SCREENING METHODS FOR DETECTING ANTICOMPETITIVE AGREEMENTS BY USING AN ICT BASED APPROACH

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Abstract

The economic companies, by virtue of their daily activities, are often in contact one another, and these interactions can sometimes lead to anticompetitive agreements. Some agreements concluded by the economic operators are absolutely necessary for the development of their current activities. It is the case of the agreements which, following the rules of competition, are able to bring a series of benefits to consumers and to the economy as a whole. On the other hand, the economic operators usually conclude secret agreements that are harmful to the economy and to the consumers as well, because they violate the competition rules. In order to detect such practices and to eliminate them, the competition authorities have at their disposal leniency policies and analytical methods for detecting anticompetitive behaviours. While the leniency policy represents an active modality of identifying the anticompetitive behaviour, the analytical methods represent an active tool for detecting such behaviour. Moreover, the effective application of analytical methods for detecting cartels leads to the increase of leniency policies' efficiency. For companies, advances within ICT have brought a slew of cost savings, opportunities and conveniences. They range from highly automated businesses processes to the big data revolution, where organizations are turning the vast trove of data generated by ICT into insights that drive new communication tools between companies. In this view, worldwide Competition Authorities must develop new tools to screen and detect cartels.

Keywords: Competition law, Anticompetitive behaviour, Cartel, ICT, Analytical methods, Improbable events.

1 Introduction

Cartels between enterprises can be achieved in several ways, among the most well-known ones being: price fixing, bid rigging, output limitation and market sharing.

Among the factors that favour cartels' formation, we mention: the elasticity of the demand, the concentration degree of sales or of buyers, barriers to entry on the market, the existence of information exchanges between companies, markets with a high bankruptcy risk, stable or declining demand, the interaction of firms competing on a variety of markets or even markets with repeated cartelization.

Nowadays, the Competition Authorities need to develop new detection and screening tools in order to be able to detect anticompetitive behaviour of the companies. Besides many real agreed advantages, ICT has also created problems and challenges to organizations and individuals alike, as well as to society as a whole. The digitization of data, the expanding use of high-speed internet and the growing global network together have led to new levels of crime, where so-called bad actors can hatch electronically enabled schemes or illegally gain access to systems to steal money, intellectual property or private information or to disrupt systems that control critical infrastructure.

There are many situations when, in order to increase their profits, the companies with big market power are trying to make anticompetitive agreements using ICT. In this view, the Competition Authorities all over the world need to keep up the step with the companies and develop new tools to detect cartels.

In this paper we will make an analysis, using ICT approaches, of several screening methods used by the Competition Authorities to detect cartels.

2 Theoretical studies on the detection of anticompetitive behaviours

Although the literature in the field is plentiful in studies concerning cartels' detection, the possibility of cartels' emergence and the necessary conditions of cartels' stability, no method offering robust results could have been identified yet.

There are four principal methods in which cartels are detected:

The first method is to determine whether company's mode of action is inconsistent with a competitive environment (method A);

The second method is to analyse if there is a structural failure in company's behaviour (method B);

The third method is to check the behavioural differences between the firms supposed to be part of a cartel and those companies activating in a competitive environment (method C);

The fourth method is to analyse weather a collusive model fits better to the data involved than a competitive model (method D).

In general, methods A and B (in a simplified form of them) do not provide direct evidence of firms' participation in a cartel. These two methods analyse the observable behaviour of a company and try to explain it by means of a competitive model. However, if it is not possible to justify the behaviour of a firm by such a competitive model, this does not automatically lead to the conclusion that the respective company participates in a cartel.

Concerning the first method (A), the main problem of the discussion is whether the competitive model formulated before be or not wrong specified. The incorrect specification of the model could be due to the unrealistic assumptions formulated in terms of costs or to the demand function as well as to the omission of some variables.

Further on, we describe the way by which the economists have implemented analytical methods for identifying the existence of competitive problems. We will discuss about a series of examples such as: bid rigging, price fixing, coordination methods for sale prices and for market shares.

