Information Exchanges Among Firms and their Impact on Competition*

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I Introduction

In order to formulate competition policy prescriptions for dealing with information exchange among firms it is necessary to study the potential effects of information acquisition and exchange on welfare and consumer surplus. The present report addresses the competition policy of information sharing from the point of view of economic analysis and is divided into two parts. In the first part a critical survey of the existing literature on information exchange is presented. This survey discusses the literature on information acquisition and exchange in static models as well as the impact of information exchange in dynamic settings as far as conclusions can be drawn from the literature. Reflecting the state of the literature the main part of the survey is concerned with information exchange in static settings. In the second part of this report the competition policy of information exchange agreements is studied. We first review antitrust policy on information sharing in the US and the UK and then turn to EC policy. Particular attention is devoted to important cases in the EC. Conclusions are summarized in Part IV of the report.

II A Survey of the Theoretical Literature on Information Exchange

1 Introduction

Information *exchange* can be considered as only one particular form of information *acquisition*. Any form of information acquisition will have three effects. First, it will make decisions of the firm that acquires the information more precisely geared to the environment. Secondly, the change in actions induced by information acquisition will have external effects on consumers in the market. Thirdly, information acquisition by a firm may have external effects on other firms that compete in the same market. We will distinguish between these three effects in our discussion of information acquisition and exchange. For this purpose it is useful to first abstract from the complications of the third effect and analyze the incentives of a monopolist to acquire information and the effects on consumer and social welfare. We will then demonstrate that the effects uncovered in that analysis give us the tools for an intuitive analysis of information exchange in markets with competing firms. We use the framework developed for the monopoly context to discuss the effects of externalities of information acquisition by rival firms and the implications for the information exchange both in monopolistic competition and oligopoly.

The analysis of information exchange in static models is complemented by a discussion of the issues that information exchange raises in dynamic settings. Finally, we study the possibilities for reducing market inefficiencies in markets characterized by moral hazard and adverse selection through information exchange mechanisms. We point out that the significant implications for competition policy arise from the latter set of issues and draw some qualitative conclusions about the type of rules for information exchange agreements that can be supported by economic analysis.

2 Increasing the Information of a Monopolist

In order to understand the effects of information exchange it is useful to try to understand the general principles underlying the effects of information acquisition in the presence of market power, but in the absence of informational externalities on competing firms. This can be done in the context of a simple monopoly model.[1] We have to distinguish between two different sources of uncertainty. One is uncertainty about demand, the other is uncertainty about costs. We will discuss both of them in turn.

2.1. Acquisition of Information about Demand

Consider a standard model of monopoly. The monopolist has a linear inverse demand function

$$p = a - Q$$

where p is the market price, Q the output produced and a the demand intercept. Consider a situation in which the value of the demand intercept a is random and unknown to the monopolist. We will for simplicity of exposition suppose that there are only two states of demand. When demand is high $a = a_H$, when demand is low $a = a_L$. We denote the expected value of a by a^*. Suppose one could give a monopolist an additional piece of information about his true state of demand a. This will certainly improve the quality of the

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[1] Note that one can interpret the analysis of monopoly information acquisition as information exchange between firms operating in unrelated markets. In this sense it is information exchange between maximally differentiated firms, a special case of the model of Vives (1984). Most of the results discussed in this section follow from Proposition 6 in that paper.

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monopolist's decision making and therefore the monopolist's profits.[2] However, improving the quality of a monopolist's decision making is not necessarily socially beneficial. The social benefits of giving a monopolist more information depend on whether a monopolist will use this information to obtain an allocation that is more efficient on average, or whether he instead uses the information to redistribute surplus from consumers to himself more effectively. This would create a greater allocative distortion on average. In other words: Will the monopolist have an incentive to increase profits by increasing the cake or by increasing his share in a smaller cake?

The answer crucially depends on whether the monopolist chooses price or quantity. From the work of Leland (1972), Weitzman (1974) and Browing (1987) we know that, in contrast to the certainty case, price and quantity setting by a monopolist is not equivalent when facing uncertain demand. If there is quantity setting prices have to adjust to the realization of demand (see Figure 1), while under price setting quantities have to adjust to clear the market (see Figure 3). If we give a monopolist better information about demand this will have different effects depending on the decision variable of the monopolist. If the decision variable is quantity, giving more information to the monopolist will lead to more quantity adjustments and less price adjustments. If the decision variable is price, the opposite will be the case.

Figure 1, 2, and 3 illustrate the arguments in the previous paragraph. The two demand curves corresponding to the two true states of demand are drawn as dashed lines. The solid

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[2] In the terminology of some of the information sharing literature there are two effects. First, the output of the monopolist becomes more variable, which is a negative effect. Secondly, output becomes more correlated with the demand intercept, which is a positive effect. However, the net effect of the two is always positive because improving information will always increase profits. We will continue in the sequel to simply talk of the net effect as the precision effect.

line is the expected demand curve that a monopolist faces if he has no information about demand. Suppose first, that the monopolist is a quantity setter. If he has no information about the true demand intercept, he will choose the optimal quantity relative to the expected demand curve, Q^*. The realized price will lie on the intersections of the vertical line and the dashed demand curve above or below the expected demand curve in Figure 1. What happens, if we give a quantity setting monopolist better information about demand? Suppose for concreteness that with some probability g the true demand state is revealed to him. Then, on average, he will produce more in the high demand state (Q_H) and less in the low demand state (Q_L). This reduces dead weight loss in high demand states (by the dashed area to the right of the vertical line) and increases deadweight loss in low demand states (by the dashed area to the left of the vertical line). Note, however, that a small move towards more production in the high demand state leads to a greater reduction in the dead weight loss than the increase in the deadweight loss from a small move towards lower output in the low demand state. This can be seen from the shaded areas in Figure 1. Hence, if the monopolist is a quantity setter, deadweight loss is reduced by improving the monopolist's information.

The Quantity Setting Monopolist with Demand Uncertainty
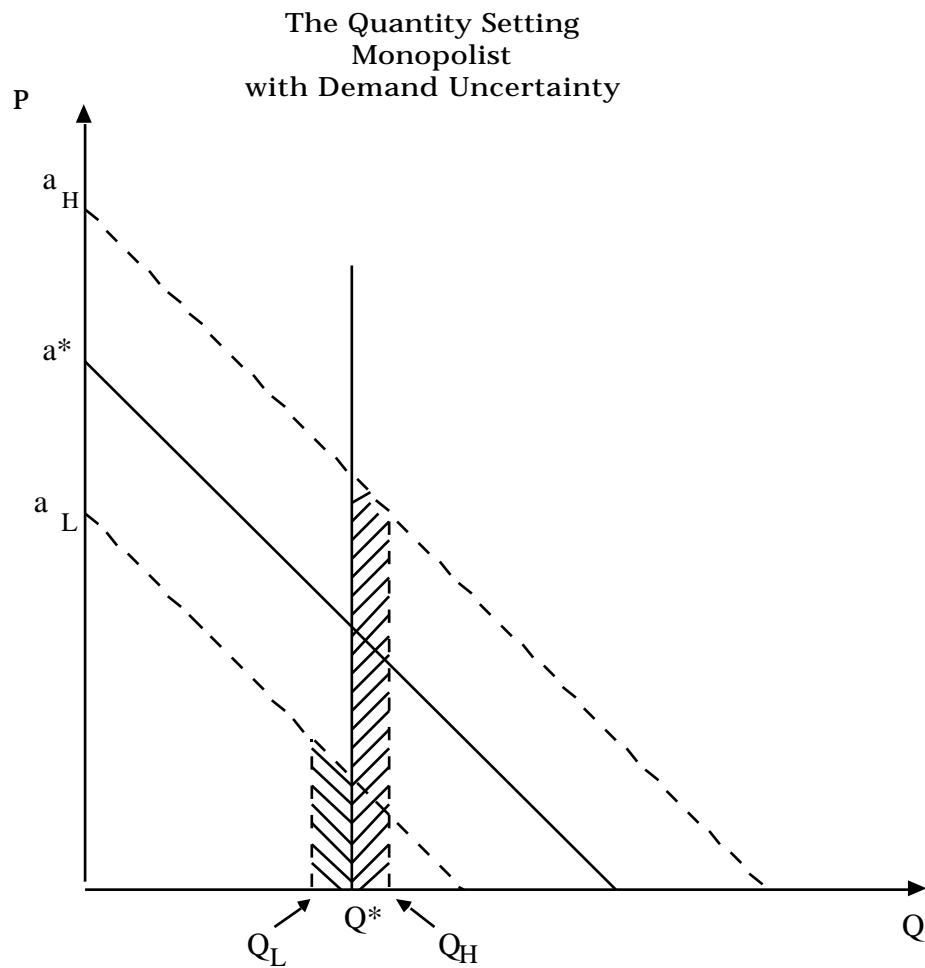
Figure 1

Increasing Information is Welfare Enhancing

It is also possible to show that in this case consumers gain from the quantity setting monopolist having the additional piece of information. To see this consider Figure 2. The consumer gains from higher consumption and lower prices in good states of the world (the upper area) outweighs the loss from lower consumption and higher prices in bad states of the world (the lower dashed area). Essentially, part of the increase in total social surplus is passed on to the consumers in form of lower prices in the good state.
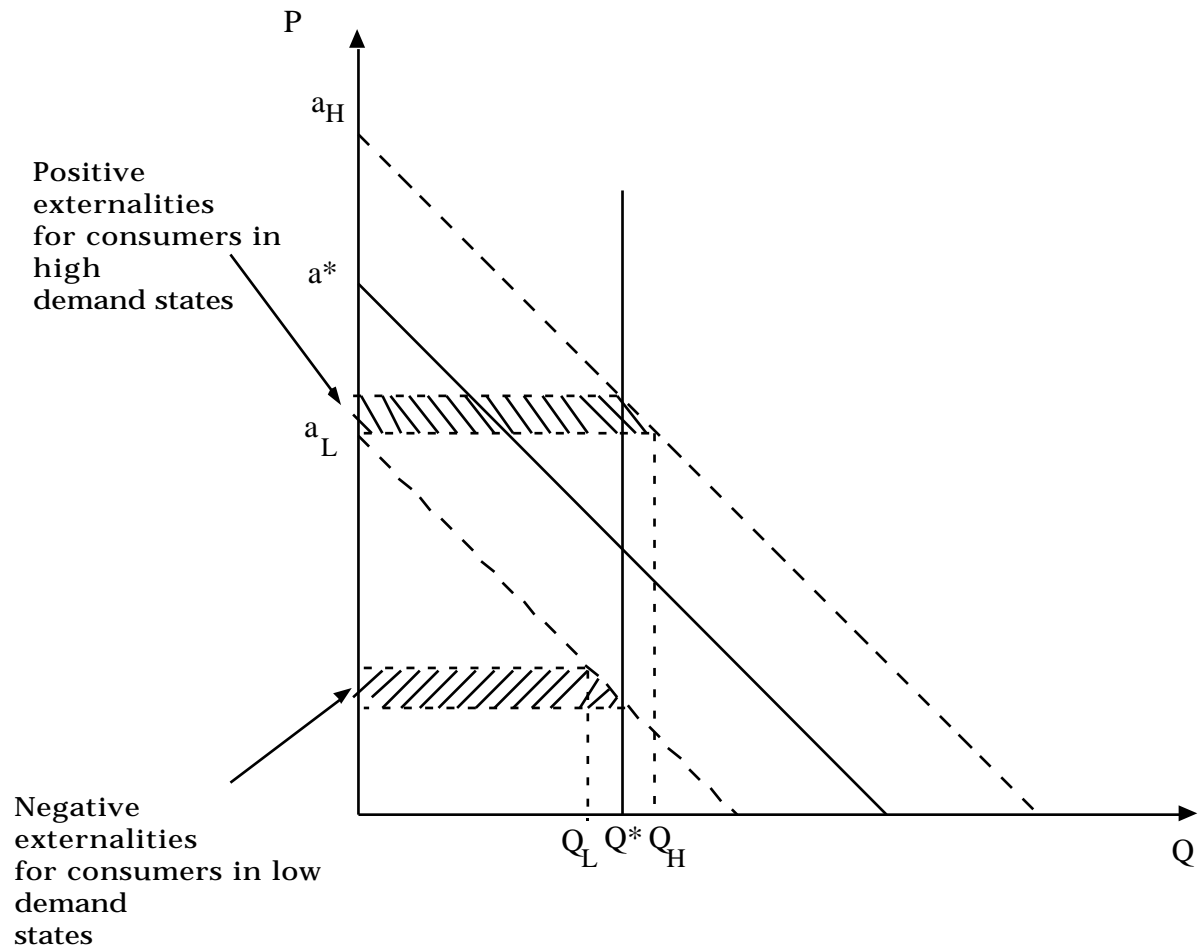
Figure 2

The opposite argument is true in the case of price setting, which is illustrated in Figure 3. Starting with no information about the true state of demand the price setting monopolist would set the optimal price relative to the expected demand function, p*. Output would adjust to clear the market at Q_L and Q_H for low and high realizations of demand respectively. This leads to large variations in output. Now suppose you give the monopolist a signal that reveals with probability g the true state of demand. On average output will be reduced in the high state (to $\hat{Q}_H$) and increased in the low state (to $\hat{Q}_L$) of demand. Hence, by exactly the same reasoning as above we will have increases in the average (i.e. expected) dead weight loss. The profits of the monopolist increase but only at costs to the consumer that outweigh these gains.

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The Price Setting Monopolist
and Demand Uncertainty
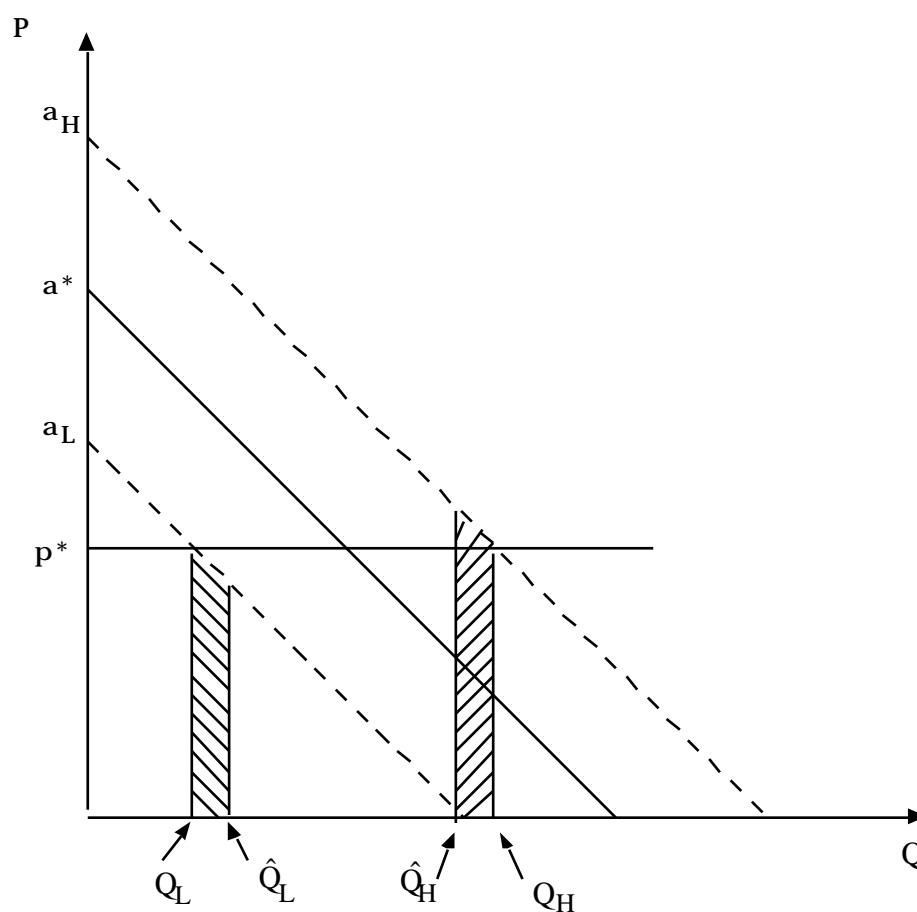
Figure 3

Increasing Information is Welfare
Reducing

The argument that giving a monopolist additional information about demand will only be socially beneficial with quantity setting, is quite a general one[3]. It rests on the observation that expected social surplus (and expected consumer surplus as well) generally increase if

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[3] It always holds for linear demand function, but in general requires some assumptions about the functional

form of demand.

output is more responsive to the actual state of the world. From a consumer surplus (and a welfare) point of view uniformity of prices and variability of output is preferred to variability of prices and uniformity of output across different states of demand. Note, that this effect creates a difference between price setting and quantity setting that has nothing to do with the usual difference between price and quantity setting in oligopoly models. This effect is not a strategic effect, but is of great importance in evaluating the welfare effects of information acquisition and information exchange, whenever there is market power.

There is another observation that is of importance for the later analysis. This is the fact that increasing the variability of demand for given expected (i.e. mean) demand will always increase profits of the monopolist if he has some information. Essentially, information of a given quality becomes more valuable under greater demand uncertainty, because the gains from adapting to the true state of demand become greater. This is illustrated in Figure 4 with an example in which the monopolist always perfectly knows the state of demand.
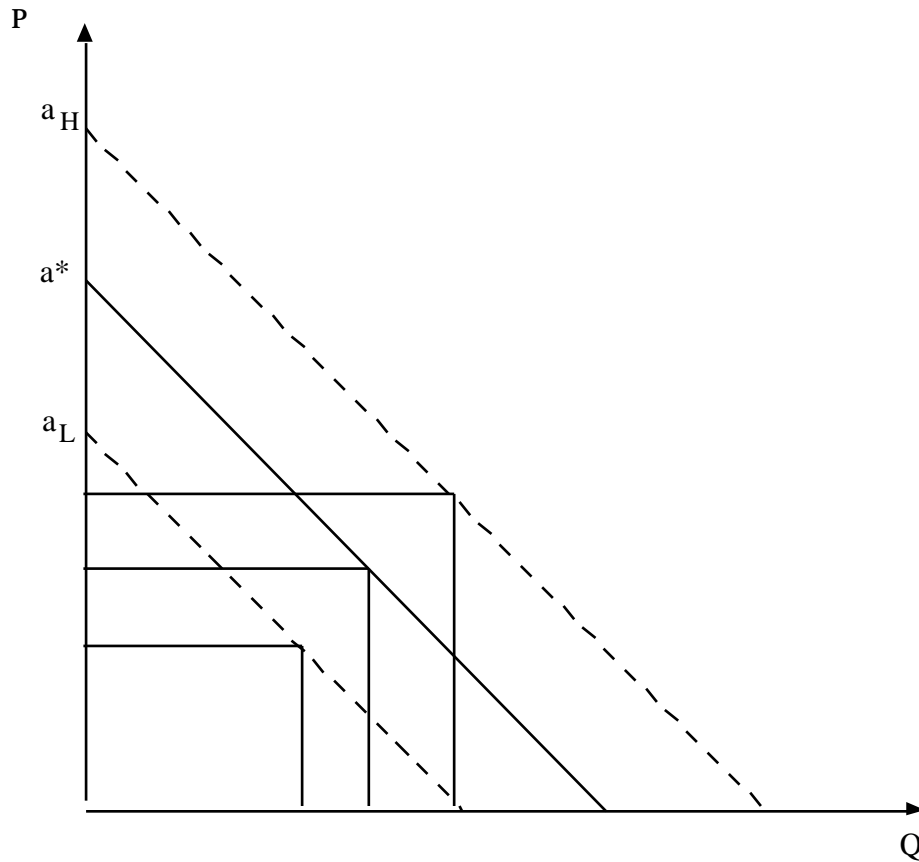
Figure 4

The central demand function corresponds to a completely certain demand. "High" and "Low" demand states are the same. Now suppose we have uncertain demand with a high and a low demand intercept. The central line then becomes expected demand. Having greater uncertainty means that the monopolist gains in high demand states and losses in low demand states. However, the gain in high demand states is always larger[4]. Intuitively, winning sales in high demand states is more valuable than the costs of losing sales when demand is low.

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[4] This is because his gains increase quadratically with linear increases in the demand intercept.

2.2 Acquisition of Information about Costs

In the case of cost uncertainty the analysis becomes much simpler. Since the demand function is not random both price and quantity setting lead to the same result . Therefore, we only have to analyze one of the cases to study the welfare impact of increasing a monopolist's information. As in the case of demand uncertainty, increasing information for the monopolist will make output higher in low cost states and lower in high cost states. As can be seen from Figure 5 the marginal benefit of an increase in production in low cost states exceeds the loss of a decrease in production in high cost states. Hence, expected dead weight loss is reduced through information acquisition.

The Monopolist with Cost
Uncertainty
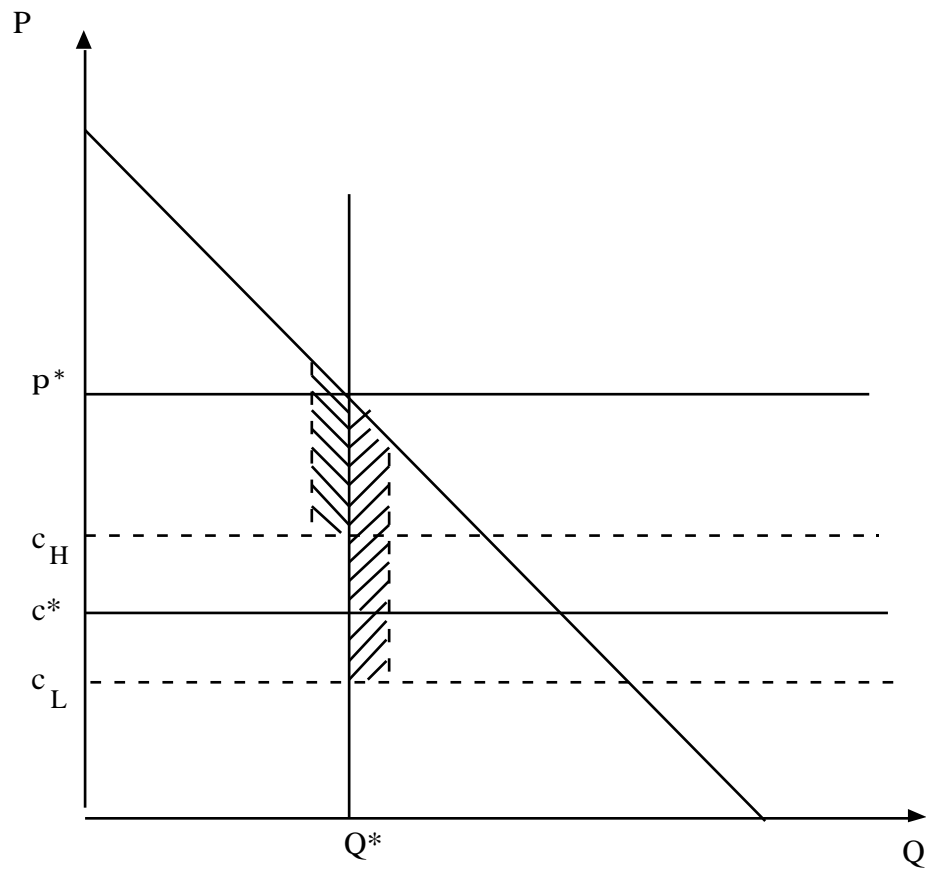
Figure 5

Increasing Information is Welfare
Improving under Price and Quantity
Setting

3 Sharing Demand Information Among Competitors

After having discussed the effects of information acquisition of a monopolist we now introduce the effects of competition between firms with market power. In this section we will concentrate on information exchange of demand information. We will think of information sharing as consisting of two parts from the point of view of a single firm. First, all competitors acquire additional information. We will analyze the externality imposed on the firm by the acquisition of information by competitors. Secondly, the firm itself acquires information through information exchange. This will have the previously noted effect of improving the firm's adaptation to demand shocks. However, there is a third effect of information acquisition. If other firms know that a firm has acquired information, as is the case with information exchange, these firms will adjust their behaviour. This effect is not present under monopolistic competition since a single firm's output or price decisions will not affect the residual demand functions other firms face[5]. To separate the different effects we will first analyze information exchange under monopolistic competition and then discuss the additional effect generated in oligopoly.

