Information Sharing: Economics and Antitrust

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1. Introduction

A classic Industrial Organization textbook stated more than 25 years ago that:

"The law on trade association price and cost reporting activities is one of the most subtle (and some add the most confused) branches of antitrust doctrine" (Scherer (1980, p. 522)).

Most likely this statement is still true today. The origin of the problem can be traced to some contradictory decisions of US Courts (American Column (1921), Linseed Oil (1923), Maple Flooring (1928), First Cement (1925)). The present position seems to be that to exchange information is not illegal per se and that it should be challenged only if it helps to reach agreements on prices or to restrict competition. During the 1920's and 1930's the attempts to form cartels using trade associations to monitor the agreements ended up in the late 1930's and early 1940's with consent decrees which established the rules that guide the statistical programs of the trade associations. Nowadays, a tough line is followed on information exchanges about current prices in oligopolistic markets.[1] In general, antitrust authorities, including the European Commission, look with suspicion information exchanges of individual firms' data, prices and quantities in particular, because it may help monitoring deviations from collusive agreements.

Information sharing among firms has received substantial attention from the economics literature. Firms may exchange information about current and past behavior, such as customer transaction data as well as cost and demand conditions. This type of information exchange typically involves verifiable information. Firms may also exchange information about intended future conduct, such as future prices or production, new products or capacity developments. This typically involves soft information. Since firms

[1] Case US v. *Container Corporation of America*.

may have incentives to share information for efficiency or collusive reasons, the welfare impact of information sharing practices is in general ambiguous.

In this paper I will survey the incentives to share information and the welfare consequences in static (non-collusive) models in Section 2; the analysis of the collusive potential of information exchange in Section 3; the impact of information technology on transparency and unilateral and coordinated exercise of market power, and I will conclude with some competition policy implications.[2]

2. The incentives of firms to share information and the welfare implications in static (non-collusive) models

Firms may exchange cost or demand information trying to adapt their output and pricing decisions to uncertainty. For example, they may exchange cost information with benchmarking procedures, trying to attain the best practice in the industry. The incentive to share information for a firm is the increased precision of information obtained, from the pooled information of rivals, about common value uncertain payoff relevant parameters. However, rivals will also get more precise information and strategies will be affected. The final result is that, in general, the increased precision has a positive effect on a firm's expected profits, while the profit impact of increased precision of rivals, together with the correlation of strategies which follows, depends on the nature of competition and shocks.

Whenever there is a mechanism to share information truthfully, like a trade association, the equilibrium incentives to share information work out so that depending on the type of uncertainty (private value or firm specific shock versus common value or industry wide shock) or nature of competition (strategic substitutes versus strategic complements)[3], to

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[2] I will draw on my previous work on the topic (see Vives (1984), Vives (1990), Kihlstrom and Vives (1992), Kühn and Vives (1995), Sections 8.3, 8.4 and 9.1.5 in Vives (1999), Vives (2002) and Vives (2006)).

[3] Competition is of the strategic complements (substitutes) type if the marginal profitability of any action of a firm is increasing (decreasing) in the actions of rivals. This implies that best response functions

unilaterally share information or not is a dominant strategy. The result is that, with the exception of Bertrand competition with cost uncertainty, to reveal information unilaterally is a dominant strategy with either private values[4] or common values with strategic complements. With common value and strategic substitutes, not revealing is a dominant strategy. (See section 8.3 in Vives (1999)). If firms are able to enter into industry-wide agreements, firms want to share information if pooling increases expected profits. There is a large range of circumstances where pooling does raise profits (exceptions are Bertrand competition under cost uncertainty and common value and strategic substitutes competition (e.g. Cournot rivalry with substitutes) with a low degree of product differentiation or slowly rising marginal costs). The implication of the results in the literature is that information sharing cannot be taken as prima facie evidence of collusion since it often raises profits under one-shot market interaction.