(Bajari and Ye, 2003) compare the collusive and competitive structural methods in order to observe which of them could be able to explain better a given set of data. The information belonging to Bajari and Ye's study refers to the first-price sealed auction in which the product is homogeneous and bidders' costs are independent. The cost function of the bidder i is extracted from a population which has the function of cumulative distribution

$$F(c_i|z_i,\theta): t[\underline{c},\bar{c}] \to [0,1],$$

where θ represents a parameter vector common to all bidders, and zi is a vector of independent and observable variables that are unique to each firm (but that may be correlated). However, the condition referring to the independence of these variables, is one essential.

The competition model is based on the equilibrium of the following game: the expected profit of the bidder i from the auction bi is

$$(b_i - c_i)\prod_{j\neq i}\left[1 - F_j\left(B_j^{-1}(b_i)\right)\right]$$

and this could be get if the bidder won the auction. $B_i(\cdot)$ represents the strategy of the firm i. As a consequence, the expected profit is equal to the multiplication of the difference between the offer's value desired for the auction's winning and the company's cost, and the probability that the firm wins the auction.

The implementation of such a model supposes the estimation of a price function for each firm and then the testing of the independence and interchangeability corresponding to companies' cost functions. The purpose of applying an independence test consists in verifying whether the unexplained part belonging to firms' offers is independent or not. The role of the interchangeability test is to analyse whether the estimated coefficients of cost functions are the same in the case of all firms or for a particular part of companies participating at the auction.

Bajari and Ye used this model for analysing the public auctions whose subjects were roads renovations in Minnesota, North Dakota and South Dakota during 1994 - 1998. The dataset included 138 auctions at which a number of 11 companies took place. These auctions were awarded on the lowest price principle. The equation of the offer which should have been estimated was:

$$\frac{BID_{i,t}}{EST_t} = \beta_0 + \beta_{i1}LDIST_{i,t} + \beta_{i2}CAP_{i,t} + \beta_{i3}MAXP_{i,t} + \beta_{i4}LMDIST_{i,t} + \beta_{i5}CON_{i,t} + \varepsilon_{i,t}$$

The dependent variable is represented by the ratio between the offer of the firm i for the project (auction) t and the cost estimated by the firm for the respective project. The variable LDIST measures the distance of the firm i from the project t, CAP represents the capacity of the firm involved in the named project, CON represents the percentage from the turnover achieved in the state in which the firm deploys its project. In other words, the variable CON quantifies the degree to which the firm i is familiar with local regulators and suppliers of raw materials.

Bajari and Ye draw the attention on the fact that if two enterprises use the same subcontractor to calculate their costs, then their offers cannot be considered independent even if between them there is no agreement.

Methods C and D allow the analyst to compare the collusion and the competition in different ways. The method C needs the identification of a competitive benchmark or of a number of companies on the market which are not involved in the presumed cartel (for example, firms could activate on a different geographical market). Therefore, we consider that it is very important for the data to include a pre-cartel period otherwise this method will be inapplicable. Another shortcoming linked to this method is that referring to the benchmark's endogeneity. If, for example, the benchmark comes from two firms that did not take part at the agreement, there is a possibility for these companies to have different characteristics from those participating in the cartel.

In the situation in which the benchmark is chosen on a different geographical market where there was no agreement, it could be possible for those two markets not to be comparable. For example, it is possible for the firms to have the motivation and the capacity to get into collusion on the first market but not on the second one.

(Banerji and Meenakshi, 2004) compared the performance of collusive and competitive models within the auctions which took place on wheat market in India. Prior to this study, it was assumed that it had occurred collusion between three major buyers which shared approximately 45% of the market.

As a competitive model, the authors chose the IPV model (independent private values) with asymmetric distributions: data of the three firms suspected of collusion were part of distributions which differed from those belonging to other market players (that all had the same distribution). The collusive model was selected as the model of offers' rotation.

This study involved an empirical analysis on a number of 421 auctions held in 1999. Data contained both quantitative and qualitative variables. In order to identify the latent distributions, (Athey and Haile, 2006) used a structural model.

