), it can now offer a compensation t which induces one buyer to accept the deal, thereby blocking entry for both buyers. (In fact, there is an exclusionary equilibrium where the incumbent pays zero compensation: even if offered nothing, a buyer alone knows that it would not be enough to induce entry, and therefore accepts the deal.)

However, there is also another equilibrium where all buyers buy from the entrant.[59] If all reject the incumbent's contract, entry will occur (the entrant is more efficient), and they will all end up buying from the entrant at a lower price. This is clearly an equilibrium, as no buyer would have an incentive to unilaterally deviate and accept the incumbent's contract.

If the buyers were allowed to coordinate their purchase decisions, then they would not accept the deal and entry would occur.[60] This is not surprising, since the argument above is built upon the fact that each buyer takes its acceptance decisions separately, and does not take into account that by accepting the deal it imposes an externality upon the other buyers. If the buyers can act as if they were a single buyer, they would reject the offer from the incumbent and would buy from the entrant at a lower price. Therefore, this model speaks in favour of *central purchasing agencies*, that is agencies which coordinate (otherwise independent) buyers' decisions, thereby breaking possible inefficient miscoordination outcomes.

Fumagalli and Motta (2002) qualify the entry deterrence power of exclusive deals. They analyse a model that incorporates the same features as Segal and Whinston (2000a), with the variant that buyers are not final consumers, but are instead competing with each other in a downstream market. They show that if buyers' competition is strong enough, a single buyer would have an incentive to break the exclusionary equilibrium, since by securing a cheaper input it would enjoy a larger share of the downstream market. Consider for instance the extreme case where downstream competition is à la Bertrand and goods are very close substitutes. In that case, any buyer would have an incentive not to accept the incumbent's offer, because in this way a buyer could address the more efficient entrant, buy from it at a lower price than all other buyers, and hence obtain most of the market for itself. (The entrant here does enter when addressed by a single deviant buyer, because the latter will buy enough units since it is able to get all the market.) An alternative way to express this result in similar terms as the Chicago argument above, is that when downstream competition is strong enough, the incumbent cannot pay a large enough compensation to convince buyers to accept the exclusive contract.

Note that in the abovementioned papers (Aghion and Bolton (1987), Ras-

[59] This is true in the simultaneous and non-discriminatory offers game. If the incumbent could discriminate offers or could exclusive deals sequentially, the exclusionary equilibrium would be unique. See technical section 4.1.1 for a discussion.

[60] More precisely, this is the only coalition-proof equilibrium of the game.

musen et al. (1991) and Segal and Whinston (2000a)), a key feature is that the exclusive contract between the incumbent and a buyer exercises some type or other of externality on (one or more) third parties. This principle is emphasised by Bernheim and Whinston (1998), a paper where the issue of whether exclusive dealing can give rise to foreclosure or market leverage is studied in a more general fashion.

4.1.1 Exclusive dealing and entry deterrence*

In this section I briefly describe the main models mentioned in the text on exclusive dealing and entry deterrence. First, I present the Chicago argument according to which exclusionary contracts would not be profitable. Then I present a simplified version of Aghion and Bolton (1987), and of the miscoordination argument due to Rasmusen et al. (1991), as later refined by Segal and Whinston (2000a).

Exclusive dealing: Chicago arguments* Consider the following model. There is an incumbent firm which produces at a cost c_I, and a potential entrant which - after paying a fixed cost of entry, f - could produce the same homogenous good at a cost c_E.[61] We assume - to make things interesting - that $c_E < c_I$ (if the incumbent was more efficient, exclusive contracts would not be at hand since entry would never occur). The game is as follows. In the first stage, the incumbent firm might offer the only buyer a compensation t in order for her to accept an exclusive contract. In the second stage, the buyer accepts or rejects the offer. If she accepted, she could buy only the incumbent's product; if she rejected, she could also buy the entrant's product. In the third stage, the potential entrant - after having observed whether a contract has been signed or not by the buyer - decides on entry (and sinks entry costs if it enters). In the last stage, firms in the market choose prices.

Demand is given by $D(p) = \theta - p$, with $\theta > 2c_I + c_E$ (this condition restricts the cases to be considered in the price game, see below).

Assume also that the entrant would find it profitable to enter in the absence of exclusive contracts: $(c_I - c_E)(\theta - c_I) > f$.

We can now solve the model backwards, to show that there are no entry-deterrence exclusive contracts which can be profitable for the incumbent and that would be accepted by the buyer.

At the last stage of the game, if no entry has occurred, the incumbent is the only seller and chooses price to maximise monopoly profit: $\max_p \pi = (\theta - p)(p - c_I)$. By taking FOCs and solving it is easy to check that under monopoly prices, profit and consumer surplus are:

[61] The assumption that the entrant has to pay a positive fixed cost of entry is not necessary. I just anticipate what is a crucial assumption for the entry deterrence model of Rasmusen et al (1991) and Segal and Whinston (2000a).

$$p^m = \frac{\theta + c_I}{2}; \quad \pi^m = \frac{(\theta - c_I)^2}{4}; \quad CS^m = \frac{(\theta - c_I)^2}{8}. \tag{78}$$

If instead entry had occurred, then Bertrand competition implies that the market will be served by the more efficient entrant firm at the price which equals the marginal cost of the incumbent: $p^e = c_I$.[62] Consumer surplus is easily computed as $CS^e = (\theta - c_I)^2/2$.

At the previous stage, entry occurs if the buyer is "free", i.e., she has not signed the exclusive contract. Else, entry does not occur.

Next, we have to check if the buyer accepts the exclusivity offer from the incumbent. She will if the compensation offered by the incumbent will offset the loss in surplus from having to buy from a monopolist: $CS^m + t \geq CS^e$. In other words the buyer accepts if $t \geq 3(\theta - c_I)^2/8 \equiv t_{\min}$.

Finally, by offering the contract the incumbent has a payoff $\pi^m - t$, whereas by not having exclusivity it will have zero payoff. After substitution, it is easy to see that the maximum compensation that the incumbent is willing to pay is $t = (\theta - c_I)^2/4 < t_{\min}$. Therefore, the incumbent will not be able to induce the buyer to accept the exclusive contract, and entry will not be deterred.

Contracts as a barrier to entry* Consider a homogenous good industry with an incumbent firm I having a cost $c_I = 1/2$ and a buyer with unit demand whose valuation for the good is $v = 1$. There exists a potential entrant E in this industry, whose cost c_E is uniformly distributed in $[0, 1]$. We consider an exclusive dealing contract (p, p_o) according to which - if accepted - the buyer commits to buy from the incumbent at a price p at a later stage, but it can be released from the exclusivity clause (and buy from the entrant) after the payment of a penalty (or "liquidated damages") p_o.[63]

The game is as follows. At time t_1, the incumbent I offers a contract (p, p_o) to the buyer, who can either accept it or reject it. At time t_2, the potential entrant decides on entry and sets a price p_E. (If no contract has been signed, the incumbent also chooses its price p.) At time t_3, there is product market and payoff realisation.

No contract First, consider the case where no exclusive dealing clause exists. Since there is price competition, firm E will enter only if its cost c_E is lower than $1/2$. In this case, it charges price $p_E = 1/2$ and gets all the market. Therefore, the probability that entry occurs is $\phi = \Pr(c_E \leq 1/2) = 1/2$ (due to the assumption of uniform distribution), and the buyer has a surplus

[62] If the entrant was much more efficient than the incumbent it could be that the entrant's monopoly price, $(\theta + c_E)/2$, is lower than c_I. The assumption made above on θ guarantees that this is not the case, and simplifies the analysis.

[63] Aghion and Bolton (1987) show that restricting attention to such a simple contract is without loss of generality.

$v - p_E = 1 - 1/2 = 1/2$. If $c_E > 1/2$, the entrant will not enter and firm I will charge $p = 1$. In this case, occurring with probability $(1 - \phi)$, the buyer has a surplus $v - p_I = 0$.

Therefore, if no contract exists the buyer's expected surplus is $\phi(1/2) + (1 - \phi)0 = 1/4$, and the incumbent's expected payoff is $\phi(0) + (1 - \phi)(1 - 1/2) = 1/4$.

Exclusivity contract If the buyer has accepted the contract (p, p_o), it will buy from firm E only if the latter firm's price plus the penalty p_o due to the incumbent is lower than the incumbent's price: $p_E + p_o \leq p$. Therefore, if it enters, firm E will charge $p_E = p - p_o$. In turn, entry will occur only if the cost of the entrant is lower than the expected price. Calling ϕ' the probability of entry if a contract exists, it will be $\phi' = \Pr(c_E \leq p - p_o) = p - p_o$.[64]

Let us now look at the incumbent's problem, which is the following:

$$\max_{p,p_o} \pi = \phi' p_o + (1 - \phi')(p - 1/2) \quad s.to : 1 - p \geq 1/4. \tag{79}$$

In other words, the incumbent has to choose the optimal price and penalty so as to maximise its expected profit. This is given by - in expected terms - the penalty if the entrant turns out to be efficient enough so as to charge a low enough price plus the sales price if the entrant has a high enough cost. However, the contract will be accepted by the buyer only insofar as it gives the latter at least the same expected surplus $1 - p$ as without the contract (where the surplus is $1/4$): this explains the constraint in the problem above.

The problem can then be written as $\max_{p_o} \pi$ subject to: $p \leq 3/4$, whose solution is given by $(p^*, p_o^*) = (3/4, 1/2)$. This implies that firm E will enter the market with a probability $\phi' = p^* - p_o^* = 1/4$. Since efficiency would require entry whenever $c_E \leq 1/2$, whereas under the contract entry occurs only if $c_E \leq 1/4$, there is a welfare loss: for $1/4 < c_E \leq 1/2$ efficient entry does not occur due to the exclusive contract.[65]

As a last step, let us check that the incumbent is better off offering this contract than not. This is easily verified, as under the contract firm I has an expected profit which is larger than what it would get without the contract: $\pi = (1/4)(1/2) + (3/4)(1/4) = 5/16 > 1/4$.

It is worth underlining that exclusive dealing does not always deter entry. When the entrant is very efficient, the incumbent prefers to allow entry and extract some of the entrant's rent through the penalty, rather than to deter entry completely.

Naked exclusion* Consider an incumbent firm selling to two distinct buyers, $B1$ and $B2$, each in a separate market and with the same demand function.

[64] Provided that $p \geq p_o$ (which is the case at equilibrium). Otherwise, the probability of entry is zero.

[65] A vertical merger between the incumbent and the buyer would give exactly the same outcome. See Tirole (1988: 196).

Simultaneous non-discriminatory offers The incumbent simultaneously offers them a fixed compensation t (to start with, suppose it must be the same for each buyer) in exchange for an exclusive deal. Buyers then simultaneously accept or reject the offer. Then, an entrant observes their decisions and decides on its entry. If it enters, it pays a fixed entry cost F (the same entry cost allows it to serve both buyers). Finally, price decisions are taken by operative suppliers. Assume that $\pi^m < CS^e - CS^m < 2\pi^m$ (the first inequality is a natural assumption, as seen above; the second is also satisfied under mild assumptions) and that $(c_I - c_E)q(c_I) < F < 2(c_I - c_E)q(c_I)$, which means that entry is not profitable if the entrant served only one buyer, but it would be profitable if serving both buyers (otherwise, the problem would be uninteresting).