When there is neither a trade association, nor a dynamic reputation to provide a credible mechanism to share information truthfully, then incentives to share depend on whether information is verifiable or not. If information is not verifiable (e.g. soft information) then typically information revelation is not possible because all firms would like to be perceived as being of the most favorable type (e.g. low cost in Cournot competition). If information is verifiable then information unravels as "good" types reveal their information while "bad" types are uncovered even if they try to hide. The practical implication for competition policy is that allowing verification mechanism fosters information sharing. However, if information is verifiable but whether the firm is informed is not, then the unraveling result need not hold, and firms can selectively disclose acquired information (Vives (2006)).

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of firms are upward (downward) sloping. This is typically the case in Bertrand (Cournot) competition with differentiated products. (See Chapters 2, 4 and 5 in Vives (1999).)

4 More specifically, when each firm receives a perfect signal about its payoff-relevant parameter, which may be potentially correlated with those of rivals.

Information could also be shared through costly signaling – like wasteful advertising - or with dynamic competition in which production levels are observable or via exchange of sales reports.

The welfare analysis of information sharing is complex. The impact on consumer surplus and total surplus depends on the type of competition (strategic substitutes or complements) and uncertainty (private or common value, cost or demand) as well as on the number of firms. Three main effects are at play. The first effect is an output adjustment to information. Pooling information allows firms to better adjust to demand and costs shocks. This will tend to improve welfare except if the firm is a price setter with market power. In that case, more information about an uncertain demand will give the firm greater scope to extract consumer surplus – just as in the case of a monopolist. Under cost uncertainty more information may soften price competition. The second effect of information sharing is to induce output uniformity across varieties. This effect is positive given the existence of consumer preference for variety. In monopolistic competition information sharing tends to make the outputs of varieties more similar with common value uncertainty and less so with private value uncertainty. The output adjustment effect tends to dominate and with monopolistic competition and demand uncertainty information sharing increases (decreases) expected total surplus under Cournot (Bertrand) competition (Vives (1990)). Finally, a third effect of information sharing is the selection among firms of different efficiencies, transferring production towards more efficient firms. The practice of benchmarking and incentive schemes based on relative performance is related to this effect.

There are potentially large efficiency benefits from information exchange. For example, the production rationalization effect of cost information exchange under Cournot competition can be very large, and is of a larger order of magnitude than the market power effect except for very concentrated markets (Vives (2002)). This effect is larger the larger the degree of uncertainty (and ex post differences in efficiency levels). This means that in markets where concentration is not very large the policy towards

information sharing may have a much larger welfare impact than classical antitrust curbing of market power.

In summary, information sharing cannot be taken as prima facie evidence of collusion, since firms may have unilateral incentives to share information and there is a range of situations where the exchange is welfare improving. However, there is another range of situations where information sharing, with no attempt to support collusion, is welfare reducing. The welfare impact depends on a range of factors but tends to be positive with Cournot/quantity competition and negative with Bertrand/price competition (the latter with the exception of cost uncertainty with common value). When there is no collusion concern therefore, competition policy should in general be lenient with information sharing under Cournot competition and tough under Bertrand competition. It must be noted that to distinguish markets characterized by quantity or price competition is not easy but not impossible.[5] An indirect way to allow information sharing is to facilitate the verification of information with benchmarking or the formation of trade associations which can audit and check the information reported by their members.

3. Information exchange and collusion

Information sharing can constitute a facilitating practice to help collusion. For collusion to be sustainable, firms must coordinate and agree on what cooperative outcome above the competitive level (or Nash equilibrium of one-shot interaction) to implement and what mechanism to use to avoid defections. Furthermore, once the mechanism is in place it must pay for firms to abide by the mechanism. Here monitoring of actions of the firms

5 For example, in the Airtours case both the Commission and the ECJ concluded that competition was mainly in terms of capacities (Cournot). In some instances the type of competition may depend on the horizon contemplated. In the short run, for given capacities of production, competition may be best described in prices, while in the long run, when capacities are adjustable, may be best described in quantities. For example, competition among gas stations in a small town in the short run, for given locations and capacities of the stations, will be in price with spatial differentiation. In the long run, when new stations can be opened or new entrants can enter, competition may be best described in capacities/locations.

trying to collude is crucial for the threat of retaliation in case of deviation to be effective. Information sharing may help firms solve the coordination and monitoring problems. In any case, the collusive concern is more acute with a few players because the critical discount factor above which collusion is possible typically increases with the number of firms in the market.

