

Competition Policy Implications from Game Theory: an Evaluation of the Commission's Policy on Information Exchange

§ 1 Introduction

One of the most vexing question for those that apply competition rules concerns how to assess oligopolies. When will market conditions lead companies in a oligopolistic market to compete fiercely on all important parameters (price, quality and innovation) and when will competition be replaced, on one or all parameters, by collusive behaviour?¹

The first idea for this paper was to investigate which are the competition policy implications from non-cooperative game theory.² Emphasis will be put on policy implications for the treatment of information exchange between companies. The main conclusions which can be drawn from non-cooperative game theory are summarized in section 2. Within the logic of this theory these main conclusions lead to three general implications for competition policy as described in sections 3 to 5. In sections 6 and 7 the implications for the treatment of information exchange are considered. This is done in section 6 by paying attention to the nature of the information that is exchanged. In section 7 the market structure, the other factor that determines the effect of information exchange on competition, is considered.

During the research it appeared that the usefulness of non-cooperative game theory for competition policy was rather limited. When looking at the influence of market structure for section 7 it became clear that models were rather incomplete. Moreover, the assumptions underlying non-cooperative game theory, especially concerning what is defined as rational behaviour, made it unable to explain a good part of the collusive behaviour that can be observed in experiment and reality. In section 8 some of the limitations to the applicability of non-cooperative game theory are introduced.

In general, non-cooperative game theory tends to underestimate the likelihood of collusion. This means that the implications for competition policy, as deducted in sections 3 to 7, can not be taken as such. They only make sense when interpreted as the minimum competition policy should do. With this in mind the Commission's policy concerning information exchange between competitors is evaluated in section 9.

§ 2 Game theoretical conclusions

¹ Collusion and collusive behaviour is used in this paper as in the economic literature. This means it concerns behaviour that leads to a price level above the competitive price. It therefore includes parallel behaviour. Collusion is therefore possible without communication between the companies involved.

² See the appendix for a short introduction to some of the relevant basic concepts of non-cooperative game theory.

There are a number of general conclusions that can be drawn from non-cooperative game theory when addressing the question of whether companies in an oligopolistic market are likely to collude or not.³ In this section I would like to draw attention to three main conclusions as, within the logic of game theory, they have certain policy implications:

- 1) In a non-cooperative game, like the prisoner's dilemma, collusion will not occur if the players know which period will be the last, in other words when the number of periods in the game is known and limited.⁴ It is in case the number is not known or is infinite that a collusive equilibrium is possible.

Backward induction explains this result. In a one period prisoners dilemma type non-cooperative game the best strategy for each player will be not to cooperate. This means that in a multi-period game it is rational for both players not to cooperate in the last period. Given the certainty that both will not cooperate in the last period it is also not rational to cooperate in the pre-last period, as there can be no reward in terms of cooperation in the last period etc.

- 2) In a non-cooperative game with an unknown or infinite number of periods players might come to a collusive outcome. The question whether the players can and do communicate, in the sense of trying to get to a non-binding agreement on their respective strategies, is fairly irrelevant. This type of communication does not change the choice of each players best strategy. Promises of a player that he will play a cooperative strategy while this is not his best choice are just 'cheap talk'.⁵
- 3) the advantage a player can obtain by not cooperating while the others do cooperate (sometimes called cheating, defecting or free riding). This incentive to free ride depends on the difference with the result the player obtains under a situation that everyone cooperates. This is reflected in the pay-off matrix. The incentive to free ride will be weighed by each player against the possibilities and rationality to punish possible defectors.⁶

The players may try to reduce for all players the attractiveness of free riding by limiting the time or scope of possible free riding and/or increase the possibilities of punishment.⁷ One of the ways this may be done is by exchanging information.

Accepting the logic and assumptions underlying non-cooperative game theory a number of implications for competition policy can be deduced from the above-mentioned conclusions.

³ For a more extensive treatment see for example: Dennis A. Yao and Susan S. DeSanti, 1993, pp 113-141; Ray Rees, 1993; Erhard Kantzenbach, Elke Kottmann and Reinald Krüger, 1995.

⁴ See the appendix for further details on the prisoner's dilemma.

⁵ See Rees, 1993, p. 27 and p. 30 on the idea of 'cheap talk'.

⁶ One should be aware that the words defecting and cheating do not refer to the breaking of a binding agreement. It is not even necessary for there to be a non-binding agreement. It refers to choosing the individual best strategy to the detriment of the collective best outcome.

⁷ The punishment strategy that is chosen by the players influences the pay-off that results after the cheating has been found out. As the question of the best punishment strategy seems still unresolved this is not discussed further here.

These policy implications will be treated next. However, it can not be stressed enough that these implications can not be accepted as such. They need qualification in the light of the limited applicability of game theory.