At the last stage of the game, price decisions are straightforward. At equilibrium, if entry has occurred, the entrant charges c_I and get every free buyer. The incumbent charges p^m to every exclusive buyer. The buyers' decisions can be illustrated by the payoff matrix in Table 6.1.

INSERT Table 6.1. Segal-Whinston: simultaneous offers

The game has two equilibria. The first equilibrium is (accept,accept), where both buyers accept the offer. When the other buyer accepts the deal, by accepting it a buyer obtains a payoff $CS^m + t$; by deviating and rejecting the offer it would get CS^m (recall that a buyer alone would not induce entry). Therefore, the equilibrium arises for any $t \geq 0$.

There is also a second equilibrium, (reject,reject), where no buyer accepts the deal. There is no profitable deviation from this pair: by deviating and accepting the deal when the other rejects it a buyer would have to make $CS^m + t > CS^e$. But there is no t which satisfies $t > CS^e - CS^m$, since by assumption $\pi^m < CS^e - CS^m$.

There are therefore two equilibria of the whole game. One (exclusionary equilibrium), where the incumbent offers $t = 0$ and both buyers accept the deal. The other where it offers $t = 0$ and both buyers reject it. Naked exclusion arises at equilibrium, but it is not the only outcome.

Simultaneous discriminatory offers Suppose now that the same game as above is played, but that the incumbent can differentiate the offers, so that it can offer $t_1 > t_2$. The payoff matrix of Table 6.2 illustrates the new game.

INSERT Table 6.2. Segal-Whinston: discriminatory offers

It is clear that the pair (accept, accept) is still an equilibrium of the game for any $t_i \geq 0$, since by deviating from it and rejecting the deal when the other accepts it, a buyer Bi $(i = 1, 2)$ would get $CS^m + t_i \leq CS^m$. However, the equilibrium (reject, reject) is not an equilibrium any longer. To see why, notice that when buyer $B2$ rejects the contract, buyer $B1$ would get $CS^m + t_1$ by accepting the deal and CS^e by rejecting it. However, by offering a much better deal to $B1$ than $B2$, the incumbent can make it convenient for the former to accept the deal. In other words, this equilibrium is broken if $t_1 > CS^e - CS^m$, which is possible since we assumed $CS^e - CS^m < 2\pi^m$.[66]

Sequential offers The neatest example of naked exclusion arises when the incumbent can make sequential offers. Figure 6.7 illustrates the game in this case.

INSERT Figure 6.7. Segal-Whinston: sequential offers

Suppose first that the first buyer has rejected the deal in the first round, and it is up to $B2$ to decide. This buyer accepts the exclusive deal if $t_2 \geq CS^e - CS^m$, and we have just seen that the incumbent is willing to offer such high compensations. Therefore, $B2$ can always be induced to accept if $B1$ has rejected.

Suppose instead that the first buyer has accepted the deal. In this case, $B2$ accepts the deal whatever the level of the compensation, since $CS^m + t_2$ is at least as high as CS^m.

When it comes to its own decision, buyer $B1$ knows that if it accepts, the next buyer would accept too, and therefore would get $CS^m + t_1$; if it rejects, the next buyer would always accept the deal, so that $B1$ would get CS^m. Clearly, it prefers to accept the deal for any compensation level. Therefore, at the unique equilibrium the incumbent is able to offer zero (or slightly above zero) compensations, and have both buyers accepting the deal. Pure exclusion occurs, and it costs nothing to the incumbent.

Conclusions Which conclusions can be drawn from this analysis? Certainly, recent models show that exclusive contracts have a strong entry-deterrence potential. However, it should not be forgotten that exclusive contracts often have efficiency reasons as well (see also Segal and Whinston, 2000b).[67] A better understanding of how to balance exclusionary and efficiency effects of exclusive contracts is needed, but it seems safe to assume that the former might dominate the latter only if the firm using exclusive contracts has a very strong market position.

4.2 Exclusionary effects of vertical mergers

The previous sections have showed that vertical mergers have positive effects upon welfare in many circumstances, for instance, by getting rid of the dou-

[66] For instance, in the linear demand example above, in each market the incumbent can make $\pi^m = (\theta - c_I)^2/4$, while $CS^e - CS^m = 3(\theta - c_I)^2/8$. Since by getting an exclusive deal the incumbent would get monopoly profits in two markets, it is willing to pay up to 2 $\pi^m = (\theta - c_I)^2/2 > CS^e - CS^m$ to get buyer $B1$, thereby preventing entry.

[67] Heide, Dutta and Bergen (1998) provide some evidence based on survey data that efficiency reasons are more likely than foreclosure reasons and entry deterrence or other anticompetitive use of exclusive dealing. Of course, however, this does not mean that their conclusion has general applicability and justifies a presumption that exclusive deals are always good. It just means that efficiency reasons behind exclusive contracts are not just a theoretical possibility but they are quite common.

ble marginalisation problem or eliminating free-riding distortions. But might vertical mergers be anti-competitive? It has often been maintained that by integrating downstream, for instance, an input supplier would deny access to the input to all its downstream rivals, thereby gaining market power in the downstream market. However appealing at first sight, this argument has been debated by economists for a long time, and competition laws have also had quite different stances towards vertical mergers, in different countries and at different times.

The influential Chicago School maintained that this argument was not correct, and argued that vertical mergers are efficient. This claim was based on a model where an upstream monopolist sells to perfectly competitive firms. In such circumstances (as we know already from section 2.1), the upstream monopolist is able to extract all the profits from the market (since there is no problem of double marginalisation). Hence, a vertical merger would not add market power to the monopolist (from this the label *single monopoly profit* to this theory): if a vertical merger takes place, it must be because some efficiencies are created. (See section 4.2.1.)

In a more general framework (that is, referring to the case where there are several firms upstream and downstream), the Chicago School proponents also pointed out that even if an integrated firm reduced or ceased the supply of input to downstream rivals, it is not clear that this would result in effective input foreclosure: first, other suppliers might increase their share of the input market; second, the fact that the integrated firm does not buy in the input market reduces the demand for the inputs, possibly reducing the equilibrium prices in the input markets. It might well be that wholesale prices decrease, rather than increase, after the vertical merger.

It is only recently that economists have rigorously showed that under certain circumstances vertical mergers can result in foreclosure and anti-competitive outcomes. The reader should recall, that we have already seen an instance where a vertical merger might reduce welfare. This was the case where vertical integration allows a firm to solve a commitment problem (see section 2.5) and keep its prices high.

More generally, recent game theoretic models allow to analyse situations where there exist several downstream and/or several upstream firms, and show that in certain cases a vertical merger *might* create foreclosure. To understand the issues at hand, consider a hypothetical situation where a vertical merger between an upstream and a downstream firm takes place. What is the effect of the merger on the input paid by the independent downstream firms and on the price paid by consumers?

There are a number of effects that one has to take into account to answer this question. The main ones are as follows. First of all, one should check whether it is in the interest of the integrated firm to continue to supply the independent downstream firms, or to raise the price of the input it sells them.[68] If the latter

[68] Ceasing to supply can be seen as the extreme case of raising input prices to downstream rivals, when the input price becomes prohibitively high so that demand would go down to

serve an at least partially different market than the integrated downstream firm, ceasing to supply them or supplying them at higher prices, would entail foregoing profits. If the other upstream firms are competitive enough, raising input prices might not be a profitable strategy for the integrated firm. To understand the incentive of the integrated firm to increase price of the input sold to independent downstream firms, one has to carry out a similar analysis as in horizontal mergers to see whether the merging firms will be able to increase prices. Variables to consider will therefore be: the elasticity of demand for the input; the excess capacity of the upstream rivals; the existence of potential entrants (and the ease of entry), and so on.

Second, even if the upstream integrated firm ceases to supply (or sells at higher prices to) the downstream rival firms, it is not said that the cost of the input for the latter will increase, because (i) the other upstream firms might increase their supply of the input, and (ii) because the lower demand for the input (caused by the withdrawal from the market of the downstream affiliate of the integrated firm) will tend to reduce input prices. One has therefore to check, among other things, the extent to which other upstream producers sell close enough substitute inputs and whether they are not capacity constrained.

Third, even if foreclosure exists (in the sense that input prices paid by independent firms will increase), this does not necessarily imply that the downstream affiliate of the integrated firm is able to raise prices. There might be enough competition in the downstream market to make it difficult for it to exercise market power (here again, supply and demand characteristics of the market will determine the extent to which the downstream firm can raise prices). Further, the final effect on consumer surplus (and welfare) might still be beneficial due to the elimination of double marginalisation within the integrated chain. The final price might decrease, rather than increase, despite the independent downstream firms paying a higher price for the input.

It is impossible to say a priori which effect dominates over the others, but one should none the less conclude that a number of conditions must hold for a vertical merger to give rise to anti-competitive foreclosure. Further, one should also take into account that the vertical merger might involve efficiencies (other than double marginalisation) that one should balance with the possible foreclosure effects, as we indicate in section 5.

4.2.1 Exclusionary effects of vertical mergers*

One monopoly profit only* Consider an upstream monopolist U that sells to two downstream firms, D_1 and D_2, which sell a homogenous good to final consumers (having demand $q = 1 - p$), and compete in prices.[69] Assume that for each unit of output a unit of input must be bought (fixed proportions technology). The upstream firm makes take-it-or-leave-it offers to the downstream firms and these are observable and not renegotiable. Assume also that U has

zero.

[69] The original assumption of the Chicago School theory is that downstream firms are perfectly competitive.

a marginal cost $c < 1$ and that downstream firms' only cost is the price of the input, w.

In this case, a vertical merger could not increase the profit of the upstream firm. Therefore, a vertical merger would take place only if it entailed some efficiency gain. To see this, compare the two alternative structures.

Vertical separation. The downstream sellers compete in prices. Denoting with w the price at which they buy the input, the market price of the final good at equilibrium will be $p_1 = p_2 = w$,[70] and the total output will be $q = 1 - w$. The upstream firm will choose w to maximise its profits $\pi^U = (w - c)(1 - w)$. Hence, $w = (1 + c)/2$ at equilibrium, resulting in market price $p = (1 + c)/2$, and total profit for U equal to $\pi^U = (1 - c)^2/4$.

Note that this is precisely the same outcome that firm U would obtain if it sold the product directly.

Vertical merger with a downstream firm. Suppose now that the upstream firm merges with one of the retailers, say D_1. In this case, the upstream firm can either continue to set the same wholesale price as above, or sell to its affiliate D_1 only at the price $w = c$. D_1 would then choose the price $p = (1+c)/2$ which maximises its profit $\pi = (p - c)(1 - p)$. As a result, however, the total profit of the integrated firm would still be $\pi^I = (1 - c)^2/4$ (and final prices would remain unchanged). Therefore, there is no incentive to merge in this situation: if a vertical merger arises, it is only because it would lead to efficiency gains.

Recent theories: Is there foreclosure from vertical mergers?* The very simple model above builds on a number of assumptions that, if relaxed, would give rise to different results, although not all interpretable as to suggest that vertical mergers are anti-competitive.

