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ARTÍCULOS

Cartel screening data as evidence under EU case law

Screening data de carteles como evidencia bajo la jurisprudencia de la Unión Europea

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ABSTRACT This work develops in-depth topics related to data screening as evidence in a cartel investigation under European Union case law. The analysis of these aspects concerning the use of screening results as evidence rests on the review of European case law that allows one to shed some light on the principles that apply to these cases. The first part of the paper analyses, the different methods of cartel detection in general terms. Subsequently, focusing specifically on data screening, the adoption of this method by competition agencies in various jurisdictions is examined. The review then focuses on the different categories and types of cartel screening documented in the field literature, as well as the several benefits and drawbacks in the use of this detection tool as identified by the doctrine. Finally, it examines the relevant European Union cases to build both a correct standard for the performance of the inspections when decisions are based on the results of data screening, and a determination of the proper assessment of the results to find an infringement under Article 101 of the Treaty on the Functioning of the European Union.

KEYWORDS Cartel, collusion, cartel detection, data screening, dawn raids.

RESUMEN Este trabajo desarrolla en profundidad temas relacionados con el uso de *data screening* como evidencia en casos de investigación de carteles bajo la jurisprudencia de la Unión Europea. El análisis de estos aspectos, referidos al uso de resultados de *screening* como evidencia, descansa en la revisión de jurisprudencia Europea, la que permite arrojar cierta luz sobre los principios aplicables a este tipo de casos. La primera parte del trabajo analiza, en general, los diferentes métodos de detección de carteles. A continuación, específicamente respecto al *data screening*, se estudia su adopción por parte de agencias de competencia de distintas jurisdicciones. Luego, la revisión se centra en las diferentes categorías y tipos de *screening* de carteles, que se encuentran en la

literatura especializada, así como en el estudio doctrinario de los distintos beneficios de su uso como herramienta de detección y la identificación de sus principales dificultades. Finalmente, se revisan los casos de la Unión Europea relevantes para la construcción de un estándar correcto para la ejecución de allanamientos, cuando la decisión se ha fundado en los resultados de *data screening*, así como el adecuado análisis de los resultados indicados anteriormente para la determinación de una infracción al artículo 101 del Tratado de Funcionamiento de la Unión Europea.

PALABRAS CLAVE Cartel, colusión, detección de carteles, *data screening*, allanamiento.

Introduction

Traditionally, the most essential tool for competition agencies worldwide to detect cartel activities has been leniency applications. However, in recent years, the available information shows that leniency applications have declined (OECD, 2022a: 46).[1] In this context, searching for other mechanisms to detect hidden cartels became highly relevant as the prosecution of cartel offences remains one of the top priorities of competition agencies. The Directorate-General for Competition (DG COMP) of the European Commission is no exception in facing these challenges. For example, the Chief Technology Officer position recently created by DG COMP will be in charge of overseeing the ever-increasing need for state-of-the-art data analytics and will be at the technological forefront to pursue digital investigations, including digital forensics, intelligence, and artificial intelligence (AI), or any other digital developments. The establishment of this new position is, to some extent, a response to the decline in leniency applications and the development of new detection tools.[2]

Another method that has been developed in recent years is the use of digital screening tools to detect instances of collusion. Since an early discussion in an OECD Roundtable in 2013[3], this tool has been widely adopted by competition agencies in different jurisdictions. Despite the difficulty in obtaining information about their use because of confidentiality issues, the various screening methods have shown real benefits through successful detection cases and other beneficial purposes that go be-

1. For the first time since 2015, when the OECD began collecting the competition statistics data, the total number of leniency applications increased in all regions in the Competition Trend 2024 Report, reversing the previous downward trend. Nevertheless, only four jurisdictions were responsible for most of the increase.

2. European Commission, "Chief Technology Officer in DG COMP (grade AD14 – Temporary Agent) – COM/2024/10446", available at https://tinyurl.com/2p8y855j.

3. The OECD Competition Committee discussed *ex officio* cartel investigations and the use of screens to detect cartels in October 2013 to explore the various screening methods used by agencies and their successful experiences with the implementation of such screens in case enforcement.

yond their use by competition agencies. However, while the benefits are clear, the use of these tools also presents certain challenges that need to be addressed.

In this work, we will further develop topics related to data screening as evidence in a cartel investigation under EU case law. In this sense, it is relevant to establish a correct standard of proof to initiate ex officio a cartel investigation, discovered by screening, and to conduct a dawn raid. Furthermore, setting this standard correctly is vital for a correct evaluation by judges when issuing a warrant or in the case of an ex-post revision of the inspection decision. Dawn raid powers are an essential tool in cartel investigations in the context of the lack of a leniency application. Finally, a correct standard is also relevant for the procedural guarantees of undertakings.

Another topic that will be analysed is the correct assessment of the screening results, now as evidence of a cartel offence infringement. The relevance of this review is to provide clear guidance to judges, who may not be particularly familiar with the functioning and understanding of data screening results, in cases where the Commission would like to substantiate its decision, totally or partially, on this information. This guidance will help ensure that judicial decisions are informed and that the evidence is appropriately weighed in legal proceedings.

The analysis of these aspects concerning the use of screening results as evidence will rest in the review of European case law that allows us to shed some light on the principles to apply to these cases. The structure of this work will be as follows: first, will analysed, in general, the different methods of cartel detection; second, will be reviewed the different categories and types of cartel screening found in the field literature; third, will be studied their adoption of data screening by competition agencies of various jurisdictions; fourth, we will study the several benefits and the most typical drawbacks of the use of this detection tool; fifth and sixth, we will study the relevant EU cases to build a correct standard for the performance of inspection when the decision is issued on the basis of data screening results, and the determination of the proper assessment of the results mentioned before to find an infringement under Article 101 of the Treaty on the Functioning of the European Union (TFEU); and finally, our conclusion will summarize the findings and implications of our study.

Cartel Detection Methods

The pernicious consequences of cartels are clearly identified by the legal and economic doctrine: typically, collusion produces higher prices, lower quality, less variety of goods and less innovation. In general, the expert literature identifies these allocative inefficiencies that cartels produce as a cause of loss of total welfare of society and significant economic damage (Beth and Gannon, 2022: 77). Between 1990 and 2016, international cartels affected nominal sales of over USD 50 trillion and incurring in

gross overcharges of more than USD 1.5 trillion. In total, over 100 thousand corporations were found guilty of international price fixing (Pachnou and Westrik, 2023).

Because of the above-mentioned reasons, the sanction of hard-core cartels has become a priority for OECD member competition authorities (Pachnou and Westrik, 2023). At the same time, cartel activity continues to be vigorous. Between just 2010 and 2016, seventy-five international cartels were discovered each year (OECD, 2022b: 10). Despite the effort by competition enforcement, it is estimated that there are still a significant number of cartels that remain undiscovered. For example, it has been estimated that the annual likelihood of a cartel being detected in the European Union is only around thirteen per cent (Combe, Monnier and Legal, 2008: 17). Moreover, according to DG COMP statistics, cartel decisions have steadily decreased from 33 in the 2005-2009 period to 19 in the 2020-2023 period (European Commission, 2023: 4). As stated in an OECD report, there are two possible explanations for the decline in cartel decisions: the decrease in ex-officio investigations between 2016 and 2021 (including decrease in investigations due to covid during 2020-21) and the consistent decline in leniency applications since 2015 (OECD, 2024: 4).