3.1 Monopolistic Competition

In the monopoly case we showed that the monopolist always gains in ex-ante expected profits if the variance of demand is greater for given expected demand[6]. By analogy we can conclude that anything that makes the residual demand function a firm faces under

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[5] Under monopolistic competition a single firm has market power but cannot influence market aggregates by its decision. This means that it cannot affect other firms' demand functions. The model of monopolistic competition we consider is the limit of the oligopoly model, when the number of firms becomes arbitrarily large and firms retain some monopoly power.

[6] By ex-ante expected profits we mean expected profits before the information about demand arrives.

monopolistic competition (or oligopoly) less variable will hurt a firm that has some information about demand. In contrast, anything that makes the residual demand function more variable will benefit the firm. While this fact was of no importance to our analysis of information acquisition in the monopoly case it becomes important when there is interaction between firms in a market. The reason is that the variability of residual demand that a monopolistically competitive (or an oligopolistic) firm faces depends on the information of its competitors. Acquisition of information by competitors has an external effect on a firm by making the residual demand function it faces more or less variable. We will show that these informational externalities have important effects on the incentives to acquire information through information sharing.

The analysis of information exchange under monopolistic competition is due to Vives (1990). A first complication in the analysis arises because with competition there is a much richer set of possible informational environments. Most importantly, with competing firms, we have to distinguish whether shocks to demand are firm specific ("private values model") or affect demand for all firms in the market in the same way ("common value model"). Common value models are considerably simpler to analyze. We will therefore discuss them first before turning to models with firm specific shocks to demand.

3.1.1 Common Shocks to Demand

Let us illustrate the main point about competitive externalities from information improvements for competitors in an example in which demand faced by each competitor is affected by a common shock. Let demand for the good of firm i be given by

$$p_i = a\text{-}(1\text{-} d\ )Q_i \text{ - d}\tilde{Q}$$

where a is the uncertain demand parameter, Q_i is the output of the firm, and $\tilde{Q}$ is the average output of all other firms in the market. Since we assume monopolistic competition no firm

perceives any influence of its actions on the average output in the market, $\tilde{Q}$. This is the "large group assumption" underlying the notion of monopolistic competition. An individual firm's decisions have no impact on the demand of a competitor. However, several firms jointly affect demand. Note, that d is a measure of how differentiated products are in monopolistic competition. With $d = 0$ there is a pure monopoly situation and everything we have said about monopoly applies. As d goes to 1 goods become perfect substitutes and firms are not able to influence the price. The demand intercept is perceived by firm i as being $a - d\tilde{Q}$. If other firms do not have any information about a the only uncertainty in the demand intercept comes from the uncertainty about a.

The Informational Externality of Information Acquisition by Rivals

Let us first consider the case in which *firms set quantities.* In Figure 6 we have plotted the demand function that firm i faces when other firms in the industry have no information and the state is high as $D^H = a_H - d\tilde{Q}^*$ and if the state is low as $D^L = a_L - d\tilde{Q}^*$.

$$p_i = \alpha - (1 - \beta) Q_i - d \tilde{Q}$$
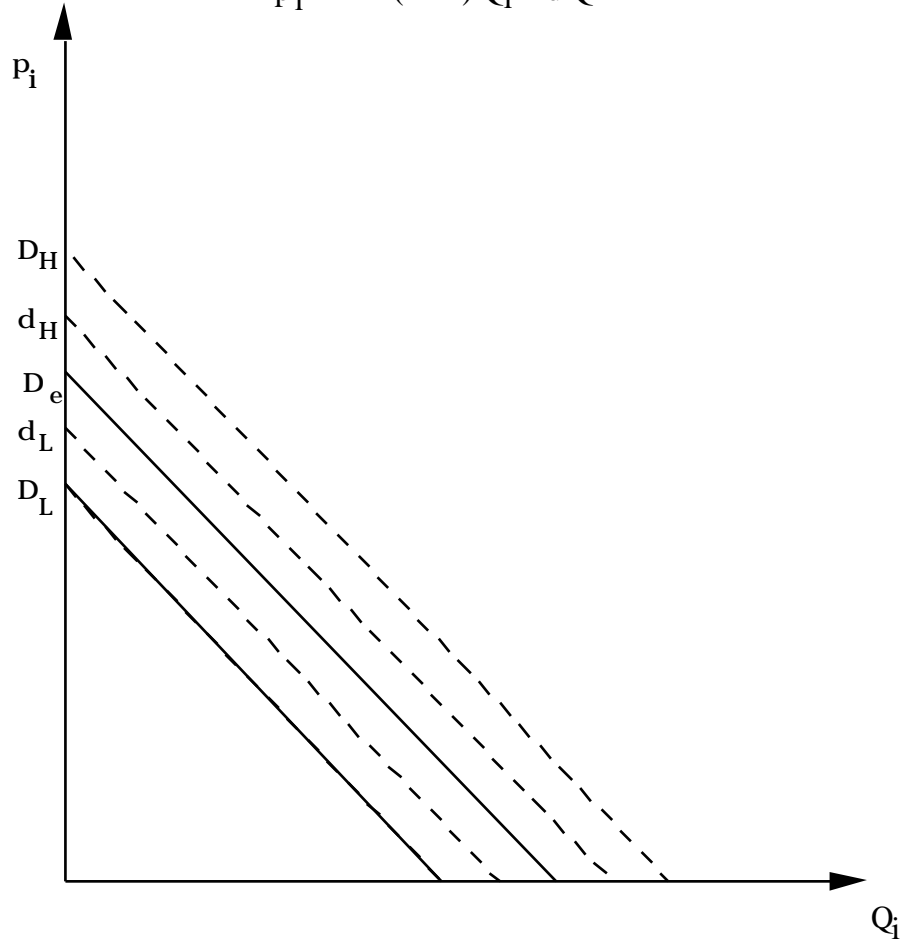
Figure 6

The external effect on residual demand

The solid line in the middle is as before the expected demand curve. Now suppose that other firms can perfectly condition on the state of demand a because they possess this information. Then they will produce more in states with high a and less in states with low a. This means $\tilde{Q}(a_H) > \tilde{Q}^* > \tilde{Q}(a_L)$ and therefore the demand intercept of firm i is reduced in high states and increased in low states. Hence, the demand intercept varies less from the point of view of firm 1. In other words, demand for firm i in the high and the low state, $d^H = a_H - d\tilde{Q}(a_H)$

and $d^L = a_H - d\tilde{Q}$ (a_H), will lie closer to expected demand than D^H and D^L. Demand for firm i is less variable if other firms have full information of *a*.

Information Acquisition by

Rivals

in the Absence of Private
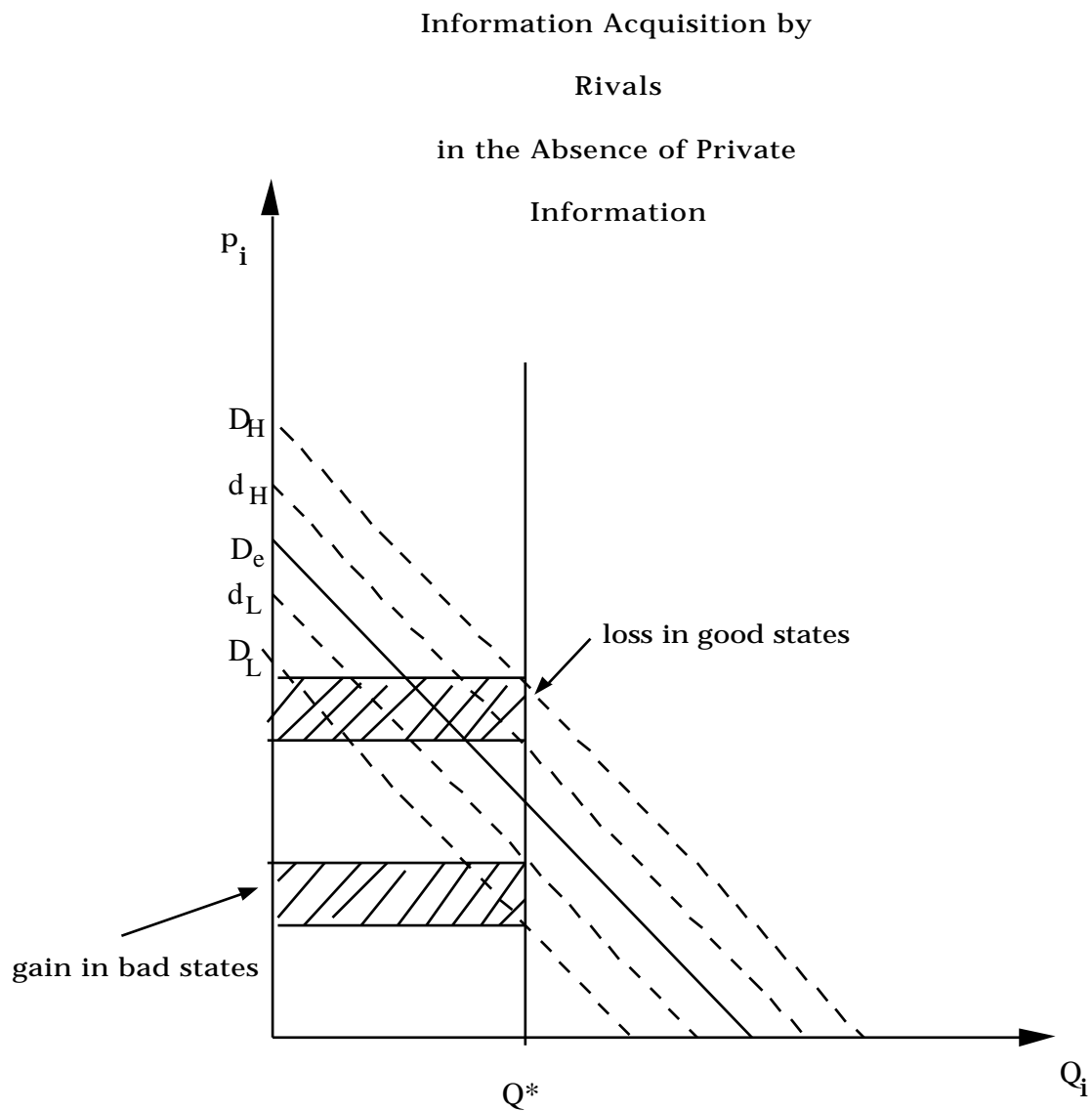
Information

Figure 7

First, note from Figure 7 that this would have no effect on firm *i* if it had no prior information on the state of demand. What is lost by lowered prices in the high state of

demand is gained by higher prices in low states of demand[7]. This is different, however, if firm *i* has some private information about demand. Decreasing the variance of demand for given expected demand will then always decrease the profits of the firm as in the monopoly case. Hence, information acquisition by competitors leads to residual demand of a firm becoming less variable if competitors are quantity setters. As a result there is a negative externality of information acquisition. Intuitively, the acquisition of information by competitors makes them react more actively in terms of output to the demand shock. This gives the remaining firm less value from exploiting the information it has about demand. Hence, in the case of quantity setting and common shocks to demand there is a negative external effect on the value of information of firms from the information acquisition of competitors.

The Incentives to Form Industrywide Information Exchange Agreements

We can now consider the effects of industrywide information sharing agreements in situations with common demand uncertainty and quantity setting. Information sharing agreements improve the information of the firms and therefore the quality of their decision making. On the other hand they mean that for each individual firm the variability of demand is decreased, which is bad for firms because it reduces the value of their pre existing information. Furthermore, the more variability is reduced through information sharing the less valuable is the extra information gained. If products are very close substitutes then variability of individual demands is reduced almost to zero and hence the gain from the additional information arbitrarily small. As a result, the loss from reduced variation in demand will outweigh any gains from the improved precision of information about the demand intercept. Hence, firms prefer not to exchange information in monopolistic (quantity) competition with common demand uncertainty when products are close enough substitutes. (See Vives 1990, Lemma 2). On the other hand, as goods become poorer

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[7] This observation was first made by Ponssard (1979) in the context of a Cournot oligopoly model.

substitutes the effect of competitors' adaptation to demand information has smaller impact on the residual demand variability of a single firm (and it disappears for unrelated monopolies). Hence, variability of demand will be reduced less while the value of acquired information is higher. The incentives to establish an industrywide information exchange agreement will therefore be increased with poorer substitutability of products.

The Reversal of Externalities and Incentives under Price Setting

With *price setting firms* the argument we have just made is reversed. Increasing the information of other firms, makes the output of those firms less variable with the demand intercept, as we have seen in the monopoly case. As a result, the demand intercept of firm i becomes more variable. With price competition the competitive externality among firms is positive. Information acquisition by rival firms increases the value of existing information for other firms. The effects of gaining more precise information about demand and the positive externality of others acquiring information both give an incentive for industrywide information sharing agreements as long as products are substitutes.
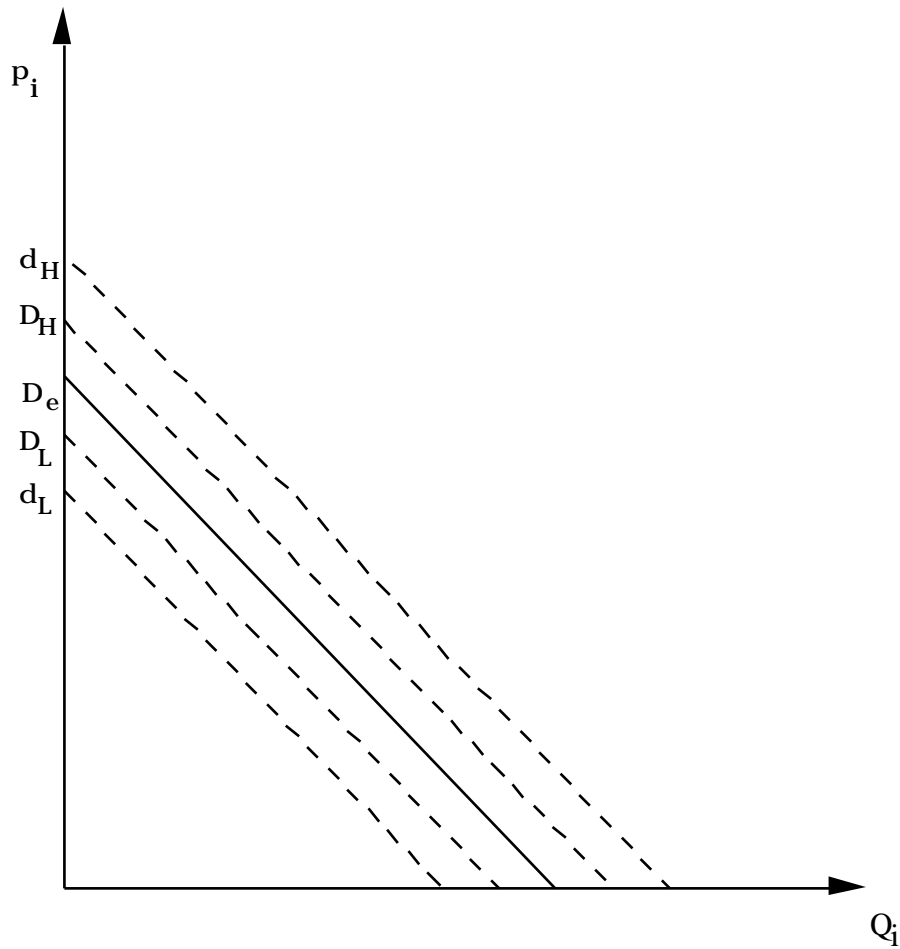
Figure 8

The Effects of Information Exchange Agreements on Welfare and Consumer Surplus

The main welfare effect of information sharing under monopolistic competition is the same as that of information acquisition in monopoly. Information sharing leads to better information for firms, which induces more quantity adjustments when firms set quantities and induces less quantity adjustments when firms set prices. Hence, information sharing leads to a decrease in expected deadweight loss under price setting. We will call this the quantity adjustment effect. However, in contrast to the monopoly case, under monopolistic

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competition we have an additional effect due to product differentiation. Product differentiation, in this model, is derived from the assumption that consumers have preference for variety. This means that for any given average output across firms consumers prefer consumption bundles that have less variation of consumption across varieties. In other words, uniformity of output across varieties is valued by the consumer when he has preference for variety. Information exchange has the effect of increasing uniformity of output across varieties, both when firms set quantities and when they set prices. If the information of firms is more correlated, output will be more uniform across firms. This has a positive welfare impact both under price and under quantity setting. We will call this the preference for variety effect.

As a result, under quantity setting, the quantity adjustment effect and the preference for variety effect go in the same direction. Welfare is increased through information sharing. On the other hand, with price setting, the two effects go in opposite direction. Vives (1990) proves that the quantity adjustment effect dominates under monopolistic competition, so that information exchange under price setting is welfare reducing[8].

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[8] To make the above argument more precise consider expected total surplus in Vives (1990), which can be written as:

$$E\left[\int \left(Q_i - \tilde{Q}Q_i - \frac{1-}{2} Q_i^2 \right) di \right] + \left[Cov\left(Q_i, \tilde{Q}\right) - \frac{1}{2} Var\left(\tilde{Q}\right) \right]$$

where E denotes the expectations operator and *Cov* and *Var* denote the unconditional covariance and variance respectively. The term under the integral sign is exactly the same for every *i* as in the case of monopoly, interpreting a -d$\tilde{Q}$ as the demand intercept and (1-d) as the slope of demand. Therefore, the effects on total surplus and consumer surplus we discussed in the monopoly section apply to this term. The second term, the difference in the covariance of individual output and average output and half the variance of average output corresponds to the preference for variety effect. This term will generally increase through information sharing. To see this note that generally the covariance between individual

The same two effects are at work in evaluating the impact of information sharing on consumer surplus. Again, the quantity adjustment effect is dominating with price setting firms. As a result, consumer surplus is increased by information sharing when firms are quantity setters and reduced if firms are price setters (see Chart 1, Vives 1990).

3.1.2 Individual Shocks to Demand

To complete the analysis of information sharing about demand in monopolistic competition we have to look at the case in which each firm's demand is affected by an individual shock to the demand intercept. In this case firm i' s demand becomes:

$$p_i = a_i - (1-d)Q_i - d\tilde{Q}$$

where the only difference is that the demand intercept a_i is now firm specific. This change does, however, significantly affect the analysis. Let us suppose that a_i is perfectly known by firm i and that demand intercepts are imperfectly positively correlated across firms. If other firms do not have any information about their competitors a single firm will expect a_i and $\tilde{Q}$ to be positively correlated. Observing a high a_i gives firm i the information that other firms, on average, will also have high realizations of their demand intercepts. Now suppose that

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output and average output is smaller than the variance of average output, i.e. $0 < Cov\ (Q_i, \tilde{Q}) < Var\ (\tilde{Q})$, whenever firms have different information. However, after information sharing they are the same. Since firms are symmetric in our model they will all produce the same output when they have the same information, which means that individual output is perfectly correlated with average output, i. e. $Cov\ (Q_i, \tilde{Q}) = Var\ (\tilde{Q})$. Hence, there is always a gain in welfare (and consumer surplus) from the preference for variety effect. In the case of price setting the first effect (which we know from the monopoly case) does, however, dominate the preference for variety effect (see Proposition 3, Vives 1990).

other firms except for firm i are perfectly informed about the realization of all the demand intercepts. How do these firms react? If the average a in the market is higher than expected firms will decrease output expecting other firms to produce more than anticipated. If average a in the market is lower than expected they will increase output expecting other firms to produce less than anticipated. Hence, after information sharing each output produced for every firm j, and therefore average output, will vary less systematically with a given a_j. What are the effects for the variability in the demand intercept that firm i faces? Firm i has full information about a_i when setting output. Average output $\tilde{Q}$ will before information sharing vary positively with a_i because of the correlation between private shocks. After information sharing $\tilde{Q}$ varies less systematically with a_i, which makes the demand intercept $a_i - d\tilde{Q}$ more variable from the point of view of firm i. Hence, other firms obtaining information has a positive external effect on firm i.

Note that this conclusion is unchanged under price setting behaviour. When firms obtain information and are price setters, they will increase prices if they find that demand intercepts are higher than expected, because they expect other firms to set higher prices. The opposite is the case if demand intercepts are lower than expected. However, the average quantity produced will again vary less systematically with an individual demand intercept a_i. The positive externality from other firms obtaining information persists.

The Incentives for Information Sharing

The incentives for industrywide information sharing agreements in such a market can again be summarized by looking at information sharing for each firm i as consisting of first informing all other firms, and then improving the information of firm i. We have shown that the first move has a positive external effect on firm i while improving information is always beneficial to the firm given that in monopolistic competition the acquisition of information by a single firm does not affect the behaviour of others. As a result it is profitable for firms to establish industrywide information sharing agreements as shown in Vives (1990, Chart 1).

Again we can deduce the main effect of information sharing, the output adjustment effect, from the simple monopoly case. Under quantity setting the variability of output increases for each firm while it decreases under prices setting. However, the preference for variety effect will tend to go in the opposite direction from that in the common value case. Optimal adaptation to demand shocks implies that firms with high realizations of the demand intercept produce more than firms with low realizations of the demand intercept. Information sharing will, therefore, tend to increase the disparity in outputs among different firms. Since there is preference for variety this effect will lower welfare and consumer surplus. In the case of price setting by firms the output adjustment effect and the preference for variety effect both decrease welfare and consumer surplus. Under quantity setting the output adjustment effect again dominates in monopolistic competition yielding an increase in welfare (see Vives 1990, Proposition 3). The effect on consumer surplus is, however, ambiguous because of the preference for variety effect.

3.1.3 A Summary of the Effects of Information Sharing in

   Monopolistic Competition

To summarize we note that there are two effects of information sharing for firms in monopolistic competition. First, firms get more information, which is like receiving a better signal. This is always good for firms. On the other hand, other firms get better information. This can be good or bad for firms. There are also two effects of information sharing on welfare and consumer surplus. First, there is an output adjustment effect. Information sharing under quantity setting leads to more output adjustment. This leads to a tendency of deadweight loss being increased from information sharing under price setting and decreased from information sharing under quantity setting. Secondly, there is a preference for variety effect. When there are common shocks to demand information sharing makes outputs across firms more uniform. When there are firm specific shocks to

demand information sharing makes output across firms less uniform. With preference for variety consumers prefer a more uniform distribution of output across varieties. Hence, there is a positive effect on consumer surplus from information sharing when there are common shocks to demand, but a negative effect on consumer surplus when there are firm specific shocks to demand.

