Article

Outsmarting Pac-Man with Artificial Intelligence, or Why AI-Driven Cartel Screening Is Not a Silver Bullet

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I. Introduction

Competition law has been around since ancient Rome.[1] Yet, what concretely constitutes a cartel is still elusive.[2] Maarten P. Schinkel has proposed an intriguing definition. He has argued Pac-Man epitomises 'an international cartel, manoeuvring with the objective to eat away at consumer surplus—the so-called "pac dots"—and the occasional windfall profit—"fruits"'.[3] While doing so, Pac-Man has to escape the oversight of four different competition authorities—the famous 'ghosts'. The latter do not wander randomly. Each of them uses a different chasing procedure. Any Pac-Man player has to 'understand the behaviour of the ghosts and manipulate them accordingly' if she wants to win the game.[4] As soon as she understands the ghosts' rules of engagements, she will be able 'to foresee the next move of each of them and avoid them all'.[5]

Artificial Intelligence (hereafter, 'AI') has the potential to reshuffle the deck of this pursuit and evasion scenario. European Commission (hereafter, 'EC') Executive Vice-President and Commissioner for Competition Margrethe Vestager has equated 'algorithm-based technological solutions' with a 'structural competition problem'.[6] She has contextualised that 'the world is changing fast'.[7] Technology has always been a driver of evolution.[8] In *The Square and the Tower*, historian Niall Ferguson has explained that more accurate nautical instruments were developed because Portuguese sailors wanted to 'establish a new and superior trade network viable'.[9] Based on Ferguson's reasoning, Nicolas Petit has argued that 'the tech giants develop technology to overcome real world constraints [namely] that information is distributed while computation requires centralization'.[10] Technology is not, however, the preserve of undertakings. To go back to Schinkel's metaphor, AI allows the rise of 'structural competition problem' favouring Pac-Man, but

Key Points

- AI-driven cartel screening seems to be the perfect candidate to modernise EU competition law proceedings.
- However, AI-driven cartel screening raises a data, an algorithmic, and a human challenge.
- Useful insights may be gleaned from the Proposal for an AI Act to solve these drawbacks, i.e., data governance (art. 10), transparency (art. 14), and human oversight (art. 14).
- Developers and users of AI-driven cartel screening should voluntarily endorse the AI Act to avoid any challenges of European Commission's decisions based on violation of the duty to state reasons.

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1 Margrethe Vestager, 'A new era of cartel enforcement' (The Italian Antitrust Association Annual Conference, Rome, 22 October 2021).

2 Niamh Dunne, 'Characterizing Hard Core Cartels Under Article 101 TFEU' (2020) 65 The Antitrust Bulletin 376.

3 Maarten P. Schinkel, 'Balancing proactive and reactive cartel detection tools: some observations' in Directorate for financial and enterprise affairs—Competition committee, 'Ex Officio cartel investigations and the use of screens to detect cartels', OECD Competition Law & Policy Roundtables, DAF/COMP(2013)27, 7 July 2014, available at https://www.fne.gob.cl/wp-content/uploads/2014/07/2013-Ex-officio-cartels-investigation-3569-KB1.pdf.

4 *Ibid*.

5 *Ibid*.

6 Commission, 'Antitrust: Commission consults stakeholders on a possible new competition tool' IP/20/977 (Brussels, June 2020).

7 *Ibid*.

8 Thomas K. Derry and Trevor I. Williams, *A Short History of Technology from the Earliest Times to A.D. 1900* (Oxford University Press 1960); W. Brian Arthur, *The Nature of Technology: What It Is and How It Evolves* (Free Press 2011); Eric Schatzberg, *Technology: Critical History of a Concept* (The University of Chicago Press 2018).

9 Niall Ferguson, *The Square and the Tower: Networks and Power, from the Freemasons to Facebook* (Penguin Press 2018) 74.

10 Nicolas Petit, *Big Tech and the Digital Economy: The Moligopoly Scenario* (Oxford University Press 2020) 120.

also the development of new enforcement strategies for Ghosts. Public authorities can similarly use AI systems 'to keep pace with the changing technologically advanced market landscape'.[11] This is common sense. With the complexification of competitive practices, enforcement authorities will have to 'develop increased technical competence to understand new forms of algorithmic competition'.[12] Or to put it differently, one way for Ghosts to 'outsmart Pac-Man' is to leave aside their 'fixed routines' and adopt balanced 'proactive and reactive cartel detection tools'.[13]

Yet, the EC still 'struggle to remedy anticompetitive practices in increasingly complex, fast-paced and evolutive markets' that in turn decrease legal certainty and therefore the quality of the ecosystem wherein undertakings evolve.[14] The Stanford Computational Antitrust, for instance, complains about this problematic 'disconnection between diagnostic and treatment' and observes that 'there are passionate discussions about the practices implemented by digital players' but very few debates on 'the use of technological tools to address them'.[15] Amongst these tools lies AI-driven cartel screening.[16] This algorithmic solution flags indicators of anti-competitive behaviour that then trigger the need for further investigation.[17]

AI-driven cartel screening is, however, not a panacea. First, AI-driven cartel screening is data dependent and therefore requires a large amount of quality data. Second, unknown parameters weight of the AI systems prevent public officials to state reasons of their decision. Third, while it is fairly assumed keeping human-in-the-loop will be a critical safeguard against data and algorithmic limitations, cognitive biases challenge the effectiveness of human oversight as a safety requirement.

Upshot? AI-driven cartel screening has the potential to outsmart Pac-Man, but it is certainly not a silver bullet. On the contrary, algorithm-based solutions are what French Philosopher Bernard Stiegler called a *pharmakon*, namely both the poison and its remedy.[18] Algorithms-based solution raises structural competition problem, but also a new opportunity to solve them. To prevent the cure being worse than the disease, this paper aims at identifying effective safeguards that allow proper implementation of AI-driven solution. This paper argues the appropriate safety requirements are data governance, transparency, and human oversight. To build this argument, this paper proposes a sixfold structure. To set the scene, section II exposes the EU ambition to strengthen competition law enforcement and introduces cartel screening. Sections III to V discuss why AI-driven cartel screening raises data, algorithmic, and human challenges and how they can be mitigated. Section VI concludes.