§ 3 First implication: do not worry about markets when a limited number of contracts can be won

The first implication, related to the first conclusion described above, is that in competition cases a clear distinction has to be made between markets where the oligopolists meet a distinct number of times while bidding for contracts/fighting over clients and markets where the number is unknown or infinite. While the second type of market may be the pre-dominant type, the first type may occur in instances where the product has a short life cycle or where in the foreseeable future only a limited number of contracts will be divided. The latter may be the case for example for certain large public works. In these cases game theory leads to the conclusion that rational operating companies will not collude. This means that competition authorities have an argument to spend less resources on these sectors. In case a competition authority none the less still supposes that collusion is at hand it needs to argue that the basic assumptions underlying non-cooperative game theory are not applicable in this case.⁸

§ 4 Second implication: do not worry about communication on future behaviour

The second implication, not so widely understood yet it seems, is that the traditional distinction made in competition policy between explicit and tacit collusion -whether or not there is explicit communication on price or output strategy- is not relevant from a game theoretical point of view. The difference is just 'cheap talk'. Whether companies do or do not come together in smoke filled back rooms to hammer out an agreement detailing how much each will produce and what price will be charged, this will not change their incentives to cooperate or defect and will therefore not change their best strategy.

What is important on the one hand is the punishment strategy that will be followed, but here too communication is not relevant; communication ex-ante does not increase the credibility and communication ex-post violates renegotiating proofness.⁹ What is important on the other hand is the relative incentives to defect and cooperate (the pay-off matrix), but communication on planned prices or output will not change these. Within a game theoretical analysis communication on how much to produce or what price to charge can only help companies, once cooperation is already everyone's best strategy, to determine and choose between the different collusive equilibria that are possible.

⁸ There may be good reasons to argue contrary to this implication as in practice the sector of public works is traditionally one of the sectors where most cartels are concluded.

⁹ A punishment strategy would lose its credibility if it is in the interest of the parties to renegotiate once the occasion arises that the punishment must be implemented, that is when both the punished and the punisher(s) have an interest in not (fully) applying the punishment.

What does this mean for competition authorities when assessing companies that actually communicate on planned prices, output or customer sharing? Firstly, it means that this communication itself does not lead to collusion. When the pay-off matrix is such that, with the help of a credible punishment strategy, parallel behaviour is the logical outcome anyhow, then communication just helps to determine and choose between collusive outcomes. It is only in as far as communication may lead to a worse (higher prices etc.) collusive outcome than would otherwise have been reached or when it increases the stability of collusion that such communication itself acts as a competition restriction.

This is of importance as competition authorities and courts have always laid great stress on the difference between tacit and explicit collusion. It is the general opinion that tacit collusion or conscious parallelism can not be forbidden as it can not be held against companies that they pursue independently their own best strategy and it would be impossible to find an effective remedy.¹⁰ Game theory now teaches us that something similar is true for communication between competitors on future prices or outputs, that is when explicit collusion is at stake.

This does not mean that competition authorities can ignore or stop trying to detect such communication. The communication itself can still be used as an indication that collusion takes place. Companies can be expected to engage in such communication in order to optimise the collusive outcome, although it can not be excluded that some only participate in order not to be found out as free riders. It does mean however that ordering the firms not to communicate anymore on future pricing or output decisions does not remedy the situation. It also means that the attention of the authorities should be concentrated more on those company practices that do change the attractiveness of cooperating versus defecting. This is the third implication to be discussed.

¹⁰ As in most economic literature tacit collusion and conscious parallelism are the same; collusion without communication (agreements, meetings etc.).

§ 5 Third implication: do worry about exchange of information

Various practices that facilitate cooperation are described in the literature. Rees for example mentions the following facilitating devices: information exchange, trade associations, price leadership, collaborative research and cross-licensing of patents, most-favored-customer and meeting-competition clauses in buyer seller contracts, resale price maintenance, basing point pricing, common costing books.¹¹ These devices all try to limit the influence of factors that destabilise cooperative outcomes or enhance the factors that support cooperative outcomes. This can be done by monitoring each others behaviour thus making detection of free riding easier, by making the infliction of punishment better targeted, or by making it easier for firms to reach a consensus by reducing the effects of factors such as product heterogeneity, uncertainty about future cost, demand or capacity and technological change.

This means for competition authorities that, as far as oligopolistic markets are concerned, they are to concentrate on the detection and analysis of these facilitating practices. This offers the possibility to scrutinise conscious parallelism as close as possible and take remedial action where possible. In terms of the US anti-trust practice it means (de)fining the "plus" in "conscious parallelism plus something else that together restrict competition".