Note that the dominating effect on welfare is the output adjustment effect. This effect does depend on whether there is price or quantity setting, but is in no way related to the competitiveness of the market. The expected levels of output are not influenced by information sharing. On the contrary, the dominant effect is also present in the case of pure monopoly. This indicates that in static models the welfare results of information exchange need not change qualitatively simply by going from a highly concentrated market to one that has a large number of firms.

3.2 Oligopoly

While much has been made of the "strategic effects" of information sharing, the results of the oligopoly literature on information sharing can basically be understood in terms of the arguments made for the case of monopolistic competition. Under oligopoly and demand uncertainty there are again two main effects of information sharing on firms. One is the increased precision of information, which benefits the firm. The other is the increased precision of information of others which may benefit or hurt the firm depending on whether residual demand becomes more or less variable. Hence, there is a direct information effect and an indirect informational externality. However, a third effect arises in oligopoly because firms have a perceivable effect on their competitors. A firm knows that other firms know when it acquires information and it knows that these firms act according to that knowledge. If a firm knows that another firm has just acquired the information it has itself it will change its behaviour accordingly. Hence, the fact of acquiring information may not only improve the precision of information but at the same time affect the variability of the

residual demand function. However, while this may influence the value of information acquired, it does not in any significant way affect the qualitative conclusions from the analysis. The net value of the information acquired from other firms through information exchange will still remain positive. We can therefore without loss of insight still analyze information sharing as the combination of two steps: First all firms except for firm i receive the relevant information in the market which generates an informational externality for firm i. Secondly, firm i is given all the information in the market, which produces a net gain. We will discuss the literature on the subject based on these two effects.

3.2.1 Common Demand Uncertainty and Quantity Setting

Consider first common demand uncertainty and quantity competition. As in the case of monopolistic competition giving other firms more information will reduce the variance of the demand intercept. Given the signal that the firm receives this reduces profits. On the other hand receiving additional information from others increases benefits. Hence, there is a trade-off between the benefits of information precision through information sharing and the losses from giving other firms more precise information. As in the case of monopolistic competition with perfect substitutes information sharing reduces the profits of firms (Vives 1984, Gal-Or 1985). If we make the goods poorer substitutes the informational externality gets smaller since adaptation to the demand shock by other firms does not feed through as much into the demand intercept of the remaining firm. If goods are poor enough substitutes there will be incentives for information sharing (Vives 1984). By the same argument increasing marginal costs of production will reduce the informational externality because it is more costly to react to information. In particular, exploiting good information about demand is costly if marginal costs are increasing. Hence, the reduction in variability of residual demand becomes smaller the steeper marginal costs are. If marginal costs are increasing fast enough, the effect of increased precision in information will dominate and there will be an incentive for industrywide information sharing agreements even under Cournot competition (Kirby 1988). These incentive effects are summarized in Raith (1993,

Proposition 4.4).

As in the monopolistic competition case welfare and consumer surplus are increased (Sakai 1989). Hence, for very imperfect substitutes, i.e. almost monopolistic markets, or for very steep marginal costs private and public incentives of information sharing go in the same direction. This is as in the pure monopoly case.

3.2.2 Common Demand Uncertainty and Price Setting

With price competition and common shocks to demand the effects are again identical to those of monopolistic competition. Under price competition the residual demand of a firm gets more volatile when other firms improve their information. Hence, firms benefit from this effect. There is always an incentive to form industrywide information exchange agreements. As under monopolistic competition there are two effects on total expected welfare and expected consumer surplus. On one hand there is a negative effect from the output adjustment effect. Increasing information of firms reduces the adjustment of output to the state of demand. On the other hand there is a positive preference for variety effect. Output becomes more uniform across firms. However, the first effect always dominates from the point of view of consumers. Consumer surplus falls. However, welfare may rise if goods are close enough substitutes.

3.2.3 Quid pro Quo Agreements and Unilateral Information Revelation

The literature has quite extensively discussed the possibilities of Quid-pro-Quo Information Sharing Agreements and Unilateral Information Revelation (see Vives 1984, Kirby 1988, Raith 1993). A Quid-Pro-Quo agreement means that firms come to an agreement to give their private information to other firms if and only if other firms give up their private information. Unilateral Information Revelation means that firms would wish to reveal information to others regardless of whether they obtain information or not. Such a one-sided commitment to reveal private information to others will only improve the information

of others without improving the precision of information for the firm. Hence, under Cournot competition only quid pro quo information sharing agreements are possible since information acquisition by others has a negative external effect on the value of information of the firm. In contrast, firms will be willing to unilaterally reveal information if they compete in prices. Then, as we have shown, information revelation on a common demand shock makes demand more volatile leading to an increase in the value of information. Note, that this is not in conflict with the model of information sharing under monopolistic competition. The only difference is that under monopolistic competition a single firm cannot effectively change the information set of other firms. Hence, the firm is always indifferent between revealing its information to others or not.

3.2.4 The Effects on Entry

It has been argued in competition policy cases that information sharing may increase barriers to entry. It should be noted that our analysis above leads to an ambiguous conclusion with respect to this claim. The profits of a potential entrant will be affected by information exchange only through the external effect of the information sharing agreement. This effect is negative in the case of quantity competition and therefore might be considered as a barrier to entry. However, it is positive in the case of price competition. Information exchange would therefore encourage entry in the case of price competition. There has been no formal analysis of information sharing in the presence of entry threats. However, from the previous discussion we can obtain some conclusions. We would expect a smaller negative welfare effect of information exchange agreements under price competition since they increase the possibility of entry. On the other hand entry threats may prevent information exchange from occurring. If firms anticipate that information exchange will lead to entry they may decide not to undertake it. On average we would expect entry to reduce the welfare effects of information sharing under price setting. With quantity setting the conclusion is more ambiguous. Since under Cournot competition there is a tendency

towards excess entry in markets[9], the reduction in entry incentives might have an additional welfare benefit in such models.

3.2.5 Private Shocks to Demand

Private shocks to demand will again have effects similar to those discussed in the model of monopolistic competition. To see this consider the case of quantity competition. If other firms are informed that firm i has a low (high) state of demand, others will produce more (less) because they know firm i has an incentive to produce less. Hence, with information sharing the (intercept of the) residual demand function becomes more volatile, benefiting the firm. In consequence, firms will have an incentive to share information under quantity competition (Fried 1984, Li 1985, Shapiro 1986). Indeed, sharing information is now a dominant strategy for firms and firms will be willing to unilaterally commit to sharing information. Welfare and consumer surplus are, as in the case of monopolistic competition, affected in two ways. First, there is the output adjustment effect, which is positive in the case of quantity setting. Secondly, there is the preference for variety effect which is negative because of private value uncertainty. Expected welfare will again be increased. However, the preference for variety effect will be larger for smaller numbers of firms leading to reductions in consumer surplus for duopoly (and more generally for markets with few firms). In this sense markets with a larger number of firms will make information sharing with quantity competition and private demand shocks more likely to lead to welfare improvements (Sakai 1986, 1989).

Similarly, under price competition, additional information of competitors will also lead to more variability in residual demand. If firms are informed that firm i's demand is high (low) they will set higher (lower) prices. This means the outputs other firms produce get more negatively correlated with the demand parameter a_i. Therefore, the demand intercept

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[9] See, for example, Mankiw and Whinston (1986).

gets more variable in a_i through information exchange. Hence, information exchange improves the precision of information and increases the variability of residual demand (a positive informational externality). However, both the output adjustment effect and the preference for variety effect are negative, so that expected welfare and expected consumer surplus are reduced.

4 Sharing Information About Costs in Monopolistic Competition and Oligopoly

We have seen that in the case of a monopoly uncertainty about costs meant that price setting and quantity setting were equivalent. In the case of competition, however, such a clear distinction between cost and demand uncertainty cannot be made. In particular, cost uncertainty of one firm will induce demand uncertainty for the other firm, since residual demand depends on the actions of the other firm.

4.1 Information Sharing under Quantity Setting

The analysis is significantly simplified in the case of quantity setting. Quadratic preference models with shocks to the level of marginal cost can always be reinterpreted as models with shocks to the intercept of demand and certain marginal costs. The analysis of private incentives, total welfare effects, and consumer surplus coincides.

4.2 Information Sharing under Price Setting

Under prices setting behaviour there is an added complication to the effects of information exchange. Up to now informational externalities came about indirectly. Acquisition of information by competitors had an effect on a firm only if it had some information about the uncertain parameter. Competitors gaining information meant a reduction or an increase in the value of the information the firm possessed. As a result there were only external effects of information acquisition if firms had some information. In contrast, in the case of cost

uncertainty and price setting behaviour there is the possibility of direct externalities of information acquisition on competitors. Even when a firm has no information about its own costs or those of its competitors can there be an external effect of information acquisition about costs by competitors on its expected profits. With cost uncertainty and price setting firms we will face a *direct correlation* between its costs and its demand intercept when rival firms acquire information about its costs. To see this consider the profit function a firm faces in such a market:

$$[p_i - c_i][a - bp_i + dS_{j \ i} \ p_j]$$

Now suppose that firms *j* have information about the costs of firm *i*, then prices p_j will systematically vary with c_i even if the price of firm *i*, p_i, remains unchanged.

To see more clearly what this effect does, let us consider an extreme situation. Suppose all firms have the same marginal cost level *c*. However, firm *i* is unaware about this cost level. We will look at the effect of other firms acquiring information about *c*. From our discussion of demand uncertainty with Cournot competition, we know that in the quantity setting case there would be no effect on the expected profits of firm *i* (see Figure 7). Now consider Figure 9. The three lower horizontal lines represent the high cost state, the expected marginal costs, and the low cost state, respectively.

Profits in the High Cost State
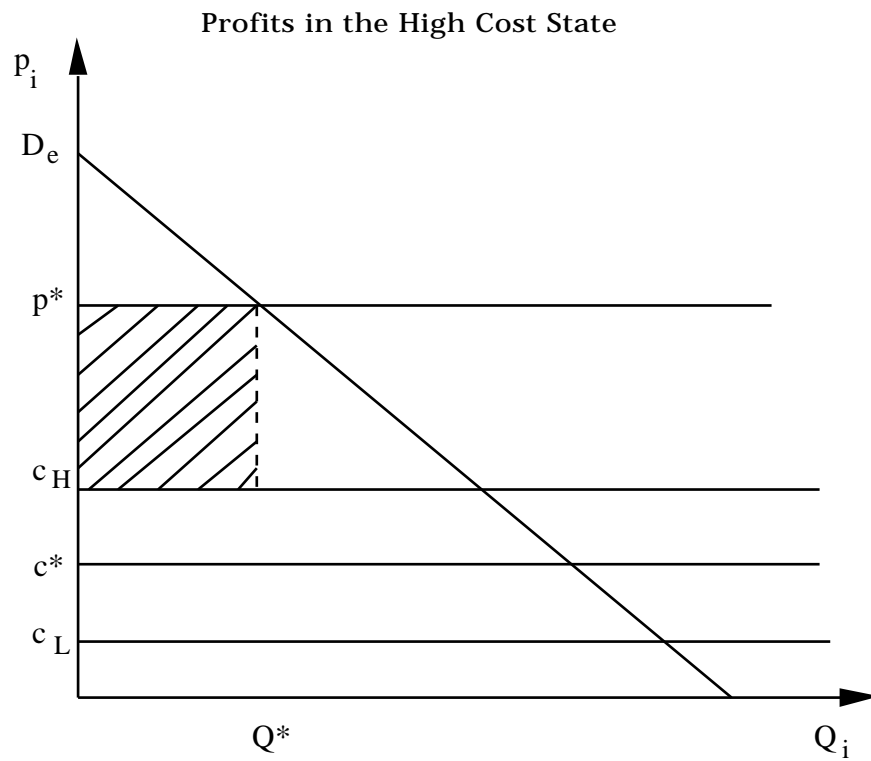
Figure 9

The downward sloping line is the expected state of demand. Without any information the market equilibrium is at (p^*, Q^*). In Figure 9 we have shaded the area that correspond to profits of firm *i* in the high cost state. In Figure 10 we have shaded the area that corresponds to profits in low cost states. Now suppose other firms are informed about the cost level.

Profits in the Low Cost State
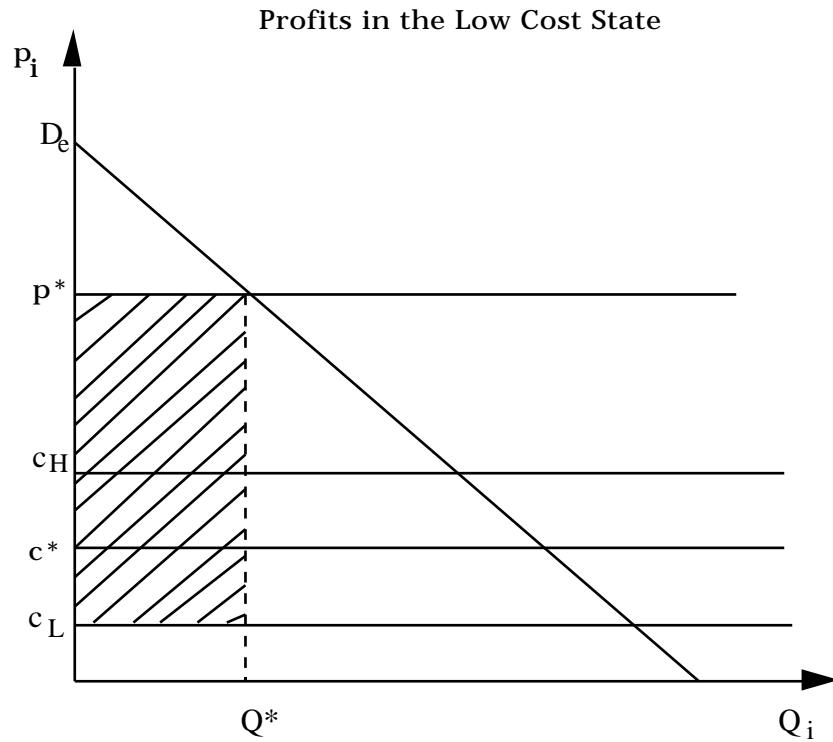
Figure 10

They will set higher prices in high cost states, thereby reducing output, and they will charge lower prices in low cost states, thereby increasing output. Expected outputs remain unchanged, so that the optimal price set by the remaining firm i is unchanged. In Figure 11 we have shaded the areas that correspond to the profit changes of the uninformed firm i in every state of this regime, when other firms obtain information about the state of costs.

P_i

$D_e(c_H)$

D_e

$D_e(c_L)$

Profit gains in the high cost state

p^*

c_H

c^*

c_L

Q^*

Q_i

Profit losses in the
low
cost state
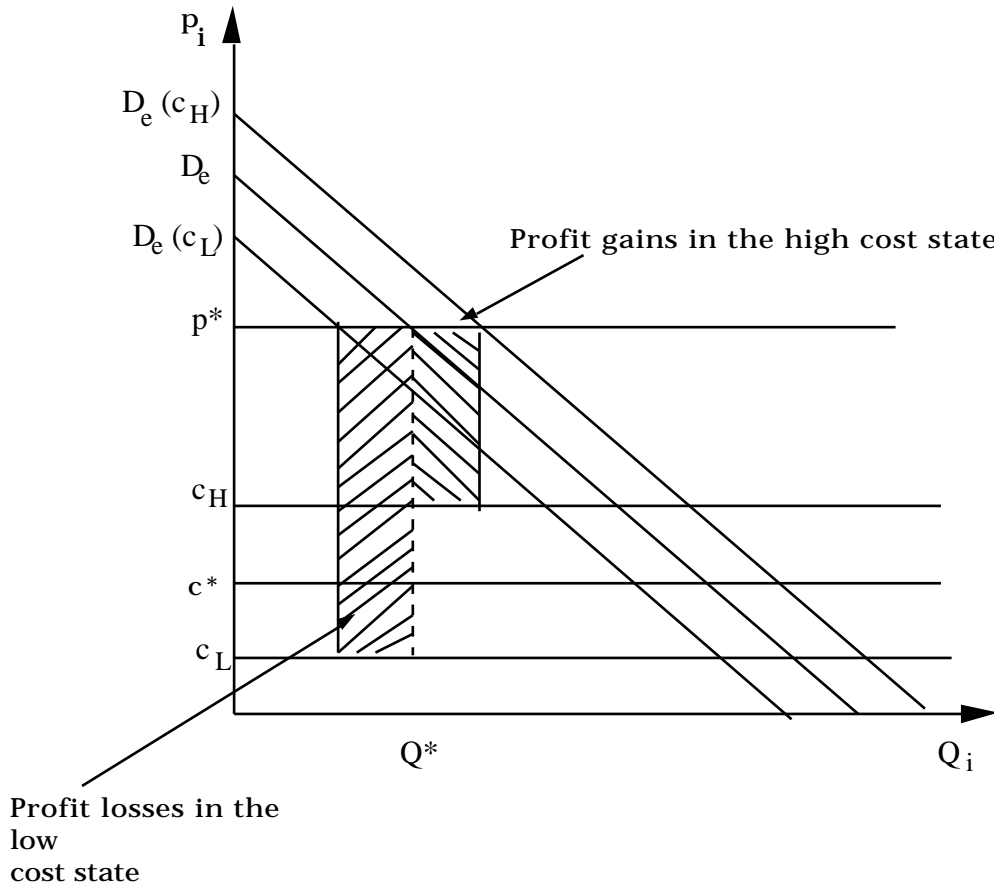
Figure 11

Note that firm i gains from the increased information of other firms in high cost states and looses in low cost states. In high cost states other firms will increase their prices thus increasing residual demand. Firm i gains by selling more units at the same price as before. When costs are low other firms gain market share by selling at lower prices, leading to a lower residual demand function and lower sales for firm i. Hence, we have externalities of information acquisition even on firms that do not possess private information.

If we consider the net effect from this direct externality from other firms acquiring information we see from Figure 10 that on average the uninformed firm i has lower expected profits. On the other hand, in more general models we will also have the positive

indirect external effects and the increased precision effect of information sharing. However, it should be clear that there is a trade-off involved. Indeed, results depend delicately on the parameters and the number of firms in the market (Raith 1993).

5 Summary

In the pages above we have provided a unifying explanation of the incentives to share information and its welfare consequences in different environments. We have seen how the intuition from the monopoly case could be extended to monopolistic competition and oligopoly situations. We provide here a summary of the results of the literature (the references can be found in Table 3).

5.1 Incentives to share information

Results on the incentives to share information are contained in Table 1. The Table gives information about the sign of the information externality generated by information sharing on firms' expected profits. A positive information externality will yield incentives for a firm to share information in dominant strategies (that is, no matter what the rivals do about the pooling of data). A negative externality will not destroy necessarily the incentives to share information with a quid pro quo type arrangement provided expected profits increase (due to the increased information that firms have). As is clear from the Table, the sign of the externality depends on the particular specifications of the model. A change of strategic variables (prices instead of quantities) or of the type of uncertainty (common value versus private value), may yield different incentives to share information. Furthermore, under price competition with cost uncertainty a direct externality from information acquisition by others complicates the picture.

Incentives to share information

Demand

	C.V.	P.V.	
price setting	+ Yes (D.S.)	+ Yes (D.S.)	
quantity setting	- ? (Only quid pro quo)	+ Yes (D.S.)	

Cost

	C.V.	P.V.	
price setting	? ?	? n small: No (D.S.) n very large: Yes (D.S.)	
quantity setting	- ? (Only quid pro quo)	+ Yes (D.S.)	

<u>**Table 1**</u>

C.V.: Common value, P.V.: Private values

How to read the Table:

Information Externality (+/-)
Incentives to share (Yes/?/No)
(How?: quid pro quo, dominant strategy-DS)

We have seen that information sharing may emerge (be it in quid pro quo arrangements or with unilateral commitments) in a wide array of circumstances in which firms compete. Exceptions are Cournot competition with common value uncertainty when goods are close substitutes (or with slowly increasing marginal costs) and Bertrand duopolistic competition with private value cost uncertainty.

5.2 Welfare impact of information sharing

Table 2 summarizes the welfare effects of information sharing on consumer and total surplus. These results depend on two main features of the market. First, the type of decision variable (price or quantity) matters. If firms are quantity setters increasing information decreases the degree of output adjustment. It is important to note that this is an effect that is independent of the degree of competitiveness of the market. Secondly, the type of uncertainty (common value versus private value) matters. This is true because of a preference for variety effect. Consumers prefer, in these models, consumption patterns that are uniform across varieties. With common value demand uncertainty production patterns will become more uniform with information sharing and benefit consumers. With private value uncertainty production patterns tend to become less uniform with information sharing, which leads to a reduction in welfare and consumer surplus. These two effects may be reinforcing or countervailing depending on the combination of uncertainty and decision variable (as well as whether there is demand or cost uncertainty). Furthermore, the relative size of the two effects may vary depending on the size of the industry.

Welfare

Demand

	C.V.		P.V.		
price setting	ETS:	ECS: - − poor sub. + good sub. (n large: -)	ETS:	ECS: - − Monop. Comp + n = 2	
quantity setting		ECS: + ETS: +	ECS:	− n small(n < 9) ? otherwise ETS: +	

Cost

	C.V.		P.V.		
price setting		ECS: ? ETS: +	ECS:	− n small (n < 9) ? n large ETS: -	
quantity setting		ECS: + ETS: +	ECS	− n small (n < 9) ? otherwise ETS: +	

Table 2

These underlying effects generate a relatively complex picture of the impact of information sharing on welfare and consumer surplus. Fine tuning of competition policy to take into account the welfare impact found in this literature appears to be a formidable task. Note, for example, that welfare results of information sharing literally depend on whether prices or quantities are set. While we know that generally Bertrand competition is more competitive than Cournot competition (see Vives 1985), it is not the case that the competitiveness of the market determines the welfare results. For example, a market may not be very competitive, but firms may still be setting prices, not quantities. This makes it very difficult to use econometric evidence to determine the welfare results of information exchange. Econometrics has helped in trying to determine the degree of competition in markets by

estimating mark ups over marginal costs.[10] This literature does not, however, identify whether the decision variable is price or quantity. The static theory of information exchange therefore appears to be insufficiently related to observables to base policy conclusions on it.

Literature

Demand

	C.V.	P.V.	
price setting	Vives 84 Vives 90	Vives 90	
quantity setting	NS 82 Clarke 83 Vives 84 Gal-Or 85 Li 85 Kirby 88 Vives 90	Vives 90	

Cost

	C.V.	P.V.	
price setting	Sakai 89	Gal-Or 86 Sakai 86 Sakai-Yamato 89	
quantity setting	(same as demand)	Fried 84 Shapiro 86 Gal-Or 86	

Table 3

Surveys: Sakai (1989), Raith (1993)

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[10] See, for example, Bresnahan (1989) for a survey of the econometric literature that tests for market power in industries.

6 Ex-Post Incentives to Exchange Information

In all the static models of information sharing discussed above there is a conceptual problem. It is usually assumed that firms can commit to share information through a trade association before they have actually received the information. However, what guarantees that firms stick to the agreement and truthfully report this information? Indeed, if the statements about the information received cannot be verified no credible information exchange can take place. In oligopoly, firms have in general an incentive to lie about the true information received to induce more favorable behaviour by their competitors (see Ziv 1993 for a recent demonstration of the result). However, when information can be verified, for example if actual bills of sales can be sent to the trade association, these incentives change as has first been noted by Grossman (1981). In a systematic analysis of ex-post exchange of verifiable information Okuno-Fujiwara, Postlewaite, and Suzumura (1990) have shown that firms will always completely reveal their private, verifiable information for the types of settings that have been analyzed by the information sharing literature. This means information will even be exchanged if ex ante, i.e. before the private information arrives, firms would prefer a commitment not to exchange information. It is important to note that the welfare analysis of information exchange remains identical to the one above. Welfare results only depend on whether information is exchanged or not.