II. The promises of cartel screening

A. Strengthening competition law enforcement

The germinal idea of improving EU procedures with digital technology is in Jean-Claude Juncker's 2014 Political Guidelines[19] which were concretised by the Digital Single Market for Europe in 2015.[20] Regarding AI, the mid-term review of the implementation of that strategy solely mentions in 2017 that the EC 'will continue to monitor the opportunities and challenges brought by artificial intelligence solutions'.[21] To do so, the EC published a consultancy tender seeking 'advice on how Artificial Intelligence could potentially improve DG Competition's processes'.[22] The EC's White Paper on Artificial Intelligence of February 2020 mirrored this objective by assessing how to equip law enforcement authorities, including public enforcement in competition law, with AI systems.[23] In her mission letter, EC President Ursula von der Leyen asked Margrethe Vestager to make sure that 'competition

11 Cary Coglianese and Alicia Lai, 'Antitrust by Algorithm' (2022) 2 Stanford Computational Antitrust 1, 2. AI systems are widely adopted by public administrations. See, *e.g.*, Justin B. Bullock, 'Artificial intelligence, discretion and bureaucracy' (2019) 49 The American Review of Public Administration 751; Michael Veale and Irina Brass, 'Administration by Algorithm? Public management meets public sector machine learning' in Karen Yeung and Martin Lodge (eds.), *Algorithmic Regulation* (Oxford University Press 2019); Matthew M. Young, Justin B. Bullock, and Jesse D. Lecy, 'Artificial discretion as a tool of governance: A framework for understanding the impact of artificial intelligence on public administration' (2019) 2 Perspectives on Public Management and Governance 301; Ryan Calo and Danielle Keats Citron, 'The automated administrative state: A Crisis of Legitimacy' (2021) 70 Emory Law Journal 797.

12 Salil K. Mehra, 'Algorithmic Competition, Collusion and Price Discrimination' in Woodrow Barfield (ed.), *The Cambridge Handbook of the Law of Algorithms* (Cambridge University Press 2020) 205.

13 Schinkel (n 3).

14 Thibault Schrepel, 'Computational Antitrust: An Introduction and Research Agenda' (2021) 1 Stanford Computational Antitrust 1, 2.

15 *Ibid*.

16 Martin Huber and David Imhof, 'Machine learning with screens for detecting bid-rigging cartels' (2019) 65 International Journal of Industrial Organization 277.

17 Joseph E. Harrington, Jr. And David Imhof, 'Cartel Screening and Machine Learning' (2022) 2 Stanford Computational Antitrust 133.

18 Bernard Stiegler, 'Question de pharmacologie générale. Il n'y a pas de simple pharmakon' (2007) 13 Psychotropes 27.

19 Jean-Claude Juncker, 'A new start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change' (European Parliament plenary session, Strasbourg, 15 July 2014).

20 Commission, 'A Digital Single Market Strategy for Europe' (Communication) COM (2015) 192 final.

21 Commission, 'Mid-Term Review on the implementation of the Digital Single Market Strategy: A Connected Digital Single Market for All' (Communication) COM (2017) 228 final.

22 Commission, 'Consultancy "Artificial Intelligence Applied to Competition Enforcement"' (October 2017) COMP/2017/017.

23 Commission, 'White Paper on Artificial Intelligence—A European approach to excellence and trust' COM (2020) 65 final, 2 at n 5.

policy and rules are fit for the modern economy'.[24] The EC's proposal for a new complementary tool (hereafter, 'NCT') to strengthen competition enforcement was one of the measures aimed at fulfilling this objective.[25] The NCT was, however, ultimately abandoned.[26] Adopted on 28 April 2021, the Single Market Programme (hereafter, 'SMP') similarly ambitions 'to improve the functioning of the internal market (. . .) by enforcing Union law' (art. 3(1)(a)).[27] Specific objectives highlight the need to improve the effectiveness of the internal market in light of the digital transformation by improving the application of competition rules (art. 3(2)(a)(i)), for instance with data-gathering and analysis tools (art. 8(2)(d)(i)).

The European Court of Auditors (hereafter, 'ECA') emphasised the development of new tools is necessary. The ECA highlighted a reduction of *ex officio* investigations due to a decrease of market surveillance capacity on the one hand, and an increase of cases' complexity on the other.[28] The ECA has therefore demanded the EC to put more effort into proactively detecting anti-competitive behaviours. The ECA has suggested the SMP could decrease this scissors effect by revitalising *ex officio* procedures.

Revitalisation may be done by helping officials open the right investigation. During the initial assessment phase, the EC examines the case and decides whether it deserves further investigations.[29] In light of this, it should be borne in mind that the EC has finite resources and therefore cannot follow up all investigations.[30] As the EU General Court noted, the EC is entitled to give different priority degrees to complaints received.[31] Significant discretion means that the EC is free to focus 'its enforcement resources on cases where it appears likely that an infringement may be found, in particular on cases with the most significant impact on the functioning of competition in the internal market and risk of consumer harm'.[32]

In this regard, Andreas van Bonin and Sharon Malhi have astutely argued that AI systems might be particularly useful in helping the EC initiates the 'right' investigations, and reversely decides 'not to initiate (or to drop) a particular investigation'.[33] This 'algorithmic shift in the fight against cartels'[34] is in fact only the refinement of Regulation 1/2003 ambition of 'freeing up resources to focus on serious infringements'.[35] By processing data quicker and more efficiently, AI systems can help identify sooner market deficiencies.[36] They might also allow a shift from reactive claims of competition infringements or leniency applications to proactive interventions. Expressed this way, what van Bonin and Malhi have proposed is AI-driven cartel screening.

B. Defining cartel screening

The idea behind cartel screening is simple. There exists 'conventional wisdom on collusion' that permits the identification of 'factors that are supposed to hinder or facilitate' collusive behaviours.[37] It has become a cannon trend in competition literature to distinguish between structural and behavioural cartel- or trust-facilitating devices.[38] This distinction is, however, far less clear than it may initially appear.[39] As Frederic Scherer noted, market structure and conduct in the market cannot 'be divorced completely' and it is a herculean task 'to identify