Unobservable offers. First of all, consider the case where the upstream firm's offers are unobservable. In this case, we know from section 2.5.1 that the upstream firm might have an incentive to merge with a downstream firm so as to solve its commitment problem. In this situation, the merger will lead to foreclosure of the downstream rival, and this will be anti-competitive, in the sense that it will lead to higher prices. However, notice that this conclusion hinges on the assumption that the upstream firm was unable to solve its commitment problem through vertical restraints.

Downstream firms have market power. Efficient foreclosure Second, consider the case where offers are observable but downstream firms D_1 and D_2 have some market power. In particular, assume for simplicity that they compete in quantities rather than prices (to model market power with prices we would need differentiated products). Inverse demand is given by $p = 1 - q_1 - q_2$.

[70] If $w_i < w_j$ downstream firm i which pays less for the input will get all the market by selling at the price w_j. However, this will not be optimal for U, as it would leave some of its rents to downstream firm i.

Under *vertical separation*, at a symmetric equilibrium the downstream firms will pay w for the input. They choose q_i to maximise $\pi_i = (p-w)q_i$. This is the standard Cournot game, resulting in equilibrium quantities $q_1 = q_2 = (1-w)/3$, and equilibrium price $p = (1+2w)/3$.

If the upstream firm is constrained to linear contracts, then it will choose w to maximise $\pi^U = 2(w-c)(1-w)/3$. From the FOCs it follows that $w^s = (1+c)/2$. By substitution, one obtains final prices and the upstream firm's profits as $p^s = (2+c)/3$ and $\pi^{U,s} = (1-c)^2/6$, whereas each downstream firm makes $\pi^{i,s} = (1-c)^2/36$.

Consider now a vertical merger between U and D_1. The best thing that U can do is to foreclose the rival downstream firm by not providing any input to it, whereas providing its own affiliate at input $w = c$. In this case, D_1 will charge price $p^{vi} = (1+c)/2$, and the vertical merger will give the integrated firm profits $\pi^{vi} = (1-c)^2/4$. The merger is profitable, since $\pi^{vi} > \pi^{U,s} + \pi^{1,s}$.

In this simple model, therefore, there exists foreclosure and the rival downstream firm is hurt by the vertical merger. However, the merger is efficient because it removes double marginalisation. Indeed, it can be easily checked that $p^{vi} < p^s$, which implies that consumers also gain from the vertical merger. (It is easily checked that welfare increases with respect to the case of vertical separation.)

Upstream firm is not a monopolist: possible anti-competitive foreclosure Let us analyse now an example where the upstream firm is not a monopolist any longer. To make things as simple as possible, consider a setting where the upstream firms U_1 and U_2 have respectively marginal cost $c_1 = 0$ and $c_2 \in (0, 1/2)$ and simultaneously choose the prices at which they offer the input to D_1 and D_2, which compete in quantities. Effectively, this is as if the downstream firms were making a simultaneous procurement auction. Let us consider the effect of a vertical merger between U_1 and D_1.

Consider first the case when all firms are independent. In this case, each of the two firms will receive the input from firm U_1 at a price c_2, since the upstream firms are playing a Bertrand game with asymmetric costs. The downstream firms play a standard Cournot game with cost c_2, and being otherwise symmetric the equilibrium quantities and prices are given by: $q_1^{vs} = q_2^{vs} = (1-c_2)/3$, and $p^{vs} = (1+2c_2)/3$. Firm U_1's profits are given by $\pi_{U1} = 2c_2(1-c_2)/3$, whereas each downstream firm earns $\pi_i = (1-c_2)^2/9$.

Suppose now that there is the merger between U_1 and D_1 and as a result the integrated firm decides not to provide the input to firm D_2 any longer: U_1 announces that it will not make any bid to supply D_2 (I shall discuss this assumption below). In this case, the less efficient firm U_2 will become the monopolistic supplier of firm D_2.

Since the downstream affiliate of the integrated firm will have a unit cost $c_1 = 0$, the last stage of the game is a Cournot game between firm D_1 with cost 0 and firm D_2 with cost w_2. It is easy to check that equilibrium outputs of this game will be $q_1 = (1+w_2)/3$, and $q_2 = (1-2w_2)/3$.

At the first stage of the game, upstream firm U_2 chooses its wholesale price to firm D_2 to maximise $\pi^{U_2} = (w_2 - c_2)(1 - 2w_2)/3$. The optimal solution is $w_2 = (1 + 2c_2)/4$. Since $w_2 > c_2$, it is clear that downstream firm D_2 is effectively foreclosed relative to the pre-merger situation: the input has become more expensive.

By substitution, one can then check that the equilibrium quantities will be given by $q_2^f = (1 - 2c_2)/6$ and $q_1^f = (5 + 2c_2)/12$; market price by $p^f = (5+2c_2)/12$; and the vertically integrated firm's profits by $\pi_1^f = (5+2c_2)^2/144$ (the label f standing for "foreclosure").

The total profits of the merging firms are higher, since $\pi_1^f > \pi_{U1} + \pi_1$, but the merger is not necessarily efficient: $p^{vs} < p^f$ for $c_2 < 1/6$.

Therefore, if $c_2 < 1/6$, the vertical merger leads to foreclosure and it is anticompetitive (it can be checked that total surplus decreases).

Remark 1. A crucial assumption in this model is that the upstream affiliate of the integrated firm commits not to take part in the supply for the other downstream firm. But does it have an incentive to commit not to supply D_2? If it took part in the competition to supply D_2, it would win it by setting a price c_2. As a result, equilibrium quantities would be $q_2^{nf} = (1 - 2c_2)/3$ and $q_1^{nf} = (1 + c_2)/3$. The final price would be $p^{nf} = (1 + c_2)/3 < p^{vs}$ (the vertical merger would benefit consumers), and $\pi_1^{nf} = (1 + c_2)^2/9 + c_2(1 - 2c_2)/3$. It can be checked that $\pi_1^f > \pi_1^{nf}$ can be rewritten as $(28c_2^2 - 20c_2 + 3) > 0$, which corresponds to $c_2 < 3/14$.

Therefore, for $c_2 < 3/14$ it is optimal for the integrated firm to pre-commit not to supply the rival downstream firm. For $c_2 < 1/6$ the merger is anticompetitive, whereas for $c_2 \in [1/6, 1/2)$ it is not.

Remark 2. In the example I have assumed that there is only one other upstream firm apart from D_1. Assume now instead that there is at least another input supplier having the same cost c_2. In this case, after the vertical merger between D_1 and U_1 the rival downstream firm D_2 would always be supplied at the price c_2 because of the competition among the upstream firms. U_1 would find it more profitable to supply the rival downstream firm itself and the vertical merger would always be pro-competitive because it reduces double marginalisation within the vertically integrated firm.

5 Conclusions and policy implications

We have seen that vertical restraints and vertical mergers have a number of efficiency features: although in some circumstances they might have some anticompetitive effects, a per se prohibition rule would clearly be inappropriate, since it would forego efficiency effects which are likely to dominate in most cases. A rule of reason appears certainly more advisable.

This statement holds for all types of vertical restraints and vertical mergers: different restraints are often substitutable for each other. Furthermore, there is no unanimous ranking of vertical restraints in terms of welfare. Therefore, there is no economic justification for a policy that treats restraints in a different way, say using a per se rule of prohibition against retail price maintenance while always allowing all other restraints.[71] By the same token, it would be inconsistent to have, say, a tough stance against some vertical restraints while being lenient on vertical mergers.

A rule of reason for vertical restraints and vertical mergers does not mean that all vertical agreements should be examined by the antitrust agencies. This would simply be impossible, as they would have to use their scarce resources to monitor thousands of vertical relationships. Vertical restraints and vertical mergers might be anti-competitive only if they involve firms endowed with significant market power (we have seen in several cases that the potential harm created by a vertical restraint decreases with the presence of competitors). Accordingly, there is no need to monitor restraints and mergers which involve firms with little market power. An efficient policy towards vertical restraints would grant exemption to all the vertical restraints and mergers of firms which do not have large market power. From the operational point of view, it would seem a good proxy to exempt firms with market shares below, say, 20-30% (as in the new regime created in the EU, except that practices such as RPM are black-listed: see chapter 1).

This leaves the problem of how to deal with vertical restraints and vertical mergers which involve firms with significant market power (a fortiori, the same applies for dominant firms) and which have possible exclusionary effects. In these cases, a rule of reason should be adopted, and one should balance possible efficiency effects with possible anti-competitive effects.

Balancing exclusionary and efficiency effects of vertical mergers and vertical restraints The analysis of vertical mergers above emphasised that (i) input foreclosure does not necessarily follow from them; (ii) even if downstream rivals are indeed foreclosed, final prices do not necessarily increase. This suggests a two-step procedure for the cases where the vertical merger involves firms above a certain market share threshold.[72] First of all, it should be established whether the merger will likely lead to input foreclosure, that is, that input prices for independent downstream firms will increase (*competitors* will be harmed). If so, the investigation should continue to the second step. If not, the merger should be cleared. In the second step (if applicable), it should be established whether final consumer prices are likely to increase or not (*competition* will be harmed).

A similar procedure should be followed for vertical restraints that might lead to foreclosure of rivals. It should be proved that exclusive dealing (or other

[71] In other words, there is no rationale for adopting block exemptions by type of vertical restraints. As discussed below, it is market power that matters, independently of the type of restraint.

[72] Riordan and Salop (1995) propose a four-step procedure to deal with possible exclusionary vertical mergers which blends in well with the analysis above, and which is similar to the one presented here. Their paper is entirely devoted to this issue and is richer and more complete than my analysis. It is a highly recommended reading.

exclusive clauses, or refusal to supply) would not only harm competitors, but also competition, in the sense of being likely to reduce consumer welfare. The defendant should then be able to produce convincing enough evidence that the vertical restraints adopted entail enough efficiency gains for consumers to benefit from them.

6 Exercises

Exercise 1 ** Consider the same model as in section 2.1.1, but with the following two differences: there exist $n > 1$ retailers downstream, who compete in quantities and have a unit distribution cost d in addition to the wholesale price w they have to pay to the manufacturer. Show that (i) the double marginalisation problem still exists, even if there are two or more retailers downstream ; (ii) the double marginalisation problem disappears as $n \to \infty$.*

Exercise 2 ** Consider now the same model as in exercise 1, but let the n downstream firms compete in price rather than in quantity. Show that the problem of double marginalisation disappears already for $n \geq 2$. Explain.*

Exercise 3 *** Different risk-insurance properties of vertical restraints (Rey and Tirole (1986)). (Note that this is the same model as in section 2.1.2 but with two retailers rather than one.) The following exercise illustrates that different vertical restraints have different properties when there exists asymmetric information and risk aversion of retailers.*

Consider a risk-neutral manufacturer that has a unit cost c and sells via two identical retailers which are infinitely risk-averse and have a unit distribution cost γ. The products sold by retailers are perceived as homogenous,[73] with final demand q given by $q = d - p$. There exist both demand uncertainty $d \in \left[\underline{d}, \overline{d}\right]$ and distribution cost uncertainty $\gamma \in \left[\underline{\gamma}, \overline{\gamma}\right]$, with $\underline{d} > c + \overline{\gamma}$, and with realisations of d and γ being independent. The game is as follows. First, when both market demand d and distribution costs γ are unknown to everybody, the manufacturer makes take-it-or-leave-it-offers to the retailers, in the form of a non-linear contract $(F + wq)$. Second, d and γ are observed by the retailers (but not by the manufacturer). Third, retailers take price decisions p (i.e., they compete à la Bertrand).