What all these devices have in common is the exchange of information as the central element. This is obvious for the direct exchange of information between competitors or the exchange through an intermediary like a trade organisation (collection and dissemination of data, forecasting studies, common costing books etc.). But it is also the case when the exchange runs via the customers (price leadership, MFC and MC clauses, rpm, basing point pricing). The remainder of this paper will therefore be devoted to a treatment of the role of exchange of information. As the effect of information exchange on competition is basically dependent upon the kind of data that is exchanged and the market structure in which it takes place, these factors will be discussed next.

§ 6 Nature of the information

Within a game theoretical context a number of general 'rules' can be formulated concerning the influence the nature of the exchanged information has on the likelihood of collusion.¹² These rules are linked to the following aspects:

- a) whether it concerns aggregate or individual company data;
- b) whether it concerns current or historic information;
- c) whether the exchange is public or not;
- d) whether the exchange is frequent or not;
- e) what kind of data are actually exchanged (concerning costs, prices, output etc.).

¹¹ Rees, pages 35-37.

¹² The exchange of information between companies can also have beneficial effects. More competition and efficiency may result from increased transparency. However, in this paper these possible beneficial effects are not dealt with.

Ad a) The exchange of aggregate data concerning the whole market or industry is in general less likely to help collusion when compared to the exchange of data that distinguishes individual companies. The latter is a precise instrument to monitor the behaviour of these companies, making it clear who is breaking ranks and making a better targeting of punishment possible. In other words the incentives to defect are diminished while the threat of punishment is increased.

This does not mean that the exchange of aggregate data can always be considered harmless from a competition policy point of view. In their model Green and Porter state that below a critical market price level the oligopolists will automatically assume that someone has cheated and trigger off a price war.¹³ This means that aggregate price information could be of use to oligopolists when trying to collude. Aggregate output information will even be of more use to them as this would reveal immediately whether someone is defecting.

Ad b) Information can concern either the future or the current situation (including the recent past) or the further past. As a general rule it can be expected that the exchange of historic information will not increase the likelihood of collusion to any serious extent. The older the data the less they will provide an efficient way to detect free riding. It will differ per case when the time lag between starting to free ride and being found out becomes too long to sustain collusion. It will also depend on the appropriate discount rate. However, it may be useful from a competition policy point of view to pronounce on a clear cut-off point after which data become historical and can be freely exchanged between competitors.

Data on current behaviour of firms or on behaviour in the recent past is the type of information that in a game theoretic perspective may increase the likelihood of collusion. Recent information on pricing or output or sales reveals who is defecting and allows immediate punishment. Information on current capacity or cost structures allows an assessment of the possibilities to apply and endure punishment. It is therefore clear that competition policy will have to be occupied by this type of data exchange.

The application of game theory to the exchange of data on future behaviour gives some more remarkable outcomes as already indicated above. Communication between competitors about how they are going to price their product, on how much they want to produce, how they want to change their capacity etc. is just 'cheap talk' without influence on the likelihood of collusion. It is only when the communication finds place by informing the customers and carries a commitment, that it may increase the likelihood of collusion as argued in the next point.

Ad c) Whether the exchange is public or not can both increase and decrease the likelihood of collusion. In general the exchange of data in public can be expected to decrease the likelihood of collusion as it decreases the informational advantage of the incumbent firms over customers and possible entrants. Buyer power and possible entry may now work more effectively as a constraint on collusion.

¹³ E.J. Green and R.H. Porter, 1984.

However, in one instance collusion may become more likely. When companies inform publicly their customers of their intended future prices this normally has a committing effect. What was 'cheap talk' when kept between competitors becomes less 'cheap', with a higher competition distorting potential.¹⁴

Ad d) The more frequent the exchange of information the higher in general the likelihood of collusion. A higher frequency increases the possibility of monitoring the market. A changed behaviour by one of the competitors, entry into the market etc. are observed faster.

Ad e) From a game theoretic perspective the data can be divided in three groups. The first group -data on prices, other sales conditions, sales and output- helps the colluding firms to identify free riding. The second group -data on current cost, demand and capacity- helps determine what effective punishment strategies are available and helps identify possible collusive equilibria. The third group -data on investment, R&D and future cost and demand- helps reduce the longer term uncertainty that may threaten a collusive equilibrium.

From a competition policy perspective especially the first and also the second group will require attention. They are most directly related to the success of collusive behaviour.

§ 7 The market structure

The likelihood of collusion is not only influenced by the nature of the exchanged information but also by the market structure within which the exchange takes place. General economic theory teaches that collusion becomes in general more difficult when a number of factors increase: the number of firms in the market, product heterogeneity, inequality between companies concerning demand and costs, uncertainty about demand and costs, rate of technological development and threat of entry. Collusion becomes more difficult for three reasons. Each companies market share diminishes and therewith the interest to stay within a collusive arrangement. Differences between the companies and their products result in increased divergence of interests between them. More information is required in order to monitor each others behaviour. In other words the incentives for free riding increase while the possibilities to detect and punish free riding diminish.