24 Ursula von der Leyen, 'Mission letter to Margrethe Vestager, Executive Vice-President for A Europe fit for the Digital Age' (Brussels, 1 December 2019) 5.
25 Commission, 'Inception Impact Assessment of the New Competition Tool' Ares(2020)2877634.
26 Vasileios Tsoukalas, 'Should the New Competition Tool be Put Back on the Table to Remedy Algorithmic Tacit Collusion? A Comparative Analysis of the Possibilities under the Current Framework and under the NCT, Drawing on the UK Experience' (2022) 13 Journal of European Competition Law & Practice, 234, 241–242.
27 Regulation (EU) 2021/690 of 3 May 2021 establishing a programme for the internal market, competitiveness of enterprises, including small and medium-sized enterprises, the area of plants, animals, food and feed, and European Statistics (Single Market Programme) [2021] OJ L153/1.
28 European Court of Auditors, 'The Commission's EU merger control and antitrust proceedings: a need to scale up market oversight' (November 2020) Special Report n°24.
29 Commission notice on best practices for the conduct of proceedings concerning Articles 101 and 102 TFEU [2011] OJ C308/6, 12.
30 Commission, 'Commission Staff Working Paper accompanying the Communication from the Commission to the European Parliament and Council: Report on the Functioning of Regulation 1/2003' COM (2009) 206 final, paras 37, 194, and 247.
31 Case T-24/90 *Automec Srl v Commission of the European Communities*, ECLI:EU:T:1999:97, paras 77 and 85.
32 Commission notice on best practices (n 38) 13.
33 Andreas von Bonin and Sharon Malhi, 'The Use of Artificial Intelligence in the Future of Competition Law Enforcement' (2020) 11 Journal of European Competition Law & Practice 468, 469.
34 Nathalie de Marcellis-Warin, Frédéric Marty, and Thierry Warin, 'Vers un virage algorithmique de la lutte anticartels? Explicabilité et redevabilité à l'aube des algorithmes de surveillance' (2021) 23 Revue internationale d'éthique sociétale et gouvernementale 1.
35 Report on the Functioning of Regulation 1/2003 (n 42) 36.
36 Albert Sanchez-Graells, 'Procurement corruption and artificial intelligence: between the potential of enabling data architectures and the constraints of due process requirements' (2021), available at https://papers.ssrn.com/abstract=3952665.
37 Jean Tirole, *The Theory of Industrial Organisation* (7th printing, The MIT Press 1988, 1994) 239. Other conventional wisdom may be found in Frederic M. Scherer, *Industrial Market Structure and Economic Performance* (Rand McNally & Company 1970); Robert H. Porter, 'Detecting Collusion' (2005) 26 Review of Industrial Organization 147; Robert C. Marshall and Leslie M. Marx, *The Economics of Collusion: Cartels and Bidding Rings* (The MIT Press 2012).
38 Christopher R. Leslie, 'Trust, Distrust, and Antitrust' (2004) 82 Texas Law Review 515, 519 and 564.
39 Paul A. Groutt and Silvia Sonderegger, 'Structural Approaches to Cartel Detection' in Claus-Dieter Ehlermann and Isabela Atanasiu (eds.), *European Competition Law Annual 2006: Enforcement of Prohibition of Cartels* (Hart Publishing 2007).

links running from market structure to such aspect of conduct'.[40]

Structural screens imply an analysis of market structure that increase the probability a cartel emerges, *i.e.*, market concentration,[41] entry barriers,[42] frequency of undertakings' interaction,[43] horizontal[44] and vertical product differentiation,[45] innovation and advertisement level,[46] demand stability,[47] and buyer bargaining power.[48] It should be borne in mind that the EC started an investigation to identify 'sectors for priority action' after the entry into force of Regulation 1/2003.[49] The then-identified key sectors were media, IT, energy, retail banking, business insurance, and pharmaceutical industries as they are 'economically highly important' and 'directly impact consumers'.[50] Behavioural screens propose an observation of either the methods or the outcomes of collusion. This concerns low price variance,[51] sharp increase in high price–cost margin,[52] sharp decline of price followed by sharp increase,[53] homogenisation through increase of product standardisation and pricing formula,[54] decrease of customer-specific prices,[55] stabler distribution of market shares,[56] stabler customer base,[57] buy-back,[58] and compensation scheme.[59] Behavioural screens ambition to identify collusive markers (*e.g.*, high price), structural break (*e.g.*, abrupt change in price), and anomalies (*e.g.*, below-cost pricing) in the data-generating process.[60]

Screening isolates 'outcomes that are improbable or anomalous',[61] but does 'not provide sole and sufficient proof that any wrongdoing did take place'.[62] Screening leaves unaddressed whether the spotted inconsistencies with the competitive model are 'due to the formation of a cartel or some other change'.[63] From a procedural perspective, antitrust enforcement implies a three-stage process whereby *screening* is nothing but the first prong. This step induces a triage 'used to identify industries worthy of close scrutiny'.[64] Screening flags unusual patterns that calls for further investigations that in turn lead to 'actionable evidence and convictions'.[65] Red flags raised by cartel screening may trigger an *ex officio* investigation and motivate, for instance, a dawn raid.[66] This means that screening does 'not replace human judgement, but it could expand the toolkit used to identify potential violations and launch *ex ante* investigations'.[67] The 10-year-old Libor scandal illustrates this as 'had any member band that sets Libor or any antitrust authority undertaken

40 Scherer (n 53) 131.
41 Arthur G. Fraas and Douglas F. Greer, 'Market Structure and Price Collusion: An Empirical Analysis' (1979) 10 Journal of Reprints for Antitrust and Economics 465; Margaret C. Levenstein and Valerie Y. Suslow, 'What Determines Cartel Success?' (2006) 44 Journal of Economic Literature 43.
42 Joseph J. Harrington, Jr., 'Some Thoughts on Why Certain Markets are More Susceptible to Collusion' in OECD Global Forum on Competition 'serial Offenders', 29–30 October 2015, available at https://joeharrington5201922.github.io/pdf/Harrington_OECD_10.15.pdf.
43 Maria Bigoni, Jan Potters and Giancarlo Spagnolo, 'Frequency of interaction, communication and collusion: an experiment' (2019) 68 Economic Theory 827.
44 Grout and Sonderegger (n 55).
45 Jonas Häckner, 'Collusive pricing in markets for vertically differentiated products' (1994) 12 International Journal of Industrial Organization 155; Iwan Bos and Marco A. Marini, 'Cartel stability under quality differentiation' (2019) 174 Economic Letters 70; Iwan Bos, Marco A. Marini and Riccardo D. Saulle, 'Cartel formation with quality differentiation' (2020) 106 Mathematical Social Sciences 36.
46 George Symeonidis, 'Cartel stability in advertising-intensive and R&D intensive industries' (1999) 62 Economic Letter 121; Georges Symeonidis, 'In Which Industries Is Collusion More Likely? Evidence from the UK' (2003) 51 The Journal of Industrial Economics 45.
47 Marc Ivaldi and others, 'The Economics of Tacit Collusion' in Final Report for DG Competition, European Commission, 2003, available at https://ec.europa.eu/competition-policy/system/files/2021-04/the_economics_of_tacit_collusion_2003.pdf.
48 Cristopher M. Snyder, 'A Dynamic Theory of Countervailing Power' (1996) 27 The RAND Journal of Economics 747.
49 Report on the Functioning of Regulation 1/2003 (n 42) 14.
50 *Ibid*., 16.
51 Rosa M. Abrantes-Metz and others, 'A Variance Screen for Collusion' (2006) 24 International Journal of Industrial Organization 467.
52 Joseph E. Harrington, Jr, 'Detecting Cartels' in Paolo Buccirossi (ed.), *Handbook of Antitrust Economics* (The MIT Press 2008) 232; Patrick Andeoli-Vesbach and Jens-Uwe Franck, 'Endogenous Price Commitment, Sticky and Leadership Pricing: Evidence from the Italian Petrol Market' (2015) 40 International Journal of Industrial Organization 32.
53 Directorate for financial and enterprise affairs—Competition committee, 'Ex Officio cartel investigations and the use of screens to detect cartels', OECD Competition Law & Policy Roundtables, DAF/COMP(2013)27, 7 July 2014, available at https://www.fne.gob.cl/wp-content/uploads/2014/07/2013-Ex-officio-cartels-investigation-3569-KB1.pdf, 29.
54 Christian Lorenz, 'Screening markets for cartel detection: Collusive markers in the CFD cartel-audit' (2008) 26 European Journal of Law and Economics 213.
55 Patrick Rey, 'On the Use of Economic Analysis in Cartel Detection' in Claus-Dieter Ehlermann and Isabela Atanasiu (eds.), *European Competition Law Annual 2006: Enforcement of Prohibition of Cartels* (Hart Publishing 2007).
56 Harrington (n 68) 245.
57 Elisabetta Iossa and others, 'Collusive Market Allocations' (2020) Working Paper, available at https://faculty.fuqua.duke.edu/~marx/bio/papers/MarketAllocation.pdf.
58 Emmanuel Combe, *Economie et politique de la concurrence* (2nd ed., Dalloz 2020) 151.
59 Joseph E. Harrington, Jr, 'How Do Cartels Operate?' (2006) 2 Foundation and Trends in Microeconomics 1.
60 Harrington and Imhof (n 17).
61 Rosa M. Abrantes-Metz and others, 'Libor manipulation?' (2012) 36 Journal of Banking & Finance 136, 138.
62 OECD (n 69) 38; Serena Cocciolo and others, 'Using Data Analytics in Public Procurement: Operational Options and a Guiding Framework' (2022) International Bank for Reconstruction and Development/The World Bank, 7 (red flags 'can be useful in identifying unusual patterns in certain market' but do not constitute 'sufficient proof of collusion'). See also Juan M. Ortner and others, 'Screening Adaptive Cartels' (2022) NBER Working Paper, http://www.nber.org/papers/w30219 (qualifying 'statistical screen' as 'statistical evidence' but noting 'formal prosecution cannot rely on statistical evidence alone').
63 Harrington (n 68) 216 (adding at 237 that data 'supporting collusion need not imply evidence against competition').
64 *Ibid*., 215.
65 Ortner (n 78).
66 Harrington and Imhof (n 17) 135.
67 Albert Sanchez-Graells, '"Screening for Cartels" in Public Procurement: Cheating at Solitaire to Sell Fool's Gold?' (2019) 10 Journal of European Competition Law & Practice 199.