A main challenge for antitrust authorities, as emphasized by Kühn and Vives (1995), is that inferring collusion from market data is difficult even when sufficient data is available. Indeed, quantitative studies have been shown to be quite sensitive to the specification of the empirical model.[6] The implication is that competition authorities have relied on a "parallelism plus" doctrine to show collusion. This means in practice that to infer collusion market evidence has to be supplemented by hard evidence on facilitating practices. Communication among firms, which is typically traceable in records or meetings, may provide such evidence.

Communication about future conduct may help solve the coordination problem. This communication is typically soft information about planned prices, production, new products or capacity expansion and can be explicit or implicit with signals. The information communicated is not verifiable and is basically cheap talk. Despite this it may help solve coordination problem by reducing strategic uncertainty. For example, in experiments with repeated games communication tends to move prices towards collusive outcomes. To be sure sharing of plans could also be an indirect way to share information about demand or costs. It has been claimed, for example, that the role of the publication of production plans in the US automobile market is to reveal demand information (Doyle and Snyder (1999)). However, since there are other ways to share directly information about demand it should be explained why this indirect way is used.

[6] A typical example is provided by the different conclusions arrived at by Porter (1983) and Ellison (1994) on the railroad cartel in the 1880s in the US.

The ATP (Airline Tariff Publishing) case provides a good example of sharing of price announcements with electronic databases. This refers to a joint venture of all US airlines to collect and store data prices quoted on computer reservation systems. A practice of price posting with no commitment value for customers (a price pre-announcement with first ticketing date) was discontinued by consent decree (running up to 2004). Furthermore, "footnote designators" were simplified so that they could not be used to signal coordinated pricing in linked routes. It was feared that the price pre-announcements could be used as a tâtonnement to settle on collusive prices. This case set no legal precedent in the US because it never went to trial and the remedy addressed only institutional aspects of the airline industry. However, it clarified the DOJ's willingness to pursue coordinated pricing facilitated with rapid communication. (See Borenstein (1994)).

The European Commission (1985) charged wood pulp producers of violation of Article 81(1) for colluding on (quarterly) price announcements and transaction prices and in exchanging price information. The European Court of Justice (1993) rejected the claim that price announcements and parallel pricing are sufficient to infer collusion since alternative non-collusive explanations of pricing were consistent with the data. Furthermore, price announcements were made public to consumers and in fact were introduced because of pressure from downstream paper customers. Buyers considered them a commitment to maximal prices providing insurance and price protection. This would be akin to price announcements in ATP without a first ticketing date.

We see therefore that antitrust practice, in accordance with theory, contemplates the coordinating potential of communication of plans but considers as possible countervailing factor the benefit that consumers may obtain from a price announcement that represents a commitment.

Information exchange about cost or demand conditions has also dynamic effects and may help both the coordination and the monitoring problem. First of all, it may help in dividing market or allocating cartel quotas and therefore may help coordinate on a collusive outcome. For example, asymmetric costs which are private information

represent an obstacle for even a legal cartel in which side payments are possible because production has to be allocated efficiently among cartel members in order to implement the monopoly rule.[7] If the cartel strategies have to be self-enforcing and firms are sufficiently impatient, they may not be able to sustain collusion without communication on costs (Athey and Bagwell (2001)). Cost communication would therefore be a facilitating device for collusion. However, forbidding communication may result in productive inefficiency. Sufficiently patient colluding firms may tolerate a high degree of productive inefficiency before lowering prices. This trade off on the effects of communication may be more acute with price than with quantity competition. Similarly, with private information on uncertain demand firms must coordinate on allocative firm efficiency. Communication then improves coordination by avoiding undercutting by poorly informed firms, allows firms to avoid costly price wars and to adjust better prices. The latter effect may benefit consumers if firms collude (see Gerlach (2006)). In this context partial communication (for example, in high demand states) may be enough to sustain full collusion.

Second, information exchange on demand and output levels reduces the noise in market statistics and helps making inferences and detecting deviations. It may help in creating a public record on which to base the collusive scheme. This is so in particular the more disaggregated (by submarkets or product groups) is the information, helping to detect deviations and to tailor punishments to deviators. Reducing demand uncertainty enlarges the scope of attainable collusive outcomes by increasing the efficiency of monitoring (Green and Porter (1984)).