Apart from this more general statement what can be said about the likelihood of collusion? It is perhaps not surprising, but nonetheless disappointing from a policy makers point of view, that neither game theory nor economic theory in general provides a detailed quantitative answer that encompasses all factors. What is usually done is that the influence of one or two factors are analysed while applying rather rigid assumptions concerning the other factors.

¹⁴ This does not make it easier for competition authorities to take action. It is obvious that companies who publicly inform their clients of effective price changes are at the same time informing their competitors. However, it is difficult, if not impossible for competition authorities to deny companies such a practice. It is much easier to intervene when the companies are directly exchanging information between them.

The factor that is often taken as a starting point for competition policy analysis is the number of firms or the market concentration. The question arises what non-cooperative game theory can tell us on the influence of this factor on the likelihood of collusion. An, admittedly incomplete, search into the game theoretical literature seems to reveal that the question has hardly attracted attention. Most authors assume in their model either a two person game or a n-person game without further specification. The only relevant literature seems an article by Selten of 1973 and recent work of Philips which builds upon the ideas of Selten.¹⁵ Their conclusion is that '4 are few and 6 are many', that is when there are four firms or less in a market the likelihood of collusion will be 1 while this likelihood drops to close to 0 when the number of firms becomes six or more.

However, also the work of these authors seems of little relevance to the specific question as to what the influence is of the number of firms in a non-cooperative game like the prisoner's dilemma. The model of Selten, which is also the basis of Philips work, excludes the possibility of cheating. Each company decides beforehand whether it will cooperate or not. Once it has decided to cooperate it sticks to its promise. This therefore resembles more the situation of a cooperative game with enforceable agreements. The model shows that such binding agreements will be formed with a likelihood of 1 as long as the number of firms does not exceed four.

Non-cooperative game theory in its present state therefore does not seem to offer much guidance to competition policy concerning the stated question. The following are therefore only rough intuitive thoughts without modeling or empirical proof to underpin them:

- A monopolist, assuming entry is not possible, will with a likelihood of 1 ask the monopoly price. However, competition policy will not be able to take effective action unless it can order the monopolist to break up or it can lower entry barriers.
- With a limited number of firms in the market (possibly Selten's 4) the game theoretical situation may be one of a non-cooperative game without prisoner's dilemma.¹⁶ In such a case cooperation is the dominant strategy for each company. In other words, for each company there is no gain in free riding, even when it could be done undetected. The extra profit as a result of gained market share does not outweigh the loss that results from having to lower its price.¹⁷ In this situation a collusive outcome will still result with a likelihood of 1. As in the case of the monopolist, competition policy has no behavioural remedies, only a break up or lowering of entry barriers would help.
- Once the number of firms increases further the situation changes into a non-cooperative game like the prisoner's dilemma. This means that each company has the incentive to free ride.

¹⁵ Selten, 1973, and Philips, 1995 and 1996.

¹⁶ See the last pay-off matrix in the appendix.

¹⁷ This can only be true if more realistic assumptions are used as the ones often found in game theory. In particular, it can not be assumed that a marginal price decrease will allow the company to take over the whole market. Instead, it seems more realistic that a substantive price reduction will be required and that a company, within one period, will only be able to expand its output by 10%/20%/30%/40%/50%, depending on the particular sector.

Whether a collusive outcome will result depends on the trade-off between this incentive and the chance to be found out and punished. The likelihood of reaching a collusive outcome lowers as the number of firms increases. It is likely to be reduced to 0 above a certain number, possibly Scherer and Ross's 10 to 12 firms.¹⁸ In cases which resemble a non-cooperative game like the prisoner's dilemma competition policy can be more effective by attacking facilitating devices (see section 5 above).

§ 8 Limits to the applicability of game theory

As already mentioned in the introduction, a competition authority may have its reasons to assume that the prisoner's dilemma type non-cooperative game setting may not apply in a certain case. Three reasons can be put forward to justify this approach.

The first is that the situation conforms to a cooperative game setting. This is especially relevant for state owned or regulated sectors, where the state may be able to impose binding agreements or exert pressure to cooperate. From a competition policy perspective this means that the problem is one of reconciling different policies, within one government or between different levels. This may be of interest to the analysis of what is called in EC jargon the article 90 cases and policy, but it falls outside the scope of this paper.