Assume that the refusal-to-deal and price discrimination are not possible. (i) Find the optimal contract and the equilibrium solutions for the cases of (1) Competition (C); (2) Exclusive territories (ET); (3) Resale price maintenance (RPM). (ii) Show that under demand uncertainty (fix $E(\gamma) = \overline{\gamma} = \underline{\gamma}$) the following rankings hold: $\pi_C = \pi_{RPM} > \pi_{ET}$, $W_C = W_{RPM} > W_{ET}$. (iii) Show that under cost uncertainty (fix $E(d) = \underline{d} = \overline{d}$) the following rankings hold: $\pi_C > \pi_{ET} > \pi_{RPM}$, $W_C > W_{ET} > W_{RPM}$.

[73] To facilitate interpretation, as in Rey-Tirole (1986) think of the retailers being located away from each other but with consumers having zero cost of transportation.

Exercise 4 *** Consider the same model as in section 2.2.1, but with two differences. First, the cost of providing services now falls upon variable rather than fixed cost:* $C(q_i, e_i) = wq_i + \mu\frac{e_i^2}{2}q_i$. *Second, the quality of services perceived by consumers is given by the maximum quality offered in the market by any retailer:* $e = \max\{e_1, e_2\}$. *(This is the model briefly sketched by Tirole (1988, pp.182-3).) Show that: (i) There is underprovision of services under a separate structure and linear pricing: each retailer offers zero services; (ii) producer surplus is higher under vertical integration with two retailers compared to vertical integration with only one retailer; (iii) vertical integration increases welfare relative to a separate structure; (iv) using exclusive territories and RPM vis-à-vis his two retailers allows the manufacturer to restore the outcome of vertical integration with one retailer.*

Exercise 5 *** Consider the utility function* $U = v\sum_{i=1}^{n} q_i - (1/2)\left(\sum_{i=1}^{n} q_i^2 + 2g\sum_{j\neq i}^{n} q_i q_j\right) + y$ *where* $g \in [0,1]$ *represents the substitutability parameter. This function entails "love for variety", in the sense that demand increases as the number of retailers increases. A manufacturer has unit cost* c *and sells through retailers which sell its product in the final market by competing in quantities to consumers characterised by the utility function above. (In the case of vertical separation, they buy the input at wholesale price* w *and the manufacturer has all the bargaining power. Retailers do not have any costs other than* w*.) (i) Find the equilibrium wholesale price, final price and quantity under vertical separation for any given number of retailers,* n*. (ii) Find the same equilibrium values, again for given* n*, under the assumption of vertical integration. (iii) Endogenise now* n*, and show that there exist values of the fixed cost of entry,* f*, such that only one retailer would enter at a vertically integrated equilibrium, but two retailers would enter at a vertically separated equilibrium. (iv) Show that consumer surplus and welfare are higher under vertical integration with one retailer compared to the vertically separated structure with two retailers.*

Exercise 6 *** Consider a game where a manufacturer first offers (unobservable) contracts which specify the number of units a retailer can buy and the fixed amount for the purchase. Then, each of* n *retailers decides whether to accept or reject such a contract offer and orders the number of units it wants to buy accordingly. Lastly, each retailer brings quantities to the market and the market clears (compare with section 2.5.1). (1) Find the Perfect Bayesian Equilibrium of this game, under the assumption that firms have passive beliefs (if a retailer receives an unexpected offer, it does not change its beliefs about the offer received by a rival retailer.) (2) Show that the larger the number of retailers the stronger the commitment problem of the manufacturer (that is, the lower the profit the manufacturer will make). (3) Find the equilibrium solution under the hypothesis that retailers have symmetric beliefs: when they receive an unexpected offer from the manufacturer, they believe that all other retailers will also receive the same unexpected offer.*

Exercise 7 *** (Commitment problem with linear contracts) Assume an upstream manufacturer,* M*, sells a product to retailers* R_1 *and* R_2*.* M *has a* *constant production cost c, and the retailers' only variable cost is w_i, the wholesale price they pay to M (assume a one-to-one transformation technology). R_1 and R_2 produce a homogenous good and compete in prices.*[74] *Final demand is given by $q = 1 - \min(p_1, p_2)$, where p_i is R_i's price (retailers share the market equally if they have the same price). The manufacturer makes take-it-or-leave-it offers to the retailers. Consider two alternative games. (1) At t_0, M offers each retailer a contract (w_i, F_i), where F_i is a fixed fee. At t_1, each retailer pays F_i. At t_2, each retailer chooses p_i and consumers buy. (2) At t_0, M offers each retailer a contract (w_i). At t_1, each retailer chooses p_i and observes demand q_i. At t_2, each retailer buys q_i, pays $w_i q_i$ to the manufacturer and satisfies consumers' demand.*

(a) Find the vertically integrated solution in this game. (b) Show that in game (1) the manufacturer has an incentive to renegotiate the contract with one retailer when the contract which would restore the vertically integrated outcome is offered to retailers. (c) Show that in game (2) the manufacturer has no incentive to renegotiate the linear contract.

Exercise 8 *** Consider the model in section 3.1.1 and study the following game. At the first stage, each of the two producers decide on whether or not to delegate output decisions to retailers. Then, if choosing delegation, they set the (non-linear) contract to their retailer. Finally, quantities are chosen (by the manufacturer or by its retailer if delegation has been chosen). Show that (i) the equilibrium where both firms delegate is unique, (ii) this configuration makes the firms worse off than if they had both chosen not to delegate; (iii) consumers are better off at the equilibrium.*

Exercise 9 *** Consider the model of section 3.2.2. Two manufacturers make take-it-or-leave-it offers to a common retailer. Each offer specifies the final resale price p_i and a franchise fee contract $F_i + w_i q_i$. The retailer can either accept or reject the offers (but the market fails unless he accepts both offers) and he then decides on the level of effort e_i to market each good i. Assume that $D(p_i, p_j, e_i) = a - bp_i + \gamma p_j + e_i$, and that the retailer's cost of effort is $C(e_i) = ke_i^2/2$. Show that at the unique equilibrium the existence of the common agent allows manufacturers to make collusive profits.*

Exercise 10 ** (A simplified version of Salinger (1988).) Consider a vertical industry where two upstream (homogeneous) firms compete à la Cournot and sell to a centralised market for the input (upstream firms cannot sell directly to downstream firms, they sell to the input market auctioneer). Two downstream (homogenous) firms buy the input in the centralised input market and compete à la Cournot in the final market, where inverse demand is $p = 1 - Q$ (Q being the total output). All firms have zero costs and there is a one-to-one relationship*

[74] Note that with homogenous products and price competition, a non-linear contract is not necessary to restore the first-best (a linear contract is optimal). However, I have chosen to deal with homogenous products for illustrative purposes. One can repeat the exercise with a demand function $q_i = (1/2)(v - p_i(1+\gamma) + (\gamma/2)(p_i + p_j))$ and see that the same results hold under differentiated products, as originally showed by O'Brien and Shaffer (1992).

in the production technology between input and output. (a) Find the equilibrium output and wholesale and final prices. (b) Consider then a vertical merger between an upstream firm and a downstream firm, and assume that after the merger they withdraw from the input market (the downstream affiliate does not buy additional input from the input market and the upstream affiliate does not sell additional input to that market). Show that there is no foreclosure, in the sense that the wholesale price paid in the input market decreases.

Exercise 11 *Consider an industry which produces a good X. To produce this good one needs to transform an input, call it Y, which is not substitutable with other inputs or raw materials. There is only one firm, A, which can supply input Y. Suppose now that there exists only one firm, B, which produces X. Would you allow a merger between these two firms? Justify your answer.*

Exercise 12 *Consider now the same example as before but with the following change. There are two firms, B and Q, which sell good X. Would you allow a merger between firm A and B? Explain which model supports your answer, and briefly describe it.*

Exercise 13 *An internationally successful brand which sells fashion clothes is considering to give a franchise to local agents in a country where sofar it has sold only through exports (it has sofar held only around 1% share of the relevant market, whereas in its home country the firm has almost 55% of the market). It plans to give the franchise only to one franchisee in each town of this foreign country. The franchisees would also have to operate under an exclusivity clause (they cannot sell competitors' products). The fashion firms operating in this market and the large distributors get to know about the franchise contracts and file a complaint with the local competition authority. You are an economic consultant hired by the authority to give an advice on this case.*

Exercise 14 *In an imaginary autarkic (i.e. without imports from abroad) country, film production is a quite concentrated business. Three film companies have around 30% each of the market in an average year, whereas the remaining 10% of the market is (on average) shared by 10-15 independent companies. Distribution in movie theaters is fairly concentrated as well, with 5 companies having more or less the totality of the market. The market leader has 25% of the market. One of the three big film producers has announced a takeover of the largest distribution company. What sort of economic considerations should a competition authority take into account to decide whether or not to clear the takeover proposal?*

Exercise 15 *Nimbus is the market leader of broomsticks, the key device to play the Quidditch game. Its quality is so superior to all other competing suppliers that it manages to charge a very high price premium on its products, even the low-range models. In terms of the number of units sold, it has roughly 40% of the market, but the market share rises to 80% if one looks at the total value of the broomsticks sold. Nimbus does not sell directly to the public, but through dealers* *specialised in magical items. The Magical Ministry for Sports has just found out that Nimbus is price discriminating among dealers. Some dealers manage to get considerable (secret) price discounts relative to others. The Ministry has fined Nimbus on the ground that it is unfairly distorting competition in the market for Quidditch broomsticks, and it has ordered the firm to be transparent on its prices, and to sell to dealers at the same price schedule (but price rebates can be justified if a larger quantity is ordered). You are sitting in Hogwarts School for Witchcraft and Wizardry and answer a question in the exam of the course for Magical Competition Policy: Is the Ministry right or not? Why?*

Exercise 16 *Consider the following case. The firm "Red" is the leader in the English bicycles market, in which it has a market share of 60%. (Market definition is not an issue here, since everybody agrees that the bicycle market is the relevant market.) Two other firms, "Green" and "Yellow" have respectively 15% and 10% of the market, the rest of the sales being distributed among very small firms. "Red" produces different types of bicycles. The top of the range model is "Red Star", which incorporates all the major technological developments in the sector and it is produced by using the most sophisticated materials. This model is sold at a price which is twice as much as the average price of all the other bicycles, and can be bought only in specialised shops. The supermarket chain "Everything" has repeatedly asked "Red" the possibility to sell the model "Red Star", but the firm has always refused to supply it. The supermarket chain could sell all other bicycles produced by "Red", but not the top range model. Given this continuous refusal, "Everything" has decided to denounce "Red" to the Commission of the EC. After a detailed analysis, the latter has decided that "Red" has infringed article 86 (abuse of dominant position). The case is now on appeal at the Court of Justice, and you have to give your opinion on it.*

6.1 Solutions of exercises

Solution of Exercise 1. (i) Under vertical separation, the downstream firms solve the standard Cournot problem, $\max_{q_i} \Pi_{D_i} = (p - w - d)q_i = (a - q_i - \sum_{i \neq j}^{n} q_j - w - d)q_i$. Imposing symmetry on quantities yields $q_i^C = (a - (w + d)) / (1 + n)$ and $\Pi_i^C = [(a - (w + d)) / (1 + n)]^2$. The manufacturer, which perfectly anticipates this outcome on the final market, will solve: $\max_w \Pi_U = (w - c)nq_i^C(w)$ which yields the optimal wholesale price $w = (1/2)(a - d + c)$ and the manufacturer's profits $\Pi_U^S = (n/(1 + n))\left((a - d - c)^2 /4\right)$.