In general, cartel detection methods have been divided into two categories: reactive and proactive methods (Zlatcu and Suciu, 2017: 17). Reactive methods are characterized as third-party information that is provided to competition authorities. These methods include leniency applications from cartel members, information obtained from whistle-blowers, complaints received from competitors, customers or consumers, and information provided by other competition agencies. Conversely, proactive methods consist of detection activities from the competition authorities by their own initiatives. These proactive methods typically include sector inquiries or market studies, which involve reviewing markets to ensure that competition is functioning properly, and industry screening through economic and data analysis.

Without a doubt, leniency applications have been the main focus of competition authorities as it has shown to be the most effective tool in detecting and deterring cartels (Beth and Gannon, 2022: 77). Nevertheless, competition enforcement cannot continue to depend almost exclusively on it as a detection method of cartel activity. As it has been characterized by some authors: "[t]here is no other area of criminal investigation which essentially waits for the guilty to confess as its key detection tool" (Abrantes-Metz and Metz, 2019: 2). This is not only a matter of principle; from a practical perspective, developing new detection tools is essential because the number of leniency applications in recent years has declined. Specifically, between 2015 and 2020, leniency applications have been reduced worldwide by sixty-four per cent and, in the European case, seventy-one per cent (OECD, 2022a: 46).

There are also theoretical grounds not to rely solely on leniency applications. Some authors have stated that leniency programs are an effective tool mainly for unsuccessful and unstable cartels that are about to collapse, but in the case of sophis-

ticated and profitable cartels, their effectiveness may be limited (OECD, 2013: 5). Additionally, this work argues that leniency applications tend to detect cartels only of a particular type of industry and not across the whole economy. Finally, in the case of small economies, leniency applicants have less incentive to go to the authorities because the likelihood of commercial retaliation against them is higher in concentrated markets (OECD, 2013: 5).

The latter does not mean competition enforcement should abandon reactive detection methods, such as leniency programs, but rather that a mixed cartel detection policy approach should be adopted. Specialized literature has argued that proactive techniques, such as data screening, can produce positive externalities like improving the efficacy of leniency applications (OECD, 2022a: 10). The reason for this is quite simple: the possibility of a leniency application increases when the detection rate by competition authorities is higher. The incentives of an applicant are higher if the "race for leniency" is complemented with a proactive detection tool that increases the possibility of detecting the cartel.

Categories of Cartel Screening

Cartel screening has been defined as "a method to detect and validate anomalies that may be indicative of cartel activity through (usually) a quantitative analysis of procurement data in accordance with competition economic theory" (Beth and Reimers, 2019: 3) or, in a broader definition, "a cartel screen is a data-based method by which suspicious patterns, indicative of possible cartel activity, can be identified" (Beth and Gannon, 2022: 78). The mentioned suspicious patterns will rise when the screen results in outcomes typically related to cartel behaviour or when they are not associated with what usually will produce a competitive environment.

The specialized literature in the field has identified different categories of cartel screening. The main ones are sales screens/procurements screens, screening with priors/screening without priors, and screens of tender bids/screens of posted market prices (Beth and Gannon, 2022: 3). Nevertheless, without a doubt, the most crucial distinction is between structural screens and behavioural screens.

Structural and behavioural screens

Structural screening consists of an analysis of the characteristics of a market structure to identify if that specific market tends to form cartels. Some of these structures are market concentration, entry barriers, frequency of undertakings interaction, horizontal and vertical product differentiation, innovation and advertisement level, demand stability, and buyer bargaining power (De Cooman, 2023: 4). It is important to highlight that a positive result from a structural screen does not imply that an actual

cartel exists, but rather indicates that, in abstract term, the specific market has a high risk of collusion (Beth and Gannon, 2022: 79).

In the 2013 OECD policy roundtable, this type of screening was typically used by competition authorities to confirm previous suspicions or to identify markets or industries that raise red flags that a cartel is more likely to occur and, therefore, may require more detailed scrutiny (OECD, 2022b: 8). In the case of internal use of such tools by private entities a positive result in the screen may require further compliance efforts to avoid the risk of collusion.

On the other hand, behavioural screens observe the conduct of undertakings that may indicate the operation of a cartel in a specific market. It monitors information at a firm level instead of a market level. This is conducted by observing the methods or the outcomes of an operational cartel through patterns of unusual and unexplained behaviour incompatible with proper competition (De Cooman, 2023: 4). Usually, the methodology to perform this exercise consists of selecting markers or flags by developers to distinguish between conduct consistent with regular competition from the collusive one. For example, in settings where a product is sold in geographically different markets, but sufficiently similar to be used as a benchmark, higher prices can be used as a collusive marker. In a case like this, a market would be flagged when the price is high relative to the average price across all markets (Harrington and Imhof, 2022: 137). In the second place, it is necessary to identify structural breaks or exogenous shocks that explain the change in the company's conduct (OECD, 2022b: 8).

This methodology focuses on low-price variance, a sharp increase in high price/cost margin, a sharp decline of price followed by a sharp rise, homogenization through the expansion of product standardization and pricing formula, a decrease of customer-specific prices, stabler distribution of market shares, stabler customer base, buy-back, and compensation scheme. Specifically, the behavioural screens attempt to identify collusive markers such as high price in comparison with some benchmark competitive price, structural break as an abrupt change in price, and anomalies like below-cost pricing in the data-generating process (De Cooman, 2023: 4).

Since the discussion by the 2013 Roundtable, the focus of development by the academia and by competition authorities has been behavioural screening. This evolution starts with the early use of econometrics and, especially during the last years (OECD, 2022b: 16), an increased interest in using machine learning to optimize the prediction of whether a conduct is consistent with collusion.

Evolution of behavioural screens

The OECD Roundtable discussion of 2013 identified a greater focus by national authorities on structural screens based on theoretical economic research regarding the

rationality and stability of cartels (OECD, 2013: 20). The early adoption of this type of screen can be attributed to its relatively straightforward and simple implementation. This is because it does not require extensive staff training or the use of complicated econometric analysis during the screening process (OECD, 2013: 20). Since this report, the interest in using behavioural screens has increased considerably, as mentioned before by the adoption of several competition authorities.

Traditionally, the use of behavioural screens has rested primarily on economists and in the use of econometrics. In simple words, econometrics has been defined as "the application of statistical methods to economic problems", and they have long been used to predict outcomes (Abrantes-Metz and Metz, 2018: 2). Behavioural screens require a solid economic theory behind them because they require distinguishing between competition and collusion. The difficulty in making the mentioned distinction is why collusive markers rest in extensive literature labelled "theory of collusion".[4] The discussion regarding type I and II errors will be studied in section 4.1. A review of academic papers on digital screens shows that the abovementioned solid economic theory is usually also supported by empirical testing (OECD, 2013: 26).