Similar results to Okuno-Fujiwara et al. can be obtained when information is not verifiable but there are costly signals, like advertising, which can be used to credibly transmit this information. This method of information exchange is, however, more costly since it involves the expenditure of resources in order to make the information exchange credible (Ziv 1993, Kühn 1993). As a result, disallowing information exchange via verifiable documentation like sending invoices to a trade association may be equivalent to forbidding information exchange or may lead to information exchange at higher social cost.

7 Trade Association Rules

Information sharing agreements usually take the institutional form of a Trade Association. Trade Association rules will therefore be important in determining the incentives for information exchange.

Trade associations conduct statistical programs in which individual data of firms are collected, aggregated and disseminated either to the members of the T.A. (exclusionary disclosure) or to all the firms in the industry and other interested parties (non-exclusionary disclosure). Vives (1990) has pointed out a free rider problem when non-exclusionary disclosure rules are applied. Consider the case of a monopolistically competitive market. A firm that does not participate in the information sharing agreement does not affect the market outcome (because the firm is negligible). However, it will receive the aggregate market information saving the fee for the T.A. Services with an exclusionary disclosure rule such a free rider problem does not arise. If all firms share information the defection of a single firm from the agreement will not affect the market aggregates but it will prevent the firm's access to the signals reported by the T.A.. Consequently, it will have lower expected profits provided the T.A. fee is not very high. (Vives (1990)).

Exclusionary disclosure rules are only exclusionary in the sense that trade associations exclude firms from participation that do not contribute to information sharing. However, in practice we often also find exclusionary agreements that restrict membership of information sharing agreements. In trade associations this sometimes occurs in the form of privileges for specific members of the trade association.[11] Unfortunately, there is no theory of such discriminatory information sharing agreements to date.

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[11] This is for example the case in the Japanese Optoelectronic Industrial Association (Horiuchi 1990).

8 Dynamic Aspects of Information Exchange

8.1 Exchanging Data on Past Prices or Quantities

Up to now we have been considering exclusively information exchange on signals about demand and costs. In most practical cases, however, the issue is one of information exchange about past prices or production. The nature of such information exchange is that it involves data from one period being used for decisions in another. To analyze this type of information exchange we have to abandon the analytical framework of static one period models. To fix ideas consider a model in which there are two periods of production and firms are imperfectly informed about demand and costs. Prices or quantities produced of period one will convey information about past costs or demand. This will be information that is useful for the future, because generally demands and costs in one period will be correlated with demand and cost in the next period. Price or quantity observations from the first period are then (possibly imperfect) signals about future market conditions. For example, if firms set prices then quantities sold reveal information about the state of demand to the seller. Passing on this information before decisions are made in period 2 can then be regarded as passing on signals in the sense of our earlier discussion.

There is, however, a difference with the static model discussed before. In the previous model firms could commit ex-ante to information sharing of the signal, but could not take unobservable actions that would influence the signal. Indeed, being able to manipulate the precision of the signal unobservably would be equivalent to the problem of ex-post information exchange with non-verifiable information. In two period models firms can set prices or quantities which are not observed by the other firm. If only one of these variables are reported to other firms, competitors have an incentive to change prices or quantities from the static oligopoly price in order to manipulate the information content of the information exchanged ex-post. The work of learning and experimentation in duopoly has formally demonstrated this "signal jamming" effect when there is interrelated learning about demand or costs over time (see Riordan 1985; Aghion, Espinosa, and Jullien 1993;

Mirman, Samuelson, and Urbano 1993; Mirman, Samuelson, and Schlee 1994). Jin 1994 shows in a duopoly model with demand uncertainty that sales reports increase (decrease) firms' profits and decrease (increase) consumer surplus and social welfare in a Cournot (Bertrand) industry. Indeed, with no sales reports firms in a Cournot industry have an incentive to overproduce to try to convince rivals that demand is low; in a Bertrand industry firms have an incentive to charge high prices to try to convince rivals that demand is high. In both cases the attempt is to induce softer behaviour of the rival (lower quantity or higher price). Sales reports eliminate the incentives to misrepresent and lead to lower outputs in the Cournot case and lower prices in the Bertrand case. The welfare implications of sharing sales reports are thus very different from the ones derived from sharing signals about demand (see Tables 1 and 2). Indeed, results tend to be reversed, with sales reports improving welfare with price but not with quantity competition. Furthermore, with sales reports information sharing is never an equilibrium, it is a dominant strategy not to report. As expected including the signal jamming incentive makes the results obtained in the information pooling models about demand or costs less robust.

8.2 Information Exchange and the Scope for Dynamic Collusion

Our task in this section is to explain what kind of conclusions about the role of information exchange can be drawn from dynamic models of tacit collusion. With tacit collusion we mean any type of cooperation between firms which is not sustained by legally enforceable contracts. The theories do not distinguish between explicit "agreements" between firms and implicit anticipation of reactions by rivals in dynamic interactions (as for example in what is termed "conscious parallelism" in the competition policy literature). This is because in theory there is no significant difference between these two types of behaviour.[12]

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[12] Explicit agreements may help in solving coordination problems in selecting an equilibrium. However, this coordination can be achieved by unilateral communication by just one firm, which has been

It is a fairly old idea in industrial economics and the theory of competition that collusion between firms is achieved because firms interact repeatedly in the same market. The basic insight is that deviations from some collusive price in one period may be "punished" by competitors by price cuts in following periods. The problem for early theorists of industrial organization in rigorously formulating a theory of collusion over time, was that they were lacking the analytical techniques for formulating dynamic models of oligopolistic interaction. Instead, Hall and Hitch (1939) and Sweezy (1939) developed a static model of a "kinked demand curve" to capture the dynamic intuition given above. In this theory, firms agree (possibly implicitly) to charge some focal price. Price increases will not be followed by competitors, while price cuts would be responded to by matching price cuts of the competitors. However, such a short cut to modeling dynamic phenomena generates severe conceptual problems. As Stigler (1947) pointed out the focal price was completely indeterminate. As a result the model had no predictive power on how collusive outcomes would change as a response to changes in demand or the technological environment. In particular, in the theory of the kinked demand function rigorous reasoning about cartel behaviour under incomplete information (for example of market conditions or the behaviour of rivals) was not possible. Consequently, the traditional literature on implicit collusion could not really address the question of how information sharing affected the opportunities of collusion in a market.

The development of game theoretic tools in the 1980ies has made it possible to fully model dynamic interaction between oligopolists and address the questions raised in the early literature in a rigorous way. This extensive modeling effort has much improved our understanding about collusive mechanisms. In addition, especially for environments with

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branded as insufficient evidence for a concerted practice in the legal literature (see Van Gerven and Navarro Varona 1994, p. 600). Furthermore, there is no satisfactory economic theory that would explain why communication would resolve coordination problems in a determinate way.

asymmetric information, the recent literature has proved that some of the earlier textbook arguments are not valid. As a result the literature developed in the 1980ies has supplanted earlier efforts.[13] Since a basic understanding of dynamic models of collusion is essential for understanding the effects of information sharing on the scope for tacit collusion, we will first briefly review the main contributions of this literature to the theory of competition policy.

The first contribution of the game theoretic literature to the theory of collusion (see Friedman 1971; Aumann and Shapley 1976; Rubinstein 1979) was to demonstrate that collusion could be an equilibrium phenomenon in a dynamic context. They demonstrated that collusion was sustained by the threat of a switch to an equilibrium with lower payoffs. A high price could be sustained because firms would anticipate that gains from price reductions today were outweighed by losses associated with a low payoff equilibrium in the future. From this tradeoff it is clear that the degree of collusion sustainable depends on how much firms value future profits. If firms are myopic and only value current profits no collusion is sustainable. If firms discount future profits only to a very small extent they can

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[13] The formal game theoretic literature has attempted to give equilibrium foundations to some of the earlier concepts in the informal literature on collusion. In particular, Maskin and Tirole (1988) have shown that there exist equilibrium outcomes in dynamic models of collusion that correspond to kinked demand curve equilibria and Edgeworth Cycles. These equilibria do, however, generally coexist. We leave this analysis aside for our main discussion because it does not provide guidance for the study of the impact of information sharing on collusion. For other attempts to formalize arguments of the earlier literature see MacLeod (1985) and Rotemberg and Saloner (1990). The diffusion of these results to the competition policy literature is naturally slow. Much of the literature on antitrust and competition policy is still based on kinked demand curve arguments (see for example the discussion of the Wood Pulp case by van Gerven and Navarro Varona (1994)). On the basis of current research such practice may lead in many cases to misguided policy conclusions.

reach the monopoly solution. However, any lower degree of collusion also remains sustainable as an equilibrium so that any outcome between static competition and full collusion is possible as an equilibrium outcome if there is little discounting of future profits. This result is known as the "Folk Theorem" in dynamic games.

The "Folk Theorem" at first sight appears to generate an embarrassing richness of possible outcomes, seemingly precluding policy conclusions. However, it became soon clear that the proper way to think about collusion was to analyze the range of possible collusive outcomes achievable. First, there is the question which is the highest degree of collusion that is sustainable in a market, when there is discounting. Secondly, one might want to ask whether the highest degree of collusion is sustainable for the firms by fairly simple strategies. The two questions where essentially answered by Abreu (1986, 1988). He observed that the degree of collusion sustainable was higher the higher the available punishment. The "optimal punishment strategy" was therefore one that responded to any deviations by a firm with the harshest available punishment. Abreu showed that such punishments had a very simple structure: As long as other firms stuck to the collusive price firms would not deviate. However, any deviation would be answered by a short, drastic cut in the price, followed by collusion.

The work by Abreu (1986,1988) made it possible to systematically analyze the claims in the informal literature about factors that facilitate and hinder collusion. For example, it is true in these complete information games of collusion that more frequent interaction between competitors facilitates collusion. If interaction is less frequent any possible punishments are further away in the future and the highest degree of sustainable collusion is lower. Other claims, however, had to be modified. For example, multimarket contact was generally thought to blunt competition because firms would be reluctant to deviate in one market fearing punishment in all markets. Bernheim and Whinston (1990) have shown that this argument overlooks the fact that firms may have incentives to deviate in all markets simultaneously. As a consequence they find that in many situations multimarket contact has

no effect on the degree of collusion sustainable. More generally, market features that reduce competition in static settings have ambiguous effects in dynamic settings. On one hand a reduction in competitiveness in static settings reduces the incentives to deviate on the other hand they may also reduce the maximal punishment that can be induced. Because of this the distinction between collusion in homogeneous goods markets and heterogeneous goods markets made by the informal literature has not been borne out by the theory (see Tirole 1988). Even large diversity between firms in some dimension may not be an impediment to achieving collusion (see Harrington 1991).

Heterogeneity among firms may, however, become an impediment to collusion when there is asymmetric information among firms about this heterogeneity. For example, firms may have private information about their own costs, which is unobservable for competitors. In this case it becomes a problem for firms to efficiently design cartel quotas, because each firm has an incentive to lie about its true costs. Kihlstrohm and Vives (1989, 1992) have shown, that this may even be a problem when firms can write legally binding cartel contracts that include payments between the firms. If direct monetary payments between firms are not allowed fully collusive outcomes can generally not be achieved (Roberts1985). This does not imply that the outcomes under asymmetric information about costs are welfare improving relative to full collusion. The reason is that inefficient firms may produce relatively more than they would under perfect collusion. These costs may well outweigh any gains achieved through lower prices.

The most important critique of arguments for tacit collusion was put forward by Chamberlin (1933) and Stigler (1964). These authors observed that it was essential for the effectiveness of any punishment strategies, that firms could detect whether a competitor had violated the (implicit) agreement or not. Stigler argued that cartels would inevitably break down because competitors could not observe secret price cuts by rivals. While Stigler makes an important point about the informational requirements for sustaining solutions his contribution still remained far from providing a systematic understanding of what kind of

information firms need to sustain collusive outcomes. For example, firms may draw inferences about the behaviour of competitors, even if they cannot observe their rivals actions. Very low sales in one period may, for example, signal that a competitor has violated a collusive agreement.

The critique of Chamberlin and Stigler of perfect information models of collusion is the context in which the issue of the impact of information exchange on collusion is of the greatest relevance. The body of literature that can help most for policy formulation on information exchange is the literature about dynamic collusion in the absence of perfect observability of strategies. This work concerns that firms cannot perfectly observe the actions of their competitors and have to infer this information from market data. For example, if firms set quantities, the market price achieved will contain some information about the actual behaviour of competitors. While this literature has not explicit modeled the role of information exchange agreements it gives a consistent framework in which to discuss the relationship between information exchange and collusion. Below we will review this literature and discuss which conclusions can be drawn from it about the role of information exchange mechanisms.

8.2.1 Dynamic Collusion with Public Information

The theoretical work that has done most to further our understanding of secret price cutting and non-cooperative collusion in dynamic settings is the model by Green and Porter (1983b). Previous models of dynamic collusion (see Friedman 1971; Aumann and Shapley 1976; Rubinstein 1979; Abreu 1988) had restricted themselves to environments in which firms could perfectly observe each others behaviour, technologies and demand. They were unsatisfactory because collusion could never break down in equilibrium. In contrast, the model of Green and Porter provided a way to look for collusion in the pattern of collusive and "price-war" phases that were generated in equilibrium. In the model of Green and Porter it is essential that there is uncertainty about demand and firms cannot observe each

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others actions.[14] Firms set quantities in each period and a price is obtained. If the price is low the firm has an inference problem: Was the price low because demand was unusually low or because someone cheated on the implicit cartel agreement? To sustain collusive outcomes firms enter phases of "price wars" (non-cooperative (one shot) behaviour) for a period of time, whenever low prices are observed[15]. This behaviour is actually not punishment for deviations. In equilibrium no firm deviates, but all firms understand that the lack of public observability of the behaviour of other firms makes it necessary to have price war phases when demand is unexpectedly low.

It is important to note for the issue of information exchange that anticipated demand shocks will not lead to break down of collusive phases but unanticipated demand shocks do. Collusion is never perfect since non-cooperative phases necessarily occur in order to sustain collusion. These results included a subtle, but important distinction from Stigler's argument about the effects of unobservability of the actions of others. Stigler argued that unobservability leads to the *break down* of collusion, for which price wars were taken as evidence. The theory of Green and Porter stressed that price wars were necessary components of strategies that *sustained* collusive behaviour.

Given this framework it is instructive to consider what happens if firms exchange private information about demand. Since knowledge of the true state of demand is improved this is like reducing the uncertainty of demand. Porter (1983a) has shown that the highest price that can be sustained approaches the full information price as noise goes to zero. In this sense pricing will get closer to monopoly pricing as information is increased. Furthermore,

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[14] This model therefore provides a first formalization of Stigler's intuition about the effect of secret price cuts.

[15] Strategies of this type are called "trigger strategies" in the literature. More complicated punishment strategies are also possible.

detection of deviations becomes easier implying that the expected length of punishment phases can be shortened for any given amount of collusion. This implies that on average consumers are worse off and welfare is reduced with an increase in the informativeness of signals about demand. Note, that no punishments are ever carried out in equilibrium if firms can actually observe the total output of their competitors after every period. This gives sufficient information to detect whether some firm has cheated and cheating would lead to certain punishments. As a result punishments never have to be carried out in equilibrium and collusion is perfect.

The model of Green and Porter is restrictive in the sense that it only considers "trigger strategies". Later authors (see for example Abreu, Pearce and Staccheti (1990), Fudenberg, Levine, and Maskin 1990)) have tried to understand how much collusion can be maximally sustained when players cannot perfectly observe each others' strategies. While there are circumstances under which perfect collusion is achieved, the basic message of the literature for information sharing regimes remains unchanged. As Kandori (1992) shows, more precise information about demand will strictly expand the set of equilibria making more collusive outcomes possible. This means that information exchange of demand information will tend to increase the scope for collusive behaviour and tend to reduce phases of break down of cooperation.

Note, that these arguments imply a difference between the exchange of information on demand data and the exchange of information on quantities transacted. If quantity information is exchanged in the Green and Porter model the fully collusive outcome can be sustained. If private information about demand is exchanged, more collusive outcomes can be sustained which, however, need not reach the fully collusive outcome. Essentially, the observation of past actions of rivals is much more effective for sustaining collusion than the observation of competitors signals about demand. An intermediate possibility, not discussed in the literature, is the exchange of information about an aggregate of past actions of a rival. We should expect from the above results that disaggregating information over

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time will increase the possibilities for collusion.

However, the literature on dynamic games with imperfect observability of actions has also demonstrated that some claims that have been made in textbooks about industrial organization and competition policy have to be qualified. For example, Scherer and Ross (1990, p. 308) state: "The longer the adverse consequences of rival retaliation can be forestalled, the more attractive undercutting the accepted price structure becomes". (See also Tirole, p. 241). While this argument is true in repeated games of perfect information it is not valid in the context of imperfect information about rivals strategies. Abreu, Milgrom, and Pierce (1991) have shown that reducing reaction lags may have exactly the opposite effect. Their model follows a frequent interpretation of reaction lags as arising from infrequent decision making. Making decisions more frequent means that more complex deviation strategies can be designed to which a competitor has to react with less accumulated information about the market. As a result the likelihood of punishments has to be increased in order to sustain collusive conduct. This is exactly the opposite result to the arguments in the informal literature. Abreu, Milgrom, and Pierce (1991) go even further by demonstrating that less frequent information release may increase the possibilities for collusion. Releasing information less frequently reduces the frequency with which competitors can react to rivals, but it ensures that every reaction corresponds to more precise information. The efficiency of punishments is therefore increased and the firms achieve more collusive outcomes. Again this result is in contradiction to the traditional literature that argues that detection lags reduce the possibility of collusion.

Note, however, that these results do not contradict the claim that *aggregating* information over time may reduce the possibilities of collusion. This argument relies on the fact that aggregation leads to less information being released and therefore firms having less precise information about demand. One has to be very careful about a distinction between the degree of aggregation of information and issues of the timing of information release. While aggregation of information over time appears to lead to the expected results, the delay of information release does not constitute in general an impediment to collusion but may in

contrast facilitate it. However, pure disaggregation of information should more generally facilitate collusion. Consider, for example, disaggregation of information across submarkets. If firms can set distinct prices in submarkets, observing aggregates of output across the submarkets will reveal less information about the overall state of demand than disaggregating information. This should make it more difficult to collude. This argument is simply based on the earlier insight that more precise information about demand (or costs) will make collusion easier.

8.2.2 Dynamic Collusion with Private Information

In the Green and Porter model the signal that competitors use to infer the strategy of a competitor is the publicly observed market price. This approach has helped us to understand some issues about the effects of information exchange and the aggregation of information over time. However, with this approach the distinction between information exchange of individualized firm data and aggregate data (across firms) which is often made in competition policy cannot be rationalized. The reason is that Green and Porter consider only a case in which there is common demand uncertainty in a homogeneous goods market. In that context observing aggregate output statistics will suffice to induce perfect collusion. Total production is completely determined by the cartel agreement. If any firm cheats this can be perfectly inferred from observing the aggregate Figure for output. Green (1980) has shown that information exchange on *individual data* can be a very powerful instrument to induce collusion. In his model there is a large number of firms and every firm is so small relative to the market that a defection of a single firm would not be detected. If actions of other firms cannot be observed the outcome is competitive. However, if every firm can observe every other firm's output decision the fully collusive outcome can be sustained despite the fact that there is a large number of firms. Hence, information exchange on individual firms' quantities can help sustain perfect collusion, while exchange of aggregate demand information need not.

In general, in situations in which market aggregates are not sufficient statistics to verify whether firms conformed with collusive behaviour or not, information on individualized data will be very important to sustain collusion. The exchange of individualized data is beneficial in two ways. First, it may make it easier to detect deviations from collusive agreements as in Green's model. Secondly, it allows the design of individualized punishment strategies that single out individual firms. These effects come out most clearly in recent work by Kandori and Matsushima (1994) and Compte (1994). They consider general models of competition where players have private information about demand. The models considered amount to versions of the Green and Porter model in which neither prices nor quantities achieved by other players can be observed because there are not just common shocks to demand but also private shocks. This literature also points to another reason why individual data may be important to sustain high degrees of collusion. Efficient collusive agreements will generally induce firms with high demand to produce more and firms with low demand to produce less. Inducing firms to truthfully reveal this information to each other requires the exchange of individualized data. While this is a very young literature it confirms the view of the traditional Industrial Organization literature (see, for example, Scherer and Ross 1990, pp. 308-311) that improving information about competitors actions is a very powerful instrument to sustain tacit collusion.

8.2.3 Lessons to be drawn from the Literature on Dynamic Collusion

This literature gives a number of lessons for the design of competition policy towards information sharing. First, sharing information about demand from market studies or even cost information has qualitatively less potential for relaxing competition than information exchange of past prices and quantities. This is the case because observing strategies directly makes it much easier to trigger punishment phases only if deviations occur. Secondly, the degree of aggregation of information over time matters significantly. If yearly data is transmitted this makes it more difficult to detect deviations or draw inferences about

unanticipated demand fluctuations than if daily data is available. Thirdly, disaggregating information according to submarkets will aid collusion since such data allows better detection of small deviations in sub markets making it less necessary to trigger punishment phases. Fourthly, delays in information release (or equivalently a reduction in reaction lags) have ambiguous effects on the degree of collusion. A regulation of the degree of disaggregation of data is therefore a less problematic intervention in information exchange systems than a regulation of the frequency of data exchange. Finally, and importantly in terms of a distinction made in the practice of competition policy, sharing of *individual* data of actions of firms (namely, prices and quantities) is a very effective policy device to sustain collusive agreements.

8.3 Exchanging Data on Planned Prices or Quantities

In our discussion so far we have concentrated on the exchange of past prices and quantities. We have seen that some (possibly indirect) observability of the actions of competitors is essential for sustaining collusive outcomes. However, in the traditional literature on competition policy significant importance has been attached to the idea that announcements of future behaviour may act as an instrument to sustain collusion or at least to solve coordination problems in attaining particular outcomes. At the center of these arguments are early theories about price leadership and conscious parallelism.

It has been suggested that price announcements may simply act as a communication device to coordinate competitors to achieve the best collusive equilibrium. The idea is that such announcements are not commitments to transaction prices charged later on but rather pure devices to transmit information. Communication of this type appears to be an obvious way to overcome coordination problems in settings in which there are many possible equilibria.

[16] However, theoretical research on the subject has not succeeded in substantiating the intuition that communication facilitates coordination. As Rabin (1990) has shown the original equilibria of a game without communication remain equilibria when communication is allowed. Essentially, if agents believe that messages of competitors sent to them are unreliable, they will ignore announcements of competitors in equilibrium. In this sense theory gives us no support for regarding price announcements that are pure communication devices and do not commit to the price charged to consumers as being anticompetitive. Other authors (Aumann 1990, Fudenberg and Tirole 1991, Harsanyi and Selten 1988) give strong theoretical arguments why one should not expect firms to always coordinate on equilibria such that no other equilibria exist that give all firms greater profits. As a result we have no generally accepted theoretical argument that would allow us to conclude that communication about future behaviour is anticompetitive.[17] On the other hand, it should be noted that it is hard to find any argument why private communication between firms about future planned prices or production would be beneficial. It appears that despite of the lack of formal theoretical support the only way one can explain such Behaviour is that firms use communication to coordinate their future market conduct.