an econometric screen, they likely would have detected these anomalies, undertaken a more in-depth investigation, and discovered the wrongdoing'.[68] Launching an investigation means entering the second step of antitrust enforcement, *i.e.*, the *verification*. This prong is necessary to 'systematically exclude competition as an explanation' for the spotted behaviour.[69] The final task of *prosecution* only occurs if the verification has validated the screening observations.

Therefore, screening induces presumption and not irrefutable evidence. Such presumptions may, however, trigger a reversal of the burden of proof.[70] It would then be up to the flagged undertakings to prove their behaviour looks like but is not a cartel.[71] The famous *Woodpulp* clause might be of paramount interest for undertakings under investigation.[72] In that landmark case, the European Court of Justice (hereafter, 'ECJ') held that 'parallel conduct cannot be regarded as furnishing proof of concertation unless concertation constitutes the only plausible explanation for such conduct'.[73] Applying *mutatis mutandis* this argument to cartel screening induces that flags raised during screening activities cannot be regarded as a proof of collusion unless these abnormalities cannot be explained otherwise. It would therefore be enough for undertakings to establish that it is the market characteristics that lead to a situation similar to cartelisation to overturn the presumption.

C. Cartel screening and machine learning

Screening identifies patterns of collusion. Expressed this way, to boost screening with AI is intuitive. Formally speaking, an AI system aims at 'discovering correlations (sometimes alternatively referred to as relationships or patterns) between variables in a dataset, often to make predictions or estimates of some outcome'.[74] Machine learning systems identify (statistical) patterns from large datasets and 'then use the uncovered patterns to predict future data, or to perform other kinds of decision making under uncertainty'.[75] In this regard, the objective of unsupervised learning is 'to capture the structure in the whole dataset, not any particular target'.[76] As a result, unsupervised learning system 'can automatically discover interesting and useful patterns in (. . .) massive amounts of unlabelled data'.[77] Such definitions could not be better suited to illustrate the mirroring between AI and screening. Upshot? AI-driven cartel screening draws the sketch of suspicious businesses by identifying the recurring characteristics (patterns) of cartels to improve the proactive detection of anticompetitive behaviours. To go back once more to Schinkel's metaphor, AI-driven cartel screening allows the Ghost to know where the Pac-Man is.

Screening works.[78] Empirical studies conclude that screening 'may be used for antitrust screening and prosecution [or regulatory] purposes'.[79] The fact that recent researches evaluate AI-driven cartel screening as highly accurate is just the icing on the cake.[80] This technology may help 'antitrust regulators to better pinpoint potential legal violations'.[81] In a similar vein, AI systems also 'allow agencies to better predict which mergers are likely to generate anticompetitive concerns and which are not'.[82] In a nutshell, AI-driven cartel screening is heralded as 'a new beacon of hope'.[83]

68 Rosa M. Abrantes-Metz and D. Daniel Sokol, 'The Lessons from Libor for Detection and Deterrence of Cartel Wrongdoing' (2012) 3 Harvard Business Law Review Online 10, 11; Danilo Sama, 'Cartel Detection and Collusion Screening: an Empirical Analysis of the London Metal Exchange' in Mitja Kovac and Ann-Sophie Vandenberghe (eds.), *Economic Evidence in EU Competition Law* (Intersentia 2016) 204.

69 Harrington (n 68) 215.

70 Jacques Crémer, Yves-Alexandre de Montjoye and Heike Schweitzer, 'Competition Policy for the Digital Era (Final report)' (2019) European Commission, Directorate-General for Competition, available at https://ec.europa.eu/competition/publications/reports/kd0419345enn.pdf.

71 Jorge Gallego, Gonzalo Rivero and Juan Martinez, 'Preventing rather than Punishing: An Early Warning Model of Malfeasance in Public Procurement' (2021) 37 International Journal of Forecasting 360.

72 Nicolas Petit, 'Algorithmes tarifaires et droit européen de la concurrence' in Jonathan Wildemeersch and Paschalis Paschalidis (eds.), *L'Europe au présent! Liber Amicorum Melchior Wathelet* (Bruylant 2018) 170.

73 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 *A. Ahlström Osakeyhtiö and others v Commission of the European Communities*, ECLI:EU:C:1993:120, para 71.

74 David Lehr and Paul Ohm, 'Playing with the Data: What Legal Scholars Should Learn About Machine Learning' (2017) 51 UC Davis Law Review 653, 671.

75 Kevin P. Murphy, *Machine Learning: A Probabilistic Perspective* (The MIT Press 2012) 1.

76 Keith Frankish and William M. Ramsey (eds.), *The Cambridge Handbook of Artificial Intelligence* (Cambridge University Press 2014) 342.

77 M. Emre Celebi and Kemal Aydin, 'Preface' in M. Emre Celebi and Kemal Aydin (eds.), *Unsupervised Learning Algorithms* (Springer 2016) v.