Under vertical integration, the firm chooses the standard monopoly price and output, i.e. $\max_p \Pi^{vi} = (p - c - d)(a - p)$, which yields $p^{vi} = (a + c + d)/2$, $q^{vi} = (a - c - d)/2$, and $\Pi^{vi} = ((a - c - d)/2)^2$.

We see that $\Pi_U^S < \Pi^{vi}$, i.e. the upstream firm makes less profit under vertical separation than the vertical chain makes under integration. This is due to the fact that under separation, the downstream firms still earn a positive mark-up, which leads to the problem of double marginalisation.

(ii) Note that as $n \to \infty$, $\Pi_U^S = (n/(1 + n))\left((a - d - c)^2 /4\right) \to ((a - c - d)/2)^2$, i.e. the upstream firm's profits under vertical separation converge to the profits under vertical integration. As the number of downstream firms increases, their mark-ups decrease, and so double marginalisation becomes less of a problem.

Solution of Exercise 2. Under vertical separation, downstream (Bertrand) competition will imply that all retailers charge at marginal cost, i.e. $p = w + d$, and so $Q = a - (w + d)$. Hence, the upstream firm will solve $\max_w \Pi_U = (w - c)(a - w - d)$ which yields $w = (1/2)(a - d + c)$. Now, we see that the resulting final price, quantity and upstream profits correspond exactly to the vertically integrated case, i.e. $p^S = p^{vi} = (a + c + d)/2$, $q^S = q^{vi} = (a - c - d)/2$, and $\Pi_U^S = \Pi^{vi} = ((a - c - d)/2)^2$. Since Bertrand competition implies that downstream firms' profits are driven down to zero even if there are only two of them, the problem of double marginalisation will never arise whenever $n \geq 2$.

Solution of Exercise 3. (i) Let us find the optimal contracts under the different cases. (1) Competition. Since retailers compete à la Bertrand, $p = w + \gamma$. They make zero profit and thus $F = 0$. The manufacturer will choose w so as to maximise its expected profit $E(\pi) = E[(d - w - \gamma)(w - c)]$. By writing $E(d) = d^e$ and $E(\gamma) = \gamma^e$, one can also find: $w_C = (d^e + c - \gamma^e)/2$, $p_C = (d^e + c - \gamma^e)/2 + \gamma$, $\pi_C = (1/4)(d^e - c - \gamma^e)^2$. Total welfare can also be computed as $W_C = E((1/2)(d-p)^2) + \pi_C = (3/8)(d^e - c - \gamma^e)^2 + var(d)/2 + var(\gamma)/2$. (2) ET. Each retailer is a monopolist in its area of distribution and maximises $\pi_r = (d - p)(p - w - \gamma)/2$. Final price and retailer profit will be $p = (d + w + \gamma)/2$, $\pi_r = (1/8)(d - w - \gamma)^2$. Since the retailers are infinitely risk-averse, the franchise fee F must be set in such a way to guarantee them non-negative profits even in the worst state of nature. Therefore, it must be $F_{ET} = (1/8)(\underline{d} - w - \overline{\gamma})^2$. The manufacturer's problem will be to choose w to maximise $E[(d - (d + w + \gamma)/2)(w - c)] + (1/4)(\underline{d} - w - \overline{\gamma})^2$. The solutions are: $w_{ET} = c + (d^e - \underline{d}) + (\overline{\gamma} - \gamma^e)$, $p_{ET} = [d + c + \gamma + (d^e - \underline{d}) + (\overline{\gamma} - \gamma^e)]/2$, $\pi_{ET} = (1/4)(\underline{d} - c - \overline{\gamma})^2 + (1/4)[(d^e - \underline{d}) + (\overline{\gamma} - \gamma^e)]^2$, $W_{ET} = (3/8)(\underline{d} - c - \overline{\gamma})^2 + (1/4)[(d^e - \underline{d}) + (\overline{\gamma} - \gamma^e)]^2 + (1/8)var(d) + (1/8)var(\gamma)$. (3) RPM. Retailers charge the imposed price and have profit equal to $(1/2)(d - p)(p - w - \gamma)$. Given infinite risk aversion, $F = (1/2)(\underline{d} - p)(p - w - \overline{\gamma})$. (This is the optimal fee for $p \geq w + \overline{\gamma}$. It can be showed that this is the relevant case.) The manufacturer will choose p and w so as to maximise $(\underline{d} - p)(p - w - \overline{\gamma}) + E[(d - p)(w - c)]$, subject to $p \geq w + \overline{\gamma}$. It turns out that: $F_{RPM} = 0$, $w_{RPM} = (1/2)(d^e + c - \overline{\gamma})$, $p_{RPM} = (1/2)(d^e + c + \overline{\gamma})$, $\pi_{RPM} = (1/4)(d^e - c - \overline{\gamma})^2$, $W_{RPM} = (3/8)(d^e - c - \overline{\gamma})^2 + (1/2)var(d)$.

(ii) and (iii) The rankings on profits and welfare under the different restraints and under competition can be obtained directly from the equilibrium solutions identified in (i). The main point of the paper by Rey and Tirole is to show that vertical restraints are not equivalent, as the ranking shows. This is due to the two contrasting effects that the different configurations have. The first effect is on the capability of the vertical structure to exploit monopoly power. The second effect is on the risk borne by the retailers. ET, for instance, does extremely well with respect to the first problem, as the retailers are made residual claimants and will therefore respond in the same way as a vertically integrated firm when facing demand or cost shocks. However, if $w = c$ the retailers would bear too high a risk, as their profits would not be protected against such shocks. In order to insure the retailers, the manufacturer will therefore have to set $w > c$ (it can be checked that the sensitivity of the retailers' profit to variations in demand and costs decreases with w: $\partial(|\partial\pi_R/\partial d|)/\partial w < 0$ and $\partial(|\partial\pi_R/\partial\gamma|)/\partial w < 0$), but under ET insurance is imperfect. RPM gives perfect insurance under demand uncertainty, but fares badly under cost uncertainty, as a shock to the retailer's distribution cost will greatly affect its profit margin (given that the price cannot be adjusted). As a result, RPM is better under demand uncertainty, ET under cost uncertainty. Competition scores well in terms of insurance properties (given Bertrand competition, retailers' profits will always be zero), under both demand uncertainty and cost uncertainty.

Solution of exercise 4. (i) Separation. If the two retailers compete in prices, the only equilibrium in the retailers' game is the one where $p_1 = p_2 = w$ and $s_1 = s_2 = 0$. Since consumers perceive the goods sold by retailers as homogenous, Bertrand competition drives prices to equal marginal cost $w + \mu e_i^2/2$. Consider a candidate equilibrium where $e_i = e_j > 0$, and profits are zero. Given that the quality perceived by consumers does not change if a firm i decreases its own quality to a level $e_i < e_j = e$, firm i has an incentive to decrease e_i since it will increase its unit margin and get all the demand. The usual undercutting argument leaves therefore $e_i = e_j = 0$ as the unique equilibrium, with $p_1 = p_2 = w$. The upstream firm anticipates that $p = w$ and that final demand will be $q = v - w$. It will $\max_w \Pi_u = (w - c)(v - w)$, which is solved by $w = (v + c)/2$. At the separated equilibrium, therefore, producer surplus, consumer surplus and welfare are respectively given by: $PS_s = \Pi_u = \left((v - c)^2\right)/4$; $CS_s = \left((v - c)^2\right)/8$; $W_s = 3\left((v - c)^2\right)/8$. (ii) Vertical integration. Assume again that if both retailers charge the same price, they will split market demand equally among each other. Then, a vertically integrated firm with **two** retailers will solve: $\max_{p,e_1,e_2} \Pi_{vi} = (p - c - (1/2)\mu e_1^2/2 - (1/2)\mu e_2^2/2)(v + \max\{e_1, e_2\} - p)$. Note that it will be optimal for the manufacturer to have only one retailer provide services, while continuing to sell through both retailers (consumer valuation for retailer services is determined by the maximum of the two units)[75]. Hence, set $e_2 = 0$ and derive the first-order conditions: $\partial\Pi_{vi}/\partial e_1 = -\mu e_1(v + e_1 - p)/2 + p - c - (1/2)\mu e_1^2/2 = 0$ and $\partial\Pi_{vi}/\partial p = v + e_1 - 2p + c + (1/2)\mu e_1^2/2 = 0$, leading to the following solution: $e_{1,vi} = 2/\mu$; $e_{2,vi} = 0$; $p_{vi} = \frac{1}{2}(v + c + 3/\mu)$.[76] By substitution,

[75] In fact, it can be showed that it would be optimal for the vertically integrated monopolist to have as many outlets as possible and concentrate the effort in only one of them. This will not reduce the effort but will allow to increase output where it is less costly, i.e. with all the retailers which do not have to incur the variable costs of effort.

[76] Solving the system of FOCs gives two other solution pairs. However, one is negative and the other does not correspond to a maximum since positive definiteness, i.e., $\frac{\partial^2\pi}{(\partial p)^2}\frac{\partial^2\pi}{(\partial e)^2} >$

one then obtains producer surplus, consumer surplus and welfare as follows. $PS_{vi} = \Pi_{vi} = \left((\mu(v-c)+1)^2\right)/\left(4\mu^2\right)$; $CS_{vi} = \left((\mu(v-c)+1)^2\right)/\left(8\mu^2\right)$; $W_{vi} = \left(3(\mu(v-c)+1)^2\right)/\left(8\mu^2\right)$.

A vertically integrated firm with only **one** retailer will solve: $\max_{p,e}\Pi_{vi} = (p-c-\mu e^2/2)(v+e-p)$. The only difference with respect to the two-retailers case is that, now, one unit of effort will cost $\mu e^2/2$ rather than $(1/2)\mu e^2/2$. Hence, just replace μ by 2μ in the expressions obtained above to have: $e'_{vi} = 1/\mu$; $p'_{vi} = (2\mu(v+c)+3)/(4\mu)$, and producer surplus, consumer surplus and welfare as follows. $PS'_{vi} = \Pi'_{vi} = \left((2\mu(v-c)+1)^2\right)/\left(16\mu^2\right)$; $CS'_{vi} = \left((2\mu(v-c)+1)^2\right)/\left(32\mu^2\right)$; $W'_{vi} = \left(3(2\mu(v-c)+1)^2\right)/\left(32\mu^2\right)$.We see that vertical integration with two retailers is more profitable than with only one retailer, as it allows to produce effort at half the unit cost.

(iii) It is also easy to check that vertical integration - which restores the incentives to invest in quality provision - not only increases the vertical chain profit but also enhances welfare: $PS_{vi} > PS'_{vi} > PS_s$ and $W_{vi} > W'_{vi} > W_s$.

