DIRECTORATE FOR FINANCIAL AND ENTERPRISE AFFAIRS
COMPETITION COMMITTEE

Summary of the workshop on cartel screening in the digital era

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This document was prepared by the OECD Secretariat and summarises the discussion during the workshop held at the OECD Headquarters in Paris on 30 January 2018.

More documents related to this workshop can be found at

http://www.oecd.org/competition/workshop-on-cartel-screening-in-the-digital-era.htm

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Workshop on cartel screening in the digital era

Summary by the Secretariat

On 30 January 2018, the OECD Secretariat held a *"Workshop on cartel screening in the digital era"* on the latest developments on screening methods as well as the practical aspects of screen implementation. The workshop was divided in two parts.

1. The morning session offered a general overview of cartel screening approaches proposed by the economic literature.

2. The afternoon session discussed practical experience on screens development and implementation along with challenges related to screens, such as data collection, methodology or effectiveness of the techniques used.

The workshop benefitted from the keynote speech of Professor Porter (William R. Kenan Jr. Professor of Economics, Northwestern University) and from insights of representatives of the following competition agencies:

− Competition and Markets Authority (CMA), the United Kingdom

− Conselho Administrativo de Defesa Econômica (CADE), Brazil

− Swiss Competition Commission COMCO, Switzerland

The workshop attracted a large audience; 72 people were present in person and further 98 connected remotely via Webex.

Antonio Gomes, Head of the Competition Division, opened the workshop by providing the context and background to the topic. He highlighted that the role of pro-active cartel detection measures has already been on the agenda of the OECD's Competition Committee[1]. In 2013, a roundtable discussion reviewed the main features of structural and behavioural screens concluding that competition agencies should consider complementing their reactive detection measures (amnesty/leniency programmes) by pro-actively seeking out cartels and launching more *ex officio* investigations against suspicious conducts. In order to do so, empirical screens may play a prominent role in deciding which markets or industries are more likely to be prone to cartel behaviour, and in some cases they can also flag possible cartel behaviour that would deserve closer scrutiny.

1. Latest developments in cartel screens

The first part of the workshop reviewed the factors that can facilitate cartel formation and gave a general overview on the main features of structural and behavioural screens. It also discussed some of the challenges in screen design and implementation, as well as describing some recent developments in screening techniques.

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[1] OECD (2013), Roundtable on *"Ex-officio cartel investigations and the use of screens to detect cartels"* http://www.oecd.org/competition/exofficio-cartel-investigations.htm

Professor Porter highlighted that pro-active cartel detection methods, such as screens, can complement reactive detection methods, such as amnesty or leniency programmes. By identifying markets in which industry structure is potentially conducive to collusion, behaviour is suspicious, or where the complaints of customers or rivals warrant closer scrutiny, screens can provide evidence to justify an investigation. In a procurement setting, the appropriate remedies may include redesign of the tendering process.

With regard to the economic theory on cartel formation and on the different approaches to screens, he first referred to the preconditions of collusive schemes: ability to reach an agreement and enforce it, including detection and deterrence of cheating. Then, he reviewed the differences between structural and behavioural screens. Structural screens look at the risk of cartelisation based on various industry characteristics that may facilitate collusion, such as the number or concentration of sellers, the degree of product differentiation, excess capacity, entry barriers, demand stability and pricing transparency. However, he noted that the extent to which these factors facilitate collusion depend on individual industry circumstances. Variables such as the measure of profits and indications of previous cartel existence may help to identify markets with potential concerns, but can also be misleading due to problems of interpretation. As opposed to structural screens, behavioural screens can be useful in determining whether a suspicious behaviour is more consistent with competition or with collusion. Since it is not possible to study all markets of potential concern, behavioural screens are more likely to be useful when investigating a complaint by customers or by rival firms. If the behaviour is deemed suspicious thanks to the screen, then a more detailed investigation may be warranted which may lead to a possible leniency application. This way screens can complement leniency programs.