Lately, an increase in the availability of large amounts of digital data regarding prices and quantities and the development of new technologies, which can allow its automatic extraction and analysis, has enabled the creation of new screening methodologies, the most popular one being machine learning methods (OECD, 2022b: 9-10). The main reason for this focus in the last six years of the academic literature and the competition agencies in machine learning techniques is the potential optimization in predictions in whether a conduct is consistent with collusion (OECD, 2022b: 16). It is vital to notice, previously, that competition agencies and their economists have been using data to empirically screen cartels for many years, as we mentioned before. It is not new either that while the data sets have grown larger and, at the same time, technological power has increased, the use of non-parametric or "unstructured" techniques has also augmented (Abrantes-Metz and Metz, 2018: 3). As mentioned, there is a continuum that is difficult to define from large sets of data that transform into big data, and when screening methodologies become "machine learning" (Abrantes-Metz and Metz, 2018: 3).

Machine learning is a subfield of artificial intelligence. AI has been defined as "the science and engineering of making intelligent machines through the use of algorithms that iteratively learn from data and experience", and machine learning gives "computers the ability to learn without being explicitly programmed" (OECD, 2017: 9). Furthermore, machine learning also has been characterized as "an application of minimal-structure pattern-matching algorithms to (i) infer a classification rule from a training data set and (ii) make useful predictions on new data" (Abrantes-Metz and

4. For a further discussion about the "theory of collusion", see Harrington (2006: 5).

Metz, 2018: 2). Over-simplifying, machine learning's main goal is to predict and classify (Abrantes-Metz and Metz, 2018: 2).

Mainly, three different types of machine learning approaches have been defined. The first approach is supervised learning, which uses inputs, also known as predictors or independent variables, to estimate an output, described as the response or dependent variable. This typically relies on a training dataset of solved cases, known as "tagged" or "labelled" data, which provides a sample mapping of inputs to the output (OECD, 2022b: 16). Most academic studies use this method because it is very well suited for cartel screening, allowing to reliably predict if a price or bid is collusive or not because it would be labelled as such. On the contrary, the downside of this methodology is that "the absence of cartel evidence is not the same as the evidence of cartel absence" (Deng, 2017: 499).

The second type is unsupervised learning. In the same way as supervised learning, this method estimates an output from an input. The main difference is that it uses "untagged" or "unlabelled" data. In this case, a set of inputs has an underlying probability distribution. The goal is to determine this probability distribution without the help of a supervisor indicating when an allocation is correct (OECD, 2022b: 17). This methodology is the second predominantly used by academic literature mainly to identify groups of firms that frequently interact because it can identify suspicious outliers, since it looks for cases or data points that are most dissimilar from the "norm" (Deng, 2017: 499).

Finally, the third type is reinforcement learning, which also uses "untagged" or "unlabelled" data but, differently than unsupervised learning, uses a performance criterion that rewards a positive outcome and punishes a negative outcome, learning through "trial and error" (OECD, 2022b: 17). According to the OECD report of 2022, this methodology has not been found in the academic literature of cartel screening.[5]

Increased Use of Data Screening by Competition Authorities

Considering the effectiveness and positive externalities of cartel screening tools, it would be expected that competition authorities worldwide would incorporate data screening into their competition enforcement toolkits. Nevertheless, it is difficult to conduct that review because there is a lack of public information in this regard (OECD, 2022b: 9). Mainly, the secrecy by the authorities is based on not providing information on cartel detection tools to undertakings to prevent them from adapting and sophisticating their anticompetitive conduct to avoid detection. On the contrary, other competition agencies publicly announce their screening initiatives to act as a

5. For examples of different supervised and unsupervised machine learning techniques used in recent academic literature on cartel screens see Annex B of the OECD report of 2022 (OECD, 2022b: 40).

deterrence of incurring in illegal conduct or, in the case of conducts that are already being executed, create extra uncertainty inside the cartel and, ultimately, incentivize leniency applications.

Although there is a challenge to the availability of public information, some of it is accessible. An early systematic effort to discuss international screening methods was the policy roundtable concerning *ex officio* cartel investigations and the use of screens to detect cartels in 2013. During this policy roundtable, twenty-four competition authorities provided written submissions on the status of the development of cartel screening in their respective jurisdictions. The main conclusion of the roundtable was that many of the participating jurisdictions utilized some type of cartel screening. Still, their use was in specific cases or to confirm previous suspicions (Beth and Gannon, 2022: 81). The focus in this early stage of using these tools was to aid competition authorities identify potentially risky markets where cartel activity is more likely requiring further investigation. This was conducted mainly through structural screens; consequently, behavioural screens were more limited (OECD, 2013: 9).

Since the 2013 OECD policy roundtable, we have gathered more information to conclude that there has been a proliferation and sophistication of cartel screening by national competition authorities. For example, with details until 2016, a survey by the International Competition Network showed that fifteen of the twenty-seven questioned competition authorities were performing some type of screening (Harrington and Imhof, 2022: 134). Additionally, some authors presented a list of fourteen jurisdictions that publicly announced the adoption of screening. Furthermore, in an OECD report from 2022, four jurisdictions were highlighted as examples of the use of digital cartel screens: Brazil and their bid rigging detection tool Cérebro; Colombia and their public procurement data analyst Sherlock; Singapore with their in-house detection tool Bid Rigging Detection Tool; and the Catalan competition authority and their cartel-screening tool ERICCA (OECD, 2022b: 11-12). Finally, in the first quarter of 2023, the Stanford Computational Antitrust project team invited the partnering antitrust agencies to share their advances in implementing computational tools, cartel screens as one of them, receiving twenty-six different contributions (Schrepel and Groza, 2023).

The current development and broad adoption of data screening tools by competition authorities worldwide is facilitated by an increased availability of large amounts of data on prices and quantities. Additionally, there is also a rise of new technologies that have enabled the development of new screening methods that improve the accuracy of screening results (Schrepel and Groza, 2023: 145). This further development has also allowed the expansion of the use of these techniques, for example, in the use of screens in antitrust compliance programs by private entities such as Deutsche Bahn (Beth and Reimers, 2019: 3).

Difficulties and Benefits in the Use of Behavioural Cartel Screening

Difficulties with the use of screening tools in EU cartel enforcement

There are two main groups of challenges in adopting behavioural cartel screening tools by competition authorities: data-related issues and human resources issues. Regarding the first group of challenges, we can divide them into data access, including a prominence in the use of procurement data, access to quality data and data governance and management problems.

Data access

Data access is an essential input to conduct cartel screening. This data needs to be accessible, robust, and useable (OECD, 2022b: 19), and it would define the type of empirical analysis that the competition agency can perform and its design. It would also be relevant during the implementation phase of the screening process and even during the interpretation of its results. In the case of machine learning, screening is essential for the obtention of a specific dataset to train the AI system to detect collusion in a different dataset. Without access to a sufficiently large volume of data, the training will be incorrect due to incompleteness (De Cooman, 2023: 6).