One has to contrast the private communications between firms about future prices and

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[16]Alternatively Schelling (1960) has proposed a theory of "focal points" to select between different possible equilibria when pregame communication is not possible. Unfortunately, no satisfactory theory of focal points has been developed based on this idea.

[17] Bhaskar (1988) has attempted to model price preannouncements by specifying a game in which prices become effective for consumers only when both firms quote the same price. He shows that outcomes are generally fairly collusive (subject to some distributional constraints). He attempts to capture a situation in which firms always have a chance to make price revisions before prices become effective. Any undercutting in the announced price can then be matched by a rival before the price becomes effective giving an incentive to quote high prices. It is not clear, however, to what extent the result depend on the restrictive assumptions that Bhaskar puts on the price preannouncement game.

quantities with the many cases in which price announcements may have commitment effects. For example, a price announcement may guarantee a customer a maximal price. This is the case with price advertising to consumers. Since price advertising can only establish a maximal price and not a minimal price it is hard to see how such commitments could have anticompetitive effects. Indeed, price advertising to consumers has the additional positive effect of increasing market transparency for consumers. In a market in which consumers do not observe prices directly but have to search for the best price, we know since Diamond (1971) that monopoly pricing is possible without any coordination between firms. The reason is that in an environment in which it is costly for consumers to compare prices firms have no incentive to compete for consumers. As a result informative advertising about prices in static models always increases the degree of competitiveness (see for example Bester and Petrakis 1992). It should, however, be mentioned that at the same time price advertising makes the strategies of competitors more observable and therefore facilitates collusion as discussed in the previous section. However, if in the absence of price advertising pricing close to the monopoly outcome is achieved even in the absence of collusion the collusive effect of price announcements appears to be of secondary importance relative to the increased market transparency for consumers.

Another issue that has for a long time occupied the traditional literature in industrial organization and competition policy is the phenomenon of sequential price announcements which is usually called "price leadership". A long line of literature in the 1950ies and 1960ies (Stigler 1947, Markham 1951, Oxenfeldt 1952, Bain 1960) has led to a distinction between "collusive price leadership" and "barometric price leadership". Modern studies of formal models of price leadership do not appear to support such a distinction. Deneckere and Kovenock (1992) provide probably the most rigorous analysis of endogenous price leadership in static models. They show that firms will endogenously generate price leadership with the result that profits rise relative to simultaneous move games. In their model larger capacity firms become price leaders and provide a price umbrella for the follower. Other authors have attempted to formalize the intuition in the earlier literature on

price leadership in the context of dynamic models. For example Macleod (1985) shows that a dynamic collusive equilibrium may emerge in which the strategies of firms are exactly those posited by theories of conscious parallelism (or barometric price leadership). He argues that "conscious parallelism" may reflect a simple rule of thumb to sustain collusive outcomes. However, his model is set in a world of certainty, so that in equilibrium price adjustments are never observed. Furthermore, many other equilibria exist in these types of markets. In particular, optimal punishment strategies of the type analyzed by Abreu (1988) have a very simple structure which could also be interpreted as a rule of thumb. Furthermore, Rees (1993) has demonstrated with empirical work that Abreu's optimal punishment strategies do explain observed behaviour very well. Rotemberg and Saloner (1990) have attempted to capture the intuition of collusive price leadership in a model in which the price leader reveals private information about the market, which helps establish more efficient collusive outcomes from the point of view of the firm. They show that such collusive agreements may be worse than overt collusion. Again, the analysis suffers from the fact that it does not give a full characterization of possible equilibria. However, their model makes clear that the distinction between collusive and barometric price leadership as made in the traditional literature does not seem justifiable on the grounds of the present theoretical models.

9   Information Exchange in Markets with Potential Market Failure

So far we have looked at the issues arising in markets in which firms can exchange private information about the state of the market or the cost structure. However, there was no private information of customers as in adverse selection or moral hazard problems. These are, however, typical in banking and the insurance industries. As we know asymmetric information between customers and firms of this kind may lead to severe inefficiencies and even market breakdown. In such markets information exchange about past trading

relationships may have a large scope for Pareto improvements since it may significantly reduce the problems of asymmetric information. An example for such mechanisms are information sharing arrangements about borrower default or other credit risk information (which in some countries has to be exchanged by law).

These issues have recently been analyzed in a series of papers by Pagano and Jappelli (1993), and Padilla and Pagano (1993, 1994). A nice example of how information exchange can improve market performance is given in Padilla and Pagano (1993). In their paper firms have to exert effort in order to make projects succeed. Banks cannot observe the effort nor the costs of effort of the firms at the time they have to give a first loan. However, after some time has passed a bank will know from the repayment information concerning the first loan of its borrower whether it is a high effort or low effort firm. If a bank does not share information on this fact, it can extract an informational rent from high quality borrowers who would be treated as average borrowers by other banks. Information sharing reduces these rents by introducing competition for these customers. Hence, the marginal returns to effort in projects is higher for low risk borrowers when information sharing is introduced. Padilla and Pagano show that in quite general circumstances this will lead to an overall welfare improvement.

What should be noted about this literature is mainly that in markets in which customer moral hazard and adverse selection are of importance there is a strong reason to permit the sharing of customer information between firms.

III The Competition Policy of Information Sharing

1 Information Sharing as a Concern for Antitrust Policy

The concern about information sharing in antitrust policy is intimately connected with the development of trade associations, and is more recent than the concern about cartel organizations. Especially in the US, where concerns about information exchange first arose in the 1920's, the debate on information sharing was mainly about the legitimate role that trade associations could play. Below we will briefly discuss the development of trade associations and their antitrust treatment in two important countries with relatively long histories of competition policy on information exchange.

1.1 USA

1.1.1 The Development of Trade Associations in the US

In the US the first antitrust legislation came into place in 1890 with the passage of the Sherman Act. This legislation made it illegal to enter into contracts in restraint of trade. The law was aimed at ending the growing cartelization in the US economy symbolized by the railway cartel of the 1870/80's. The first trade associations in the United States were organized in the middle of the 19th century. However the first big wave of trade association foundation only comes in the 1870/80's. They were in their main part classical cartel organizations and reflected the trend towards cartelization at the time. These organizations formed as a response to the depression of the 1870's with the aim of combating falling prices. However, low prices remained even after the depression ended due to tougher price competition in markets which, by this time, were fairly homogeneous and were characterized by excess capacities. A second problem that manufacturers faced were large uncertainties both on the demand side and in input prices. It is, however, clear from the

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evidence that the main aim of trade associations was to control production and increase prices. Becker (1971) reports in a study of the American Wholesale Hardware Trade Associations in the 1870-1900 time period:

> "In a few branches of the hardware trade, however, the associations were able to cope very well with these conditions. Indeed, some associations worked comparatively well. Manufacturers of copperware - bathtubs, boilers, sinks, and general copper products - had organized in 1886. They successfully controlled production and increased prices. The stamped ware association was another successful group. Manufacturers organized it after a severe price decline in the early 1880's, and by the end of the decade the group apparently succeeded in maintaining prices."

According to Becker's study trade associations failed where they did not manage to eliminate all competition. This occurs either because there are several trade associations in the same trade but different geographical locations that competed with each other, or where some producers were not affected by the domestic price cuts because of their position in export markets. Becker reports:

> "The conditions existing among the producers of nails were typical. In the 1880's, prices set by an association of nail manufacturers in the West were subverted by an eastern-based group, and vice versa. Manufacturers in the West formed and quickly violated agreements. Since each producer usually had capacity far in excess of the association's limits on his share of the market, and since each had relatively high fixed costs, the pressures were great to produce more than the prescribed limit and to sell quickly for a "killing". Other groups had similar problems."

After the Sherman Act came into force such agreements became illegal. The industry turned to an obvious substitute: consolidation by merger. In industries with very

homogeneous products the outcome was a highly concentrated market structure with large dominant firms. In the "typical" market for nails, for example, the American Steel and Wire Company was founded in 1899 and dominated the market.

Antitrust authorities in the US had, given this history of trade associations, reasons to become worried, when the trade association movement gained momentum again around 1920. This came with the promotion of "open price associations" (see Carrott 1970, Scherer and Ross 1990 Chapter 9), the first time that trade associations were conceived as information gathering and information exchange instruments for firms in the industry. The most influential Figure in this movement was Arthur Jerome Eddy with his 1912 book "The New Competition". While some authors have claimed that Eddy's "idea was that competition would be keener if business had accurate market information, particular information on prices" (Lamb and Shields 1971), Scherer and Ross (1990) have pointed out that the movement was in no way favorable to competition. Eddy writes:

"Of all the rivalries in which man engages, brute competition in the production and distribution of wealth is the most contemptible, since it is the most sordid, a mere money making proposition, unrelieved by a single higher consideration. ... Cooperation, whether voluntary or involuntary, ... is the only regulator of prices. Competition, free and unfettered, is absolutely destructive to all stability of prices."

Historians have confirmed that this anticompetitive motivation was shared by the trade association movement as a whole:

"The major reasons for this growth [of trade associations in the 1920's] was the general movement away from cut-throat competition and the increasing desire for more regularity, continuity, and stability in business." (Carrott 1970).

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Particularly interesting is the fact that A. J. Eddy understood very well the importance of reporting transactions prices in order to avoid the secret price cutting that modern dynamic theory has formalized. As Scherer and Ross (1990) point out Eddy's description of the operation of "open price associations" capture exactly the content of these theoretical results:

> "The theoretical proposition at the basis of the open price policy is that knowledge regarding bids and prices actually made is all that is necessary to keep prices at reasonably stable and normal levels."

The importance of Eddy's insight was to see that it was not necessary to have formal contracts to establish collusion on prices or market sharing. Instead he advocated information exchange, preferably on an individualized basis, of data about prices and quantities. The advantage of this practice was, that it did not indisputably violate the Sherman Act. For example in the lumber industry firms switched from price controls that openly violated the Sherman Act to the distribution of information about sales, production, stocks, contracts, and production methods. On top of this companies created uniform rules for grading lumber, in this way creating possibilities of improved monitoring of competitors' pricing.

1.1.2 The American Column Case

This development was particularly pronounced in the hard wood industry which consolidated trade association activities in 1919 in the American Hardwood Manufacturers Association AHMA. This became the largest trade association at the time. It held annual and monthly meetings and after receiving information from its members issued weekly and monthly reports analyzing market conditions. Reports to the association had to include monthly stock and production figures (including normal, actual, and estimated future Figures). Reporting went so far that companies had to file sales reports showing the buyer's name, the kind of lumber sold, the destination, and the selling price (see

Carrott 1970). The trade association manager sent out monthly newsletters distributing this information.

The Justice Department decided to make this a test case and demonstrate that information sharing agreements of this type were in violation of the Sherman Act. In late 1919 the government filed a bill of complaint under the Sherman Act against the American Column and Lumber Company and over 300 other lumber manufacturers belonging to the AHMA. A US District Court Decision in 1920 confirmed the Justice Department's position that the exchange of statistics had the effect of controlling prices and production and therefore violated the Sherman Act. The problem of the decision was that it did not clear up the question of what kind of information exchange was legal and which was not.

An appeal to the Supreme Court did not do much to clarify this question. The Supreme Court upheld the decision on the basis that there was evidence that the information exchange agreement had the result of raising prices. The Court had seen evidence that "many members had written to the manager of statistics that his reports had had a material influence in eliminating cut-throat competition and obtaining the best possible price" (Carrott 1970). This suggested that demonstrating a violation of the Sherman Act required proving effects on prices of the information sharing agreement. There were also three dissenting votes in the Supreme Court. One of the concerns of these judges was that restrictions on the exchange of information would interfere with the guarantee of freedom of speech. However, there were also more economically based arguments. Judge Holmes feared that the absence of information exchange would put small firms at a disadvantage since larger firms would have better access to market information. Judge Brandeis was concerned that in the absence of information exchange hardwood mills would consolidate into larger trusts.

The fact that the decisions on *American Column* did not establish rules for legal information exchange led the National Chamber of Commerce to claim that the vast

majority of trade associations were legal and had "circulated statistical information necessary for economic advancement" (Carrott 1970). In contrast the Federal Trade Commission claimed in several reports on the Lumber industry in 1921 and 1922 that the industry controlled prices and production, reducing competition in the market. The discussion about the decision also reflected the fact that the general evaluation of competition had changed since the adoption of the Sherman Act. On the side of industry fears about a "return of unbridled competition" were publicized as a reaction to the Supreme Court decision.

1.1.3 The Linseed Case

In 1923 the Supreme Court upheld for a second time the government prosecution of a trade association in *United States v. American Linseed Oil Company*. The case involved twelve corporations which manufactured, sold, and distributed linseed oil, cake, and meal. The companies had had an agreement since 1918 to exchange price lists, daily sales reports on prices and terms, and a monthly report on the stock at hand.

The case had initially been rejected by the US District Court in Chicago. The court stated that there was no proof that parties had engaged in price fixing, limiting production, or dividing up territory. Hence, the information provided was regarded as "what the intelligent businessman would secure" (Carrott 1970). Although this argument appears to be perfectly in line with the reasoning in *American Column* the Supreme Court overturned the decision. It decided unanimously that *Linseed* was no different from *American Column* and therefore violated the Sherman Act. The additional argument the Court provided in this case was that "producers had such great knowledge of each other's affairs, [that] they possessed a major advantage over their customers, who were not so well organized and did not have the same information" (Carrott 1970).

1.1.4 The Reversal of Position by the Supreme Court: *Cement* and *Maple Wood Flooring*

In 1925 there was a significant reversal in the position of the Supreme Court in its decision on two further cases against trade associations that had been brought by the government. The first one of these is a decision in *Cement Manufacturers Protective Association v. United States.* The government had conducted a long investigation of the *Cement Association* and had concluded that cement manufacturers had colluded in production and price setting since 1916. In the first years this behaviour was supported by the War Industries Board, but was continued after the war. The *Cement Association* required its members to report the following data: all contracts including the name of purchaser, the kind of project, the amount contracted for, and the price; all canceled contracts; all accounts outstanding sixty days or more; production, shipments, and stocks of the previous month. The information was disseminated in daily reports. The trade association even monitored purchases of cement by contractors to avoid that contractors bought more cement for resale to other contractors.

The second case, *Maple Flooring Manufacturers Association v. United States*, also involved the construction industry. In this case the government investigated because of complaints by the contractors about high prices for materials. It was apparent that the *Maple Flooring Association* had violated the Sherman Act between 1916 and 1921 by establishing a minimum price for the sale of maple, teach, and birch flooring, supported by drastic financial penalties for deviators. After January 1921 the association claimed to have abandoned the price floor policies, but operated an information sharing system in which firms reported weekly on total sales for each quality, kind, and grading of flooring, the delivered price, the freight rate, and commissions paid. These were complemented by

monthly reports about stocks and unfilled orders.

While lower courts decided these cases were along the same lines of *American Column* and *Linseed* the Supreme Court overturned the decisions. It held that in both cases it had not been proved that companies had used the information to collude on prices and production. For example, price uniformity in the case of a homogeneous product like cement did not establish collusion. The Supreme Court also stated explicitly that it had no objection to the exchange of information if it was not used to control prices. Summing up the majority opinion of the Court Carrott (1970) writes:

> "[Justice Stone] believed that trade associations had great economic value. He indicated that the circulation of statistics on production, costs, and prices prevented overproduction, led to a more scientific knowledge of business conditions, and avoided economic crises. The maintenance of traditional competition was much less important."

While the Court made an argument that its judgement was in line with *American Column*, Carrott (1970) has documented, that the reason for the shift in opinion is a change in the composition of the Supreme Court. The dissenting judges on *American Column* were strongly in favor of the majority opinion, while judges who where in the majority on *American Column* wrote dissenting opinions. By 1925 US Antitrust enforcement had therefore come back to regarding information sharing as legal and only considered price fixing as a violation of the Sherman Act. The Federal Trade Commission did successfully prosecute trade associations over the next 25 years. However this success was due to the fact that in all cases price fixing agreements were be proven to exist.

1.1.5 More Recent Cases and Current Policy

Most of the antitrust cases of the 1940's ended in consent decrees that led to some rules for trade associations that appear to be generally followed. The most important one of them is

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the rule that individual firm data should not be reported. There is however no law that would prevent companies from unilaterally revealing these data to competitors. In many cases this data is indeed transmitted through trade journals. It is furthermore held as established legal opinion that data should be made available to customers to avoid "unfair bargaining advantages" for sellers. However, there are no rules concerning the exclusion from information exchange programs of competitors.

While these statements describe the set of criteria under which companies have to be worried about a challenge by the US antitrust authorities, none of these rules have been contested in court. The basic principle that collusive practices have to be established has not been repealed and there are no cases in which the pure existence of an information exchange agreement that reported individualized data would have been confirmed as a violation of the Sherman Act in the US courts. Today there are simply too few cases that ever get to this stage.

The Supreme Court seems, however, to have slightly toughened its line on information exchange in the late 1960's. In US v. *Container Corporation of America* 18 companies supplying 90 percent of the cardboard cartons in the southeastern United States were found to be in violation of the Sherman Act. There was no centralized information exchange agreement but companies informed each other about prices currently or last quoted to particular customers. Those prices were matched subsequently by the competitor. The market was fairly concentrated with 6 firms controlling 60 percent of sales. There were signs of overcapacities, despite of rapidly growing demand, and falling prices. The court found that the practices had helped stabilize prices and therefore were in violation of the Sherman Act. Although this decision seems to be somewhat tougher than the earlier precedents it still relies on some degree of proof of collusive behaviour. The exchange of price or quantity information as such appears not to be a violation of the Sherman Act by itself, with the only exception that reports on planned future production or prices might be challenged. This issue concerns the more limited topic of price preannouncements which

we discuss in the next section.

1.1.6 US Policy Towards Price Preannouncements

US Courts have always been reluctant to condemn public announcements of future prices as anticompetitive because of the potential benefits to consumers in comparing prices and adjusting purchase times. The case law on price preannouncement in the US has therefore attempted to develop rules to distinguish between price announcements with positive effects and those with collusive potential.

The first prominent case on price pre-announcements decided by the Supreme Court was Sugar Institute v. United States (U.S. 533 ,1936). The Sugar Institute was a trade association whose members sold 70-80% of refined sugar in the US. Price pre-announcements in the industry followed an obvious pattern. If a firm wanted to generate a price increase, it announced to customers and competitors the price increase leaving a transition period in which customers could buy at the old price. If other sugar refiners did not follow with their prices, the price increase was generally withdrawn. Since price increases did not become effective immediately, producers would not suffer in sales if their suggested price increase was not matched. It is important for this case that the Sugar Institute operated internal rules under which it was forbidden to charge transaction prices below the announced prices.

While the government contended that the announcements were a means of coordinating price increases, the Sugar Institute argued that prior announcement of price increases was to the advantage of the buyers, who could bring purchases forward to avoid higher prices at later dates. The Supreme Court did not follow either of the arguments. It found that the anticompetitive restraint did not lie in the price announcements by themselves, but in the mechanism of the trade association that assured adherence to announced prices, preventing secret price cuts.

Recently, the issue of price pre-announcements has been of importance again in the case *Ethyl Case* (E.I. Du Pont de Nemours&Company v. Federal Trade Commission, Ethyl Corporation v. Federal Trade Commission, 729 F. 2d 128, 1984). In this case a regular 30 days advanced notice of price increases by manufacturers of antiknock gasoline was found not to fall in the category of an unfair business practice. While the Second Circuit Court considered advance price announcements to be a "facilitating practice" for collusion, it held that there must be some evidence of anticompetitive intent (or of lack of an independent business reason) to find it an "unfair business practice" under the FTC Act.

The role of price preannouncements in US antitrust law has been further clarified by the recent case *U.S. v. Airline Tariff Publishing Company (ATP)* , which was settled by consent decree in March 1994 and promises to become a landmark case for the treatment of price pre-announcements in US law. The Airline Tariff Publishing Company is a joint venture of all the major US airlines. It collects and distributes fare information. ATP maintains a central database of all airline fares. All fare data is distributed to the member airlines, which use the information for their internal reservation systems and their pricing departments, as well as to the major Computer Reservation Systems (CRSs) that serve travel agents. ATP charges a small fee for every change in quoted fares by a participating airline. Furthermore, ATP updates all CRSs once a day, so that information about changes in fares are communicated to other competing airlines with at most one day delay.

It is clear that a system of price announcements of this type allows a lot of information exchange between firms. However, as in previous cases the US government was not concerned about such price quotes that were directly communicated to customers. The US government saw a violation of antitrust law in the fact that airlines were quoting fare prices that were never made available to customers. Movements in such fare quotes were interpreted as pure instruments of communication and coordination between firms. Airlines were able to distinguish between price quotes that were effective for consumers and those that were not by attaching "First Ticketing Dates" (FTD) and "Last Ticketing

Dates" (LTD) to the quotes. An FTD had the effect that tickets at the quoted price could not be sold before the date set by the airline. The LTD governed when a fare ceased to be available for sale. In particular FTDs prevented quoted prices from constituting a commitment to consumers of actually quoting such a price at the announced date, because announced fares could be withdrawn before the specified first ticketing date arrived. Since LTDs also have no commitment value the US government concluded that they could only have value for signaling to competitors that an airline wanted a type of (usually discount) ticket removed. The US government concluded that First and Last Ticketing Dates were an instrument to separate credible communication of prices to customers from negotiation about prices between the firms.

The case of the US government appears to be supported by the available evidence (see Gillespie 1994). Airlines that wanted to initiate price increases would set an LTD for some day in the future on the old fare and post a new increased fare with an FTP on the following day of the LTP. This would create a window up to this date in which there would be no fare change and other companies could respond to the proposed price rise. If competitors did not follow the proposed price rise, the price increase was either withdrawn or the first ticketing date for the higher fare postponed to give competitors more time to respond. The US government demonstrated that intricate indirect negotiations about prices occurred with proposals and counter proposals, each firm setting price quotes that had an FTP attached. There is also evidence that LTPs were used to signal the desire to abandon certain classes of discount fares.

Two features are most relevant from an economic point of view of the price announcements with first and last ticketing dates. First, these are price announcements that do not contain any commitment to consumers to a highest price. Second, there is a pattern of proposal and counter proposal of prices which do not become effective to consumers. This pattern mirrors one we would expect to observe in more explicit negotiations about prices between firms. These two features of the market are closely related. If announced prices are actually

commitments to customers to maximal prices we should expect few deviations of transactions prices from announced prices. If deviations occur they should be downward. More importantly, we should not observe adjustments in the announced prices. The use of price quotes for negotiation excludes the possibility of price commitment relative to customers, because negotiations require the possibility of adjustments in announced and transactions prices. The Department of Justice of the US was very careful to spell out this distinction. It therefore contended that not the price announcements per se, but the use of first and last ticketing dates was evidence of an agreement among the airlines to fix prices. It took the evidence of price announcements and adjustments that did not become effective for customers as equivalent to evidence of direct negotiations between firms about prices, which is normally considered as conclusive evidence for collusion. All this appears to be in close agreements with the general conclusions we have drawn about the role of price announcements from economic theory in the first part of this study.