In terms of the practical implementation of screens, Professor Porter focussed on price patterns. Price changes at time of cartel formation or at the end of a cartel can be useful markers. At the beginning of a cartel, prices gradually increase, as cartel experiments with the price that the market can bear. Likewise, the ends of cartel agreements tend to result in a sudden price collapses. As shown by variance screens, when a cartel is active, prices can be less responsive to costs and generally are less variable (Abrantes-Metz, Froeb, Geweke & Taylor, 2005). Aside from price changes, temporary price wars may also be detected. In a bid rigging scheme, phony or complementary bids are usually higher to create the appearance of competition. In this case, the data should be split along two dimensions; cartel vs non-cartel, or low bid vs higher bids to test whether the low bidder for a given group is determined by the same process as the ranking of higher bids. Bajari & Ye (2003) adapted a method to test who participates in the cartel. However, a sophisticated cartel could pass this test, by inflating all bids (serious and phony) by the same amount, preserving the ranking of bids based on costs. Another possible method is to use the behavior of outsiders as a standard of comparison, if the cartel is not all inclusive. Average bid auctions are also frequently used to award procurement contracts. Low and high bids are discarded according to a pre-specified rule, and the winner's bid is the closest to the average of the remaining bids. In such cases, screens are validated on sample where collusion was uncovered to determine the presence and the membership of ring. Besides price patterns, market allocation and market share patterns may also indicate collusion.

Professor Porter also emphasized the dual nature of data availability. On the one hand it offers the prospect of more extensive investigations; on the other, it can facilitate collusion. In particular, more readily available pricing data speeds the detection of deviations from agreed upon prices, dampening the incentives to cheat, especially if rivals respond more quickly than customers to price cuts. Typical examples include price transparency rules (Albaek, Mollgaard & Overgaard, 1997), price comparison websites (Ellison &Ellison

2009, 2017), or the Airline Tariff Publishing case investigated by the US Department of Justice. Corruption in a bidding process is also an area of concern. In this respect bids having multiple dimensions (e.g. prices of multiple items) are especially vulnerable (Burguet & Che, 2004). Interestingly, Lewis-Faupel, Neggers, Olken & Pande (2016) found adoption of e-procurement in India and Indonesia resulted in entry of non-local bidders and quality improvement but not in lower prices.

2. Agencies case studies

The second session moderated by Antonio Capobianco (Senior Competition Expert, OECD Secretariat) continued on with practical implementation of screens along with the related challenges and risks in different countries. The key questions included:

- How can screens be implemented effectively?

- What are the main challenges and risks associated with the implementation of screens?

- What are the data requirements? How can large data sets (e.g. publicly available data or e-procurement data) be used to enhance the reliability of screens?

First of all, Kate Bridge (Assistant Director in the Advocacy Team) and Heena Mistry (Advocacy Officer) of the Competition and Markets Authority (CMA) gave an overview on the background of the CMA's Screening for cartels tool along with a live demonstration on how the tool works using a dummy data set.

Kate Bridge described the main milestones in the development of the tool, as follows:

1. *Project Initiation* - *"To design and test a methodology which can be applied to information gathered by public sector procurement organisations in order to identify potential anti-competitive behaviour amongst public sector suppliers."*

2. *Develop tests and methodology* – including (i) procurement of data science services, (ii) literature review, test identification, and (iii) input from ICAs and UK partners.

3. *Data gathering / processing* – challenges with getting access to data to validate and calibrate the tool.

4. *Package and 'soft launch'* – including (i) contract on front end development, (ii) user feedback, tool refinement, and (iii) challenges of government IT.

5. *Publish, disseminate and review.*

Moving on to the main features of the tool, she emphasized that the tool looks for suspicious signs along the following four themes. As shown by the table below, within each theme, there are different indicators with suggested weighting.

Theme	Indicators chosen (suggested weighting)
Number and pattern of bidders	Low number of bidders (20) Single bid (30)
Suspicious pricing patterns	Winning price is outlier (20) Similar pricing across bids (20) Costs appear to be made up (40)

Low endeavour submissions	Same authors in two or more bids (200)
	Low endeavour losing bids (40)
	Similar text in losing bids (200)
Combination tests	Similar text and word count in losing bids (50)
	Low number of bidders and made up prices (20)
	Winning price is outlier and made up prices (10)
	Low endeavour losing bids and made up prices (10)

The key benefits of the tool include local testing on the user's computer; the creation of a user community to spread awareness and promote deterrence; better prospects of innovation; development; and dissemination. The tool requires basic bid data organised in a folder structure, which is familiar to UK procurers. As the tool is automated, the folder structure is crucial since the tool reads the folder levels. The tool is also user-friendly with adjustable thresholds and weight for the individual element of the test. The results show which (if any) of the tenders are most suspicious. Until now, the CMA has received mainly positive feedback with an increasing number of requests for access to the tool. For example, 29 contracting authorities have requested it. In terms of the difficulties, apart from some IT security and calibration issues, which have been successfully resolved in the latest version, there were no other major problems at the time.