In particular, the central challenge competition authorities face in data access is the obtention of raw and disaggregated data that is not publicly available. Because of obvious detection problems, this information cannot be requested from the companies under investigation. There are different data sources where agencies can obtain data from (OECD, 2022b: 19-20): first, from publicly available information from companies' registries, chambers of commerce, and e-procurement platforms. Second, information is kept by public sector authorities, including sector regulators, government bodies and procurement entities. Third, through web-scraping, that has been defined as a "method for crawling websites and automatically extracting structured data on it. The use of algorithms may greatly facilitate the data collection process, as well as data analysis" (Lianos, 2021: 27-28). Finally, data can also be purchased from private commercial data providers.

Prominence of procurement data

The need for data availability is the main reason why there has been a focus by academia and competition agencies on the use of public procurement data to detect bid-rigging cases. Bid rigging is an anticompetitive conduct where firms conspire to raise prices or lower the quality of goods or services offered in public tenders (Imhof, Karagök and Rutz, 2018: 235). This practice is highly harmful to governments and taxpayers because procurement amounts represent on average twenty-nine per cent

of the government expenditure in OECD countries and up to a thirteen per cent of GDP (Imhof, Karagök and Rutz, 2018: 235). This practice is a fertile ground for the application of screening methods because data is available in national and sub-national e-procurement systems (OECD, 2022b: 20). All the detection tools mentioned before, Brazil (Cérebro), Colombia (Sherlock), Singapore (Bid Rigging Detection Tool) and the Catalan competition authority (ERICCA) are examples of bid rigging detection tools.

Because of the many cases of use of digital procurement data to detect bid rigging through screening, it has been possible to identify possible defects and omissions in data availability. The first identified defect is the absence of centralization and data fragmentation. This lack of centralization implies that there is not a comprehensive dataset to conduct the screening properly (OECD, 2022b: 20). This situation will be more acute in the cases of federal countries where the data of public tenders will be managed at a national level, a regional or state level, or even municipal level.

A second challenge is that the available data of tender offers may not be machine-readable when the data is not recorded in a consistent format or contains mistakes. Because of that, it cannot be directly incorporated into the digital screen without a cleaning process that can be resource-intensive, depending on how it is conducted. The most intensive resource method would be to clean errors manually by the extraction, structuring and cleaning to form a consistent dataset. Automated techniques, like matching algorithms, have been proposed to save time and agency resources (Fazekas and others, 2022: 26).

A third problem in using screening in public procurement is the need for a sufficiently comprehensive database to be able to conduct reliable analysis. For example, according to an OECD report, most European countries' procurement data only register the bidding and evaluation phases and do not record information on contract implementation or modification (OECD, 2022b: 21-22). Some recommendations to address this problem have been to issue the publication of guidance from governments on procurement data submission and storage or legislative changes to facilitate data sharing between regulators, public procurement bodies and competition authorities (OECD, 2022b: 23). For example, in Chile the competition authority conducted a market study on public procurement and published some recommendation on 2020 regarding the management of digital documentation and the update of the public procurement portal.[6]

6. Fiscalía Nacional Económica, "FNE publica Informe Final sobre Estudio de Mercado de Compras Públicas y envía al Ministerio de Hacienda recomendaciones para mejorar el sistema", 4 de noviembre de 2020, available at https://tipg.link/NU7L.

Availability of quality data

Another essential input to conduct cartel screening is data quality. This has been especially highlighted in the case of AI-driven cartel screening (De Cooman, 2023: 7). AI-based systems, such as machine learning, can be trained with the "entire universe of data" or on statistically representative data. Ideally, these systems require data access at a speed that mirrors the market activity (De Cooman, 2023: 7). Nevertheless, this quality data may not always be available. As we have seen before, data from undertakings is impossible to obtain in the early stages of confidential cartel investigations, and publicly available data and aggregated data may not be trustworthy.

The data quality challenge is particularly relevant in machine learning screening because, differently than previous automatization mechanisms, these systems "require to figure out their own by making inference from data" (De Cooman, 2023: 7). The direct consequence is that inferences from non-quality data would provide non-reliable results: "if you put garbage in, you get garbage out" (Abrantes-Metz and Sokol, 2012: 11). Nonetheless, a realistic approach is required to consider the possibilities of errors in detection by cartel screening and, specifically, the chances of type I and II errors, as explained in the next section.

Risk of incurring in type I and II errors

Screening tools provide economic evidence that is sometimes ambiguous and can be evidence of both independent and collusive behaviour. Thus, we can say that they inherently have the risk of incurring in type I or type II errors (OECD, 2022b: 15). Type I errors correspond to mistakenly identifying a cartel where there is none (false alarm or false positive) and type II errors, or false negative, involve the non-detection of a cartel despite its existence (De Cooman, 2023: 7-8).

Type I errors are more likely in the case of structural screens. As mentioned, these screens have a broader scope and are less sophisticated than behavioural screens. For example, this type of screen would flag a concentrated market with high barriers of entry, which is not by itself collusive (De Cooman, 2023: 7-8). As mentioned, structural screens are based on data about an industry, which makes it more likely that a cartel "will form" and, in contrast, the behavioural approach uses data that is itself evidence that a cartel "has formed". Joseph Harrington states, "[a]t the heart of this problem are omitted variables" (Harrington, 2006: 3).

Behavioural screens can also incur in type I errors. It is essential to analyse the screen results carefully because different legal and illegal circumstances may explain the conduct. For example, price correlation can be the result of collusion, tacit collusion or even coincidence (OECD, 2022b: 15). From an evidence-based perspective, it has been argued that constitutes a hard-to-dismiss presumption of collusion, the

more asymptotically safe the test is. A test is asymptotically safe if it admits a small rate of false positives (De Cooman, 2023: 8).

False positive errors are problematic for the detection of cartels mainly for two reasons. On one hand, type I errors can lead to initiate an unjustified investigation. This cost is particularly troublesome considering the limited resources that competition agencies have. On the other hand, after the non-collusive finding of the conduct, the competition official may lose confidence in the system, disregarding subsequent recommendations even if they are positive (De Cooman, 2023: 9). Nevertheless, it is vital to notice that the resource-intensive concern about screening will be increasingly mitigated by the development of less expensive and more sophisticated technology as it is the case of AI, and specifically, machine learning algorithms (Abrantes-Metz and Metz, 2019: 4).

In the case of type II errors or false negatives, the situation is the reverse. These errors are less likely while applying structural screens because collusive behaviour is more difficult to sustain in markets without facilitating factors for collusion. On the other hand, false positives are more likely to occur while conducting behavioural screens when they are applied in a different context from that for which they were designed (OECD, 2022b: 16). The reason for this is that the specific screen may fail to identify an illegal activity that was not incorporated in its design. For example, some authors found an increase in false negatives when using a model trained on Japanese auction data when applied to Swiss auction data (Huber and others, 2020: 1015).

However, a correct specification of the collusive model is complex because "there exists a lot of different ways that lead to collusion" (De Cooman, 2023: 7). De Cooman provides an interesting example using a cartel case regarding the sale of feed phosphates used in animal feed.[7] On one hand, abrupt changes in price or price-cost margins have been argued as an effective type of behavioural screen, because statistically, cartels form when companies experience or anticipate price decreases (De Cooman, 2023: 7-8). On the other hand, the Animal feed phosphates cartel was set up precisely when there was not such decrease and, in consequence, a behavioural screen based only in price would have resulted in a type II error. The conclusion is that there are no fool proof markers, which are highly relevant to the specific design of the screens and the circumstances in which they will be applied.