78 Ulrich Laitenberger and Kai Hüschelrath, 'The Adoption of Screening Tools by Competition Authorities' (2011) 9 CPI Antitrust Chronicle 1; OECD (n 69); Thibault Schrepel and Teodora Groza, 'The Adoption of Computational Antitrust by Agencies: 2021 Report' (2022) 2 Stanford Computational Antitrust 78.

79 Yuliya Bolotova, John M. Connor and Douglas J. Miller, 'The Impact of collusion on price behavior: Empirical results from two recent cases' (2008) 26 International Journal of Industrial Organization 1290 (noting at 1290 that the proposed methodology 'may be used for antitrust screening and prosecution purposes'). Korbinian von Blanckenburg, Konstantin A. Kholodilin and Alexander Geist, 'The Influence of Collusion on Price Changes: New Evidence from Major Cartel Cases' (2011) 13 German Economic Review 245 (noting at 245 that the proposed methodology 'may be used for antitrust screening and regulatory purposes').

80 Huber and Imhof (n 16); Giovanna Massarotto and Ashwin Ittoo, 'Gleaning Insight from Antitrust Cases Using Machine Learning' (2021) 1 Stanford Computational Antitrust; Douglas Silveira and others, 'Won't Get Fooled Again: A supervised machine learning approach for screening gasoline cartels' (2022) 105 Energy Economics 105,711.

81 Coglianese and Lai (n 11) 8.

82 Anthony J. Casey and Anthony Niblett, 'Micro-Directives and Computational Merger Review' (2021) 1 Stanford Computational Antitrust 132, 133.

83 Nils Köbis, Christopher Starke and Iyad Rahwan, 'The promise and perils of using artificial intelligence to fight corruption' (2022) 4 Nature Machine Intelligence 418.

However, screening still has its sceptics.[84] Its usefulness notwithstanding, screening is also deficient for a threefold reason, *i.e.*, a data, an algorithmic, and a human challenge.

III. A data challenge

A. Data availability

AI-driven solutions are able to analyse extensive datasets quicker and more efficiently,[85] at least under the right conditions.[86] All digital solutions are information dependent and are therefore 'significantly affected by problems in the availability (. . .) of the information they rely on'.[87] AI-driven cartel screening does not escape the rule.

AI-driven cartel screening is a data-driven approach whose objective is to detect collusion in dataset T (for target).[88] The AI system was trained on a training dataset (W) that contains 'identified episodes of collusion and competition' for the same market as dataset T.[89] If dataset W does not have enough examples of competitive and non-competitive behaviours or if dataset W does not exist at all, then training may be done using a dataset Z corresponding to a comparable market (*e.g.*, same product or service but in a different geographic area).[90] The effectiveness of such transposed models depends on the comparability between markets described in dataset Z and in dataset T.[91]

Therefore, data availability is key to AI-driven cartel screening. 'No data, no fun' is the prevailing idiom.[92] Without access to a sufficiently large volume of data, training will be incorrect due to incompleteness.[93] In such scenario, recommendations driven from AI-driven cartel screening could be far from reliable.[94] Using algorithmic tools could also create a bias in competition law enforcement resulting from the application of AI systems to detect abnormal patterns due to different level in data availability. Antitrust authorities have indeed access to large databases for some but not all markets.[95] For instance, the high level of transparency[96] imposed by the EU on procurement markets explain why literature on screening is so prolific regarding bid rigging[97] and procurement corruption.[98] For other markets, however, there is no or very little available data. AI systems would thus potentially replicate this bias by recommending the prosecution of investigations only on undertakings for which there were data used for the learning phase.[99]

Problems may, however, also arise in contexts wherein large datasets are available. This was the case in the United Kingdom with the 'Screening for Cartels Tool'.[100] This tool was launched to allow buyers to assess tender procedures and identify potential bid rigging. It suffers at least two major drawbacks. First, whilst public procurement transparency implies data availability, this tool was paradoxically suffering lack of data. Data was available but the CMA 'succumbed to the hype' and published the tool before its training was complete.[101] The tool was trained on approximately 100 tenders involving 500 bids. This volume is far too small to train an algorithm. Second, the tool was not a centralised but a distributed model. This means that any new data fed to the algorithm by a given operator 'will remain unknown to the parallel versions of the algorithms used by' other operators.[102] The upshot

84 Rosa M. Abrantes-Metz, 'Recent successes of screens for conspiracies and manipulations: Why are there still sceptics?' (2014) *CPI Antitrust Chronicle* 1, 7; Schrepel (n 14).
85 von Bonin and Malhi (n 49); Daryl Lim, 'Can Computational Antitrust Succeed?' (2021) 1 Stanford Computational Antitrust 38 (arguing computational antitrust might help forecast killer acquisitions).
86 Ke Wang and others, 'An AI-Based Automated Continuous Compliance Awareness Framework (CoCAF) for Procurement Auditing' (2021) 4 Big Data and Cognitive Computing 43.
87 Sanchez-Graells (n 52).
88 Harrington and Imhof (n 17) 154.
89 *Ibid*.
90 David Imhof and Hannes Walliman, 'Detecting bid-rigging coalitions in different countries and auction formats' (2021) 68 International Review of Law and Economics 106,016; Martin Huber, David Imhof and Rieko Ishii, 'Transnational machine learning with screens for flagging bid-rigging cartels' (2022) 185 Journal of the Royal Statistical Society Series A 1074.
91 Harrington and Imhof (n 17) 153–154.
92 Sanchez-Graells (n 52).
93 This explains why machine learning was not achievable before the advent of large digitised dataset. Ira S. Rubinstein, 'Big Data: The End of Privacy or a New Beginning?' (2013) 3 International Data Privacy Law 74; Pedro Domingos, *Master Algorithm: How the Question for the Ultimate Learning Machine Will Remake Our World* (Basic Books 2015).
94 von Bonin and Malhi (n 49).
95 *Ibid*., 469.
96 See, *e.g.*, Kirsi-Maria Halonen, Roberta Caranta and Albert Sanchez-Graells (eds), *Transparency in EU Procurements: Disclosure Within Public Procurement and During Contract Execution* (Edward Elgar 2019).
97 Timothy G. Conley and Francesco Decarolis, 'Detecting Bidders Groups in Collusive Auctions' (2016) 8 American Economic Journal: Microeconomics 1; David Imhof, 'Empirical Methods for Detecting Bid-Rigging Cartels' (PhD Thesis, Université de Franche-Comté and University of Fribourg 2018); Sanchez-Graells (n 87); Huber and Imhof (n 16); David Imhof, 'Detecting Bid-Rigging Cartels with Descriptive Statistics' (2019) 15 Journal of Competition Law and Economics 427; Cocciolo (n 78); Hannes Wallimann, David Imhof and Martin Huber, 'A Machine Learning Approach for Flagging Incomplete Bid-Rigging Cartels' (2022) Computational Economics, available at: https://doi.org/10.1007/s10614-022-10315-w.
98 Mihaly Fazekas and Gabor Kocsis, 'Uncovering High-Level Corruption: Cross-National Objective Corruption Risk Indicators Using Public Procurement Data' (2017) 50 British Journal of Political Science 155; Maurizio Lisciandra, Riccardo Milani, Emmanuele Millemaci, 'A corruption risk indicator for public procurement' (2022) 73 European Journal of Political Economy, 102,141; Köbis, Starke and Rahwan (n 104).
99 Marcela Mattiuzzo and Henrique F. Machado, 'Algorithmic Governance in Computational Antitrust—A Brief Outline of Alternatives for policymakers' (2022) 2 Stanford Computational Antitrust 23, 29–30.
100 Sanchez-Graells (n 87).
101 *Ibid*., 209.
102 *Ibid*.

of this is twofold. On the one hand, decentralisation of information drastically decreases the pace of accuracy improvement as it is unlikely that any operator 'will carry out this analysis over a sufficient number of tenders so as to improve the parameters significantly'.[103] On the other hand, even if improvement was possible, each parallel version would have evolved in a different way.