Looking back at the experiences and lessons learned, the CMA highlighted that the project ran for longer than expected and it was more resource-intensive than expected. It also required internal and external specialised expertise, particularly on data science and IT development. Importance of managing expectations (internal as well as external) and being aware of the limitations of the tool were also mentioned. The availability and quality of third party data was crucial to the progress and the correct shaping of the project. Nevertheless, the CMA underlined that apart from helping procurers spot and stop cartels, the tool/project raised awareness to the risk of bid-rigging and helped building relationships with stakeholders.

In terms of looking forward, the CMA pointed out that the tool is now part of its toolbox for engagement with procurers, which also includes the CMA e-learning module, a 60-second summary[2] and short video[3] promoting the tool. However, some open questions still remain, such as (i) how is the tool being used?; (ii) how does the CMA capitalise on growing community of users?; (iii) what will be the next step after the 2018 review.

In order to get an insight into how the tool works in practice, **Heena Mistry** (CMA) demonstrated the main features of the tool using a dummy dataset. Once the tool was downloaded, the following five simple steps illustrate how the tool works.

1. *Creating a file structure and saving the data* – the folder structure will allow the tool to find and analyse the data, therefore within a separate folder there should be sub-folders for buyers and then within each buyer folder separate folders for each tender associated with that buyer. Within each tender folder, the relevant Invitation to Tender (ITT) and any document or table which summarises the bids received, are to be saved. Then, within each tender folder, one must create separate folders for each bidder in which the full bid submission (including annexes) must be saved.

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[2] https://www.gov.uk/government/publications/bid-rigging-advice-for-public-sector-procurers

[3] https://www.gov.uk/government/publications/screening-for-cartels-tool-for-procurers/about-the-cartel-screening-tool

2. *Creating a 'bid-info' pricing .csv file for each bid* – In order for the tool to identify the file and extract the data it must use specific naming protocols, it must be saved in .csv format and the data must be presented in a specific way.

3. *Selecting the folder path and running the tool* – When the tool opens, a new test can be set up at any time by copying the template again or copying a previously saved version of the test. Once named, the user can click on the new test and the "Results Homepage" will open. The page has four main sections: (i) folder path, (ii) input data, (iii) adjustable thresholds and weightings, and iv) results table and suspicion score. On entering the folder path into section i), the tool will extract the data from the files and present it in the input data summary table. The information in the table can be edited by clicking the edit button.

4. *Amending thresholds and weightings* – the table describes each test and the pass/fail threshold. An explanation of the pre-set weighting is available on the CMA website. The thresholds and weightings have been set in light of the CMA's initial testing of the tool. However, the thresholds and weighting of each test can be adjusted to reflect more closely the knowledge of the market, the suppliers, the bids or the value the contracting authority places on a specific test.

5. *Interpreting the results* – the results are presented in an outputs table. Each row represents one tender (not each supplier). The bids and price data associated with the tender either pass or fail each test, and the tender as a whole is given a 'suspicion score' made up of the test outcomes weighted for significance. Where test data is incomplete, the result field will show a yellow triangle in the corner with some explanation of the data issue. The results data is stored on the user's computer and is not seen by anyone unless the user chooses to share it.

Further information on the tool can be found on the CMA web pages[4] and to request the tool along with a user guide outlining the steps above in more detail, please email the CMA at screeningforcartels@cma.gov.uk.

After the CMA, **Yavuz Karagök** (Senior economist, Competition Commission of Switzerland, ComCo) presented ComCo approach to screening, especially simple screens, partial screens and bid rotation test applied by the agency.

He started by explaining that ComCo has opened several bid rigging cases in the past years. However, the prosecution of bid-rigging cartels is difficult because ComCo generally needs to have insider's information to open an investigation. Firms usually submit leniency applications after the opening of the investigation not before. Therefore, in order to fight more effectively ComCo needs to reduce dependency on external sources, which raised the question of whether there is any method that can be used to detect bid-rigging cartels without requiring insider information or a leniency application. In 2008, ComCo decided to initiate a screening project to strengthen its fight against bid rigging. The aim was to elaborate a screening tool based on data that is available without the collaboration of possible cartel participants (no prior leniency). The required characteristics of the detection method were also defined as follows;

- It should provide evidence of reasonable grounds for suspicion, convincing non-economists (particularly judges) to launch an investigation *ex officio*.

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[4] https://www.gov.uk/government/publications/screening-for-cartels-tool-for-procurers

- It should use exclusively publicly available data, because the method should run in secrecy without raising the suspicion of potential cartel members.