A recommendation by the OECD to minimize type I and II errors is adopting a multi-screening approach (OECD, 2022b: 14). This is to conduct a series of screening tests rather than a single one, and this methodology could be facilitated by adopting machine learning techniques (De Cooman, 2023: 7-8). An example may show the beneficial aspect of using multiple screens and the interaction between different

7. Case COMP/38866 ("Animal feed phosphates") Commission Decision of 20 July 2010.

markers. According to some literature, "demand fluctuations hinder collusion" (De Cooman, 2023: 7-8). On the other side, a demand increase encourages collusion in cases where entry barriers are sufficiently high to prevent the entrance of new competitors into the market (De Cooman, 2023: 7-8). In consequence, only conducting a screening on demand stability would lead to a type II error. The conclusion would be entirely different if this screening were complemented with a structural one, considering the high entry barriers that would mitigate the demand fluctuation. Nevertheless, it is essential to remember that although machine learning can identify patterns, it is "poorly suited for predicting all the forces in the economy" (Schrepel, 2021: 13).

False positives can also arise from selection bias in the available data (De Cooman, 2023: 8). This bias can be observed in the specialised literature regarding screening and the creation of collusive markers that rest exclusively in data of discovered and successfully prosecuted cartel investigations (De Cooman, 2023: 8). As we know, most of the obtained data comes from leniency applications. Still, it is not evident that this portion of discovered cartels is representative of the total of cartel cases. This is especially true if the detection of cartels in the EU is shallow (Combe and others, 2008: 17). In this sense, the bias is to construct markers with data of a sub-group of cartel cases: "ineffective cartels".

It is important to note that although there may be instances where cartel screening results in erroneous outcomes, this does not negate the value of utilising this method. Abrantes-Metz defended it with an analogy between cartel screening and medical screening: we do not say that the latter lack value, even if they contain a specific rate of errors, so "why should we hold cartel screening to an inexplicably high standard not satisfied by any other screening procedures?" (OECD, 2013: 233).

Data governance and management practices

Cartel screening will be as effective as the data set used to conduct it. This is even more relevant in the case of AI-driven screens, as the algorithm needs to be adequately trained to distinguish between competitive and non-competitive behaviour. The training effectiveness will depend on the characteristics of the available dataset. For the abovementioned reasons, the analysis of data governance is relevant to reduce the possibilities of type II errors. One useful reference in this respect is the discussion about the AI Act proposal by the European Commission in 2021[8] and the Adopted text by the European Parliament in 2024.[9]

8. European Commission, "Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act) and Amending Certain Union Legislative Acts", Brussels, 21.4.2021 COM (2021) 206 final. ("AI Act Proposal").

9. European Parliament, "European Parliament legislative resolution of 13 March 2024 on the proposal for a regulation of the European Parliament and of the Council on laying down harmonised ru-

For example, Article 10(2) of the AI Act Proposal established the requirements regarding data governance for providers of AI systems, stating that "[t]raining, validation and testing data sets shall be subject to appropriate data governance and management practices". Even though, the importance of data governance has been highlighted, the concept of "appropriate data governance" has been the subject of criticism because of the need for further improvement, in the sense of a lack of clarification (De Cooman, 2023: 19). Furthermore, the AI Act Final Draft incorporates a clarification to the concept adding that "[t]raining validation and testing datasets shall be subject to appropriate data governance and management practices appropriate for the intended purpose of the AI system".

Specifically, concerning the training of the data set, the AI Act Proposal dictates in its Article 10(3) that "[t]raining, validation and testing data sets shall be relevant, representative, free of errors and complete". The requisite of the training data to be "complete" and "free of errors" has also been the subject of criticism, on the grounds that it is unrealistic (De Cooman, 2023: 19). The AI Act Final Draft has nuanced this requirement by establishing instead that "training validation and testing datasets shall be relevant, sufficiently representative, and to the best extent possible, free of errors and complete in view of the intended purpose".

The AI Act Proposal, in its explanatory memorandum, paragraph 1.2, regarding consistency with existing policy provisions in the policy area, expressly states that "the proposal is without prejudice to the application of Union competition law". This has been explicitly incorporated in the body of the act by the AI Act Final Draft, for example, in relation to Article 5 regarding prohibited AI practices where in Article 5(1a), the draft says that "[t]his Article shall not affect the prohibition that apply where an artificial intelligences practice infringes other Union laws". Nonetheless, it is impossible to apply the AI Act directly to EU competition law procedures; the act can be implemented voluntarily by adopting codes of conduct according to Article 69(3) of the AI Act Final Draft:

> Codes of conduct may be drawn up by individual providers or deployers of AI systems or by organisations representing them or by both, including with the involvement of deployers and any interested stakeholders and their representative organisations, including civil society organisations and academia. Codes of conduct may cover one or more AI systems taking into account the similarity of the intended purpose of the relevant systems.

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les on Artificial Intelligence (Artificial Intelligence Act) and amending certain Union Legislative", Acts (COM(2021)0206 – C9-0146/2021 – 2021/0106(COD)) ("AI Final Draft").

Expert knowledge and skill: The creation of intelligence units and hiring of data scientists

Another major challenge facing the application of screening techniques to detect cartels is the need for investment in expert knowledge and digital skills. This is one of the reasons that the application of these techniques is resource-intensive for competition agencies. The need to invest in obtaining the mentioned resources has meant, fundamentally, an increase in hiring some specific types of professionals and creating dedicated data units.

First, regarding the hiring of new professionals by competition authorities, they have focused on employing technology specialists. During the early stages of cartel screening development, the hiring of professionals concentrated on economists because of the need for econometrics knowledge. Today, especially with the development of AI-based screening, the most demanded professionals are data and computer scientists. This process has been compared to the pattern initiated with the "more economic approach" in the EU's late 90s and early 2000s, during the era of modernization of competition law enforcement and the appointment of chief economists at the European Commission in 2003 (Lianos, 2021: 17-18).

Second place, competition agencies have created exclusive data units inside their organizational chart. The tasks entrusted to these units include data gathering and cleaning, support to teams working on cases concerning digital data and markets and the development of screening tools. Even in the cases where data units were not created formally, the authorities hired chief technology officers or embedded staff dealing with big data, AI and machine learning in other divisions or teams (OECD, 2022b: 24). In the case of the European Commission, DG COMP has created a Data Analysis and Technology Unit and the position of Chief Technology Officer who will be at the helm of the mentioned unit centred in digital tools and data science and to support DG COMP's increasingly data-driven enforcement and market monitoring tasks.[10] Some examples of European competition authorities that have created a specialized unit or created the position of Chief Technology Officer are Finland, Netherlands, France, United Kingdome, Czech Republic, Germany, Austria, Poland, Hungary, Sweden, Spain and Greece (Lianos, 2021: 18-25). In the case of Chile, the competition authority created an Intelligence unit under the Anti-cartel division.[11]

Finally, it is worth mentioning that although data scientists are essential in conducting cartel screening, economists and competition lawyers should also necessarily

10. European Commission, "EU Commission Vacancy Notice 2023") CTO in DG COMP – COM/2023/10424", available at https://tinyurl.com/2tbv6pue.