The exchange of information about current and past individual conduct has even more potential to solve the monitoring problem. Information on customers, orders, and prices is typically hard, verifiable, information. It helps in detecting deviations (Stigler (1964)), reducing uncertainty and, indeed, creating a public record on which to base a collusive scheme (Kandori and Matsushima (1998) and Compte (1998)). For example, producer price transparency is good for collusion because it makes detecting price cuts easier.

7 See Cramton and Palfrey (1990) and Kihlstrom and Vives (1992).

The UK Tractor (1992, 1994) case provides a clear illustration of the collusive potential of detailed firm information exchange. The UK tractor market was concentrated and in decline, with a trade association which allowed detailed and frequent information exchange allowing identification of most tractor sales. Sales took place by individual negotiation in a sequence of auctions for contract purchases. In this context a bidding ring would need to know whether an auction has taken place and who has won it. Despite the potential efficiency reasons for the exchange (to deal with warranty claims and to monitor the performance of retailers and salespeople) the Commission concluded (1992) that "own company data and aggregate industry data are sufficient to operate in the agricultural tractor market". That is, individual data of other firms were not necessary. The agreement was found to be in violation of Article 81(1) because the market was concentrated, it allowed each firm to monitor sales of rivals, and constituted a barrier to entry. It should be considered also that the information exchanged was not made available to purchasers. The Court of First Instance upheld the decision (1994). This is a case where the information exchange is attacked directly and not only as materially helping a collusion case. Another pure information exchange case is Fatty Acids (1986). Following an excess capacity period in the 1970s, the market leader Unilever unilaterally reduced capacity and proposed an individual data exchange on sales with two other major producers (Henkel and Oleofina). In this exchange it was understood that a customer switch between majors were "stolen sales" while new customers were "legitimate gains". The implied objective was to sustain collusion among the majors and exclude small firms. The strategy was successful in so far that the market share of Unilever remained constant and that of the other two majors increased. The Commission fined the firms for anti-competitive information exchange (Art. 81. (1)). (See Kuhn and Vives (1995)).

In summary, the collusive potential of communication and information exchange can be classified as follows.

- High:
  - Private communication of future plans (but public commitment to customers may yield benefits).

  - Exchange of individual data on prices and quantities.
- Medium:
  - Exchange of individual data on demand and costs.
- Low:
  - Exchange of aggregate data.

4. Information technology and market transparency

An open issue is the impact of information technology on the anti-competitive potential of information dissemination, transparency, and sharing. Internet is a formidable search-facilitating technology, for example with search engines facilitating price comparisons. Price transparency lowers search costs for consumers and has a competitive static (unilateral) effect. Indeed, price transparency increases the effective demand elasticity facing a firm because it makes easier for customers to react to price cuts. This was corroborated in a classic study about the competitive effects of advertising the price of eyeglasses (Benham (1972)). However, it must be pointed out that search costs are the product of the impact of technology and firms' response, basically differentiation attempts, be it obfuscating price comparisons, facilitating quality information (Amazon) or providing complementary"clicks and mortar" services (Barnes & Noble).

Consumer price transparency has furthermore potential ambiguous dynamic coordinated effects. This is so because with more transparency it is more tempting to undercut, because of the higher elasticity, but at the same time more severe punishment for deviants are possible. The result is ambiguous in general but the net effect in the Hotelling model of product differentiation is that collusion is harder to sustain with more consumer transparency (see Schultz (2002)). Still, with endogenous search decisions in a homogeneous product market, increasing transparency may increase collusion because rational consumers will only increase search in the punishment phase, and not in the collusive phase when all firms charge the same price. Hence, in general we are back to an ambiguous impact of consumer transparency on collusive potential.