- It should be a simple process to analyse large datasets; no systematic in-depth analysis of individual tenders.

In sum, the detection method should be simple and reliable. ComCo decided explicitly and consciously that to focus on "simpler" *behavioural* detection methods. The key milestones in the development of the method were as follows;

1. Start of the screening project (2008)

2. Data gathering process (data obtained in September 2011)

3. Elaboration and application of screening tools: indicated a high probability for the existence of a bid-rigging cartel in one region.

4. Opening of an investigation (15th April 2013)

5. Dawn raids (15th April 2013)

6. Closing the investigation (8th July 2016) - The investigation confirmed the results of screening tool. As a result, ComCo fined the members of the bid-rigging cartel.

7. Publishing of a Paper[5]

In terms of data and methodology, Mr. Karagök explained that ComCo relied on procurement authorities' tender data. Specifically, data from 282 tender (~1500 bids and 138 firms) on road construction in the canton of St. Gallen was analyzed for the period 2004-2010. Benchmark database relating to other cantons, such as Ticino and Aargau, was also used. As of the methodology, the ComCo mainly used descriptive statistics, such as variance and relative distance analysis. Results showed that variance was lower in tenders where bids were set collusively than in non-collusive tenders. The coefficient of variation (CV) captured the variance from the distribution of the bids and because the CV is scale invariant, it allowed comparison between tenders. ComCo found, as the literature suggests, that where the CV was smaller, collusion was more likely. Aside from variance, ComCo calculated relative distance test with the following formula: the difference between the two lowest bids divided by the standard deviation of the cover bids. A "relative distance" greater than 1 indicated potential bid-rigging activities.

The relative distance was developed by ComCo based on its experience from previous investigations. Results showed that bid riggers manipulated the auction by creating a notable difference between the bid of the designated winner and the "cover bids". ComCo observed a notable gap between the first and the second best bid. However, the gaps between the cover bids were very small. This pattern was indicative of bid rigging, because: 1) in practice price is an essential criterion to award contracts in spite of other non-price criteria (technical solution, quality or environmental aspects); 2) the gap between the first and the second best bid was notable, especially in view of witness statements stating that members of bid rigging cartels regularly make sure that the designated winning bid is 3-5% lower than the next best bid; and 3) the losing bids were close to each other not wanting to appear too expensive for procurement authorities and sending a negative signal concerning the price level.

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[5] David Imhof, Yavuz Karagök, Samuel Rutz; SCREENING FOR BID RIGGING — DOES IT WORK?, Journal of Competition Law & Economics, nhy006, https://doi.org/10.1093/joclec/nhy006

ComCo also presented its experience with screens for partial collusion. In some cases, bid rigging was found but not in all the tenders ('partial collusion'). Since such cases are usually difficult to identify, ComCo developed a combination of descriptive screens to target contracts, which simultaneously exhibit a low coefficient of variation and a high relative distance. The screens capture different aspects of the price setting behaviour of colluding firms. Results from previous investigations serve to determine the threshold values for both screens. In order to identify a subgroup or subgroups of firms, two criteria are used; i) frequent participation in conspicuous tenders and ii) regular simultaneous participation of the same firms in conspicuous tenders. In addition, ComCo analyses the geographic activities of the firms within the identified subgroups.

Based on these analyses, ComCo found that six firms identified in the subgroup are jointly active in the same region. ComCo concluded that the geographical analysis largely validates the results from the identification of the homogenous subgroup and can raise suspicions concerning local bid rigging. Aside from this, the test also revealed that transportation costs play a major role in the construction industry. The region under review borders several other cantons and such political frontiers may limit market access for potential competitors, while analyses of structural screens (number of bidders per tender and size of contract) showed no significant differences between the regions.

Finally, to identify collusive behaviour within the identified group, ComCo developed a 'cover-bidding screen'. Cover bids are typically calculated to ensure that the designated winner really wins the contract. Accordingly, the designated winner submits a "low" bid, while all other firms a deliberately "high" bid. In the absence of side payments, a cover bidding behaviour typically involves a rotation element. To test for cover bidding, ComCo analysed the (pairwise) bidding behaviour of the suspect firms and the interaction of the suspect firms within the identified subgroup. To ensure comparability, bids needed to be normalized. For each tender, the winning bid always gets assigned the value 0 while the highest bid gets assigned the value 1. The results indicated that the identified subgroup operated like a bid-rigging cover with cover-bidding mechanism.