11. Fiscalía Nacional Económica, "FNE crea Unidad de Inteligencia dependiente de la División Anticarteles", 1 de octubre de 2020, available at https://tinyurl.com/3w8bhmde.

be involved in the process of competition agencies. They are critical in deciding what variables to include, what form they should take, knowledge and experience in recognizing and dealing with illegal conduct, choosing the suitable screening method, setting the parameters for the screening tools, assessing the screening results, and other significant decisions (OECD, 2022b: 25).

International cooperation

A final challenge that we can identify is related to the development of digital screens, and this is the need for a long-term investment. Competition agencies need to improve their tools and methodologies, and it will take some time to evaluate the benefits of this development. A possible solution to mitigate the identified risks is international cooperation between competition authorities. Collaboration between them can save time and resources potentially essential in prosecuting cartels. Especially relevant in this regard are the obtained skills, the built datasets and the specific screen that may be developed in parallel by the different agencies (OECD, 2022b: 25).

In particular, the types of information that can be shared are the technical skills required to develop screens, the expert knowledge obtained by investigation officials, the necessary data to train the screening models, and even the coding. Interestingly, there is research that supports the idea of the possibility of transnational transferability of bid-rigging screens based on machine learning. Some authors, using Japanese data from the Okinawa cartel (construction sector) trained predictive models to classify tenders between collusive or competitive that performed very well afterwards while using Swiss data (Huber and other, 2020: 1015). Additionally, they also prepared a machine learning model based on data of one jurisdiction for testing in the other country and, although the performance deteriorated, it showed substantially higher results than different methodologies (Huber, Imhof and Ishii, 2022: 101). Other examples of international cooperation, according to the OECD report of 2022, is the case of the Danish Competition and Consumer Authority that developed a machine learning based screening tool, called the Bid Viewer tool, with the cooperation of other competition authorities like the Spanish and Sweden agencies (OECD, 2022b: 26).

The international cooperation, at the same time, will have its challenges. The main one will be related to data privacy issues from sharing sensitive data. However, the sharing of trained algorithms, in principle, will not be subject to this problem because there is no need to reveal the sensitive underlying data (OECD, 2022b: 26). Nonetheless, this creates a potential problem for questioning the use of screening tools. If authorities do not know how the algorithm was constructed or from which data, it is challenging to address its limitations. Finally, the knowledge and the expertise needed for the development of data screening tools can be shared by competition au-

thorities in well-known international networks like the OECD and the International Competition Network.

Benefits for cartel investigation proceedings through the use of screening techniques

Support the opening or closing of investigations to conduct dawn raids or other investigation powers

Despite the multiple challenges previously identified for the use of screening tools as a cartel detection mechanism by competition authorities, they are being used, and they work (Abrantes-Metz and Metz, 2019: 8). There is a perceived value in implementing these tools through different moments of an investigation. First, behavioural screens may serve as grounds to open a cartel investigation and for the subsequent application of investigation powers such as requests for information and, especially, dawn raids. The obtention of evidence of the anti-competitive conduct, ideally direct evidence, may be crucial to achieving an infringement decision by the Commission that can be upheld in the appeal process before European courts. This concern is based on the idea that, as a general rule, a screening result that identifies suspicious conduct is insufficient to prove a breach of competition law (OECD, 2022b: 27).

Nevertheless, indirect economic evidence can support the start of an investigation. The standard to open an investigation and issue an inspection decision is lower than proof of an infringement decision. This is true in cases where the competition authority needs the obtention of a warrant from a judge to perform this investigation power or, as the Commission, when there is an ex-post judicial control. In section 6, we will further analyse the standard to conduct a dawn raid with information obtained by data screening.

An example of a successful application of screening in opening an investigation was a case in Switzerland where the Swiss Competition Commission opened an investigation and sanctioned a group of firms for bid rigging in 2016, based on a screening methodology on road construction procurement dataset using markers to identify cover bids and a bid rotation scheme (Imhof, Karagök and Rutz, 2018: 235). Additionally, there is a case in Brazil, in the fire fighting and prevention market, of a successful dawn raid using the result of data screening. Although the initial detection of the cartel was after a red flag found by the procurement authority (tenders with same email address), empirical analysis by the competition authority consisted of behavioural screens including average bid, average bid variance, bid coefficient of variation, average number of participants in each bid and number of times a firm was an outlier, was used to obtain a judicial warrant to conduct dawn raids on fourteen companies (OECD, 2022b: 28).

Prioritization of cases and sector inquiries

A second beneficial aspect of applying screening tools by competition agencies is the possibility of facilitating the difficult task of selecting the multiple cases that may come to their knowledge. In this regard, the benefit is twofold. On the one hand, using structural screens, may identify markets where collusion is more probable and, therefore, may require more in-depth analysis. In cases where specific anticompetitive conducts or specific undertakings have not – yet – been identified, a recommended option could be the use of another competition tool of the authority toolkit, such as sector enquiries, that could help identify the necessary information to open an investigation and reduce the possibilities of false positives.

On the other hand, both structural and behavioural screens can be helpful in selecting between different cases to focus on those with better chances of success. Competition agencies are generally subject to tight budgets, and extra information could help them focus their attention on open cases and closed cases that are likely to fail, which is a relevant benefit of the tools under study. This is especially important in jurisdictions where cartel investigations have been successful, and the number of complaints and suspicions of cartels increases because of the awareness of the public and confidence in institutions.

One example of the beneficial effect of prioritization of cartel cases by using data screening is the case of the fuel retail sector in Brazil. CADE, the Brazilian competition agency, developed screening tools to help them prioritize and identify different complaints concerning the fuel market. The specific methodology used by CADE included three statistical tests: (i) the evolution of the retail profit margins of the city where the cartel allegedly operated; (ii) the correlation between the retail margins and the coefficient of variation (level of dispersion in prices) for the city; and (iii) the correlation between the retail profit margin of the city compared to the retail profit margin of the respective state (Ragazzo, 2012). The screening was applied on existing data for the fuel retail market. The Petroleum National Agency collected this data. The analysis allowed the Brazilian authority to distinguish between groundless complaints and, in a few cases, to flag possible cartels. Some cases resulted in convictions; others are in advanced trials, such as Brasília and Goiânia. The growing number of detected cartels serves as motivation for further screening analysis in academia, and the results suggested evidence of collusive agreements in all evaluated cities in the study (Silveira, Vasconcelos, Bogossian and Neto, 2021: 54, 65).

Provision of evidence for an infringement decision

The third benefit identified in data screening in cartel detection is the possibility of using the analysis results as evidence of the anticompetitive conduct in an infringe-

ment decision. Nevertheless, this benefit is less probable than the use of the screening information for opening investigations or for prioritization because of the higher standard of proof for a conviction decision. As mentioned, the screening results are not direct evidence of the conduct, and they need to be interpreted to reach a conclusion and to serve as indirect evidence of the infringement. This interpretation needs to address the mentioned objections regarding the challenges of screening tools, for example, as false positives because of failure to distinguish between explicit and tacit collusion.