The U.S. government brought a civil suit against the Airline Tariff Publishing Company in 1992. United Airlines and USAir immediately settled the case against them by consent degree while denying that they were involved in price fixing. In March 1994 the remaining six airlines that had been sued signed a similar consent decree to that of United and USAir. All airlines are now prohibited from using first ticket dates on any of their fares and ATP is prohibited from disseminating any fares that contain FTDs. Last ticket dates are now only permitted for advertised promotions. This measure aims at eliminating the possibility of making price quotes that never becomes effective for consumers. It does not eliminate the possibilities for collusion, but it does eliminate all kinds of possibilities for collusive coordination of prices that do not have potential benefits for the consumers. We would expect this measure to make collusion more expensive. In its clear distinction of the different roles of price preannouncements and its focus on undisputably anticompetitive types of communications between firms the US vs ATP case is an excellent benchmark case for the competition policy treatment of information sharing through price announcements.

1.2 United Kingdom

In the United Kingdom systematic competition policy only begins after the second World War. Until the introduction of the Restrictive Trade Practices Act of 1956 cartel agreements were virtually uncontrolled. With this legislation it became significantly more difficult to legally sustain cartel agreements. Under the Act such agreements had to be placed on a public register, and would then normally be brought before a Restrictive Trade Practices Court. The Court had to decide whether agreements were against the public interest. There was a presumption that price fixing agreements or market sharing were generally against the public interest, but firms could bring arguments to support the contrary. Companies responded to these restrictions by trying to find ways of cooperation that were not covered by the Act. This was preferably done through the adoption of information exchange agreements. Swann, O'Brien, Maunder, and Howe (1974) estimate that as much as 50 per cent of British industry was covered by such schemes. While the law could deal with information exchange where it was part of a price fixing arrangement it was soon recognized that information sharing agreements allowed firms to circumvent the restrictive trade practices legislation. Information exchange agreements were brought under the Restrictive Trade Practices act in 1968, with more explicit provisions for goods markets in the *Restrictive Trade Practices (Information Agreements) Order* 1969.

Under this legislation an information exchange agreement on prices charged or quoted, planned prices or price quotes, or on terms and conditions of supplies has to be sent to the Director General of Fair Trading. He will place such an agreement on the register. The Director General then has to either bring the agreement before the Restrictive Practices Court or ask the Secretary of State to "discharge him from the duty of doing so" (Whish 1989). There seems to be virtually no case material available to come to conclusions about the actual competition policy practice (see Whish 1989, page 427). Given the fact that the law only applies to a small set of information exchange agreements, for example not to

information exchange on quantities sold or capacities, the possibilities for information sharing appear to be hardly restricted (see *UK Tractors Exchange* below). In fact even with regard to price fixing agreements the Restrictive Trade Practices Court has upheld such agreements where it thought they encouraged exports *(Water-Tube Boilermakers' Agreement 1959, LR 1 RP 285*), facilitated standardization (*Glazed and Floor Tile Home Trade Association's Agreement 1964*, LR 4 RP 239), promoted technology, or kept prices down. However, no such case has occurred since 1966.

2 EC Antitrust Policy on Information Sharing

2.1 The Legal Framework

Competition policy in the European community is based on Art 85, 86 of the Treaty of Rome and the Merger Directive. Information sharing agreements have nothing to do with abuses of dominant positions nor do they affect merger policy. The treatment of information exchange agreements therefore falls under Art. 85 of the Treaty of Rome[18]. This article prohibits agreements between firms which may affect trade between member states and which have as their object or effect *the prevention, restriction, or distortion of competition within the common market.* Article 85 (1) lists in particular agreements that contain direct or indirect price fixing, limiting production, and sharing markets. There are several ways in which information sharing may be potentially covered by Art. 85(1). First, it may be a part of a larger agreement which is prohibited like price fixing. Secondly, information sharing may be regarded as an indirect way of price fixing. Thirdly, information sharing may be regarded as sufficient evidence for the existence of an illegal agreement according to 85(1). Fourth, one could consider information sharing agreements as a necessary condition for sustaining the illegal agreements listed in Art 85(1) and find them illegal as a facilitating device. Finally, one might want to argue that information sharing agreements in themselves restrict or distort competition in the sense of Art. 85(1). Important for the legal framework is finally the possibility of Art 85(3) to exempt agreements from 85(1) that "contribute to improving the production and distribution of goods or to promoting technical or economic progress, while allowing consumers a fair share of the resulting benefits,...'". Below we will discuss how the Commission has in the cases and its policy statements interpreted these rules.

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[18] See Wish (1989) for a more detailed exposition of the legal background.

2.2 Purposes and Effects of Information Sharing Agreements

There are essentially two ways in which European Community policy views information exchange agreements. First, there is the possibility that information exchange is regarded as part of a price fixing agreement (or some other collusive agreement). In these cases there is little interest in the information agreement as such since information sharing is considered only part of a larger agreement which infringes Art 85(1) (see cases Cobelpa (OJ L 242, 1977), Suiker Unie (OJ L 140, 1973), Vegetable Parchment (OJ L 70, 1978)). However, the European Community has also argued that an information exchange agreement by itself can be an infringement of Article 85(1), even in the absence of evidence for collusion on prices. This has been a special concern in some important recent cases like Wood Pulp (OJ L 85, 1985), Fatty Acids (OJ L 3, 1987), and UK Agricultural Tractors Exchange (OJ L 20, 1993). In this section we want to discuss the set of arguments that have been made regarding these latter cases and in general policy statements that have been applied to them.

Competition policy based on Art 85(1) of the Treaty of Rome has as its aim to enforce the prohibition of agreements which have as their "object or effect the prevention, restriction, or distortion of competition within the common market". The wording of Art 85(1) therefore assumes the existence of some benchmark of "competition". For policy purposes the European Community appears to define "competition" as "independent decision making" by firms or the "absence of market coordination". The European Court has clarified this in a decision which has become central for the treatment of collusion and information exchange (Suiker Unie&Ors v. EC Commission 1975, ECR 1663):

> "The criteria of coordination and cooperation ... must be understood in the light
> of the concept inherent in the provisions of the Treaty relating to competition
> that each economic operator must determine independently the policy which he
> intends to adopt on the Common Market...Although it is correct to say that this

requirement of independence does not deprive economic operators of the right to adapt themselves intelligently to the existing and anticipated conduct of their competitors, it does, however, strictly preclude any direct or indirect contact between such operators, the object or effect whereof is either to influence the conduct on the market of an actual competitor or to disclose to such a competitor the course of conduct which they themselves have decided to adopt or contemplate adopting on the market."

From the above quote one could conclude that any communications between firms operating in the same market are prohibited under Art. 85(1). This is not and cannot be in practice the interpretation of the above argument. Any communication between firms will, if it has a purpose, have the result of changing actions of the firms in one way or the other. One cannot distinguish in any way, whether an information exchange agreement comes about because each firm gains information or because a firm wants other firms to obtain information in order to change their course of action. Firms reacting intelligently to the market will always be aware of both effects. For example, in the static theory of information exchange strategies of competitors become more correlated because with information exchange firms have more correlated information. When information is exchanged firms anticipate that an intelligent adaptation to better information about market conditions leads to this correlation effect. Firms will only exchange information if this effect is not negative enough for them to dominate any gain in information. However, firms still set prices (or quantities) completely "independently" in the sense that there is no joint decision making and no mechanisms that would enforce joint decision making indirectly. It appears that while firms might anticipate how competitors react to the information about market conditions that they supply, there seems to be no consistent argument that would support the claim that firms are less independent in their decision making with information exchange than without.

A closely related and recurring point in the decisions is that information exchange (e.g.

Wood Pulp, OJ L 8511, 1985)

> "creates a system of mutual solidarity and influence and thereby tends to substitute for the risks inherent in competition."

This statement can be interpreted in two ways. First, it could just be taken as a rephrasing of the earlier claim that exchanging information somehow leads to coordination between firms in an unspecified manner. An interpretation that would be compatible with economic analysis would be that information exchange would facilitate tacit collusion (in dynamic interaction of firms), by improving the monitoring possibilities of rivals' behaviour. As we have discussed in the survey part of this report improving monitoring ability quite generally increases the scope for tacit collusion in dynamic games. In order to police agreements price wars do not have to occur as frequently in order sustain tacit collusion and higher prices can be sustained. Direct exchange of price or quantity information in form of invoices or other verifiable information significantly increases the potential for sustaining collusion non-cooperatively. We see in this the main way in which information exchange can have significant effects on the presence of collusive behaviour. While it is very hard to prove infringements of Art 85(1) in form of price fixing agreements, these agreements can be credibly sustained only if there is sufficient information about the actions of competitors. It may therefore be sensible from an economic point of view to treat certain types of information exchange (e.g. direct exchange of quantity and price information) as infringements of Art 85(1) because they are likely to be motivated by an attempt to facilitate collusive conduct.

2.3 Market Transparency and Hidden Competition

In many cases (in particular in *Wood Pulp*) the Commission has argued, separately from other objections, that the increased market transparency provided by information exchange agreements was detrimental to "competition". In *Wood Pulp* the Commission stated that "the market is made artificially transparent simply by the fact that the prices quoted by the

firms to which this decision is addressed are made known so early,...". Whether publication of prices "distorts competition" is again a question that depends on what one assumes as the benchmark for a competitive market. Normal competitive conditions are characterized according to the Commission by indirect information transmission about prices through customers:

> "...information normally passes from one producer to another in a multi-stage process: from the producer to his agent or subsidiary, from the agent or subsidiary to the customer, from the customer to the agent or subsidiary of another producer who is ultimately informed and then makes his own announcement."

This description of how information is transmitted in markets is certainly not the one of the perfectly competitive model or of an efficiently working market. From consumer search theory we know that markets that operate similarly to those in this description may have close to monopolistic outcomes. The reason is that reduced transparency in the market also means reduced transparency for consumers. Consumers can only observe that a price is low and respond to a "secret price cut" if they can observe other prices. In search markets, like the one described above, price comparison is costly. If it where not, information would spread very fast. Hence, even in static models outcomes close to monopoly may be sustained simply because of the lack of transparency of the market. However, such a market would be interpreted as "competitive" according to the above quote.

On the other hand it is true that in a dynamic context, as we discussed above, increasing market transparency for producers may help considerably in sustaining tacit collusion by making secret price cutting more readily detectable by competitors. Increasing transparency in the market will therefore have two effects: it tends to increase the incentive to deviate from collusive agreements because it decreases consumer search

costs, but it also increases the ability of firms to detect and punish deviations from (implicit) collusive agreements. For policy purposes this suggests some degree of asymmetry in the treatment of information exchange depending on whether it is exclusive among producers at the same level in the production chain or whether information sharing extends to downstream customers. For example, information sharing through announcements in the trade press seem to be of much less concern for competition policy than the exchange of price and quantity data through an exchange of invoices. Announcements in the trade press significantly reduce search costs for customers and will tend to intensify competition. On the other hand information sharing at the same level of the supply chain will be much more likely to be purely used as a monitoring device for collusive agreements as discussed in the survey of the theory.

The latter concern about market transparency is captured in another statement in *Wood Pulp*:

> "Although the large number of competitors should theoretically make concentration between producers more difficult, this difficulty was neutralized by the transparency of prices in the market."

Such a statement overlooks the effect of increased transparency for consumers, which may lead to more competitive outcomes. As a consequence the claim that in a market with a large number of participants competitive pressure might be neutralized through information exchange need not hold when the information is disseminated to customers.[19]

Finally, there is a recurring theme in Commission statements about information sharing

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[19] This does not mean that we conclude that in Wood Pulp there was no problem of collusion. As we argue below the market effectively looked like a fairly tight oligopoly.

that is closely related to the "secret price cutting" argument. This relates to the idea that "normal competition" entails "risks" for firms like those of competitors undercutting their prices. For example, in the *White lead* decision the Commission stated that the monthly exchange of delivery information would

"reduce or even remove the risks which could arise if they were not aware of each other's market policy and the amount they delivered"

Or in *COBELPA* the Commission declared:

"the only possible explanation for the exchange of this information (mutual notification of prices) is the desire to create conditions of competition diverging from normal market conditions, by replacing the risks of pricing competition by practical cooperation."

These statements are hard to defend on the basis of economic theory. If "risks" would refer in this case to true uncertainty then eliminating risks from the market would normally improve welfare. If information sharing agreements had insurance effects this would be a positive effect of information sharing, not a negative one. Another interpretation of 'risk' in this statement (and a quote in the previous subsection) is that it simply refers to the possibility of lower profits because of competition. Under this interpretation there is no additional contribution of this argument to those already made.

2.4 Aggregate versus Individual Data

The Commission makes a sharp policy distinction between the exchange of aggregate industry data ("General statistical information") and individual firm data. According to the Seventh Report on Competition Policy the commission has no objection to the exchange of information on production or sales as long as the data does not go as far as to identify

individual businesses.[20] A difference is made when it comes to the exchange of price information, or general terms of sale, supply, and payment. The criterion used is that the information exchanged cannot be information that is "usually kept strictly confidential" (see the *COBELPA* case). Furthermore, information that identifies individual firms cannot be exchanged.

It is not straightforward to draw such a sharp distinction between different types of information exchange on the basis of the economic analysis of information sharing. Both aggregate and individual data may facilitate collusive agreements. However, in the presence of private information, *individualized* data may also facilitate punishment strategies that single out a deviating firm and hence induce more efficient cartel enforcement. Individualized data may be also of significant importance in collusive strategies that aim at inducing the exit of other firms in the market (as in *Fatty Acids*) or try to impede entry through threatening tough competition as a response to entry. For strategies of this type information sharing on individual data may be important. On this basis there seems to be sufficient justification for the distinction that the Commission draws. However, other distinctions should be at least as important. For example, a criterion of frequency of information exchange appears very important. Exchange on yearly data seems to have very little potential to affect the scope for collusion, while exchange of daily data would have a very large effect. Similarly breakdown of Figures into fine regional market segments may facilitate the detection of deviations from cooperation and thus facilitate collusion.

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[20] This implies, of course, that information exchange in a duopolistic industry is prohibited, since information about the rival can be perfectly recovered from "aggregate" data. It is not quite clear from the statements of the Commission, whether there is a qualitative jump when there are 3 firms in the industry in its treatment of information exchange.

As the *Vegetable Parchment* case has shown the commission goes further than disallowing information exchange on individual data. In this case the Commission objected to firms sending copies of their invoices to a trade association that would prepare aggregate statistics. The Commission declared:

> "The regular sending to ... an association ... of invoices or other individual data normally regarded as business confidences would be an indication of ... concerted practice [since] for the preparation of monthly statistics … it is sufficient to send only totals from invoices during the relevant period."

This policy is highly questionable viewed from an economic analysis of information exchange. One of the greatest problems in information exchange for firms is to exchange data credibly. Simply saying "I had terrible sales" will not convince any competitor, since the firm has an incentive to induce others to produce less. If firms exchange data which cannot be verified they will have an incentive to manipulate their statements to influence the beliefs of other firms while still obtaining the full benefit of information from other firms. In economic models of ex-post information exchange this implies that information exchange breaks down completely. Hence, the policy of the Commission comes down to effectively forbidding the exchange of information. If the Commission does believe that the compilation of accurate aggregate statistics is beneficial it should allow the firms to send their invoices to trade associations who compile these statistics. The fact that this is "normally secret business information" is exactly what makes it necessary to resort to such credible exchange mechanism if one wants to obtain credible statistics.

2.5 The Role of Market Concentration

The Commission has also stated repeatedly (see Seventh Report on Competition Policy) that it takes into account the structure of the relevant market when assessing the effects of information exchange agreements. If one is concerned about information exchange as a means to facilitate implicit collusion this is a sensible policy. It is significantly easier to

sustain implicit collusion in tight oligopolistic markets. Increases in monitoring possibilities through information exchange will have more of an effect on implicit collusion in such markets, because in more fragmented markets significant collusion will not occur even with better information. The welfare analysis of information exchange in static models is, however, not affected by this argument. In static models the welfare conclusions are not significantly affected by market size considerations as the monopolistically competitive model of Vives (1990) shows. It is not the case in general that with few firms in the industry information exchange hurts consumers while with many it does not.

2.6 Information Exchange as a Barrier to Entry

Recently, in *UK Tractor Exchange* [21], the Commission has argued that information sharing agreements may put potential market entrants at a competitive disadvantage, because they are not initially part of the agreement. Hence, such agreements may constitute barriers to entry. As we have shown in the theoretical part this is not a valid argument. Information sharing agreements that increase profits of firms in the industry may also increase profits for potential entrants if there are positive informational externalities as in static models under price setting behaviour. It can not be concluded that information exchange is a systematic barrier to entry.

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[21] We discuss this case in more detail below.

3 An Analysis of Information Sharing Issues in Important EC Cases

3.1 Wood Pulp

One of the richest cases in terms of various forms of information exchange is the *Wood Pulp* Case (OJ L85/1 1985).[22] The wood pulp industry has been a focus of antitrust attention for a long time, in particular in the US. On the surface the industry appears quite fragmented. There are more than 800 firms in more than 30 countries. However, the existence of important export cartels and the high degree of forward vertical integration make it much harder to assess the true degree of concentration in the market. Only 40 per cent of the production is sold on the open market, while the other sixty percent is used internally. Of these 40 per cent a large proportion is sold in the form of long term contracts of fixed supplies which should be assessed similarly to vertical integration. Furthermore, little information is available in the case materials to draw conclusions about the degree of downstream concentration, which is essential data to evaluate the effects of concentration.

More than 50 firms sell wood pulp in the European Community with the largest producers being Canada, the USA, Sweden, and Finland. These producers were to a large extent linked to cartel sales organizations. The most important one of these is the Pulp, Paper, and Paperboard Export Association of the United States, more commonly known as "Kraft Export Association" (KEA). The KEA is an exporters cartel registered in 1952 under the Webb-Pomerene Act. This is a classical sales cartel organization with joint price fixing. A similar function for the Finnish producers is performed by FINNCELL, the

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[22] For an early analysis of the Wood Puld case including an extensive discussion of information sharing issues and tacit collusion see Phlips (ch. 6, 1988).

joint sales agency of the Finnish producers.

The EC Commission opened an investigation into the European wood pulp industry in 1977 concerning the conduct of firms since 1973. This investigation led to the discovery of "restrictive practices" and the Commission opened proceedings under Articles 4 and 5 of EC regulation #17 in 1981. The Commission requested additional information in 1982 to verify the objections made by the firms involved. Its Decision (L85/1 1985) followed in December 1984. The firms concerned were found to have violated Art 85(1) by colluding on price announcements and transactions prices. Another, independent, violation of Art. 85(1) was found in the exchange of price information between firms. The firms involved appealed to the Court of Justice of the European Communities, which repealed the fine against KEA for collusion in prices within the cartel. According to the Court these were practices that were explicitly permitted in the US by the Webb Pomerene Act and were therefore outside the powers of the Commission. However, the Court rejected the claims of other firms that disputed the extraterritorial applicability of EC law against firms with their main operations outside the EC. The main part of the complaints of the affected firms against the charges of collusion in prices was referred to the Fifth Chamber of the court. The Court decided in March 1993 to repeal the larger part of the decision. There were two reasons for this decision. First, there was the formal reason that some of the objections of the EC Commission had not been made known to the companies in the official EC complaint sent to the firms. Secondly, the Court rejected the claims that price announcements and parallel pricing were proof of collusion between firms. Only where the Commission was able to present evidence for meetings that led to agreement on prices were the collusion charges upheld[23].

For the decision of the Court two reports of economic experts were of crucial importance.

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[23] The fines for contractual clauses that prohibited resale were also upheld.

The Commission had argued that the uniformity of prices across firms and parallel price movements constituted evidence for collusive price settings. As the experts pointed out the Commission overlooked the fact that in markets with almost perfectly homogeneous goods prices across firms have to be (close to) uniform in equilibrium independently of the differences in cost structures. This is a feature of homogeneous goods markets irrespective of the degree of collusion in the market. As such the experts' argument reflects the general fact that it is generally infeasible to infer collusion from price and quantity data alone. The experts also clarified that, contrary to the opinion of the Commission, the absence of price discrimination across regions is rather evidence against collusion than for it. The reason is that collusive price setting should give firms greater possibilities to exploit differences in price elasticities across regions.

There are many ways in which information exchange has taken place in this market. We will now discuss some of these ways and their potential effects in more detail.

3.1.1 Pre-sales Price Announcements to Downstream Agents and Customers

Characteristic for the wood pulp industry are pre sales price announcements which take place quarterly. These fall into two categories: direct private announcements to downstream customers or agents and public announcements through the trade press. Public price announcements generally conformed with the transactions prices, i.e. generally there were no revisions of prices after public announcements in the trade press. Price announcements generally took place simultaneously or almost simultaneously. As far as they are sequential there is no pattern of price leadership. The Commission report concludes: "The close succession or even simultaneity of the price announcements and the similarity of both announced and transactions prices cannot be explained by the existence of a market leader whose prices are adopted by his competitor". Given these facts price announcements cannot have been used for information sharing and coordination in a given

quarter since adjustments to the released information almost never took place.[24] Especially in the case of information transmission to downstream customers either directly or through the trade press we can only expect that uncertainty for downstream producers and search costs are reduced, which should lead to an improvement.

The fact that most of the time price announcements and transaction prices are identical together with the fact of quarterly price announcements may suggest that these announcements are a commitment by upstream producers of wood pulp to reduce the risk downstream firms face. This conjecture based on theoretical considerations seems to be directly supported by the evidence accumulated by the economic experts. They found that the pressure for prior price announcements came from the paper producers who were using wood pulp as their main input.

We have argued in the section on theory that the most convincing theoretical explanations of price preannouncements to consumers is a commitment to a maximal price charged to customers. This point is also confirmed by the evidence of the economic experts in the Wood Pulp case. They established that buyers considered the price announcements as ceiling prices for their future transactions with the suppliers. This implies that secret price cuts on future transactions prices were still possible. Competition would then imply that in states of unexpectedly high demand the ceiling prices would be binding constraints on transactions prices, while transaction prices should fall below the announced prices in times of unexpectedly low demand. If wood pulp producers have relatively good information about demand, deviations of transactions prices from announced prices should be fairly infrequent. The price patterns in the wood pulp market confirm nicely to such explanations. For example, transaction prices below announced prices were

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[24] There is a deviation from this pattern in 1976, which might be explainable by unanticipated shocks in demand or costs, a possibility that seems not to have been investigated in this case.

observed at the beginning of 1977 when "the expected growth in demand had not materialized and an increase in prices was less likely". What is typical for such situations is that announced prices are adjusted afterwards to the new demand conditions, as happened after the last quarter of 1981. Such patterns therefore cannot serve as evidence for collusive behaviour on transactions prices.

The infrequency of downward adjustments of prices in response to demand shocks is also explained by another feature of the wood pulp market: the presence of inventory holdings by wood pulp producers. Prices would react very little to transitory shocks in demand if producers have the ability to build up inventories. Inventories help firms to smooth pricing behaviour across transitory shocks so that only permanent shocks to demand should feed through to price changes.

Preannouncing prices either to agents or directly to downstream customers can therefore not be seen as proof for collusive behaviour in the market. On the other hand, the pricing pattern as such does not disprove the possibility of collusion on transaction prices. Price patterns of the same nature would be generated by colluding firms in the setting described. However, the charge of collusion on preannounced prices made by the European Commission seems to make little sense in such a context. What is important for firms is whether they achieve collusion on transaction prices. Coordination on announced prices does not appear to be important to achieve this.