(iv1) Exclusive territory (ET). If one retailer is given an exclusive territory, i.e. it is the only one which can sell the manufacturer's product, ET alone would not solve the problem since it would create the usual double marginalisation problem. Therefore, an ET contract should be combined with non-linear pricing of the type seen above: $(w = c; F)$. The problem of the retailer will then be: $\max_{p,e}\Pi_{et} = (p-c-\mu e^2/2)(v+e-p)/2-F$. Barring the fixed cost which does not affect the FOCs, this is precisely the same problem as a vertically integrated monopolist with **one** retailer. Therefore, the solution will be the same as in (ii), while F will be used to redistribute profits between retailer and manufacturer. If the latter has all the bargaining power, then it will appropriate all the producer surplus.

(iv2) Resale price maintenance. RPM will also have to be used in combination with a non-linear contract $(w = c; F)$. The problem of a retailer i is given by: $\max_{e_i}\Pi_{rpm} = (p'_{vi}-c-\mu e_i^2/2)(v+\max\{e_i, e_j\}-p'_{vi})/2-F$. RPM removes the price undercutting temptation. However, it leaves the incentive to free ride on services provision as $e = \max\{e_1, e_2\}$. Consider a candidate equilibrium where $e_1 = e_2 = e > 0$. This cannot be an equilibrium since a firm would prefer to deviate and provide no quality given that the other is providing a positive level of quality: $\pi_{rpm} = (p'_{vi}-c-\mu e^2/2)(v+e-p'_{vi})/2 < \pi_{dev} = (p'_{vi}-c)(v+e-p'_{vi})/2$. However, there are two asymmetric equilibria where only one firm provides effort, while the other does not, i.e. where $e_i = e'_{vi} > 0 = e_j$ for $i = 1, 2$ and $i \neq j$. First, note that the problem of the retailer who makes effort would be identical to the effort choice problem under exclusive territories, which gives $e'_{vi} = 1/\mu$ as a solution. Therefore, the profit made by the 'effort' retailer is $\pi_i = \Pi'_{vi}/2 = \left((2\mu(v-c)+1)^2\right)/\left(32\mu^2\right)$. By deviating and providing an effort $e_i = 0$, this retailer will make $\pi_d = (p'_{vi}-c)(v-p'_{vi})/2 = (2\mu(v-c)+3)(2\mu(v-c)-3)/\left(32\mu^2\right)$. As $\pi_i - \pi_d = (2\mu(v-c)+5)/\left(16\mu^2\right) > 0$, the candidate equilibrium is indeed an equilibrium. RPM therefore restores the vertically integrated solution (p'_{vi}, e'_{vi})

$\left(\frac{\partial^2\pi}{\partial p\partial e}\right)^2$, is not satisfied.

for the upstream manufacturer. Since it cannot enforce a contract on the basis of the effort made by the retailers, it will offer the same contract to both. Each retailer will pay the same fixed fee $F = \Pi'_{vi}/2$. Note that although the manufacturer makes the same profit, producer surplus will be higher under RPM than under the vertically integrated case with **one** retailer considered above. RPM is in some sense more efficient than ET or VI with one retailer, as it allows to exploit the beneficial effect of the effort spillovers among retailers, similar to the situation of VI with two retailers.

Solution of exercise 5. (i) From the maximisation of the consumer programme one obtains the (inverse) demand function $p_i = v - q_i - g\sum_{j\neq i}^{n} q_j$. Under vertical separation, (last stage) equilibrium quantity and price for given w are given by $q^S = (v-w)/(2+g(n-1))$, and $p^S = (v + w(1+g(n-1)))/(2+g(n-1))$. The upstream manufacturer chooses w to maximise $\pi = (w-c)nq^S$. Hence, $w^S = (v+c)/2$. By replacing this value into q^S and p^S one finds equilibrium quantity, price and per retailer profit: $q^* = (v-c)/(2(2+g(n-1)))$, $p^* = (v(3+g(n-1)) + c(1+g(n-1)))/(2(2+g(n-1)))$, and $\pi^* = ((v-c)/(2(2+g(n-1))))^2 - f$. (ii) Under vertical integration each outlet produces at marginal cost c. Equilibrium quantity, price and per-outlet profit are: $q^I = (v-c)/(2(1+g(n-1)))$, $p^I = (v+c)/2$, and $\pi^I = \left((v-c)^2\right)/(4(1+g(n-1))) - f$. (iii) Under separation, entry will occur until retailer profits are driven down to zero, i.e. $((v-c)/(2(2+g(n-1))))^2 - f = 0$. Under vertical integration, the firm will set n optimally, i.e. $\max_n \pi^I = \left((v-c)^2\right)/(4(1+g(n-1))) - f$. Suppose that f is such that the optimal number of outlets under vertical integration is exactly 1, which implies that $f = (1/4)(v-c)^2(1-g)$. Then, inserting this expression for f into the zero-profit condition for retailers under separation and solving for n, we obtain: $n = (1/g)\left(\sqrt{1/(1-g)} - 2\right) + 1$. This equation will solve for $n = 2$ if $(1-g)(2+g)^2 = 1$, i.e. if $g \simeq 0.8793$. (iv) Given that (f, g) is such that $n^*_{vi} = 1$ but $n^*_S = 2$, i.e. $g \simeq 0.8793$ and $f = (1/4)(v-c)^2(1-g)$, we obtain the following expressions for welfare: Vertical Integration: $CS_1^{VI} = \left((v-c)^2\right)/8$; $PS_1^{VI} = \left((v-c)^2\right)g/4$; $W_1^{VI} = (1+2g)\left((v-c)^2\right)/8$; Separation: $CS_2^S = \left((v-c)^2(1+g)\right)/\left(4(2+g)^2\right)$; $PS_2^S = \left((v-c)^2\right)/(2(2+g))$; $W_2^S = (v-c)^2(5+3g)/(2(2+g))^2$. The inequality $C_1^{VI} > C_2^S$ implies $(1/2)(2+g)^2 > 1+g$, which will always hold for $g \simeq 0.8793$. Analogously, the inequality $W_1^{VI} > W_2^S$ implies $(1/2)(1+2g) > (5+3g)(1-g)$, which holds as well for $g \simeq 0.8793$.

Solution of exercise 6. (1) For passive beliefs, the solution follows from the extension of the $n = 2$ case in section 2.5.1. Each retailer expects profit $\pi_i = (1 - q_i - \sum_{j\neq i} q_j - c)q_i$ and therefore will be willing to buy according to its (Cournot) reaction function. Under symmetry, the intersection of the n reaction functions gives $q = (1-c)/(1+n)$. Each retailer will therefore expect to make profit $(1-c)^2/(1+n)^2$. (2) The manufacturer will earn $\pi^M = n(1-c)^2/(1+n)^2$. Since $d\pi^M/dn < 0$, the larger the number of retailers the worse the commitment problem for the manufacturer. (3) For the case of symmetric beliefs, the reasoning is exactly the same as for the case $n = 2$ treated in section 2.5.1.

Solution of exercise 7. (a) The vertically integrated outcome satisfies $\max \pi = (p - c)(1 - p)$. Hence, it is given by $p^{vi} = (1 + c)/2$, $q^{vi} = (1 - c)/2$, $\pi^{vi} = (1 - c)^2/4$.

(b) The contract which would reproduce the vertically integrated outcome is one where both retailers are offered $(w_i, F_i) = (c, (1 - c)^2/8)$. However, it is easy to see that the manufacturer would have an incentive to renegotiate the contract with, say, retailer R_1 given that R_2 has accepted. Indeed, if U sold the input to R_1 at a wholesale price $w_i < c$, R_1 could get the whole market by selling at a price slightly below c and earn $(1 - c)^2/4$. Therefore, there is scope for an agreement between U and R_1 on renegotiating the contract. Retailer R_2 would have to pay $(1 - c)^2/8$ but would have no revenue. Obviously, anticipating that renegotiation would occur, R_2 would not sign the contract in the first place. The commitment problem arises also when firms choose prices.

(c) When the contract is a pure linear pricing one, it does not commit retailers to buy a specified quantity. Under the candidate equilibrium contract, a retailer just commits to pay $w = p^{vi}$. If the manufacturer offered a lower wholesale price $w' = p^{vi} - \varepsilon$ to one retailer, the latter would get to serve the whole market, and the manufacturer would still make $\pi^{vi} = (1 - c)^2/4$, but the other retailer would not be addressed by any consumer and would not buy any input. Therefore, the manufacturer would not increase its profit under renegotiation.

Solution of exercise 8. At the first stage of the game, the payoff matrix would be:

INSERT Table 6.3. A delegation game (exercise)

	delegation	*vert.int.*
delegation	π^u_{ff}, π^u_{ff}	$\pi_{d/i}, \pi_{i/d}$
vert.int.	$\pi_{i/d}, \pi_{d/i}$	π_{vi}, π_{vi}

To check that both firms delegating and imposing a non-linear contract to retailers is an equilibrium, we should check that $\pi^u_{ff} > \pi_{i/d}$, that is, that when the rival manufacturer chooses to delegate, a manufacturer prefers to delegate as well rather than not. The symmetric payoffs in the table above have already been obtained in section 3.1.1. We still have to find those corresponding to the asymmetric case where one manufacturer chooses delegation whereas the other does not. The reader can check that at the equilibrium the firm that sells through a retailer will set a wholesale price $w_{d/i} = \frac{c(64+96\gamma+44\gamma^2+5\gamma^3)-\gamma^2(4+\gamma)v}{4(2+\gamma)(8+8\gamma+\gamma^2)}$ and that the equilibrium profits are:

$$\pi_{i/d} = \frac{(1+\gamma)(16+12\gamma+\gamma^2)^2(v-c)^2}{16(2+\gamma)\left(8+8\gamma+\gamma^2\right)^2}; \quad \pi_{d/i} = \frac{(1+\gamma)(4+\gamma)^2(v-c)^2}{8(2+\gamma)\left(8+8\gamma+\gamma^2\right)}.$$

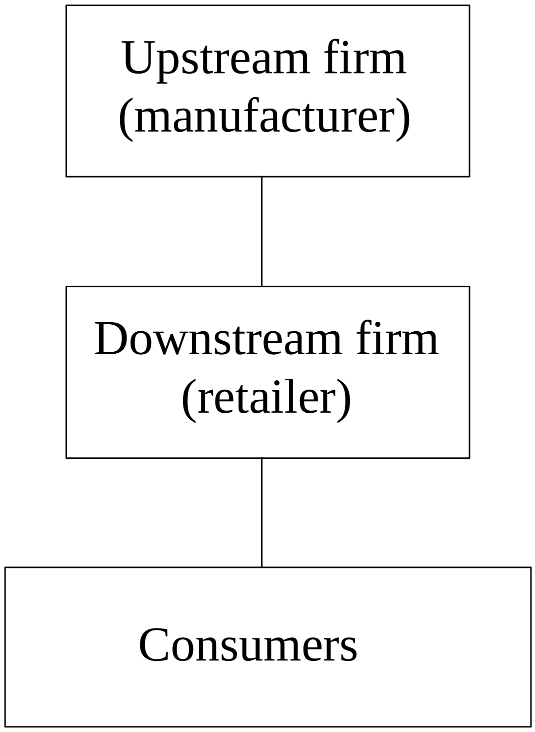
(i) It is then possible to check that a manufacturer does not have an incentive to deviate from the configuration where both manufacturers sell through retailers: $\pi_{ff}^{u} > \pi_{i/d}$. In other words, the configuration (delegate,delegate) is an equilibrium. One can also check that $\pi_{d/i} > \pi_{vi}$, implying that delegation is a dominant strategy and that the equilibrium where both sell through retailers is unique. (ii) This is a prisoner's dilemma game, where both firms end up in an equilibrium which yields lower payoff to them: $\pi_{ff}^{u} < \pi_{vi}$. The manufacturers would be better off if they were not allowed to contract with independent retailers! (iii) Section 3.1.1 shows that consumers are better off when there is delegation: $q_{ff} > q_{vi}$.