B. Data quality

The problem of data quality is what Albert Sanchez-Graells astutely labels an elephant tale.[104] He explains illustrators of medieval bestiaries had to paint elephant without ever having seen one. They therefore relied on someone else's description instead. Even if they were good painters, the result is unlikely to look like an elephant. As Judge Easterbrook once famously explained, 'the blind are not good trailblazers'.[105] This holds true for AI-driven cartel screening. AI-based systems need to be trained either on 'the entire universe of data' (*i.e.*, closed-game scenario) or on statistically representative data (*i.e.*, quality data).[106] Yet, the OECD highlighted quality data is not always available to competition agencies. Data obtained from undertakings are reliable but it is impossible to access them without tipping off potential cartelists.[107] Publicly available or aggregated data are, on the contrary, generally far less trustworthy.[108] In addition, AI-driven cartel screening requires 'data access at a speed that mirrors the market activity the regulators are seeking to oversee'.[109]

Data quality is critical to accuracy.[110] AI-driven systems are not preprogramed to respond in a certain way whenever they face certain conditions, but rather to 'learn' the appropriate response (hence the name 'machine learning').[111] This is a big difference with automation known so far as 'the only way to get a computer to do something (. . .) was to write down an algorithm explaining how in painstaking details'.[112] On the contrary, machine learning systems 'figure out on their own by making inferences from data'.[113] Inferring from non-quality data leads to an intuitive conclusion: 'dirty data, bad predictions'.[114] Rosa M. Abrantes-Metz has explained in this regard that 'screens can be very powerful tools when properly developed and implemented [but] if you put garbage in, you get garbage out'.[115] The elephant tale warns against this 'distortionary effects likely to result from policy developed on the basis of poor data that misrepresents reality'.[116]

Screening is not error-proof.[117] Scherer explained screening for collusive markers leads to 'predictions correct on the average, but subject to occasionally substantial errors'.[118] Two kinds of errors can be considered.

1. Type II error

Type II error, or false negative, involves the non-detection of a cartel despite its existence.[119] Such error is due to a misspecification of the collusive model. The problem is twofold. First, Frederic Scherer, Jean Tirole, and George Stigler have all three explained that there exists a lot of different ways that lead to collusion.[120] The Animal Feed Phosphate cartel helps carrying the point. It has been shown that a screen based on 'abrupt changes in price (or price-cost margins)' is an effective one.[121] Using price evolution as a variable to detect collusive behaviour, one could notice that statistically cartels emerge when undertakings experience or anticipate a decrease in prices.[122]

103 *Ibid*., 210.
104 Albert Sanchez-Graells, 'Data-Driven and Digital Procurement Governance: Revisiting Two Well-Known Elephant Tales' (2019) 24 Communications Laws 157.
105 Frank H. Easterbrook, 'Cyberspace and the Law of the Horse' (1996) University of Chicago Legal Forum 207,
106 Sanchez-Graells (n 52).
107 For a similar argument in concentration control, see Casey and Niblett (n 103) 144.
108 OECD (n 69) 42.
109 Coglianese and Lai (n 11) 15.
110 Lehr and Ohm (n 95) 711.
111 David Danks, 'Learning' in Keith Frankish and William M. Ramsey (eds.), *The Cambridge Handbook of Artificial Intelligence* (Cambridge University Press 2014); John Zerilli and Adrian Weller, 'The Technology' in Matt Hervey and Matthew Lavy (eds.), *The Law of Artificial Intelligence* (Sweet & Maxwell 2021) 9.
112 Domingos (n 114).
113 *Ibid*.
114 Rashida Richardson, Jason Schultz and Kate Crowford, 'Dirty data, bad predictions: how civil rights violations impact police data, predictive policing systems, and justice' (2019) 94 New York University Law Review Online 192.
115 Abrantes-Metz and Sokol (n 88) 11.
116 Sanchez-Graells (n 125); Ann Cavoukian and Michelle Chibba, 'Start with Privacy by Design in All Big Data Applications' in V. Srinivasan (ed.), *Guide to Big Data Applications* (Springer 2018) 37 (discussing 'echo chambers' problem).
117 Interestingly, it is the risk of type I and type II errors that motivates the qualification of screening as presumption rather than evidence. See Cocciolo (n 78).
118 Scherer (n 53) 132.
119 Type I and type II errors are also discussed in legal scholarship related abuse of dominance. See Yannis Katsoulacos and David Ulph, 'Optimal Enforcement and Decision Structures for Competition Policy: Economic Considerations' in Federico Etro and Ioannis Kokkoris, *Competition Law and the Enforcement of Article 102* (Oxford University Press 2010) 75; Alan Devlin and Michael Jacobs, 'Antitrust Error' (2010) 52 William & Mary Law Review 75
120 Scherer (n 53) 131; Tirole (n 53) 240; George J. Stigler, 'Theory of Oligopoly' (1964) 72 Journal of Political Economy 44 ('with oligopoly, everything is possible'), quoted in Nicolas Petit, 'The Oligopoly Problem in EU Competition Law' in Ioannis Lianos and Damien Geradin (eds.), *Handbook on European Competition Law* (Edward Elgar 2013).
121 Harrington (n 68) 233.
122 Daniel Herold and Johannes Paha, 'Cartels as Defensive Devices: Evidence from Decisions of the European Commission 2001–2010' (2018) 14 Review of Law & Economics 20,160,035, https://doi.org/10.1515/rle-2016-0035.

Yet the Animal Feed Phosphate cartel, for instance, was set up when prices were not following this downward trend.[123] Screening solely based on price would therefore had led to a false negative.[124] This led Harrington conclude that 'none of the collusive markers identified are universal, and each much be used with caution'.[125] The AI computational power does not help. Machine learning is able to identify patterns but is 'poorly suited for predicting all the forces in the economy' and therefore does not lead to 'a theory of everything'.[126] The 'golden rule' of screening is a new iteration of Tinbergen Rule: one target, one rule.[127] In other words, one size does not fit at all.[128] Screening is only useful for the circumstances for which it was developed.[129]

Second, confusion also arises from collusive markers' interaction. For instance, commentators explain 'demand fluctuations hinder collusion'.[130] Yet, an increase in demand fosters collusion when entry barriers—another structural screen[131]—are sufficiently high to prevent the entrance of new competitors in the market triggered by the demand growth.[132] As a result, solely screening demand stability leads to a false negative as it does not take into account that high entry barriers mitigate demand fluctuation.