Even though the successful use of screening results to prove the cartel on its own is less likely, it does not mean they cannot be used as proof of the infringement. As the Court of Justice established in the *T-Mobile* case, even an exchange of price information between competitors at a single meeting could give rise to a concerted practice that has as its object the restriction of competition.[12] As we know, evidence of communications between alleged cartel members is a type of circumstantial evidence, as it is the case of economic evidence (OECD, 2006: 10). Of course, this evidence can also play a supportive role in an infringement decision (Harrington, 2006: 1). As well as the use of cartel screening result to conduct a dawn raid, in section 5 we will further review the standard of proof to find a cartel infringement using that type of evidence.

Although final decisions that rest primarily on screening results are rare, the OECD Report 2022 identified a Mexican case regarding the public procurement of medicines, specifically tenders between 2003 and 2006 for the provision of human insulin and electrolyte and intravenous solutions. In this case, the Mexican competition authority used price and market share screens to identify tenders with identical award prices and winner rotation and find bidders with similar market shares that converged over time. They also found that prices did not correlate with costs and that cartel members bid, on average, the same prices (with minor variance) until the entrance of a new competitor, after which prices decreased. Their dispersion increased (Mena-Labarthe, 2015: 6-7). These different patterns identified by the competition authority, considered together, were consistent with collusion. The screening evidence was sufficiently broad, clear, and decisive for Mexico's Supreme Court, which upheld the competition authority decision in 2015 (OECD, 2022b: 30).

12. Case C-8/08 ("T-Mobile") T-Mobile Netherlands BV, KPN Mobile NV, Orange Nederland NV and Vodafone Libertel NV v Raad van bestuur van de Nederlandse Mededingingsautoriteit, EU:C:2009, paras. 58-61.

Further Analysis of the Use of Screening Results as Evidence

Screening results as grounds for a dawn raid

According to Regulation 1/2003, the Commission has direct enforcement powers to conduct all necessary inspections to determine the existence of an infringement of competition law. The European competition authority has the discretion to decide whether to conduct a dawn raid, subject to some standards. Still, it will need a judicial warrant to execute its powers on certain occasions. The reason for this is that Article 20(6) of Regulation 1/2003 does not permit the entry of companies' premises by the use of force. In consequence, in a situation where the undertaking does not allow the inspection, DG COMP officials will need the assistance of specific national authorities. While seeking this assistance, the Commission needs to comply with national legislation, and the requirements will vary depending on the country; for example, no judicial or administrative warrant before a dawn raid is needed in the Netherlands, Italy, and the UK (although the Competition and Markets Authority needs to give two days' notice). On the contrary, in Austria, Belgium, Germany, Ireland, Portugal and Spain, designated agencies require a court warrant preceding a dawn raid (in Spain, the warrant can be obviated if the investigated party grants consent for the execution of the dawn raid) (Contreras, Kingma and Scholten, 2020: 152-153).

Whether ex-ante or ex-post control, it is crucial to establish clarifications on the standard of evidence in investigations of the Commission to evaluate the role of cartel screening as a basis of a dawn raid. First, regarding the legality of the content of the order, the EU case law has established, in *France Telecom*,[13] according to Article 20(4) of Regulation 1/2003, the essential material that must be included in a decision ordering an inspection is the specification of the subject-matter and purpose of the dawn raid, the date on which it is to begin, the penalties provided for in Articles 23 and 24 of that regulation and the right to have the decision reviewed by EU courts. In Energetický,[14] the General Court further detailed those necessary requisites as follows: state the names of the recipients, the reasons which led the authority to suspect the existence of unlawful practices, the type of alleged practices thought to be anticompetitive, the affected market for goods and services, the geographical market where the alleged practices applied, the relationship between those practices and the conduct of the undertaking to which the decision was addressed, the officials authorized to carry out the inspection, the means at their disposal and the obligations incumbent on the competent staff of the undertaking, the date and places of the inspection, the penalties risked in the event of obstruction, and the possibility of and

13. Case T-399/04 ("France Télécom") France Télécom SA v Commission, EU:T:2007:80, para. 56.

14. Case T-272/12 ("Energetický") Energetický a prúmyslový holding a.s. and EP Investment Advisors s.r.o. v Commission, EU:T:2014:995, para. 75.

prerequisites for bringing legal action. Additionally, in *France Telecom*, the Court explained the purpose of these requisites as indispensable to "show that the operation carried out on the premises of the undertakings concerned is justified, but also to enable those undertakings to assess the scope of their duty to cooperate while at the same time safeguarding their rights of defence".[15]

The abovementioned cases have been recently cited in European cases like *Casino* and in national cases, as *Persuade Comunicación*. Casino is one of the three cases of the Commission against French supermarkets regarding an infringement of Article 101 TFEU for an anticompetitive exchange of information. In this case, the General Court mentioned that the European authority can only order a dawn raid on suspicion that an unlawful act was committed and that this suspicion must be grounded on sufficiently strong evidence (Jourdan and Gafsen, 2022: 305). Nevertheless, the General Court also clarified that there is a distinction between (a) the evidence required to prove the infringement itself and (b) the evidence required to justify inspections to gather such proof (Jourdan and Gafsen, 2022: 305). In the case of the evidence needed to justify the investigation power, the competition authority does not need to meet the exact requirements as regards the form, the authors, and the content of the evidence (Jourdan and Gafsen, 2022: 305). Nonetheless, the Court adds:

> It is settled case-law, moreover, that the Commission is required to disclose in detail in the decision ordering an inspection that it had in its file information and indicia providing reasonable grounds for suspecting the infringement of which the undertaking subject to inspection is suspected.[16]

The same idea is stated in the Spanish case *Persuade Comunicación* when the Audiencia Nacional declares that at that stage of proceedings, the Spanish competition authority was not required to reveal in full detail the range of evidence at its disposal or the exact legal qualification of the conduct under investigation.[17] The reason for this is that the precise purpose of the dawn raid is the obtention of further evidence, so the authority could not be required to meet the same standard of proof as in the final decision.[18]

15. Case T-399/04 ("France Télécom") France Télécom SA v Commission, EU:T:2007:80, para. 57.

16. Case T-249/17 ("Casino") Casino, Guichard-Perrachon and Achats Marchandises Casino SAS v Commission, EU:T:2020:458, para. 114.

17. Judgement of the Audiencia Nacional of 20 May 2021 in Case 56/2017 ("Persuade Comunicación") Persuade Comunicación v Comisión Nacional de los Mercados y la Competencia, ES:AN:2021:2335, sixth ground of law.

18. Case T-249/17 ("Casino") Casino, Guichard-Perrachon and Achats Marchandises Casino SAS v Commission, EU:T:2020:458, para. 114.