ComCo concluded its presentation by highlighting that simple screens produced reliable results and for the construction industry in Switzerland. Simple screens use only data on bids (winning and losing bids), which is available from procurement agencies or statistical offices, if they are not publicly available. However, the size of the sample must be large enough. Moreover, simple screens are easy to understand even for non-economists and easy to implement, since they only require calculation of descriptive statistics per tender. Hence, they are suitable for competition agencies.

ComCo also considered other screening methods, such as econometric tests proposed by Bajari and Ye (2003), which is the most widely used detection method applied to bid-rigging cartels with two econometric tests. However, it produces too many false negative results when applied to the Ticino case and needs information on costs, which is difficult, to obtain when trying to detect bid-rigging cartels, therefore it is more data-intensive and time-consuming than simple screens. ComCo also noted that simple screens can be applied to markets other than construction if the context is comparable (i.e., first-price sealed-bid auction, where price is the most important criterion to award contracts; absence of side payments; repeated and sustainable bid-rigging cartels). Simple screens can also help to capture different possible forms of bid manipulation (see Imhof, 2017b; Imhof and Huber, 2018). Furthermore, competition agencies can examine the validity of the simple screens with former cases in other markets, and adapt them if necessary. In relation to the risk of possible strategic behaviour by companies to "beat" the screen, ComCo explained that

beating the simple screens implies more coordination from firms; and more coordination means that competition agencies can find more hard evidence. As soon as competition agencies know how firms try to beat the simple screens, they can adapt them. Deterrence effect caused by the use of the simple screens destabilizes existing bid-rigging cartels. Therefore, even though it is theoretically possible for some bid-rigging cartels to beat the simple screens, there have not been any examples of this in practice.

Finally, **Felipe Roquete** (Head of the Intelligence Unit) of the Conselho Administrativo de Defesa Econômica (CADE) presented their experience on screening and also showed how their methods can be translated into real cases.

First of all, Mr. Roquete gave an overview of the development of their cartel screening unit and their screening tool. He highlighted that CADE places great emphasis on the development and implementation of both reactive and proactive investigation techniques. The combination of both reactive and proactive investigative methods makes the development of innovative cartel detection tools more effective. Therefore, the knowledge and expertise brought by well-established tools, such as CADE's leniency programme, joint actions with other public authorities, methodologies for the treatment and investigation of complaints and analyses based on precedents, provided a favorable environment for creating and testing new approaches. In this context, in 2013 CADE set up a team to evaluate the possibility of creating in-house economic filters for detecting cartels.

The first stage of this initiative involved research on best practices related to the use of information technology applied by other antitrust authorities in cartel detection. With the support of experts from CADE's Department of Economic Studies, from the International Unit and from the General Superintendence, gathering information from other jurisdictions not only allowed CADE to map the advantages provided by innovative techniques, but also the main challenges faced in the implementation of similar projects. In parallel, CADE sought to develop partnerships with other Brazilian public authorities with expertise in the use of big data, such as the Federal Court of Accounts (TCU), the Ministry of Inspection, Transparency and Control (MFTC) and the Council for Financial Activities Control (COAF).

The initial findings pointed to *public procurement* as the most appropriate area for the project since (i) there would be more data available, bearing in mind the public status of procurement within public bodies; and (ii) that the fight against cartels in public procurement would have a relevant impact in an economy with considerable public expenditures, such as the Brazilian economy. CADE's bid rigging investigation unit was favorable to the development of economic filters, since its experience demonstrated that cartels harm a significant set of public tenders. In addition, the economic filters strategy requires a significant amount of data to be analyzed regarding the bids procedures and information concerning the companies' conduct and strategies of coordinated action. This analysis would only be feasible and effective with the support of robust IT and statistical tools.

The project's second stage, initiated in 2014, involved hiring consultants with specialized knowledge in the field of statistics, IT and data mining, with the purpose of developing analytical tools. The development and the review of the proposed tools involved both the authority's cartel experts and experts from the Department of Economic Studies, who designed the tools using the highest investigative and technical standards available. Based on the products delivered by the consultants, CADE developed an interface called *Cérebro* (the "Brain"), incorporating data, data-mining instruments and statistical tests, as follows:

- Data warehouse – set of public and private database in a one, searchable IT language,
- Data mining – i) patterns and similarities in competitors behavior, ii) suspicious facts, iii) signs of simulation of competition,
- Statistical Tests – i) screenings literature, test of hypothesis, ii) generalizations based on previous cartel cases, iii) microeconomic theory.