Type II error also comes from a selection bias in available data.[133] The case studies on which scholarship draw collusive markers are exclusively composed of discovered and successfully prosecuted cartels.[134] It should be kept in mind that more than 90 per cent of the EC's investigation originate from an application for leniency.[135] Yet Schinkel stresses that 'of the cases that were truly discovered by a leniency application, it is not obvious what the type and quality is of these cartels, relative to the population of all cartels operational in our economies'.[136] This sample might not be representative of the population of cartels.[137] It might well be that 'effective collusion is clandestine'.[138] If so, then the consequences worsen as false negative would mainly concerns most effective cartels.

2. Type I error

Type I error, or false positive, corresponds to mistakenly identifying a cartel where there is none (false alarm).[139] From a terminology perspective, a test is said to be 'asymptotically safe' if it admits 'a vanishingly small rate of false positives'.[140] From an evidence-based perspective, this means that the more asymptotically safe the test is, the more the red flags it raises constitutes hard-to-dismiss presumption of collusion.[141]

Type I errors have two downside effects.[142] First, erroneously condemning a procompetitive behaviour by

123 *Animal Feed Phosphates* (Case COMP/38866) Commission Decision of 20 July 2010.
124 A regression-based approach may overcome this pitfall. Carsten J. Crede, 'A Structural Break Cartel Screen for Dating and Detecting Collusion' (2019) 54 Review of Industrial Organization 543, 549; Symeonidis (n 62).
125 Harrington (n 68) 242.
126 Schrepel (n 14) 13.
127 Jan Tinbergen, *On the Theory of Economic Policy* (North-Holland 1952).
128 Abrantes-Metz and Sokol (n 88) 11.
129 Bolotova, Connor and Miller (n 100).
130 Ivaldi and others (n 63).
131 Low entry barriers allow the entrance of new competitors that decrease the incentives to collude (Joe S. Bain, *Barriers to New Competition* (Harvard University Press 1956); H. Michael Mann, 'Seller Concentration, Barriers to Entry, and Rates of Return in Thirty Industries, 1950–1960' (1966) 48 The Review of Economics and Statistics 296; Tirole (n 53) 304–307; Jean J. Gabszewicz, *Strategic Interaction and Markets* (Oxford University Press 2000); Harrington (n 58)). Reversely, high entry barrier reduces the probability of new entrants and therefore allows for a high supracompetitive price (Peter Asch and Joseph J. Seneca, 'Characteristics of Collusive Firms' (1975) 23 The Journal of Industrial Economics 223).
132 Groutt and Sonderegger (n 55).
133 Symeonidis (n 62) 45.
134 Groutt and Sonderegger (n 55); Joseph E. Harrington, Jr. and Myong-Hun Chang, 'Modeling the Birth and Death of Cartel with an Application to Evaluating Competition Policy' (2009) 7 Journal of the European Economic Association 1400.
135 94 per cent from 1998 to 2014, 92 per cent from 2010 to 2017; Combe (n 74) 186; de Marcellis-Warin, Marty and Warin (n 50). For up-to-date statistics, see https://ec.europa.eu/competition-policy/system/files/2022-02/cartels_cases_statistics.pdf. Resource scarcity easily explains this prosecution bias. Competition authorities might be tempted to prosecute easy or driven-by a leniency application cases as they only have finite resources (Harrington (n 75)). Leniency programmes are resource efficient as cartelist gives competition authorities evidence on a silver platter by blowing the whistle (Joseph E. Harrington, Jr., 'Optimal Corporate Leniency Programs' (2008) 56 The Journal of Industrial Economics 215). Leniency reduces the investigation and prosecution costs by unearthing helpful information for competition authorities and reducing the duration of the procedure (Steffen Brenner, 'An empirical study of the European leniency program' (2009) 27 International Journal of Industrial Organization 639). The flip side of the coin is this. Leniency programmes are likely to affect *ex officio* investigation by taking up all the EC's limited resources (Joseph E. Harrington, Jr. and Myong-Hun Chang, 'When Can We Expect a Corporate Leniency Program to Result in Fewer Cartels?' (2015) 58 The Journal of Law & Economics 417, 419).
136 Schinkel (n 3) 259.
137 Joseph E. Harrington, Jr. and Yanhao Wei, 'What Can the Duration of Discovered Cartels Tell Us About the Duration of All Cartels?' (2017) 127 The Economic Journal 1977; Casey and Niblett (n 103); Köbis, Starke and Rahwan (n 104) 419.
138 William E. Kovacic, Robert C. Marshall and Michael J. Meurer, 'Serial collusion by multi-product firms' (2018) 6 Journal of Antitrust Enforcement 296, 298.
139 Goeffrey T. Fong, David H. Krantz and Richard E. Nisbett, 'The Effects of Statistical Training on Thinking About Everyday Problems' (1986) 18 Cognitive Psychology 253.
140 Ortner (n 78). For concrete example of asymptotically safe tests, see Silvain Chassang and others, 'Robust screens for noncompetitive bidding in procurement auctions' (2022) 90 Econometrica 315; Kei Kawai and others, 'Using Bid Rotation and Incumbency to Detect Collusion: A Regression Discontinuity Approach' (2022) NBER Working Paper, https://www.nber.org/papers/w29625.
141 Ortner (n 78).
142 These observations were first made about automated alarm systems but have been generalised to decision-support systems. Raja Parasuraman and Dietrich Manzey, 'Complacency and bias in human use of automation: An attentional integration' (2010) 52 Human Factors 381.

inaccurately qualifying it as anticompetitive results in a 'permanent loss of the behaviour's benefit'.[143] Second, type I errors imply the operator tries to solve a non-existent problem.[144] In a context of scarce resources, this is the 'worst kind of prediction error' as it triggers costly but unjustified investigation.[145] Once the absence of collusive behaviour confirmed, the operators' loss of confidence in the system might lead them to disregard subsequent recommendations even if they are actually positive (disregarded true positive).[146]

It is argued using a structural approach to help competition authorities trigger investigations in then-qualified archetypal market for collusion would probably result in a high-rate of type I errors. Many markets have the structural characteristics of collusion without being subject to collusive practices.[147] It is of paramount importance to understand that 'the *propensity* for collusion is not an indication that an anti-competitive behaviour has *actually* taken place'.[148] It has been hypothesised—albeit once again solely based on discovered cartels—that very low fraction of such ideal market for cartel are actually cartelised. Bayesian statistical inference helps understand why 'the likelihood of false positives with a structural approach is quite high'.[149] Given a low prior probability of collusion, the posterior probability is supposed to be still quite low.[150]