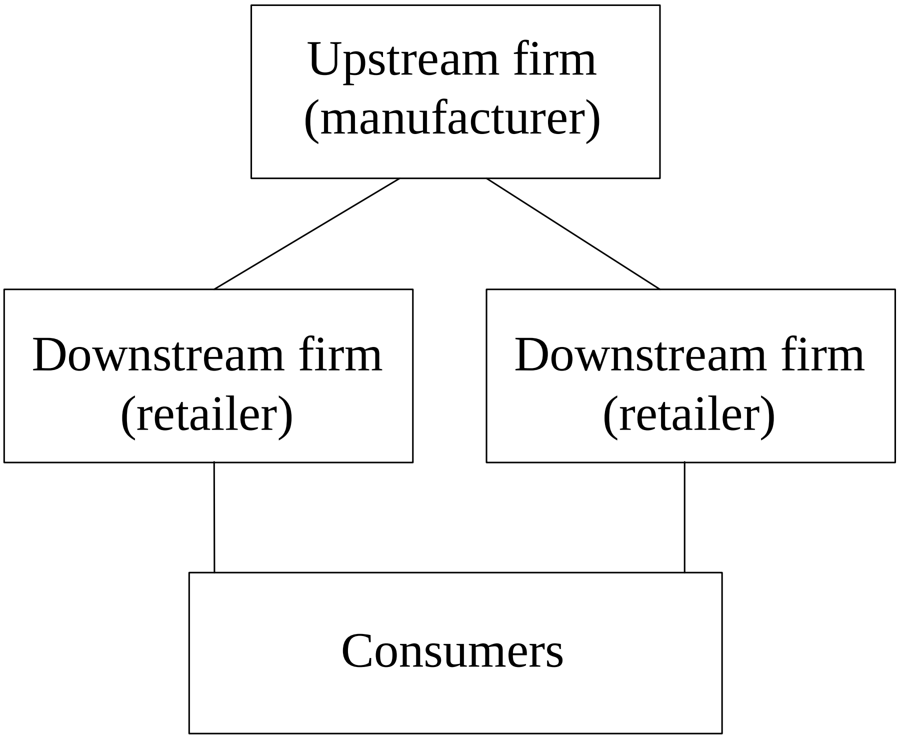
Solution of exercise 9. If the retailer has rejected either contract he earns zero profit and the market disappears. If he has accepted both contracts, then his optimal effort level on each product is found by solving: $\max_{e_i,e_j} \pi_r = \sum_{i=1}^{2} \left((p_i - w_i)(a - bp_i + \gamma p_j + e_i) - ke_i^2/2 - F_i\right)$. From $\partial \pi_r / \partial e_i = 0$ one obtains $e_i^* = (p_i - w_i)/k$. The rest of the problem is now like in the text. In particular, complete extraction of the retailer's anticipated rents implies that each manufacturer solves: $\max_{w_i,p_i} \pi_i = (p_i - c)(a - bp_i + \gamma p_j + (p_i - w_i)/k) + (p_j - w_j)(a - bp_j + \gamma p_i + (p_j - w_j)/k) - (p_i - w_i)^2 / (2k) - (p_j - w_j)^2 / (2k) - F_j$.

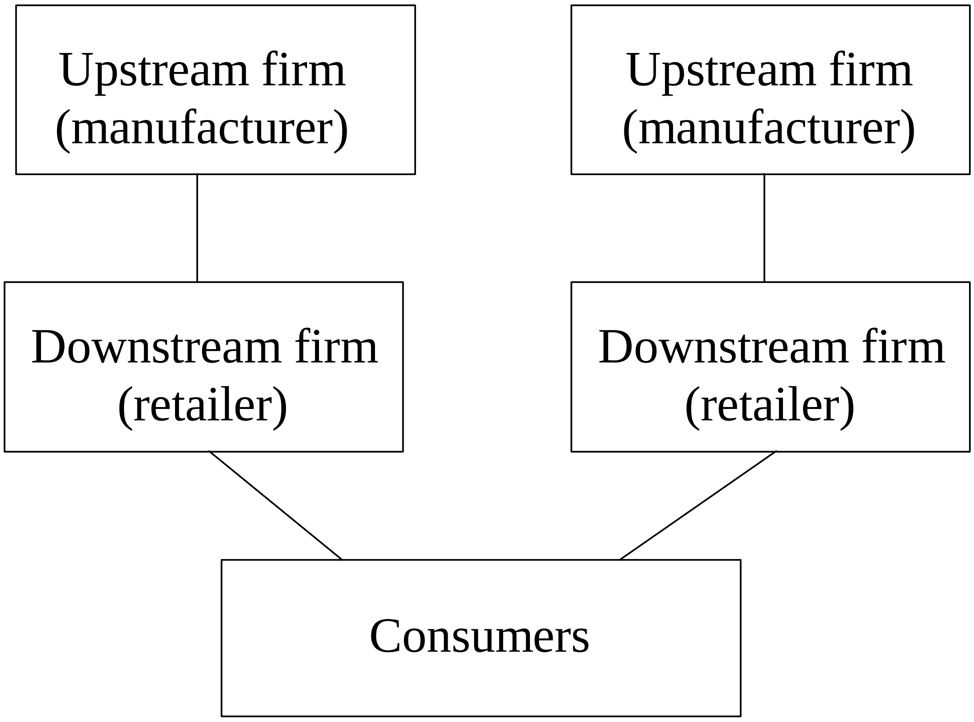
But apart from the fixed component (which does not affect equilibrium price and wholesale price), this is nothing else than the problem of a joint profit maximiser. It is easy to check in particular that $w_i = c$ at equilibrium and that the equilibrium price is the same that solves $\max_{w_i,p_i} \pi_M = \sum_{i=1}^{2} (p_i - c)(a - bp_i + \gamma p_j + e_i^*) - k(e_i^*)^2/2$, i.e. $p_i^* = p_j^* = (a + c(b - (1/k) - \gamma)) / (2b - (1/k) - 2\gamma) > c$. Note that due to the effort choice made by the retailer, w_i enters retailer i's maximisation problem, and so it will be determined in equilibrium (this was not the case for the model of section 3.2.2)

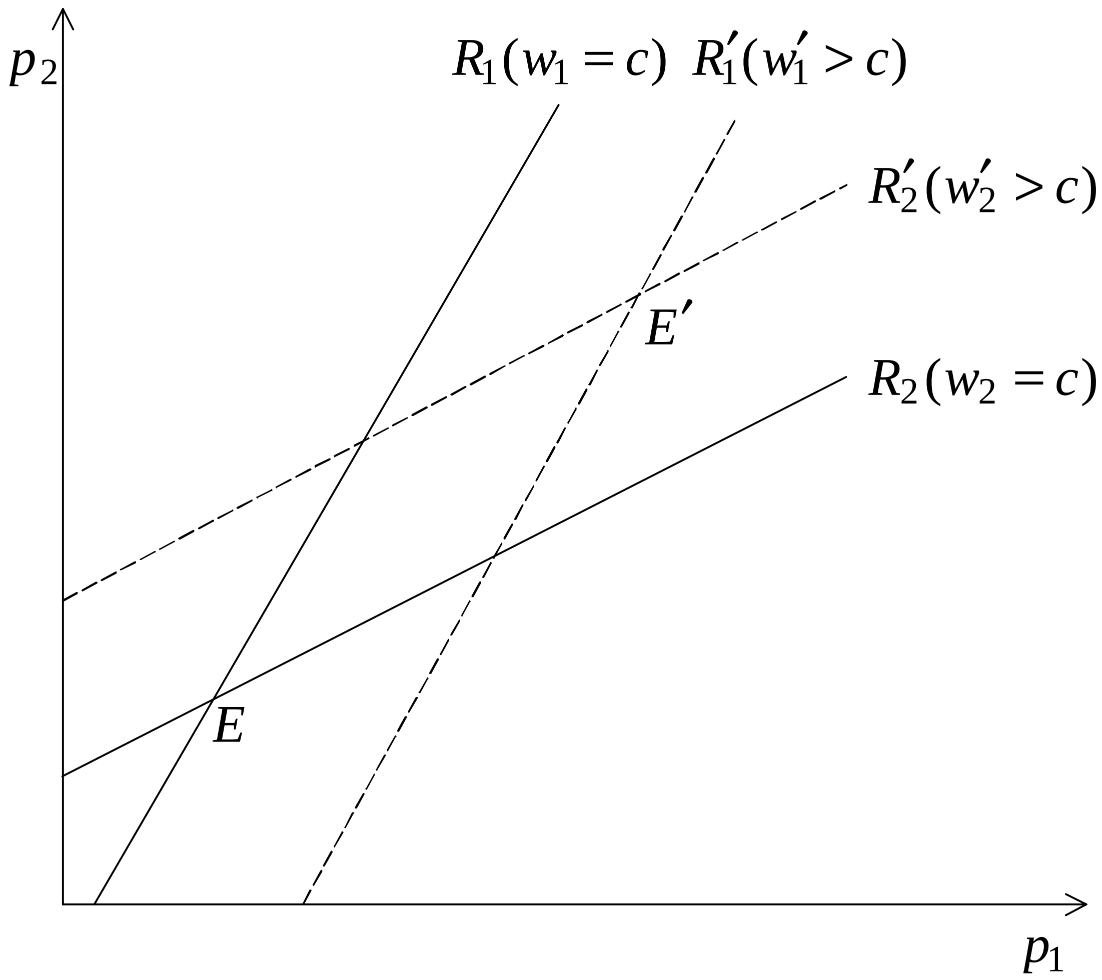
Solution of exercise 10. (a) At the last stage of the game, both downstream firms pay the input w and have profits $\pi_i = (1 - q_i - q_j - w)q_i$. Solving $d\pi_i/dq_i = 0$ and imposing symmetry gives $q = (1 - w)/3$. Therefore, total quantity sold will be $Q = 2(1 - w)/3$. Since each unit of final output Q sold by the downstream firms corresponds a unit of output X sold by the upstream firms, the latter will face an inverse demand function $w = 1 - 3X/2$, where $X = x_1 + x_2$. Therefore, the problem faced by the upstream firms will be $\pi_k = (1 - \frac{3}{2}(x_k + x_l))x_k$. From the FOCs $d\pi_k/dx_k = 0$ one obtains the symmetric solution $x = 2/9$. By substitution, the equilibrium wholesale price is $w = 1/3$ and the equilibrium price is $p = 5/9$.