In 2023, the Court of Justice of the European Union (CJEU) partially quashed the judgement of the General Court in *Casino* regarding the duty to record interviews during the inspection conducted before the formal opening of an investigation, but not in the part of interest to this work[19] (CJEU, Casino: para. 17). The General Court concluded that, in the specific case, the Commission met the standard of sufficiently strong evidence for the dawn raid in one of the alleged infringements but not in the other. According to the judgement, the first infringement, which involved the exchanges of discounts with suppliers and prices on the upstream market, met the standard with evidence of parallel behaviour plus suppliers' declarations regarding a credible possibility of exchanges (Jourdan and Gafsen, 2022: 305). The Court explicitly stated that it does not matter that the evidence may be subject to different interpretations (as parallel conduct) to constitute serious indicia, provided that the interpretation favoured by the Commission is plausible (EGC, Casino: para. 222). Additionally, the Court stated that the various indicia based on which an infringement may be suspected must be assessed not in isolation. Still, as a whole, they may reinforce each other (EGC, Casino: para. 223). In the case of the second infringement regarding the exchange of future commercial strategies on the downstream market, the General Court found insufficient evidence of public nature information in a convention of open access. Additionally, the Casino executive's presence was justified by its responsibilities in a joint purchase alliance with the other party (Jourdan and Gafsen, 2022: 306).

The case law about dawn raids under review allows us to extract some conclusions regarding the use of screening data to substantiate an inspection decision during an investigation of the Commission. First, only structural screening data would not be enough to comply with the requisites established by Regulation 1/2003 of the decision to order an inspection. Requisites like stating the recipients' names or the relationship between those practices and the conduct of the undertaking to which the decision was addressed, by its nature, would not be obtained by this type of screening. As we mentioned before, structural analysis can support the decision to conduct further research or as a complement to other evidence, but it cannot sustain on its own a dawn raid decision. More so with the existence in the EU of a prohibition for the European Commission from going on "fishing expeditions" (Lianos, 2021: 28) as ruled in *Deutsche Bahn*.[20]

On the contrary, in the case of behavioural screening, the result could sufficiently meet the required standard to exercise investigation powers like inspections. According to the standard set by *Casino*, proof of parallel conduct could constitute enough

19. Case C-690/20 ("Casino Appeal") P Casino, Guichard-Perrachon and Achats Marchandises Casino v Commission, ECLI:EU:C:2023:171.

20. Case C-583/13P ("Deutsche Bahn") Deutsche Bahn and Others v Commission, para. 60.

serious indicia of the infringement. Behavioural screens, a technique that rests on a profound academic background and with many years of development, can easily be qualified as plausible. Furthermore, in cases where more than one marker could be used, they may reinforce each other.

Finding of an infringement through screening results

It is important to remember that screens do not prove collusion; instead, they isolate improbable or anomalous outcomes (Abrantes-Metz and Bajari, 2010: 131). Additionally, there is the before-mentioned challenge regarding false positives and false negatives. Generally, from an investigation perspective, screening tools shine during the detection or verification phase of a cartel investigation but not during the prosecution part. Nevertheless, according to some European case law, even if screening induces presumption and not irrefutable evidence, this presumption could reverse the burden of proof. If this is the case, that leaves in charge of the undertaking to explain the "anomalous" result and why its conduct looks like but is not a cartel (De Cooman, 2023: 5).

As it was stated by the CJEU in the *Woodpulp* case: "it must be noted that parallel conduct cannot be regarded as furnishing proof of concertation unless concertation constitutes the only plausible explanation for such conduct".[21] By applying the same reasoning of the Court thirty years ago, collusive flags resulting from a behavioural screen could trigger a reversal of the burden of proof (De Cooman, 2023: 5). Although the positive result from the screening technique "by itself" does not prove the existence of the infringement, in the case that the undertaking could not overturn the presumption, the Commission could find that the company has violated competition law based exclusively in the cartel screening results.

Procedural guarantees and the use of screening

Finally, a significant problem common to both dawn raid and infringement decisions is the before-mentioned data challenge concerning the disclosure requirement set by *Casino*. Even though this is a general challenge regarding the use of screening data, it has some specificities in relation to dawn raids. This concern has been argued as a consequence of the duty of care standards that have been established by the European Court of Justice, especially regarding transparency requirements of decisions (Hofmann and Lorenzoni, 2023: 53). In this sense, inspection would have a direct influence on the final decision, the screening methodology used to justify the mea-

21. Joined cases C-89/85, C-104/85, C-114/85, C-116/85, C-117/85 and C-125/85 to C-129/85 ("Woodpulp") A. Ahlström Osakeyhtiö and others v Commission, ECLI:EU:C:1993:120, para 71.

sure, especially in the case of machine learning screening, should be intelligible and explainable to meet the legal standards set by reasoning requirements (Hofmann and Lorenzoni, 2023: 53).

The general recommendation of voluntarily adopting AI Act rules also applies in this discussion. A good example is Article 12 of the final draft, which includes a duty of record-keeping of some AI systems to ensure a level of traceability, keeping records of the database reference, the input data for which the search has led to a match and even the identification of the natural persons involved in the verification of the results. Other concerns in this respect include ensuring unbiased decision-making of the machine learning screen while ensuring human oversight (as required in the case of the AI Act final Draft in Article 14). Practical proposals to this issue have been the extension of the Hearing Officer's role, that is, the person who already ensures the effective exercise of the procedural rights of the parties involved in competition proceedings at the EU level (De Cooman, 2023: 17).

Conclusions

For a long time, cartel detection has rested primarily on leniency applications. Now that their number is decreasing worldwide, cartel screening has risen as an alternative or complement of this tool for different competition authorities.

Initially, there was a focus on structural screens that analysed market structure characteristics to identify if they indicated a tendency to form cartels. Latterly, the focus has been on behavioural screens that observe the conduct of undertakings that may show the operation of a cartel in a specific market.

At the same time, the methodology approach has shifted from using econometric techniques to using AI in the last years. Specifically, the focus has been the development of machine learning screening tools.

The development and use of screening tools come with different challenges concerning the availability of sufficient complete datasets to be used as inputs of the screens and in relation to the intensive use of budget and human resources inside a competition authority. These challenges can be overcome by incorporating new frameworks to help the treatment of datasets, such as the voluntary incorporation of some regulation of the AI Act Final Draft, or through the modernization of agencies by hiring new professionals as data scientists and creating dedicated expert units.

On the other hand, the use of cartel screening brings to the table different benefits for cartel investigations. The screening results can support the opening or closing of investigations and can be used to conduct dawn raids or other investigation powers. They also can help with the prioritization of cases or with the decision to initiate sector inquiries. Finally, the results can help prove anticompetitive conduct for an infringement decision.

Structural screen results on their own cannot be used for inspection decisions. Still, they can be used as the decision to conduct further analysis or as a complement to other evidence. However, according to EU case law, behavioural results could sufficiently meet the required standard to exercise investigation powers like inspections, mainly if different markers are used simultaneously.

Collusive flags resulting from behavioural screens as evidence of the infringement could trigger a reversal of the burden of proof. Although the positive result from the screening technique "by itself" does not prove the existence of the infringement, this could change in the case that the undertaking could not overturn the presumption.

Finally, the screening methodology used to justify decisions, especially in the case of machine learning screening, should be intelligible and explainable to meet the legal standards set by reasoning requirements. The voluntary incorporation of regulation of the AI Act Final Draft or the extension of the Hearing Officer's role in investigations inside the EU Commission are possible solutions to this challenge.

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