The second reason is that although the setting is one of a non-cooperative game the pay-off matrix is such that there exists no prisoner's dilemma (see above section 7). This may be relevant for certain very highly concentrated markets where each firm has such a high market share that collusive behaviour is the dominant strategy even when the game is only played once. In other words free riding is no real option. This type of situation is highly relevant for competition policy, especially merger policy. Behavioural remedies will not work. One can only try to prevent such concentrated markets to come into existence. Once existent only break-up or regulation seem possible solutions. The role of information exchange as a facilitating device can be attacked when it can be shown that it leads to a worse collusive equilibrium as would be attained without the exchange. However, as the information exchange does not facilitate the monitoring of each other in these situations it also falls outside the scope of this paper.

The third reason is however highly relevant for this paper. Although the setting may be one of a non-cooperative game, like the prisoner's dilemma, companies may behave more as if they are in a cooperative game setting. Companies may not behave as nakedly rational as non-cooperative game theory usually assumes. Social constraints, moral codes of conduct etc. do influence behaviour. Business ethics may 'command' that oral non-binding agreements are kept; "a man a man, a word a word". This does not mean necessarily that players act

¹⁸ Scherer and Ross, 1990, p 277, state "As a very crude general rule, if evenly matched firms supply homogeneous products in a well-defined market, they are likely to begin ignoring their influence on price when their number exceeds ten or twelve."

irrationally, it may also mean that their perspective becomes less 'self regarding' and more 'other regarding'.¹⁹

From experiments with the prisoner's dilemma it is known that the narrow 'self regarding' perspective is in general not realistic. Already the experiments of Flood and Dresher, at the origin of research on the prisoner's dilemma in the early fifties, show this. In a 100 round prisoner's dilemma game they show that even highly qualified players let their choice, while non-collusion is the dominant strategy, be influenced by emotional considerations and feelings of revenge and that the players act surprisingly cooperative; in 60 rounds both cooperated at the same time while only in 14 rounds both defected at the same time.²⁰

From this it transpires that in general, companies may show a more cooperative behaviour than one can expect given the underlying prisoner's dilemma type non-cooperative game setting. The consequences of this for competition policy are threefold. It firstly means that when the number of rounds of the game are known and limited, collusion may be the outcome. It secondly means that when the number of rounds is unknown there will be a higher likelihood of collusion than game theory would predict. Thirdly, it means that communication on future prices and output may not be all 'cheap talk'; companies may become rather nervous about their cooperative attitude when there is not enough communication. Communication may be essential to 'prevent' that companies starting to behave as rational as the underlying non-cooperative game assumes.

This means for competition policy that the advise to act based on a non-cooperative prisoner's dilemma type game setting can be seen as a sort of minimum policy action to be undertaken. The next step is to compare actual EC competition policy concerning the exchange of information to this minimum.

§ 9 EC competition policy and information exchange

The exchange of information between competitors, when it has as its object or effect the distortion of competition, would normally be considered under article 85 as an agreement or concerted practice. On two occasions the Commission has made general policy remarks on the assessment of such exchanges; in its notice on cooperation between enterprises of 1968 and in its seventh report on competition policy.²¹ Also in a number of cases has the exchange of information played a role. In most cases the exchange of information was part of a wider infringement. The exchange is then considered as a supportive element of the main competition

¹⁹ One could be 'other regarding' and have as moral principle that one does not want to be the first who cheats. When applied rationally this leads to collusion. Also sometimes certain deliberations do not enter the pay-off matrix; from a manager's point of view it may be very rational when he does not want to isolate himself on the green on Saturday by being the one who 'ruins' the market. See for further details H. Pellikaan, chapter 8, 1996.

²⁰ See W. Poundstone, 1992, p 106-116.

²¹ Notice concerning agreements, decisions and concerted practices in the field of cooperation between enterprises, OJ C 75 of 29-7-1968 and Seventh Report on Competition Policy, Brussel-Luxemburg, April 1978, points 5-8.

restrictive practice. These cases are left outside the present analysis as the appreciation of the information exchange is often coloured by the appreciation of the main infringement. However, the Commission decided in two cases where the exchange of information was the sole competition infringement; the Fatty Acids case and the UK Tractor case.²² These two cases and the notice and the seventh report will be discussed from the perspective of the non-cooperative game theoretic approach discussed above.

Notice on cooperation between enterprises

The 1968 notice does not give much concrete suggestions. It says, as far as exchange of information between competitors is concerned, that it is difficult to distinguish between information which has no bearing on competition on the one hand and behaviour in restraint of competition on the other. It states however two principle points.