(Harrington, 2004) analyses the internal stability of price cartels as well as the way by which they could avoid being detected by the competition authority. Harrington considers that there are two types of price cartels such as:

- Cartels which increase the prices gradually until they converge to an equilibrium level;
- Cartels which increase the prices gradually and then they reduce them up to an equilibrium level;

Although price reduction has as effect the diminution of profits but not that of the possibility to detect cartels, this phenomenon could occur due to the need of maintaining cartel's internal stability.

Harrington proposes a model with 13 parameters:

- The parameters of demand and cost: a, b, e, c
- The parameters of cartel's detection: α_0, α_1^u, α_1^d
- The penalty parameters of cartel's members: β, γ, F, T
- Discount factor: δ
- Number of companies: n

In this model of detecting cartels, the author starts from the cost function $C(q) = cq$ and from the utility function:

$$U(q_1,...,q_n) = a\sum_{i=1}^{n} q_i - \frac{1}{2}\left(b\sum_{i=1}^{n} q_i^2 + e\sum_{i=1}^{n}\sum_{j\neq i} q_i q_j \right)$$

in which qi represents the quantity consumed of goods produced by the firm i. The demand function of the firm i is:

$$D(P_i, P_{-i}) = \frac{a}{b+(n-1)e} - P_i \frac{b+(n-2)e}{(b+(n-1)e)(b-e)} + P_{-i} \frac{e(n-1)}{(b+(n-1)e)(b-e)}$$

The same model for estimating the demand function was also used by (Vives, 1999).

(Ellison, 1994) and (Porter, 1983) tried to analyse the structural disruptions within the price series. In other words, they analysed the unexpected price modifications that could not have been explained by means of changes in costs or at the demand level. As explained by (Green and Porter, 1984), in the

context in which the cartel members could be monitored only imperfectly, cartel's stability needs periodic price reductions as a punishment form for the intention of some members to leave the cartel or to violate the policy adopted by the cartel itself.

The study focuses on the rail carriers' cartel that was created to coordinate the tariffs perceived for the wheat transportation from Chicago to the East Coast. This cartel preceded the establishment of Sherman Acti which prohibits price fixing.

The empirical model estimated by Porter is a two-equation structural model that attempts to explain price fixing and markets' quantities by means of changes in cost and demand functions: Q_t represents the volume of the shipped grains, P_t is the price for the rail and *LAKES* is a binary variable that takes the value of 1 (0) when the Great Lakes are (are not) open to navigation. The Great Lakes used to provide an alternative for wheat transportation, this pattern revealing in the model by means of the negative value of parameter α_2. The variable S_t is an exogenous variable that captures changes in the structure of the cartel following the entrance of new members or the economic concentration between cartels' members. The variable I_t is a key variable of this model that takes the value 1 if firms are under cartel phase and 0 if they are in the price war phase.

3 Practice examples of analytical methods used for detecting cartels

3.1 Detection of bid rigging based on improbable events

The investigation of identical offers represents an application example for this sort of analysis.

We consider the case of a bid involving seven companies as participants. The auction is won by the lowest price offer. The offers are independent and they are placed in different envelopes by the seven participants. At the moment of opening the envelopes, it could be observed that all the offers were exactly 823.765 lei. The probability that each of the seven companies would have chosen this value/number, considering that all the offers are numbers of six figures is:

$$\left(\frac{1}{9}\right)\times\left(\frac{1}{10}\right)^5 = 1{,}11\times10^{-6}$$

Assuming that all the bids were independent, in other words no company had information about competitors' offers, the probability that all the seven participants would have chosen the same value becomes:

$$\left[\left(\frac{1}{9}\right)\times\left(\frac{1}{10}\right)^5\right]^6 = \left(1{,}11\times10^{-6}\right)^6 = 1{,}88\times10^{-36}$$

The chance of the seven bidders, acting independently and concluding an agreement on their six figures offers is nearly zero and it sends a very strong signal that the companies involved, have explicitly or implicitly reached a coordination mechanism in the case of their offers.