The data mining tools allow automating analyses that formerly required work by investigators and case handlers. The objective of this set of techniques is both the identification of evidence of cartels in public bids, like suspicious, implausible facts or behavioural patterns, and the provision of relevant information for the investigation of the cases. Statistical tests, based on the literature, especially on econometrics, seek to generalise evidence on the existence of cartels based on data related to prices, costs, profit margins and market shares. Through the identification of companies' behavior as described in academic articles, it was possible to derive mathematical models as statistical tests of general use. Despite the ongoing development of this set of techniques, many of its tools – data mining tools and screening ones – are already in operation and are undergoing steady improvement through continuous testing.

In terms of the application of the tool, CADE pointed out three areas of use; i) ex officio investigations, since it provides enough evidence for dawn raids, ii) support and enhance ongoing investigations and iii) general support of data for all units of CADE.

In the project's current stage, CADE identified a number of challenges worth considering during the implementation of similar initiatives:

- *Data.* The access, comprehensiveness, quality of the data is crucial for the effectiveness of the tool. In this respect, the agency should aware of the cost and the requirement of human resources, as well as the difficulties relating to the recruitment and training of specialist staff in data science, which play an important role from database infrastructure up to specialized algorithms.

- *Institutionalization and areas of use*. Despite being innovative in nature, given the complexity of the techniques involved and the fact that such innovation requires a certain amount of time for tests and improvements, it is important to embed the project within the competition authority's institutional structure in order to ensure its sustainability over time. In terms of the use, screening can be relevant in many ways, from intelligence gathering, priority setting, and investigation of cases. For example, a variance screen can be used to analyze and eventually reject complaints. In a limited number of cases, the results of the screening program allowed to flag possible cartel behavior.

- *Emphasis on the final user:* the use of data mining and economic filters does not imply the obsolescence of the case handler and/or investigator. The development of the parameters of such tools relies on the knowledge and the experience of analysts regarding cartel activity. Analysts are indispensable for identifying evidence of collusive conduct, the backbone of both data mining modelling and filters' algorithms. Such individuals are crucial for the activities, testing and improvement of these mechanisms.

Moving on with the case simulation, CADE provided an overview on its public procurement data. The Federal Government's e-procurement system contains information on 60.000 public tenders on a yearly basis. In general, the tool looks for patterns, such as

bid suppression, cover bidding, bid rotation, superfluous losing bidders, stable market shares, pricing patterns, text similarities and metadata in submitted files. Although CADE had to face differences in data from different institutions and their impacts on the replicability of the filters, the strategies used by the companies, especially in tenders, do not vary much. Thus, it is always important to analyze, test and validate the filters used: for example, the so-called Benford Law (or Benford / Newcomb) is used to identify possible "invented numbers" (from analysis of the first digit frequency of the numbers) and shows possible discrepancy between the frequency of the first digit of a certain set of numbers. This can indicate possible fraud. The database of Brazilian public tenders, considered all closed proposals presented in bids made since 2011, indicates that the Benford Law is respected by this set.

To conclude, CADE's experience with the development of project Cérebro demonstrates that the use of pro-active techniques for the detection of cartels works as an additional incentive for reactive tools. In other words, screening certainly serves as an additional incentive for companies to submit leniency applications, to sign Cease and Desist agreements and to report anticompetitive conducts to CADE.

The afternoon session of the workshop was closed by some concluding remarks by the moderator. **Antonio Capobianco** highlighted that agency experience shows that there are many different approaches to cartel screening, ranging from sophisticated software tools based on complex algorithms to simple and easy statistical methods. Neither of them is mutually exclusive. For example, the CMA and CADE combine structural and behavioural approach that is considered as the most efficient way to detect suspicious behaviour. Due to the data available on tenders, screens are mainly developed to detect bid rigging conspiracies, which represent a significant share of cartel enforcement in most jurisdictions. The growing availability of data and computing power provides us new ways of detecting atypical signs or unusual bidding behaviour. Thus, empirical screens can largely support regular detection tools used for law enforcement. In spite of their limitations and risks of false negatives or false positives (i.e. failure to detect or incorrectly flag cartel signs), developing screening techniques can generate deterrence and provide even stronger incentives to firms to enter into amnesty/leniency programmes.

Finally, **Antonio Gomes,** Head of the Competition Division, addressed the audience with concluding remarks and noted the developing an own screening tool is not an easy task, as it can be very resource and data intensive and it requires determination. However, the workshop covered theoretical as well as practical aspects of cartel screening and also provided meaningful insights into different experiences, which may serve as an inspiration for future work.