Firstly, that it can not be assumed as a rule that article 85 does not apply. This means that it is accepted that the mere exchange of information can be a restrictive practice. This is in line with the game theoretic reasoning that an exchange of information by itself may be able to facilitate collusion. It is also in conformity with the judgment of the ECJ in 1975 in the sugar case.²³ In this case the Court held that deliberate parallel conduct is not prohibited by article 85(1). The requirement that players act independently on the market does not deprive operators of the right to adapt themselves intelligently to the existing and anticipated conduct of their competitors. However, it does strictly preclude any direct or indirect contact, 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 the players themselves have decided to adopt on the market. An exchange of information is likely to constitute such contact.

Secondly, the notice made it clear that a restraint of competition may occur in particular on an oligopolistic market for homogeneous products. This is in line with what is said in section 7 above.

Seventh report on competition policy

In its seventh report the Commission gives a bit more guidance as to its approach towards exchange of information. It explains that the distinction between good and bad information exchange systems can be made only on a case-by-case basis in the light of all features of each agreement. However, three general points are made. Firstly, it reiterates that the problem is mainly one of oligopolistic markets. In an oligopolistic market, greater transparency strengthens the interdependence of firms and reduces the intensity of competition.

Secondly, it makes the distinction between information that is kept between the suppliers only and information that is shared with the customers. In the former case, when the transparency is improved for the benefit of the suppliers only, the customers are deprived of the possibility of taking advantage of the residual "hidden competition" according the report. This is in line with

²² Decision No 87/1/EEC, OJ L 3, 1987, and Decision No 92/157/EEC, OJ L 68, 13-3-1992, p 19. Judgments of 27 October 1994 in case T-35/92 John Deere and T-34/92 Fiatagri and Ford New Holland.

²³ ECJ, Suiker Unie, 1975, ECR 1663.

what is said in general in section 6 under point c), with the exception of the case of future prices.

Thirdly, it makes a distinction between the level of aggregation of the exchanged data. The report states that the Commission can not have objections against the exchange of statistical information, that is information on the production and demand in an industry as usually disseminated by statistical offices. Also the exchange of aggregate information per product and country, which may be more specific as usually provided by official statistics, will not be objected to as long as it is not possible to distinguish individual companies behaviour from these data. Only the exchange of individual company data - as for example on prices, other sales conditions, sales and output - are supposed to fall under article 85. This is partly in line with what was said in section six under point a); that the exchange of individual company data, as it provides improved possibilities to monitor the market behaviour of each company, should be the principle worry for competition policy. However, it totally excludes the possibility that aggregate data may also have an anti-competitive effect.

The Fatty Acids case

This was the first case where the Commission decided article 85 was infringed while it could only prove that the companies involved were exchanging information.

The case concerned the oleochemicals oleine and stearine, the principal fatty acids produced by splitting natural oils and fats into raw fatty acids and glycerol. The decision describes the oleochemical industry as comprising about 40 companies with three big integrated firms, Unichema, Henkel and Oleofina. The large integrated companies do not only produce fatty acids for third parties but also have an important captive use. Unichema, with a share of the market for sales to third parties in Western Europe of over 30%, is described as the market leader. Henkel and Oleofina had some 16% and 14% respectively.²⁴ According to industry sources, the European market was suffering from structural overcapacity and low or stagnant growth rates.

The three companies orally agreed in 1979 firstly to establish their respective total annual sales to third parties over the preceding three year period and secondly to exchange as from 1980 onwards the same information on a quarterly basis. After the Commission had pointed out to the companies that the information exchange might constitute an infringement of article 85 the companies terminated the agreement with effect from 1 January 1983.

The motivation of the companies, as described in the decision, is quite revealing:

"In 1979 Unilever was planning the acquisition of Emery's 50% shareholding in Unilever-Emery and the integration of its operations with the wholly owned Unichema subsidiary. The merger would inevitably involve rationalization and the reduction of fatty acid capacity. According to Unichema, there was a possibility of its competitors

²⁴ It is left open in the decision whether the relevant product market concerns fatty acids or whether separate markets exist for stearine (market share of the three of around 60%) and oleine (market share of the three around 80%). However, this is not of relevance for the present paper.

'misinterpreting' its merger plans as a first indication of an intention to withdraw from the fatty acid sector, 'thus setting off even more competition and loss of market share for Unichema'".

"The Unichema representative, who proposed the agreement to his colleagues, has explained to the Commission that the object - also indicated to the other parties - was to enable the participants to monitor possible major changes in their relative positions as a result of any unilateral capacity reduction by Unichema which would follow the acquisition of Unilever-Emery by Unichema."

"Unichema has stated that, owing to the fragmented nature of the market and conditions of intense competition, it considered that the major producers had a duty to 'sanitize' the market. The solution to the problems of the industry, as perceived by Unichema's senior management, was 'orderly marketing'."