3.2 Analytical methods based on prices and cost information

We consider the case of an oligopoly market where there are four players. We have calculated the weekly average of sales prices. In the same graph we will place the raw material costs. Thus, we will obtain the following graph:

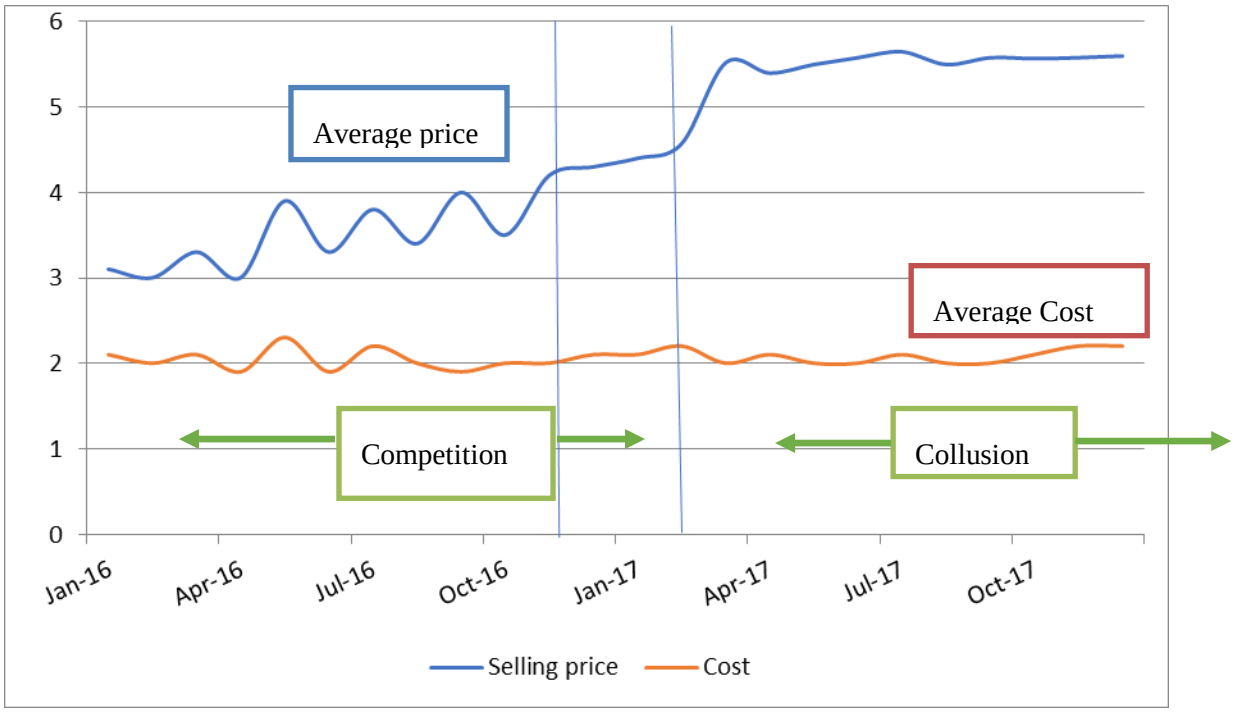

Figure 1. The evolution of prices and costs corresponding to the four market players during 2016-2017

The above-mentioned figure shows us the moment of ending the collusion born between the four oligopolistic firms. We compare the prices and the costs in what we call the "collusion" period (to the left of the first vertical line) with the prices corresponding to the "competitive" period (to the right of the second vertical line). We assume that the period between the two vertical lines represents a transition period from the collusion to competition.

The price of the analysed product decreased dramatically and it remained at a much lower level than compared to that during the collusion period. In the aftermath of the collusion, the price started to change in the same way as the cost did and it had a greater variation.

The table below gives us a clearer picture of the average, of prices and costs variation as they appear in the analysed period.

Statistics	Competition	Collusion	Differences
Price			
Average	3.43	5.55	61.75%
Standard deviation	0.37	0.08	-77.46%
CV= Std. Dev./ average	0.11	0.02	-86.07%
Cost			
Average	2.04	2.07	1.47%
Standard deviation	0.14	0.08	-39.01%
CV= Std. Dev. / average	0.07	0.04	-39.90%

Table 1. Distribution of market shares during 2014-2017

From the table below we notice that, while prices average increased by 61,75%, the standard deviation decreased by 77,46%. In the same period, the variation coefficient[ii] decreased by 86,07%.