(b) Under vertical integration, calling 1 the upstream firm and the downstream firm that merge, the downstream competition game will be between a firm with cost $w_1 = 0$ and another with cost w_2. Their profits will be respectively given by $\pi_1 = (1 - q_1 - q_2)q_1$ and $\pi_2 = (1 - q_1 - q_2 - w_2)q_2$. Solving the system of FOCs gives $q_2 = (1 - 2w_2)/3$ and $q_1 = (1 + w_2)/3$. As the integrated firm withdraws from the input market, there is now an upstream monopolist in the input market, facing inverse demand for its input $w_2 = (1 - 3x)2$, and having profits $\pi_2 = w_2 x$. From the FOC it is straightforward that $x = 1/6$ and $w_2 = 1/4$. By substitution, $q_1 = 5/12$ and $p = 5/12$. Note that the wholesale price paid by the unintegrated firm is lower than in the case of vertical separation. This might be surprising because the unintegrated upstream firm is a monopolist, but it is a monopolist which faces a reduced demand schedule. In this case, therefore, although the integrated firm does not supply the input any longer, the input is cheaper: there is no foreclosure. Further, note that the final price paid by consumers is lower and total industry output increases under the vertical merger.

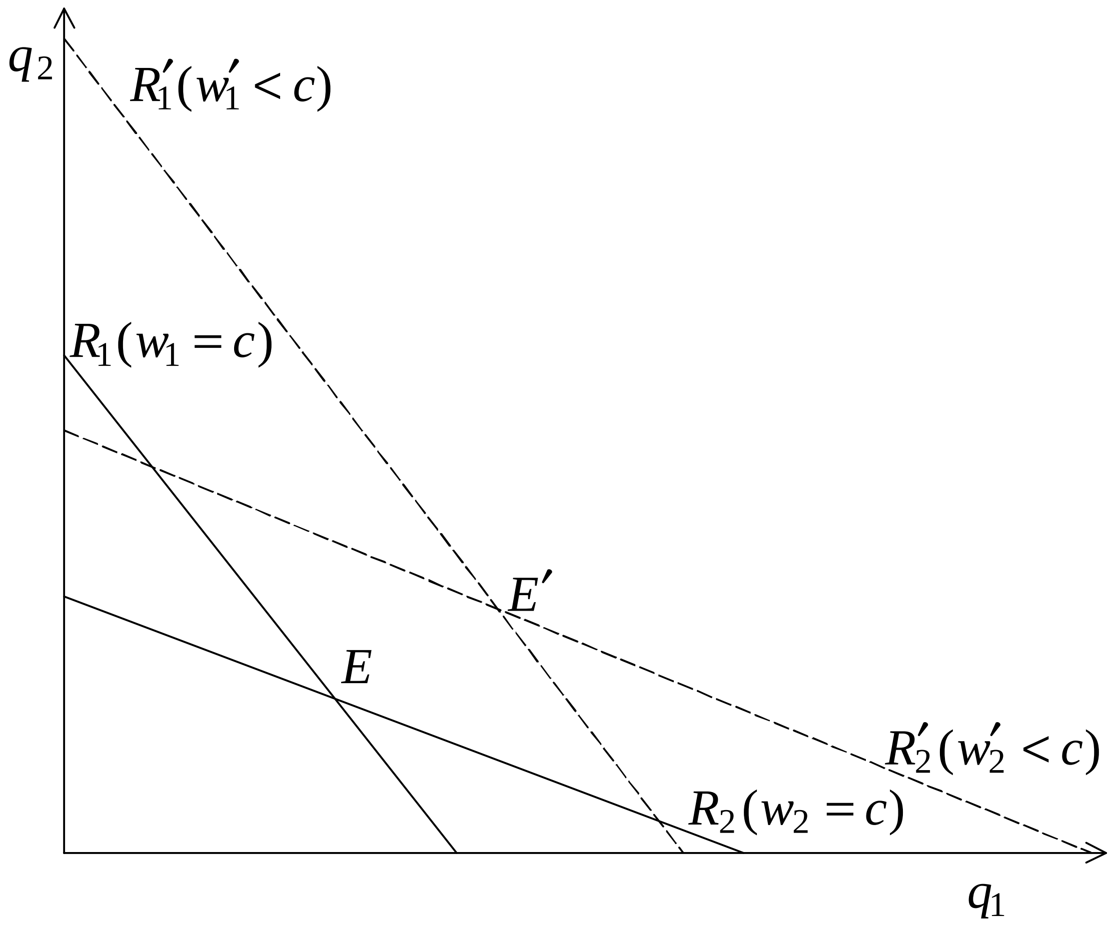

Upstream firm
(manufacturer)
Downstream firm
(retailer)
Consumers


Upstream firm
(manufacturer)
Downstream firm
(retailer)
Downstream firm
(retailer)
Consumers

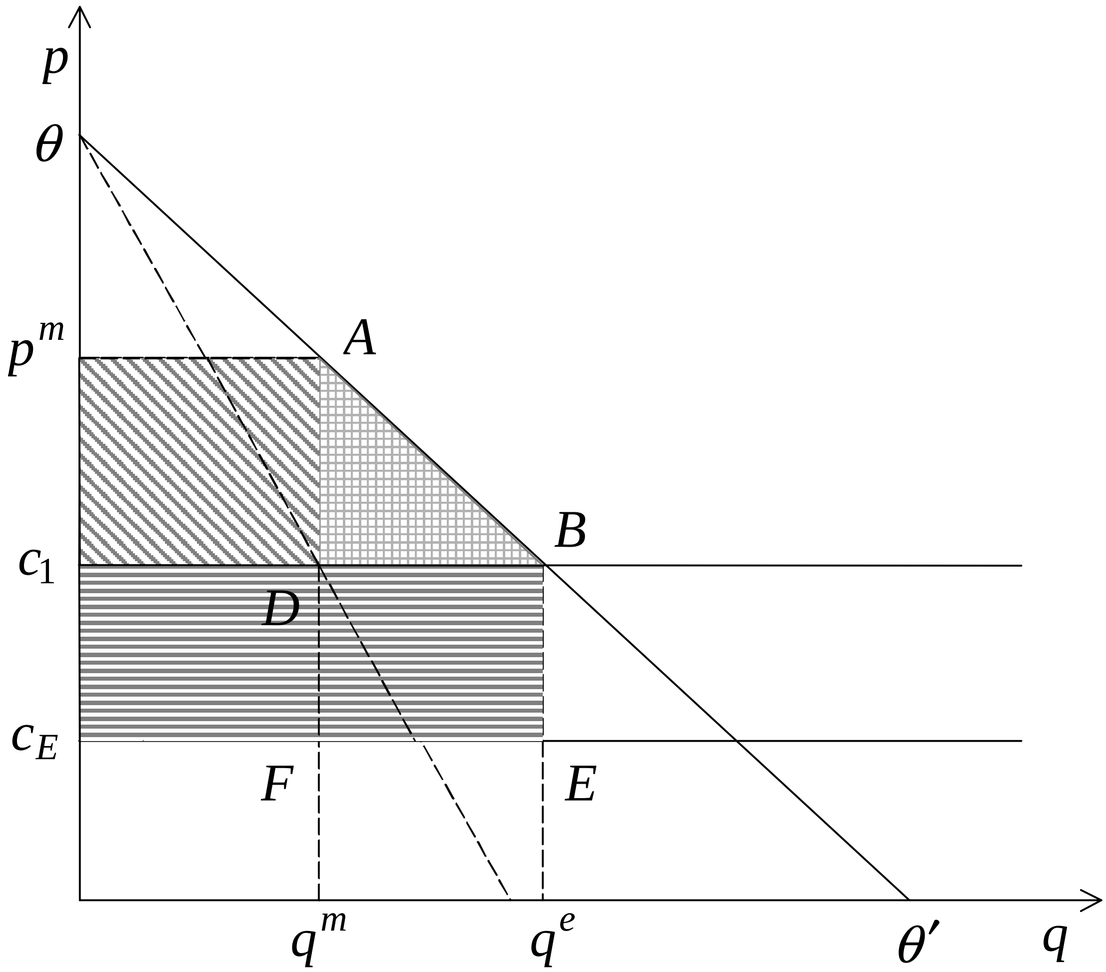

Upstream firm (manufacturer)
Upstream firm (manufacturer)
Downstream firm (retailer)
Downstream firm (retailer)
Consumers



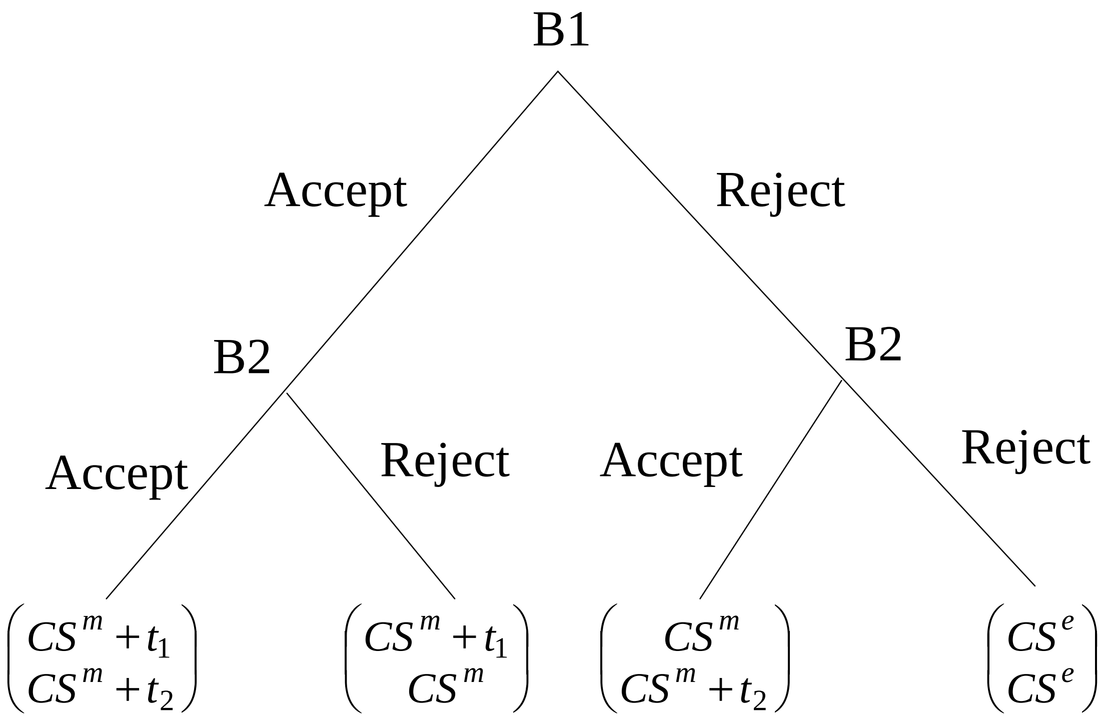
p_2
$R_1(w_1 = c)$
$R_1'(w_1' > c)$
$R_2'(w_2' > c)$
E'
$R_2(w_2 = c)$
E
p_1



q_2
$R_1'(w_1' < c)$
$R_1(w_1 = c)$
E'
E
$R_2'(w_2' < c)$
$R_2(w_2 = c)$
q_1



p
θ
p^m
A
B
c_1
D
c_E
F
E
q^m
q^e
θ′
q


B1
Accept
Reject
B2
B2
Accept
Reject
Accept
Reject
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$\begin{pmatrix} CS^m + t_1 \\ CS^m \end{pmatrix}$
$\begin{pmatrix} CS^m \\ CS^m + t_2 \end{pmatrix}$
$\begin{pmatrix} CS^e \\ CS^e \end{pmatrix}$