"Unichema's conception of its own responsibilities in this direction involved the need to adopt marketing policies which did not provoke its major competitors into blaming it for being 'destructive'. As the leading producer of a commodity product, Unichema considered it was entitled to maintain its traditional market share and, if competitors were to attempt to take from it established business by means of aggressive price cutting, it would consider such conduct as 'stealing'. If it were to lose business as a result of price cutting it would have to recoup that business in another market and so bring about a general price instability which it believed would be destructive to the interests of the trade as a whole."

"Unichema also considered that the major producers should bear the responsibility for capacity reductions. For its part, it had expressed a readiness to purchase the goodwill of smaller competitors and thereby facilitate the closure of uneconomic units. This opinion was shared by the other large producers."

"Apart from the above mentioned explanations given by the parties concerning the object of the agreement, their main argument in the course of this proceeding has been that the information exchanged related to the past only, and was of such a general nature and covered such a wide geographic market, without any breakdown for individual countries or markets, that it could not have affected their individual competitive behaviour and therefore could have had neither as its object nor effect the restriction of competition between them."

The described motivation contains many elements of a non-cooperative game like the prisoner's dilemma. Companies are afraid to be misunderstood by their competitors, afraid to provoke price cutting which again would make retaliation necessary, when business is stolen recouping it elsewhere would be detrimental to the current equilibrium, output needs to be controlled, monitoring of respective market positions is essential to allow orderly marketing.

The Commission made use of the provided motivation but took an opposing view on the competition distorting effect of the agreement:

"The agreement between Unichema, Henkel and Oleofina to exchange historic individual sales figures for the years 1976-1978 enabled the parties to determine their traditional respective position on a given market. The subsequent regular exchange of information gave each of the parties the opportunity of identifying the individual businesses of his two major competitors and thus to measure on a quarterly basis their future performance on that market."

"Despite the alleged general nature of the information exchanged it did improve their knowledge of market conditions in a way which strengthened the connection between them so that they would be able to react more rapidly and efficiently to one another's actions."

"In view of the market stabilization which the parties undoubtedly wanted to achieve, this inevitably lessened the intensity of competition that would otherwise have existed between them."

"Although there is no evidence to suggest that, in this particular case, the parties to the exchange of information agreement did fix quotas directly, the Commission nevertheless considers that the object of the agreement bears a strong resemblance to that of an outright quota-fixing agreement since it clearly aimed at dissuading the parties from adopting aggressively competitive behaviour towards each other and also at achieving stabilization of their relative positions on the market."

Also the Commission's assessment contains elements from non-cooperative game theory, especially that the monitoring of each others behaviour allows the companies to react more rapidly. However, a number of elements indicate that the Commission did not base itself on or was not aware of the apparent underlying non-cooperative prisoner's dilemma game setting of the case. The decision does not make clear that the main effect of up to date monitoring is that punishment becomes more effective while the incentive to free ride is reduced. The Commission also indicates that it considers it of importance whether the companies actually communicated on sharing the market or not, making it clear that such would not be considered as 'cheap talk'.

The UK Tractors case

This second case centers on the exchange of information identifying the volume of retail sales and market shares between the eight main producers and importers of agricultural tractors in the UK. The Commission started its investigation in 1984 and discovered the exchange in the course of inspections at the offices of some of the companies and the Agricultural Engineers Association Ltd. (AEA), the UK trade association of manufacturers and importers of agricultural machinery. The information exchange had existed at least since 1975. In 1992 the Commission took a prohibition decision which was upheld by the Court of First Instance and which is presently under appeal before the Court of Justice.

For the assessment of the information exchange agreement the Commission took account of:

- the market structure, i.e.:
 - high concentration: the eight companies (Ford New Holland, Massey-Ferguson, Case, John Deere, Renault, Watveare, Fiat and Same-Lamborghini) that participated in the agreement held 88% of the UK tractor market. The first four companies mentioned shared 77% of the market, 80% after Ford New Holland was taken over by Fiat. The remaining 12% was taken by several small manufacturers. This high concentration was further enhanced by the fact that not all small suppliers were active in all regions and/or all horsepower categories;
 - high barriers to entry: the need for an extensive distribution and service network, a stagnant/declining market, the importance of brand loyalty and the effects of the information exchange;
 - the absence of significant imports in the UK by third parties.
- the nature of the information exchanged: exact quantities of retail sales and market shares of the participants with detailed breakdowns by model, product group, region (including dealer territories) and by yearly, quarterly, monthly and daily time periods.²⁵
- the fact that the members met regularly within the AEA, giving a forum for contacts.