3.3 Detecting the agreements on sales prices coordination

We propose an analysis based on the research of small and large prices variations of 35 businesses in a given metropolitan area. The enterprises sell a homogenous product.

We have applied the graphical method in which the vertical axis represents the standard deviation and the horizontal axis highlights the prices' average in the case of the homogenous product. Our aim consists in observing a group of businesses for which the sale price has a high average and a small standard deviation comparatively to the other enterprises. This leads to the idea that market players have agreed to maintain a high average for this product; in terms of the prices, we have not noticed a large variation in the analysed period.

More exactly, the analysis has been performed on data furnished by the 35 research subjects. For each of them, we have calculated the average, the price dispersion as well as the variation coefficient of the sale price. The graph below shows us the oscillation of standard deviation in the case of pomp prices according to the average.

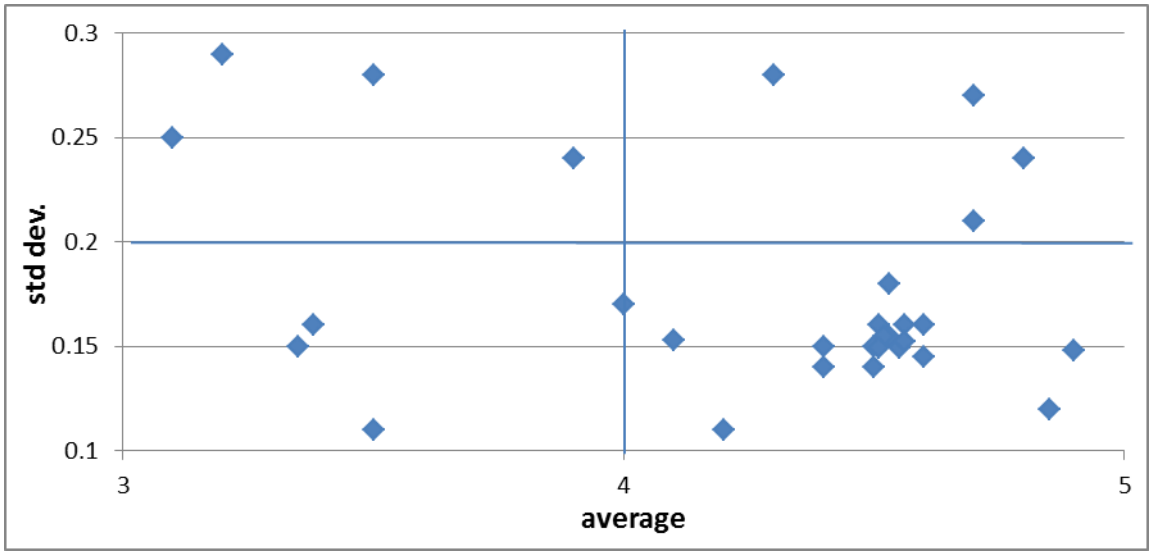

Figure 2. Oscillation of standard deviation in the case of pomp prices according to the price average (35 businesses)

As can be seen, the businesses that have high average prices in the case of the analysed product have also high standard deviations. We will look first at the so-called "outliers"iii. Such outliers do not exist.

If there had been a coordination of the competitive behaviour concerning the pomp prices for this product, they would have been grouped in the bottom right corner of the chart above. As we have just mentioned before, these prices would have represented a high average and a small standard deviation compared to the others. Prices' statistical analysis indicates the existence of market coordination in terms of prices. It is about coordination between the agents whose prices are grouped.

3.4 The analysis of market shares' evolution

Another potential analytical method used for determining the anticompetitive behaviours is given by data concerning market shares. We consider a hypothetical case in which, on a given market, there are four enterprises whose market shares are included in the following table:

	Market share %			
	2014	2015	2016	2017
Undertaking A	32	31	32	32
Undertaking B	22	23	22	22
Undertaking C	18	18	17	17
Undertaking D	15	15	16	16
Others	13	13	13	13

Table 2. Distribution of market shares during 2014-2017

The market share evolution can be translated into the following graph:

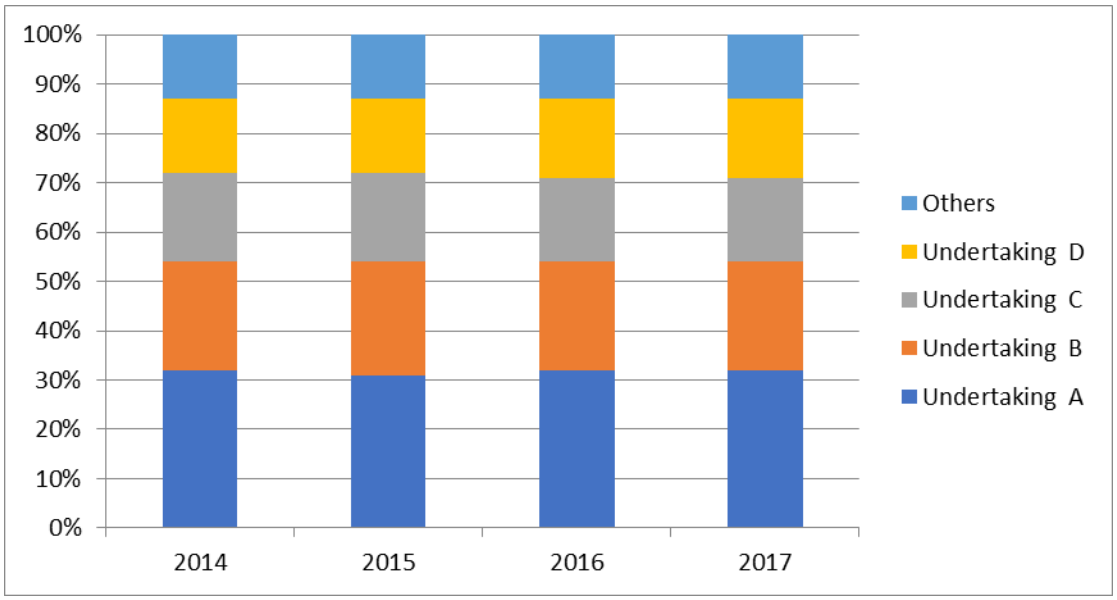

Figure 3. Market share evolution of the analysed enterprises during 2014-2017

From this graph, we can notice the fact that:

(i) Market shares which appear to be very stable over the time as well as

(ii) Market shares of all players on a given market are negatively correlated.

This analytical method may lead to the conclusion that, on the given market, there is an agreement between the enterprises – a cartel – in terms of market sharing.

4 Conclusions

The ICT methods for detecting anticompetitive behaviours are often used by worldwide competition authorities in dealing with anticompetitive cases as well as by enterprises which could claim for compensation whenever they have been harmed by the existence of a cartel on their operational market.

The use of analytical methods on the basis of statistical data could be a method for observing certain anticompetitive behaviours on the market. By utilising these methods, we are not able to prove directly the collusive behaviour of the analysed enterprises, but we could highlight the improbable results which would require more careful attention. These methods aim primarily to avoid false positive and false negative results. A false positive result states that there is a cartel on a given market although it does not actually exist. False negative results are those which state that there is not a cartel on a certain market, although this cartel really exists.

Moreover, the use of these analytical methods should have an empirical support, be easily applied and not too costly to implement.

As ICT brought new communication tools and methods used by the companies, sometimes to make anticompetitive agreements, the worldwide Competition Authorities must keep up and develop new investigation and screening tools to detect and sanction such anticompetitive behaviours.

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[i] The Sherman Antitrust Act is a landmark federal statute in the history of United States antitrust law (or "competition law") passed by Congress in 1890. It prohibits certain business activities that federal government regulators deem to be anticompetitive, and requires the federal government to investigate and pursue trusts.

[ii] **The variation coefficient** allows the comparison of certain statistical series in terms of standard deviation. A smaller variation coefficient indicates a better regrouping around the average value. The **standard deviation of a dataset** allows the estimation of its values' uniformity, more precisely, we could state that the standard deviation is smaller, the set values are clustered around the average. Inversely, the standard deviation is higher, the set values are more distant from the average.

[iii] In statistics, outlier is a value/an observation point that is very distant from other data/observations. The outliers are generally excluded from the data set which is analysed.