3.1.2 Private Communications between Wood Pulp Producers

There seem to be many instances in which wood pulp producers communicate among themselves, for example before making their price announcements. In the KEA producers meet and discuss prices before the KEA makes a price announcement. Since the KEA is a permitted export cartel under US law this is simply the way one would expect a cartel to operate in fixing its price. More interestingly, there appears to be some evidence that the

trade association of European producers FIDES provided a forum for the same type of discussions about prices before price announcements took place. Hence, the general mechanisms for information exchange may have been used to coordinate price announcements and monitor whether firms conformed with previous agreements. This evidence was sufficient for the Court of Justice to uphold the charge of collusion in some cases. However, there also seems to be some evidence that some coordination of price announcements went on through direct communications between firms. These information exchanges *prior* to price announcement should be considered as the central competition policy problem, not the price announcements in themselves. Information exchange should only be of interest when it helps to sustain tacit collusion among producers. The statement by the Commission that

> "this exchange of information was not only part of the concertation of prices
> but was also part of an independent infringement of Art 85(1)."

is from this point of view somewhat problematic. As we have argued before, the effects of information exchange should be mainly evaluated from their potential for facilitating tacit collusion. If information exchange would not raise the possibility of price fixing it is hard to make a good economic case against it.

This does not mean that we do not think that information exchange cannot be an independent infringement of Art 85(1). The practice of competition law has established that a finding of concertation on prices requires proof of an agreement between firms. It has been argued in the legal literature that such a proof requires reciprocal communication between firms , as discussed in Van Gerven and Navarro Varona (1994). These authors conclude that "the Wood Pulp" judgement directs the antitrust efforts clearly towards finding documentary evidence of concertation". This conclusion simply reflects the difficulty to prove collusion from market data. However, we know from economic theory that collusion can be established tacitly without direct communication (or only with

unilateral communication). There is no difference in market outcomes but a court would have to conclude that firms would only intelligently react to the actions of their competitors. However, there are some practices that facilitate the establishment of tacit collusion, i.e. that create an environment in which collusion becomes much easier. We believe that such practices should be considered as independent violations of Art 85(1) if beneficial effects are unlikely. From our discussion of information exchange in dynamic settings it should be clear that some forms of information exchange should fall into this category.

Information exchange may, as we discuss in more detail in other cases below, change the *environment* for firms in the industry in such a way that the scope for collusion is increased. Especially the exchange of information of individual firm data on prices or quantities, can dramatically increase the danger of tacit collusion without strong beneficial effects emerging. Therefore such exchange of information should be an infringement of Art 85(1) unless firms can demonstrate such benefits.

The *Wood Pulp* Case demonstrates the potential importance of such a rule. The case has amply demonstrated the difficulty to prove collusive behaviour in court in the absence of documentary evidence for explicit agreements. On the other hand, information exchange is necessary for enforcing agreements efficiently and some restrictions on information exchange may therefore be an efficient way of combating collusive agreements.

It should be noted that from both a policy and a theoretical perspective there is a close analogy between the Wood Pulp case and US v. Airline Tariff Publishing Co. in the US. In both cases there is a mixture of public price announcements which are effective for consumers and price preannouncements which are not and simply serve as communication devices between firms. The public price announcements in the Wood Pulp case correspond to price announcements in the ATP case in which airlines do not set restrictions on first ticketing dates. On the other hand, the private communication of

planned prices by fax and other media between firms that did not constitute commitments to maximal prices could be considered to have served a similar function as the price announcements with first and last ticketing dates in the American airlines market. A careful separation between these two types of price pre-announcements as done by the competition policy authority in the ATP case would probably have helped significantly in the analysis of the Wood Pulp case. It appears that the Commission would have had a much stronger case if it had focused on the direct private information sharing on prices among the producing firms.

3.1.3 Information Exchange Between Customers

The experts' report on the Wood Pulp case uncovered that customers in the market were exchanging detailed information about transaction prices they were obtaining from wood pulp suppliers. (See Report for the Hearing, p. I-149). This together with the system of price announcements had the explicit goal that paper producers could monitor each others' input costs and relax competition between them in the market for paper:

"The system of announced prices offered a number of advantages for pulp buyers: on the one hand it met their main concern that they should pay no more for their pulp than their competitors and on the other hand it helped them to maintain their paper prices vis-a-vis their customers."

It is clear from economic theory that monitoring of individual input costs can help in sustaining collusion between firms. Uniformity of input prices would make monitoring of cartel agreements in the paper market easier, because market share adjustments according to differences in marginal costs would be unnecessary. As a result the available evidence suggests that instead of the information exchange and price announcements being used by pulp producers to reduce competition in the market for pulp, they might have been used by paper producers to sustain agreements in the final goods market. This

is only one example in which the separation of input markets and final goods markets in competition policy practice leads to misinterpretations of the functioning of input markets. We believe that the analysis of input markets can never be done in separation from the analysis of the relevant final goods markets.

3.1.4 The Debate on "Normal" Market Transparency

The European Commission has argued in the Wood Pulp case that price announcements and information exchange made the market "artificially transparent". The experts' reports argued against this claim, but they did accept the notion that there exists some "normal" transparency of the market given by some features of market structure. We believe that such a benchmark of "normal market transparency" is not well-grounded in economic analysis and that attempts to base competition policy decisions on such concepts will lead to arbitrary results.

A first problem that has arisen in the Wood Pulp case is that neither the Commission nor the experts have carefully distinguished between the issues of market transparency for customers and market transparency for firms. Market transparency for customers is essential for having competition in a market. If customers cannot make informed price comparison firms can essentially act as monopolists even in markets with many firms. The reason is that price cuts are simply never observed by customers so that they cannot react to them. As we have stated earlier, we know from the literature on informative advertising that the possibility of price announcements (through advertisements) will generally intensify competition. Market transparency on the producer side has several aspects. First, information about past prices will help in sustaining collusive outcomes. Secondly information about the costs or demands for the goods of competitors helps in allocating cartel quotas and detecting collusion via secret price cuts. Therefore, public announcements of prices increase both types of market transparency, while private exchange between producers of cost and quantity data only increases market transparency

on the side of producers. This distinction is very important for policy conclusions. There is no sense in which one can come to policy conclusions about "market transparency" without distinguishing between the two sides of the market.

The second problem is that even with such a distinction it is hard to talk about a "normal" level of market transparency on either side of the market. One of the experts' reports argued that market transparency was not artificial because customers had forced producers to make public price announcements and also were dealing with many suppliers. This overlooks that the agreement between producers and users of wood pulp to have public price announcements as well as the vertical structure of the market are determined by behaviour on the market. Both are not exogenous market conditions. In particular, customers in this market had an interest to increase market transparency in the market for wood pulp in order to facilitate collusion in the market for paper. Trading with many suppliers may be a result of a conscious effort to acquire more information about the general level of input prices in the market. As a consequence we believe that economic theory provides a basis for analyzing the effects of particular kinds of information agreements and guidance to which should be permitted and which not. However, it does not seem to provide any foundation for the concept of "normal market transparency".

3.2 Fatty Acids

The EC Commission started proceedings against four firms in the *Fatty Acids* case in January 1986. In a decision taken in December 1986 the Commission decided the information sharing agreement between four, later three, firms during the time of September 1979 until the end of 1982 were violating Art. 85(1) of the Treaty of Rome.

The *Fatty Acids* case is of special interest because the Commission apparently decided not to treat an agreement between the three largest producers in the market as a matter of market sharing (of residual markets) but purely as a matter of illegal information sharing.

The case concerns a market with three principal competitors (Unilever, Henkel, and Oleofina) and a fairly large competitive fringe of around 40 firms. While the large firms produce more than 100 000 tons a year, some small firms produce less than 5000 tons a year and operate only in local markets. The industry has a trade association (Association des Producteurs d'Acides Gras, APAG), representing about 90 percent of production. The three most important producers have a market share of 60 percent and are all members of the Association. The Association operates an information exchange agreement in which firms report production and sales which are passed on by the APAG in form of aggregate statistics as long as individual firm data cannot be deduced directly or indirectly. This form of information exchange has not been objected to by the Commission since it satisfies the general terms the Commission has set out in its seventh Report on Competition Policy. In particular, given the way the agreement was termed, it seems likely, that established EC practice was taken into consideration when the information exchange system was set up.

The initial problem arose in 1979, when Unilever, the market leader with more than 30% market share, decided unilaterally to reduce capacity as a response to generally perceived overcapacities in the market. According to Unilever's statements it was worried that other large firms in the market would perceive Unilever's move as a first step towards withdrawing from the market in Fatty Acids. (Given that Unilever is one of the largest users of Fatty Acids and therefore highly vertically integrated in production, it is not clear why such an impression should have come about). Unilever initiated an information sharing agreement among the three largest producers in which they exchanged information on yearly total sales for the previous three years and future four-monthly reports about total sales. This accord also has an official clause in which it is stated that the information will not be passed on to the sales personnel of the respective firms.

An analysis of the statements and written evidence about the purposes and effects of this information exchange gives an interesting example about the role of individual firm data

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for sustaining collusion. The view of the leading firms seems to have been that there was a necessity to reduce capacities in the market, but that the best way of reducing capacities was by inducing exit by smaller firms (which were regarded as inefficient by the market leaders). Firms used the exchanged information together with other information obtained to make a careful analysis of where gains of their major competitors came from. While customer switches between these firms were labeled as "stolen" sales, gains in new customers (potentially from outside producers) were seen as legitimate gains. Furthermore, it appears that gains from new downstream production (i.e. demand expansions) were "legitimate". However, there seems to have been some expectation that demand from new large customers appearing on the scene should be shared in order to stabilize market shares. What is important in this market is that there is not necessarily a single price but contracts with individual customers. This allows firms to entertain collusive agreements in which they refrain from competing harshly on their established customers while intensifying competition in the residual market in order to induce exit by smaller firms. Close monitoring of sales within the group of large firms, i.e. information on individual firms, is essential for such a strategy. In the relevant period, the three largest firms did indeed sharply increase their market share of Stearin from 52% in 1979 to almost 60% in mid 1982, and in the market of olearin the market share increased from 70% in 1976/78 to 80%. At the same time Unilever's market share of the total market stayed constant, while the other two participants in the agreement (who did not reduce their capacities) grew faster than Unilever. Such an outcome would be expected from an effectively working cartel in which the relative bargaining power is determined by the relative strength of potential competitive threats induced by relative excess capacity sizes.

What economic analysis suggests in this case is that predatory strategies may have been at the heart of the information exchange agreement, given the explicit understanding among the leading firms that there should be exit by smaller firms. However, in this case it would have been very hard to establish the predatory intent of the agreement in court because of the difficulty of producing clear evidence. This suggests the benefits from protecting

competition through a policy that regards information exchange on individual firm data as a potential infringement of Article 85(1).

In economic terms there is another concern in this case, which has not been investigated by the Commission because of its focus on information exchange. The high degree of vertical integration by the large producers in the market might suggest that the policies adopted by large producers are related to concerns about downstream competitors. Eliminating alternative sources of input supplies for downstream competitors would allow market foreclosure by the large producers and would therefore make predatory strategies in the market for Fatty Acids more attractive. We cannot substantiate that this was an important consideration in this case, but again restrictions on information exchange through individual firm data puts severe limits on such strategies. The Fatty Acids case might be an example of how the Commission could efficiently act against implicit collusion by enforcing restrictions on information sharing agreements.

3.3 UK Agricultural Tractor Registration Exchange

The case of the UK Agricultural Tractor Registration Exchange is a second case in which arguments centered on the information exchange agreement that had been established by the trade association AEA (Agricultural Engineers Association). The AEA filed an application for negative clearance[25] in January 1988. This agreement was to replace an earlier information exchange agreement dating back to 1975 which had not been notified to the Commission, and had been detected by the Commission in an investigation in 1984 following a complaint of barriers to parallel imports. In November 1988 the Commission issued a statement of objections and the members to the agreement decided to suspend it. In March 1990, five members of the AEA presented a modified version of the information

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[25] An application for "negative clearance" aims at obtaining permission for the agreement from the EC before the agreement takes effect.

exchange agreement, applying for negative clearance or alternatively for exemption under Art. 85(3). The Commission came to a decision in February 1992. It considered the information exchange agreement a violation of Art. 85(1) because it permitted every firm to monitor every other firm's sales and because it considered it a barrier to entry into the UK market for tractors. An exemption under Art 85(3) was denied (OJ 1992 L 68). One of the firms involved, John Deere Ltd in Edinburgh, UK, immediately filed an application for the annulment of the Commissions Decision before The Court of First Instance of the European Community. Among other procedural complaints, the company argued that the information exchange agreement did not lead to a restriction of competition and furthermore enhanced efficiency in the market. On 27 October 1994 the Court of First Instance rejected the application supporting in all disputed points the position of the Commission.

This case illustrates two important arguments made by the Commission about the effects of information exchange. One is that information exchange eliminates "invisible" competition or secret price cutting. Second, the Commission claims that information exchange agreements can act as barriers to entry. Both of these claims have been disputed by the applicant. As in the Wood Pulp case both the applying firm and the Commission resorted to economic experts to support their claims. We will demonstrate below that except for the claims of entry barriers the position of the Commission and the Court are supported by our analysis.

The market for agricultural tractors is a fairly small and declining market with about 20 000 units sold every year. Currently only 7 firms control 88% of the market. Four of these obtain 80% market share. The trade association in this industry (AEA) has organized an information exchange that is more detailed than in any other of the cases we know. It is based on the information that has to be given to the British Ministry of Transport to obtain a license plate for the tractor. The information contains the producer, brand, serial number, sales agent, as well as information about the buyer (at least the postal code).

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However, price quotes are not reported.

We will discuss first the potential anticompetitive effects of the information exchange agreement. The applying firm had argued that the increased transparency of the market among firms increases competition "by permitting undertakings to react immediately to competitors activities". This claim is not well founded in economic analysis. On the contrary, we would expect that this is a setting in which the information exchange improves the possibilities for monitoring implicitly collusive agreements and therefore considerably increases the danger of tacit collusion. The market for tractors is somewhat special as firms can set a different price for each unit sold. This makes the market very similar to a sequence of auctions for tractors. We know that in sequences of auctions of this type (as for example in public contracting) collusion between the selling firms is a frequent phenomenon. Firms attempt to share the market by previously designating winners of auctions. The only problem firms have in sustaining collusion in such a market is that they have no information about whether an "auction" took place or not. All relevant information that firms need to obtain to sustain collusion is information about whether sales have taken place or not and whether market sharing agreements on sales were obeyed by competitors. Actual price data will not be necessary for firms because all that is important to sustain collusion in such auctions is knowledge about who quoted the lowest price. In this sense special deals offered to single customers will on average be detected through the improved monitoring of market share data and thus it is likely that almost perfect collusion could be sustained. In this sense, the argument of the Commission that information sharing of this form reduces the possibilities of "invisible competition" has a strong backing in economic theory, although some of the descriptions of what the 'secret price cutting' argument is about are sometimes not very close to the economic

arguments.[26]

In its application John Deere Ltd. argued that the information exchange agreement could not be anticompetitive because it involved exchange about past conduct and not exchange of information about future planned actions. It should be clear from our exposition of the theory of dynamic collusion and the above explanation that this is not a valid defense. The monitoring of past conduct is essential for sustaining collusive outcomes. While it is possible for firms to sustain collusive outcomes in the absence of explicit communication about future conduct if past behaviour can be monitored, it is impossible to sustain collusion in the absence of information about past behaviour whether or not firms communicate about future conduct. [27]

A particularly interesting aspect of this case is that the information system instituted generates a very detailed picture of small submarkets. The ability to break down information by submarkets makes it easier to monitor deviations from collusive agreements and hence makes collusive outcomes more likely. Even if the information exchanged would have been more aggregated across firms, the fact that information was

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[26] For example, in the EC decision it is suggested that active competition can only be maintained if firms are able "to confuse their competitors". The issue is more that monitoring of past outcomes is essential for competitors to know when they have to punish deviants. In the absence of such information about past behaviour no punishments are feasible.

[27] The applicant made other claims that have no backing in economic analysis. For example, it argued that the rapid gain of market share by a large entrant from the US market was inconsistent with collusion. This is not the case. If an entrant is very efficient relative to incumbents an (implicit) cartel agreement will take relative efficiencies into account and allocate the more efficient firm higher market share. The fact that other firms' positions in the market relative to each other remained stable is on the contrary (weak) evidence that their might have been collusion in the market.

broken down so finely into submarkets could have been a reason to prohibit this form of information exchange. In this sense not just aggregation of data across firms but also aggregation of data across submarkets is important to reduce the collusive potential of information sharing agreements. Furthermore, the Commission correctly pointed to the fact that very fine disaggregation of information makes it possible to identify individual sellers, essentially making all relevant information available to the firms. These arguments are reinforced because of the frequency of information exchange. In the *UK Tractors* case very frequent, up to daily, information was available. Suggestions for the future of the information exchange agreement envisioned monthly information exchange, which would still be a high degree of disaggregation given the relatively small number of sales involved in each submarket. The more frequent information about market condition, the greater the danger that it can be used effectively for monitoring collusive agreements.

An interesting issue in the UK Tractor case is to what extent the Commission should have considered the claims of efficiency gains that could be achieved from the proposed information exchange agreement. it is important to point out that simply the existence of an efficiency gain does not justify the application of Art 85(3). An information exchange agreement that significantly increases the possibilities for collusion in the market should only be exemptable if there are no other reasonable ways of achieving the goals of the information exchange agreement which do not involve these anticompetitive dangers. In the case of UK Tractors the applicant argued that the information exchange agreement was indispensable to enable the firm to check warranty or bonus claims because it allowed the origin and destination of the tractor to be identified. However, no additional costs would be imposed on the firm if the trade association organizing the information exchange were restricted to pass on this information only in cases where warranty and bonus claims had actually been made. At least in the case of warranties the legitimate, efficiency enhancing, goal of eliminating asymmetric information on warranty claims would in no case justify the extensive unconditional sharing of information that occurred. A similar argument can be made for the degree of disaggregation of information that the Commission objected to.

It appears that for production planning aggregate output numbers are not only sufficient, but also more important because they depend less on specific shocks in localized markets. While the claim of the firms is true that obtaining individualized data on their own would be very costly, it also seems to be true that loosing individualized data would have very small effects on production costs if at all. Finally, the firm had a valid claim in arguing that monitoring individual retailers is beneficial for the manufacturer in order to give incentives. However, the manufacturer always has information about sales to his retailers. If he has in addition information about aggregate market data this suffices to write very effective incentive contracts so that the additional gain in efficiency appears very small. Again it is important to analyze whether aggregating market information significally restricts incentive contracting. This does not appear to be the case. The Commission and the Court are therefore correct in rejecting an exemption to Art 85(3) on the basis that the business objectives claimed by the firm can be obtained in other low cost ways and that therefore "own company data and aggregate industry data are sufficient to operate in the agricultural tractor market".

The only aspect in which it is hard to follow the position of the Commission and the Court is the claim that information exchange may constitute a barrier to entry into a market. The argument of the Commission is based on the idea that firms that are not members of an information exchange agreement are necessarily at a competitive disadvantage relative to those who are members of such an agreement. If there is indeed collusion in a market that is aided by an information exchange agreement, an entrant can take advantage of the higher prices induced by the agreement without having to be part of an agreement. In order for information exchange agreements to have an impact on market entry they would have to facilitate coordinated predatory pricing by incumbents as a response to entry. While we know that this is indeed a theoretical possibility, the role of information sharing in this case is no different from that of sustaining collusion in general. In this sense entry considerations cannot constitute a separate argument. Furthermore, the Commission has stated in its report that the industry was in decline and was characterized

by overcapacities. In such a situation entry seems neither likely nor desirable (except, possibly, entry by more efficient competitors).

Finally, the case shows that there may be some undesirable inconsistency in the way the cases *Fatty Acids* and *UK Tractors* have been treated by the Commission. While in Fatty Acids the Commission has purely concentrated on the potential anticompetitive effects of information sharing of individualized firm data, in the UK Tractors case it saw it as necessary to have a careful analysis of market structure. The Commission pointed to the concentrated market structure as particularly important for its arguments on information sharing to be valid in the case of *UK Tractors*. In contrast, the *Fatty Acids* decision mentions the high degree of market concentration only in passing, placing much more emphasis on the fact that exchanging individualized data infringes on Art 85(1). This is consistent with the *Wood Pulp* decision in which the market was considered to be fairly fragmented. There may, however, be differences in these cases that may justify different weights on the role of the analysis of market structure. For example, we would think that individualized information exchange on past prices and quantities has a very strong potential to create anticompetitive effects while other types of individualized information exchange have smaller anticompetitive potential. In the first case, one would generally consider such information exchange as infringing on Art 85(1), while in the second case it would be desirable to show in addition that other features of the market make collusion likely. This would help to achieve consistency in the treatment of market structure analysis in information sharing cases.

3.4 Cases of Price Fixing with Information Exchange

Three cases from the 1980's concerning petroleum derivative products illustrate situations in which information exchange was considered a supplementary agreement to sustaining collusive price agreements. The first case, *Polypropylene* (L 230/1, 1986), started with investigations in October 1983 after the discovery of an institutionalized system of "chef

meetings" and "meetings at expert levels" between the competing firms in the industry. Official proceedings were opened in April 1984 and led to a decision by the Commission in April 1986, in which the Commission found an infringement of Art 85(1) because of concerted practices and market sharing since 1977. Some of the articles of the decision were suspended by the Court of Justice leading to the postponement of fines for one of the firms. In the final decisions on the case in December 1991 fines for some of the firms were reduced as they were not found to have participated in the concerted practices over the whole time period. The other two cases, *PVC* (L74/1, 1989) and *LdPE* (L74/21, 1989), were initiated with official proceedings in March 1988. In December 1988 the Commission in its decisions on the cases saw a practice of price fixing and setting of market quotas supported by regular meetings between the firms (from 1980 onwards in *PVC*, and from 1976 onwards in *LdPE*). The *PVC* case was dismissed by the Court of Justice because of an irregularity in the proceedings unrelated to the substance of the case.

The products Polypropylene, PVC, and LdPE are derivatives of petroleum. Polypropylene and PVC are used in a multitude of final products and in different processed forms, while LdPE is mostly used for packaging purposes. Because petroleum is the main input in production both the firms involved and market structures are fairly similar in the three cases. There are about 15 to 16 producers in the Community including Atochem, BASF, DSM, Hoechst, ICI, LINZ, Montedison, Shell, Solvay, and Enichem. All three markets are characterized by strong growth in demand for the products, but there are at the same time overcapacities generated by entry into the market. This is most evident in the Polypropylene case. In the 1970's demand grew by about 15 to 20 percent annually. The patents that Montedison was holding on different varieties of Polypropylene expired between 1976 and 1978 triggering the entry of 7 new producers in Europe, while other existing producers increased their capacities leading to overcapacities at the demand levels of the time. Demand growth slowed to about 9 percent annually in the 1980's. According to the producers "supply and demand were in equilibrium by 1982", but still the industry was complaining about structural overcapacity problems in talks with the EC

Commission in July 1982. The industry has suffered low profitability, mostly due to the high fixed costs of production.