Based on the above the Commission concluded that for two reasons the information exchange was leading to a restriction of competition. Firstly, the exchange prevented hidden competition in a highly concentrated market. Secondly, it increased the barriers to entry for non-members. The following quotations are instructive:

²⁵ In addition to this information the AEA also provided to each manufacturer information on sales by its own dealers. This allowed monitoring of the own dealers 'import and export' into each others territories within the UK and parallel import into the UK. The Commission concluded that this highly likely reduced intrabrand competition. However, this falls outside the topic of this paper and this part of the decision is therefore not included in the analysis.

"The exchange restricts competition because it creates a degree of market transparency between the suppliers in a highly concentrated market which is likely to destroy what hidden competition there remains between the suppliers in that market on account of the risk and ease of exposure of independent competitive action. In this highly concentrated market, 'hidden competition' is essentially that element of uncertainty and secrecy between the main suppliers regarding market conditions without which none of them has the necessary scope of action to compete efficiently."

"...the high market transparency between the suppliers on the United Kingdom tractor market which is created by the Exchange takes the surprise effect out of a competitor's action thus resulting in a shorter space of time for reactions with the effect that temporary advantages are greatly reduced."

"It allows them ... to see at once whether there has been any increase in the retail sales of a rival, to see the territory in which such an increase takes place, to detect the models which contribute such an increase and finally to follow whether and to what extent any price or other marketing strategies of rivals are successful, ... to limit price competition as far as possible by allowing suppliers and dealers to react to any price-cutting or other market strategies selectively by limiting their response to the absolute minimum degree necessary in terms of product and territory and by being sure to hit the right target."

"In the absence of the Exchange, firms would have to compete in a market with some measure of uncertainty as to the exact place, degree and means of attack by rivals. This uncertainty is a normal competitive risk bringing about stronger competition because reaction and reduction of prices cannot be limited to the absolute minimum degree necessary to defend an established position. Uncertainty would lead the firms to compete more strongly than if they knew exactly how much of a response was necessary to meet competition. They would have to exceed a minimum response, for instance by offering more favourable discounts to move their stock or by offering discounts for more products and in more territories."

"If a supplier chooses not to become a member of the Exchange, he is disadvantaged by the fact that he does not have available the detailed and accurate market information about other suppliers which is available to members of the Exchange. If a supplier chooses to become a member of the Exchange, he must reveal his exact retail sales by product and by every small geographic territory with the result that the Exchange then permits the established suppliers with considerable market shares and extensive dealer networks to become aware of the existence of new entry and to instantly detect the market penetration by any such new member. ... In both cases the Exchange advantages the big suppliers who already belong to it."

In this decision the Commission more profoundly understood the apparent non-cooperative prisoner's dilemma game setting of the case. The emphasis on hidden competition and uncertainty about competitors actions, a shortened reaction lag, eliminating the advantage of a company that tries to undercut, making targeted punishment possible etc. all fit very well in such a game theoretical explanation. The analysis within the context of a concentrated market

and the Commission conceding that information would only truly become historical when older than one year add to this.

However, the Commission did not solely base itself on a non-cooperative game theoretical explanation. As previously the Commission in this decision does not in principle object to the exchange of aggregate industry data, thereby ignoring a possible competition distorting effect. Also the function of the AEA in helping communication between the companies is mentioned as an important element, indicating that the Commission considers talk not as 'cheap' as non-cooperative game theory would predict. However, as explained in section 8 there may be good reasons for this last position.

§ 10 Conclusion

The following conclusions can be drawn concerning the application of non-cooperative game theory to EC competition policy on information exchange.

Non-cooperative game theory in its present state seems of limited value for answering practical policy questions. The models do not answer the basic policy question concerning the influence of factors like the number of firms, the measure of product heterogeneity, inequality between companies concerning demand and costs etc. on the likelihood of collusion being realised. This question does not seem to get much attention. Also, the models that exist do in general make use of rather unrealistic assumptions of the type that with a minimal price reduction the free rider is able to take over the whole market. To this it can be added that serious doubts can be raised as to whether companies in a non-cooperative setting will always act as game theory presupposes. Experiments indicate that cooperation is more likely than theory would predict.

This means that any implications for competition policy drawn from non-cooperative game theory have to be used cautiously. Firstly, given the above it seems justified to take such implications only as the minimum action that a competition authority should undertake. Secondly, to the extent that communication between companies can sometimes be described as 'cheap talk' the distinction between tacit and explicit collusion becomes less important. Thirdly, increased attention should be given to facilitating devices such as information exchange.

In this light it is difficult to judge EC competition policy on information exchange. However, given the importance of information exchange as a facilitating device and as many EC markets have an oligopolistic market structure the low number of pure information exchange cases seems surprising. In the UK Tractors case the Commission has shown an understanding of the principles of non-cooperative game theory without solely basing itself on such theory. Lastly, the rule to always accept the exchange of aggregate data may need modification.

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