Sometimes transparency may imply a less competitive outcome. A transparent second price (ascending) procurement auction may be less competitive than a non-transparent (sealed bid) first price auction. Suppose that firms (the bidders) have idiosyncratic costs and face an elastic demand. Then it can be shown that firms bid more aggressively in a one-shot first price auction.[8] Furthermore, a second price auction is collusive-prone since firms can signal intentions and threats (with multiple objects in particular as the example of the 1999 spectrum auction in Germany shows). This same reasoning may imply that transparent Internet car sales can be more like collusive-prone second price auctions, while dealer sales may be more like non-transparent first price auctions (not allowing dealers to infer secret price cuts of rivals).[9] A case where making the market more price transparent raised average prices occurred when the Danish competition authority decided in 1993 to collect and publish actual transaction prices in the ready-mixed concrete industry (Albaek et al. (1997)).

In general, producer transparency tends to be good for collusion while consumer transparency has ambiguous effects. Information technology has different faces. It may allow the tracing of information exchange, making the discovery of anticompetitive practices easier to monitor, or it may allow records to be erased easily in chat rooms, for example. At the same time electronic communication may allow quick responses and the implementation of contingent complex retaliation strategies. The jury is out on what will be the aggregate effect of information technology on the scope for collusion.

5. Implications for competition policy

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[8] In a second price auction we obtain the Bertrand outcome with complete cost information, while in a first price auction we obtain the Bertrand outcome with incomplete cost information. In the latter case firms set the price below the expected Bertrand price with complete information. See Hansen, (1988) and Vives (2002).

[9] See Scott-Morton et al (2000) for a discussion and evidence on this issue.

Information exchange can be not be construed to be prima facie evidence of collusion because, as we have seen, it may emerge in a wide range of competitive circumstances and lead to efficiency gains. However, information exchange can be welfare reducing also, both in collusive and non-collusive environments. This is particularly so in concentrated markets protected by barriers to entry where the collusive concern looms larger. Some of the implications for antitrust of what we have learned about the impact of information exchange follows.

In regard to the exchange of individual price and quantity data a tough line seems appropriate. The reason is that the collusive potential is large and the efficiency benefits can be obtained most likely with the exchange of aggregate data. This is consistent with antitrust practice in the US and the EU. It could be debated whether in the EU the exchange of individual price and quantity data should be considered a restriction of competition and infringement of Article 81(1) by *object* (i.e. in itself), at least in concentrated markets. In this case the form of the agreement to share information creates a presumption that Article 81(1) is infringed. An exemption could be granted (Article 81(3)) if the firms can demonstrate that the efficiencies could not be obtained otherwise, and that they more than compensate the potential anti-competitive effects. Another approach is to consider an agreement in violation of Article 81(1) if it has the *effect* of reducing competition. This corresponds to the US rule of reason, where the authorities have the burden of proof of demonstrating that the agreement infringes Article 81(1). This approach requires more analysis by the competition authority to substantiate that the agreement harms competition (in this case Article 81(3) may still be applicable).

In regard to the exchange of demand and cost data, antitrust practice is more permissive both in the US and the EU. From an analytical point of view, the exchange at the individual level is a gray area in terms of impact. Here an analysis of the effect of the practice (rule of reason) seems appropriate. For example, exchanging cost information or benchmarking in Cournot competition may have large efficiency benefits. Therefore a safe haven policy could be instituted to allow the exchange in unconcentrated Cournot markets where the collusion risk is low. Recall that information sharing on costs or

demand is good for welfare with Cournot competition independent of whether uncertainty is of the private or common value variety (see section 8.3.3 in Vives (1999)). There is debate about whether this recommendation is practical given that to distinguish the mode of competition is not always easy. My view is that the difficulties of such task have been overemphasized. Things are more complicated with Bertrand competition. Then information sharing tends to be bad for welfare with the exception of the common value cost uncertainty case, and the impact on collusive potential and efficiency must be assessed. The robust result is that when antitrust authorities examine a case they should take into account that the welfare consequences of information exchange are significant, and relatively more than classical market power concerns except in very concentrated markets. Indeed, market power vanishes quickly with a few competitors while the effect of private information decays more slowly with the number of firms. The exchange of aggregate data should not raise concerns of facilitating coordination unless there is independent evidence of collusion in the industry.

In regard to communication of future prices or outputs a tough line seems appropriate, in particular if the communication is not public and does not represent a price commitment to customers.

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