Similar problems in the industry characterize the other two products. PVC experienced strong demand growth between 1960 and 1986. Initially there was a large degree of entry leading to 30 active products. Then by 1977 market consolidation took place in the form of 12 mergers that left the industry with 14 producers. According to the reports about the case this did not eliminate the structural excess capacity problem. This may be intimately linked to the fact that the PVC market is characterized by high demand and supply fluctuations which implies that it may well be optimal that the industry operates below capacity for significant amounts of time. Excess capacity problems also characterize the market for LdPE.

In the context of Art 85(1) these are "easy" cases since the Commission was able to prove the existence of regular meetings between officials both at top and "expert" levels. It was also shown that these meetings had the object of fixing prices and agreeing on sales objectives and market shares, as well as controlling whether firms conformed with prior agreements. If evidence of this type exists it is relatively easy to show an infringement of Art 85(1) since it comes down to a classical cartel agreement. One should, however, expect that firms will in the future make it harder for competition policy authorities to find evidence of this kind. Nevertheless, the fact that information exchange on prices and sales statistics of firms is necessary to sustain such an agreement may be a reason to look at the existence of such exchange of information first. In particular in the *Polypropylene* case firms tried (successfully in some cases) to argue that documents found in another firm could not be used as evidence that they had participated in price fixing or market sharing agreements, even if they were present at such meetings. However, if one regards information exchange on individual data as the primary concern for competition policy enforcement towards collusive behaviour the possibilities for proof should be considerably improved. Since credible information exchange will usually require some documentation,

this documentation can in principle be found. This is the difference with credible agreements to collude. Firms can come to an agreement about collusive behaviour avoiding documentation without endangering the credibility of the agreement. However, enforcement of the agreement depends on credible information about the conduct of competitors. In this sense antitrust enforcement against cartel behaviour is much simpler if it is directed towards information agreements that support the underlying collusive agreement than if it attempts to prove the existence of an underlying collusive agreement.

The *PVC* and *LdPE* cases have another aspect that reappears regularly in cases with suspected collusion between firms. This is the fact that firms, despite the existence of trade associations that disseminate aggregate data, create parallel information exchange channels by which they exchange more detailed data. This pattern points to a possible policy rule for information exchange based on the regulation of the organizational structure of information exchange. Given the position of the Commission, that exchange of individualized data is generally not permissible, legitimate information exchange will generally have to pass through an intermediary in order to guarantee that only aggregate information is passed on to firms.

3.5 Exemptions in Insurance Markets: The Nuovo Cegam Case

The Commission has employed a policy of exemptions to Art 85(1) in the field of insurance (German Fire Insurance, OJ L 35, 1985; Nuovo Cegam, OJ L 99/29, 1984), which have subsequently led to a Block Exemption Regulation for some forms of cooperation involving the exchange of information (Commission Regulation No. 3932/92; OJ L 398, 31.12.1994). An analysis of the arguments for cooperation in such cases is of special interest since we have identified the insurance and banking industries as those in which factors of adverse selection and moral hazard may justify a special treatment of information sharing agreements (and other forms of cooperation). It appears to be evident from the documents that the Commission does not consider the exemptions in the insurance industry

granted under Art 85(3) to be related to moral hazard or adverse selection problems. Nevertheless, there is no immediately apparent economic justification apart from problems of adverse selection for treating information exchange in the insurance industry differently from information sharing in other industries.

This view can be illustrated in the context of the *Nuovo Cegam.* case. Nuovo Cegam is an association of Italian and foreign insurance firms operating in the Italian market for engineering insurance, i.e. insurance against the risk of damage to machinery. This market was at the time significantly less developed in Italy than in other member countries of the EC. The reason for this was believed to come from the high degree of obsolescent technology in place combined with low investment into new technology. In 1982 there were about 60 Italian firms in the industry and 10 dependencies of foreign firms, of which only 30 were doing business at significant levels. A barrier to entry existed in the market in the sense that it was perceived that a high degree of specialization was necessary to successfully compete in the market for engineering insurance. To develop the business several firms formed a first association in 1956, which was substituted by a new association (Nuovo Cegam) in 1972. The case in question concerns the latest association agreement between the participating firms, concluded in 1982, which was to be in effect until the year 2000. Two parts of these agreement are of central importance. First, the agreement provides for the setting of a common tariff for base premiums by the members of Nuovo Cegam, based on statistical claims information communicated to the association by the members. Secondly, the agreement brings together insurers and reinsurers in the market. Reinsurers that are part of the agreement concede favourable terms to the insurers in return for insurers placing *all* their reinsurance business in the market for engineering insurance with these reinsurers. The members of the association had a market share of 26% of the Italian market in engineering insurance compared to 25% of the largest firm and 46% of the three largest firms outside of Nuovo Cegam.

The Commission became aware of the Nuovo Cegam agreement in 1983 during an investigation into the insurance industry initiated under its own initiative under Art 85. In

February 1983 it sent a statement of objections to Nuovo Cegam noting three potential anticompetitive effects of the agreement which might lead to the finding of an infringement of Art 85(1). First, the Commission noted that at the direct insurance level the agreement meant that a large number of insurance companies ceased to compete among each other in the market by setting common premiums and contract conditions. Second, at the coinsurance level, the agreement forced members' to choose coinsurers among the members of Nuovo Cegam. Third, at the reinsurance level, reinsurers were restricted in their rate setting and insurers were forced to place all their reinsurance business with a limited set of reinsurers. In June 1983 Nuovo Cegam notified the commission officially about the agreement between the member firms and applied for an exemption from Art 85(1). The Commission decided the case in March 1984 (L 99/29, 1984) granting an exemption based on Art 85(3) putting some restrictions on the agreements, in particular one that guaranteed freedom of final rate setting. The Commission argued that

"the formation of an association such as Nuovo Cegam in order to acquire the specialist expertise essential for effective performance in the sector (statistical information, studies of risk, prevention techniques), and to ensure adequate reinsurance support, can be considered to be a means of improving the production and distribution of insurance services and of promoting technical and economic progress."

In evaluating this case one has to separate the issue of information exchange on statistical claims data combined with joint setting of a common tariff on basic premiums from the restrictions on reinsurance. According to the Commission the beneficial effect of information sharing between the members of Nuovo Cegam comes about because it improves the evaluation of risks that members are facing. Since insurance risks are the costs of an insurance company this means that the Commission regards the exchange of information on cost data as socially beneficial in the insurance industries. However, in the absence of moral hazard and adverse selection, there are no apparent reasons, at least from

a theoretical point of view, why information sharing about costs in the insurance industries should be regarded in a more positive light in the insurance industry than in other industries. One may want to argue that the insurance industry is significantly different from other industries because bankruptcy risks play a larger role and that information exchange (combined with joint rate setting) can help considerably in reducing such risks. This argument has, however, not been made in this case or in the Block Exemption Regulation of 1992 and there is too little available economic research in this area to evaluate how valid such an argument would be.

The reinsurance restrictions, on the other hand, give an indication of how important adverse selection problems may be in this market. As has been clearly stated in the case material insurers have to obtain expert knowledge about conditions in the market. Furthermore, because of the comparatively small size of the market expert knowledge is not widely available. This creates an adverse selection problem in the market for reinsurance. Reinsurers will tend to be less informed about the risks of particular insurance contracts than the insurers who have acquired expert knowledge. This will make the insurers face relatively adverse conditions in reinsurance markets reducing the returns from acquiring expert knowledge in the market. The particular system that Nuovo Cegam used to link insurers and reinsurers seems a potentially powerful instrument to reduce the adverse selection problem. Reinsurers may fear that insurers who have acquired expert knowledge in the market might attempt to pass bad risks on to reinsurers. By forcing the insurers to place all their reinsurance contracts with the same reinsurers guarantees reinsureres that they face an insurance portfolio with the same risk characteristics as the insurers portfolio. This should reduce the problem of insurers unloading bad risks disproportionately onto reinsurers. As far as this arrangement reduces the adverse selection problem, insurers will face better reinsurance premia and this would indeed lead to an improvement in the production and distribution of insurance services. The fact that the Commission's decision acknowledges that the costs of reinsurance are to be reduced through this arrangement points to the fact that adverse selection problems may indeed be at the heart of such special

arrangements.

Joint base rate setting by insurers may also help to alleviate the adverse selection problem between insurers and reinsurers by providing an information exchange mechanism by which expert information of insurers is aggregated and passed on to reinsurers. An analysis of agreements in insurance markets in view of their effects on adverse selection problems in insurance appears to be a more fruitful and certainly theoretically more satisfactory way of systematically dealing with exemptions under Art 85(3). Our very cursory look at this issue seems to suggest that in insurance markets in which risk assessment is well established and expert knowledge widespread arrangements like those of Nuovo Cegam should be viewed more skeptically. Commission Regulation 3932/92 may therefore go too far when block exempting the joint fixing of common base premiums and contract conditions on the basis of joint statistics from the application of Art 85(1). The case for a Block Exemption is certainly stronger in the area of information sharing on individual customer information at the insurance level, which is currently not covered by such an exemption.

IV Conclusions and Policy Implications

Our study leads to the general conclusion that information sharing in itself cannot generally be regarded as detrimental to welfare and therefore a restriction of competition. However, *economic analysis does justify competition policy intervention in regard to specific information exchange mechanisms*. We believe that these *specific* types of information exchange can be considered as a restriction of competition in themselves in the sense of Art. 85(1). In general the main reason for public policy intervention with regard to information exchange agreements must be seen in their role of facilitating practices for sustaining explicitly or tacitly collusive conduct among firms. We will elaborate on the potential role for competition policy intervention below and discuss the way they can be implemented in EC competition law. We then develop a set of rules for competition policy in this area.

Our theoretical discussion of information sharing agreements potentially suggests two different reasons for competition policy to be concerned with information exchange. The first reason corresponds to the welfare results in static models of information exchange. The second reason corresponds to dynamic models of competition in which information sharing, in particular on individual prices and quantities, can be a powerful instrument to facilitate tacit or explicit collusion. We will explain below why we believe that competition policy intervention is feasible in the latter case but not in the former.

The first question is whether a competition policy authority can, or should, work towards reducing the possible welfare losses from information exchange identified in static models. The analysis of static models reveals that information sharing cannot generally be regarded as reducing welfare. Therefore, on the basis of static models, we cannot come to the conclusion that information exchange is generally a restriction of competition in itself in the sense of Art 85(1). However, one may consider information exchanges to infringe Art 85(1), when specific market conditions are fulfilled. For example, considering Table 2, one might be tempted to formulate a policy that specifies that "information exchange is a

restriction of competition in itself if uncertainty in the industry is mainly about costs and is of the private value type". The problem with such policies is that they would have to be based on extremely precise knowledge of characteristics of an industry, which are usually not available even after a careful study of the industry. It appears for example almost impossible to verify the type of demand and cost uncertainty firms in a particular industry face. Similarly, identification of whether there is price or quantity setting is a formidable task even for the most sophisticated econometric methods.[28] It will therefore generally be impossible for a competition policy authority to verify in which cell of Table 2 it should categorize a particular industry. A lesson to draw from this literature is that the social benefits of information exchange are extremely hard to verify. For practical purposes, for example in a court of law, it therefore appears impossible to separate those types of information exchange that, in static models, lead to welfare losses from those that do not.

A different question is to what extent the theory of dynamic collusion in oligopoly gives sufficient reasons for policy intervention with respect to information sharing agreements. We have discussed that the exchange of information is an important instrument for any collusive agreement. Particularly the exchange of individualized data on firms' actions, for example on prices or quantities, are effective instruments to sustain high cartel prices and avoid cartel break down. The effectiveness of such exchange for sustaining collusion is increased with the frequency of data exchange and the breakdown of data according to

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[28] Even the much easier task of assessing the degree of mark ups over marginal costs in an industry may lead to wildly diverging results. For example, Porter (1983b), in his study of the US railroad cartel in the 1880s, concluded that collusion had led to mark-ups consistent with static Cournot competition. Ellison (1994) working on the same data set, but using a more careful model of the stochastic process driving demand, obtains the conclusion that prices were close to perfect collusion. While careful econometric industry studies may be very valuable to assess the degree of collusion in an industry, it appears impractical to base the *definitions* for restrictions of competition on factors that can only be verified by statistical evidence.

submarkets. Even aggregate data may help to sustain collusion by reducing demand uncertainty. However, this does not necessarily imply that information exchange should be a concern for competition policy. If competition authorities could, for example, effectively combat collusion on prices, separate policy intervention towards information sharing agreements would be unnecessary. However, there are two reasons why this is not the case. First, collusion between firms is notoriously difficult to prove in court. Part of the reason for this is the scarcity of evidence that goes along with collusive agreements. Second, information exchange is powerful also in situations where there are no agreements to collude in a legal sense, but firms establish collusive outcomes because they understand the interaction of the market (i.e. cases of tacit collusion). In this case courts could argue that behaviour of the firms is fully explained by that of intelligent businessmen adapting their strategies to market situations. It has been argued that such tacit collusion may not be an infringement of Art 85(1) because it does not involve communication about future conduct (see Van Gerven and Navarro Varona 1994). Information exchange does, however, have the same effect on market outcomes regardless of whether it is by agreement or spontaneous as under tacit collusion.

The case evidence that we have reviewed suggests that attempts to collude are closely connected to attempts to widen the degree of information sharing beyond the established practices of trade associations. It therefore appears desirable for an efficient competition policy to intervene to some extent in information sharing as to make explicit or tacit collusion between firms harder. This may take the form of admitting some forms of information sharing as supplementary evidence for collusive behaviour or even lead to declaring certain forms of information exchange to be restrictions of competition in themselves because they create market conditions under which collusion becomes likely (that is, they are facilitating practices).

It may be useful for formulating policy rules to draw an analogy between the policy towards information exchange agreements and merger policy. Merger policy is based on the insight that controls of market structure are much more easily implementable by

competition policy than controls of price setting behaviour after mergers. Hence, under some structural conditions in the market mergers may be disallowed because they create industry structures which make anticompetitve conduct more likely. On the other hand a large set of mergers is allowed when there is not too much danger of anticompetitive behaviour in the belief that mergers may have some efficiency benefits. In the Merger Directive this idea is captured by prohibiting mergers that create or reinforce a dominant position.

An analogous approach to information exchange agreements would be the best way to conduct competition policy in this area. Information exchange agreements, like mergers, increase the possibilities for anticompetitive behaviour. It is much easier to put some restrictions on information exchange than to prove collusion after it has occurred, just as it is much easier to show that there is a dominant position in a market than to show that the dominant position has been "abused" to set excessively high prices. Hence, in analogy to merger policy, one would want to create a list of types of information sharing agreements that will be challenged for their anticompetitive potential. On the other hand, one would want to leave information sharing agreements that create less potential for collusion untouched, because there can be benefits of information exchange. In the case of information exchange, as in the case of merger, benefits are hard to verify. As a result merger policy refrains from investigating the benefits from mergers and a similar treatment of information exchange agreements would again be desirable.

The implementation of these ideas has to be put in the perspective of Art 85. An information agreement between firms violates Art 85(1) only if it can be shown that the object or effect of the agreement is to significantly "restrict competition". The term "restriction of competition" is not a well defined economic (or legal) concept and therefore it has to be given meaning in practice with a view to the purpose of the underlying legal norm. There are two ways of filling this concept with meaning from an economic point of view. A natural definition of "restriction of competition" would be "any action that would have as an effect the reduction of social welfare (or consumer welfare)". Unfortunately, for

the reasons expounded in the report, the full welfare analysis required in every case for the industry in question is generally infeasible. Such a definition would therefore remain of a purely theoretical nature, a mere reference point, that would rarely be applicable. A more practical definition of "restriction of competition" would be "any activity that significaly increases the scope for collusive behaviour". This would be based on the implicit belief that collusive behaviour would be likely to occur whenever there is significant scope for it. Such a definition would still allow us to think of "restriction of competition" as actions that are likely to reduce welfare. Such a definition also appears to virtually coincide with the recent European Court of Justice interpretation of Article 85(1) as explained in the Tractor Exchange case. There the Court stated: "...Article 85(1) of the Treaty prohibits both actual anticompetitive effects and purely potential effects, provided that they are sufficiently appreciable...".

On the basis of this definition of "restriction of competition" one will still have to make some judgement as to what kinds of information exchange should be classified as "restrictions of competition". Because of the importance of information exchange for dynamic collusion, one might want to go as far as categorizing any information exchange as a restriction of competition. Nevertheless, because of the potential social benefits from improved information on general demand and cost conditions in the industry, information exchange on aggregate data as commonly practiced by trade associations could then, on the basis of Art 85(3), be permitted by Block Exemption. In cases of more disaggregated data, exemptions under Art 85(3) could be granted if firms can make convincing arguments that there are particularly high social benefits and relatively low dangers for collusion in the industry otherwise. In the case of exchanges of individualized data on prices and quantities there should generally be no exceptions because the danger of collusion is much higher. In this way one could regulate the exchange of information between firms according to the degree of danger to create collusive outcomes and the degree of potential benefits that firms can demonstrate.

We believe that the course of action most in line with current EC competition policy would

be to limit the label "restriction of competition" to those classes of information exchange agreements that *significantly* increase the scope for collusive behaviour. The exchange of individual price and quantity data falls in this category but not the exchange of aggregate anonymous data. Indeed, it is hard to find plausible business reasons, other than collusion, that might justify the exchange of individual price and output data. In addition, the case material - especially the discussions about information exchange in US antitrust history - seem to indicate that firms understand that such information exchange greatly facilitates collusion and that collusion can be achieved by firms even in the absence of explicit communication about collusive agreements. As a result, information exchange on individual price and quantity data is likely to have the effect that firms achieve collusive outcomes without having to resort to explicit agreements on prices and quantities that are illegal under Art 85(1). We believe that this fact, in conjunction with the absence of alternative business reasons for the exchange of such data, justifies classifying this particular type of information exchange as a restriction of competition in itself. (This would still leave the Commission the possibility of granting an exemption according to Art 85(3), if firms could demonstrate that in a particular case there exist other important business reasons for this type of information exchange, that could not be achieved otherwise, while at the same time the danger of collusion in the market was relatively low for other structural reasons).

In contrast, other types of information exchange cannot be categorized as "restrictions of competition". In those cases there is a much greater set of possibilities that the information exchange actually improves social or consumer welfare. In these cases we would still consider that the detection of very detailed and disaggregated information exchanges should be taken as partial evidence for collusive behaviour. In particular, information exchange on individualized data should be sufficient evidence for the Commission to start an investigation into possible collusive conduct in an industry. Overall, we believe that the degree to which information sharing agreements should raise concern should be related to the degree of disaggregation and frequency of information exchange.

These arguments lead us to a number of simple rules for the competition policy treatment of information exchange whenever the structure of the industry under consideration raises market power concerns. Indeed, information exchange agreements cannot constitute a restriction of competition according to our definition if the firms involved in the information exchange jointly have a small market share in the relevant market.[29] Under those circumstances information exchange cannot significantly increase the scope for collusion and the exercise of market power and therefore should not concern the competition authorities. When the combined market share of the undertakings participating in the exchange is large (or more in general when the concentration in the market is high) we propose the following rules about the type of data exchanged and about the institutional structure of the exchange.

Rules for the Type of Information Exchanged

1. *The exchange of individual price and quantity data will be considered a restriction of competition in itself and is therefore an independent infringement of Article 85(1). An exemption according to Art 85(3) should only be granted if the firms demonstrate that there are business reasons (other than collusion) that require this type of information exchange and cannot be achieved otherwise. In addition the exemption should only be granted if the structural features of the industry make collusive outcomes unlikely.*

    Individual price and quantity data, as well as individual data on stocks and capacities are not usually necessary for firms to improve the efficiency of operations. They can normally only be explained by the attempt to facilitate collusive conduct including tacit collusion. Art 85(3) should only be invoked in exceptional circumstances.

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[29] We will not define here appropriate thresholds for "small combined market shares" or market concentration but probably it would make sense to establish them in a consistent way with the merger regulation. See Neven et al (1993) for an excellent analysis of merger regulation in Europe.

2. *The exchange of other individualized data will not be considered a restriction of competition in itself but it will be cause to investigate a possible infringement of Article p85(1). Particularly, when the exchange of data is frequent and detailed, and when markets are concentrated and barriers to entry are high, information exchange should be admitted as supplementary evidence in a collusion case.*

Individualized data that does not directly relate to the strategies of firms like information about costs or demand (in form of market studies) have significantly less collusive potential. However, they still can contribute to sustaining collusive agreements but efficiency reasons for information exchange are more likely so that it cannot be considered a restriction of competition in itself. On the other hand, the case evidence suggests that colluding firms systematically resort to individualized data exchange in their efforts to sustain collusion. Detection of individualized information exchange should therefore be considered as an indication that there may be more important collusive agreements between the firms.

3. *The exchange of aggregate data (through trade associations) will not be challenged unless there is independent evidence of collusion in the industry.*

Note that in this case there are still increased possibilities for collusion. However, they are significantly smaller than in the first two cases. Furthermore, static models of information sharing show that, contrary to the view of Clarke (1983) (which was based on a very specific model), the presence of information sharing itself cannot be seen as prima facie evidence for collusion. Information sharing may emerge in a wide set of circumstances and lead to efficiency gains. Hence, intervention only on the basis of information exchange appears to be too restrictive.

4. *Communications about intended future price setting behaviour not combined with commitments to maximal prices for consumers should be considered as a restriction of competition. Information exchange through public price announcements to customers (in particular in the trade press) should not be challenged.*

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While the distribution of information about future conduct may have collusive potential there is a countervailing effect from increased information of customers. Price announcements that include a commitment to (maximal) prices facilitate the comparison of prices for consumers and therefore have a pro-competitive effect. Intervention against public announcements of prices does not seem justified in this case. In contrast, when there is no public commitment to prices relative to customers it is hard to see any other purposes in the exchange of information about planned future behaviour than the intent to coordinate (or negotiate) collusive market conduct. Such private communication between producers are in their nature similar to direct negotiations about future conduct in face to face meetings.

5. *There should be exemptions on information sharing on individualized customer information (possibly in form of a block exemption) in markets like banking and insurance when these can be justified by problems of adverse selection or moral hazard. These agreements should not include agreements on prices.*

In financial markets and banking there are particular problems with moral hazard and adverse selection related to asymmetric information between customers and firms (where customers may also be insurers and firms reinsurers). Information sharing can significantly improve the functioning of the market and the supply of services to customers.

Rules for the Institutional Structure of Information Exchange

1. *The By-pass of Trade Associations by information exchange agreements of a coalition of firms in the industry may be a motive for the competition policy authority to investigate whether there exists a collusive agreement in the industry.*

This rule is based on the information provided through the cases. Collusion often goes along with agreements of additional information exchange outside the Trade

Association. Such exchange will necessarily be more disaggregated, since only a subset of firms in the industry takes part in them. Furthermore, Trade Associations carefully design their information exchange programs in order not to violate competition policy standards. This is an additional reason why by-pass of the association should raise concerns.

2. *Trade Associations should be allowed to collect verifiable information or to conduct auditing procedures on firms to compile their aggregate statistics.*

This is necessary to make credible information exchange possible. A contrary policy may be equivalent to disallowing information exchange.

3. *Trade association programs on joint research on demand or cost should generally not raise policy concerns.*

This amounts to joint investment in research which will generally save on resources for the participating firms. The efficiency gains of such practices are clear, the danger to collusion appears relatively low as long as the agreements do not extend to the production and marketing stages.

4. *Trade Associations should not be run by managers of participating firms.*

Otherwise there is effectively complete disaggregation of data for the firm whose manager runs the trade association program.

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