Type I error is a non-negligible drawback, as screening cannot distinguish between mere parallelism and anti-competitive behaviour. Screening detects tacit collusion whose equilibria was attained not illegally through communication but through parallelism without engaging in any sort of illegal behaviour *per se*.[151] This obviously raises the risk of false positive. This is, however, not enough to discard the use of AI-driven cartel screening. It would be unjustified to hold antitrust screens to a higher standard than, *e.g.*, medical one. An ultrasound of the thyroid is able to identify node but unable to distinguish between malignant and benign. The fact that this test (the *screen* for abnormality) only raises a red flag for the physician to biopsy (the *control* for malignancy) does not mean ultrasound is useless, so 'why make the analogous argument about an antitrust screen?'[152]

C. Data governance

Sir Arthur Conan Doyle wrote in *A Scandal in Bohemia* that 'it is a capital mistake to theorise before one has data'.[153] The point is apt. Competition law enforcement authorities 'do not want to lag behind' undertakings developing new collusive techniques.[154] Their 'over-optimism[155] about digitisation 'augurs a rather quick propagation' of AI-driven techniques in public proceedings in the foreseeable future.[156] Yet quality data is generally missing. The insight of *A Scandal in Bohemia* is this. The construction of a better data architecture is a prerequisite for the development of AI-driven cartel screening. In its absence, AI-driven recommendation will be equivalent to 'a seer who predicts certain doom unless sinners mend their ways'.[157] From a public governance perspective, it is difficult to accept a public administration developing algorithmic solutions based on little or poor-quality data.[158] The algorithmic cart should not be put before the data horse. Creating a quality database will, however, be challenging. For the training to be complete, this database should include competition and collusion cases. The difficulty stems from a low-detection rate of collusive behaviour. Cartels, indeed, wear a 'cloak of secrecy'.[159] Economists Peter Bryant and E. Woodrow Eckard concluded in 1991 that the probability for an undertaking of getting caught in a price fixing strategy was between 13 and 17 per cent.[160] In 2020, probability of

143 Devlin and Jacobs (n 140).
144 Stephen R. Dixon and Christopher D. Wickens, 'Automation reliability in unmanned aerial vehicle flight control: A Reliance compliance model of automation dependence in high workload' (2006) 48 Human Factors 474.
145 Huber and Imhof (n 16) 278; Gary T. Marx, 'The Iron Fist and the Velvet Glove: Totalitarian Potentials within Democratic Structures' in James E. Short, *The Social Fabric: Dimensions and Issues* (Sage Publications 1986).
146 Stephen R. Dixon, Christopher D. Wickens and Jason S. McCarley, 'On the independence of compliance and reliance: Are automation false alarms worse than misses?' (2007) 49 Human Factors 564.
147 Combe (n 74) 182–183
148 OECD (n 69) 39 (emphasis not added).
149 Harrington (n 68) 214.
150 Harrington and Imhof (n 17) 135.
151 Hans Friederiszick and Frank P. Maier-Rigaud, 'Triggering inspections ex officio: Moving beyond passive EU cartel policy' (2008) 4 Journal of Competition Law and Economics 89.
152 Rosa M. Abrantes-Metz, 'Ex Officio Cartel Investigations and the Use of Screens to Detect Cartels' in Directorate for financial and enterprise affairs—Competition committee, 'Ex Officio cartel investigations and the use of screens to detect cartels', OECD Competition Law & Policy Roundtables, DAF/COMP(2013)27, 7 July 2014, https://www.fne.gob.cl/wp-content/uploads/2014/07/2013-Ex-officio-cartels-investigation-3569-KB1.pdf, 233.
153 Arthur Conan Doyle, 'A Scandal in Bohemia' (July 1989) Strand Magazine, reproduced in Arthur Conan Doyle, *The Adventures of Sherlock Holmes* (George Newnes Ltd 1892) 7.
154 Sanchez-Graells (n 125).
155 Albert Sanchez-Graells and Michael Lewis, 'Digital Technologies, Hype, and Public Sector Capability' (*How to Crack a Nut*, 13 July 2022), available at https://www.howtocrackanut.com/blog/2022/7/13/digital-technologies-hype-and-public-sector-capability.
156 Sanchez-Graells (n 125).
157 Bob Heyman, 'The concept of risk' Bob Heyman and others (eds.), *Risk, Safety and Clinical Practice: Health Care through the Lens of Risk* (Oxford University Press 2008) 19 (albeit not discussing cartel screening but risk assessment).
158 Sanchez-Graells (n 125).
159 OECD, 'Using Leniency to Fight Hard Core Cartels' (2001) OECD Policy Brief, available at https://www.oecd.org/daf/ca/1890449.pdf.
160 Peter G. Bryant and E. Woodrow Eckard, 'Price Fixing: The Probability of Getting Caught' (1991) 73 The Review of Economics and Statistics 531.

detection was still around 15 per cent in both the EU and United States.[161] What an observer sees looking at cartel landscape is only the proverbial 'tip of the iceberg'.[162] This means instances labelled as 'competitive' may in fact represent undiscovered collusion. Past data will therefore need to be carefully reassessed to decrease the risk of a high rate of false negative.[163]

In this regard, the EC's Proposal for an AI Act provides useful requirements.[164] Providers of AI systems have to respect 'appropriate data governance' and management practices regarding training, validation, and testing datasets (art. 10(2)). This provision constitutes a good but steep starting point. Some improvements are needed. First, requiring that training dataset has to be 'complete' and 'free of errors' (art. 10(3)) seems unrealistic.[165] Article 10 however targets 'appropriate' data governance. If this means what is required is appropriate completeness, then the level of appropriateness has to be clarified.[166]

The problem is, the AI Act expressly states it is 'without prejudice to the application of Union competition law'.[167] An analysis of the AI Act confirms EU competition law proceedings falls beyond its *ratione materiae* scope of application.[168] Yet this Proposal may still be voluntarily endorsed (art. 69). Providers of AI-driven cartel screening should cease this opportunity. Without data governance, the effectiveness of algorithmic solutions they develop will be reduced to a trickle.

IV. An algorithmic challenge

A. Right to good administration and duty to state reasons

According to Article 41 of the EU Charter of fundamental rights (hereafter, 'CFR'), 'every person has the right to have his or her affairs handled impartially, fairly and within a reasonable time by the institutions and bodies of the Union'.[169] The EU General Court confirmed Article 41 CFR applies to administrative body that thus has to 'gather, in a diligent manner, the factual elements necessary for the exercise of its broad discretion'.[170] Article 9 of the (non-binding but overlapping with the CFR) European Code of Good Administration Behaviour (hereafter, 'CGAB') strengthens this principle by emphasising that 'the official shall take into consideration the relevant factors and give each of them its proper weight in the decision'.[171] In the same vein, the European Ombudsman added that civil servants should be 'impartial, open-minded, guided by evidence'.[172] Legal scholarship concludes the duty of care 'although not explicitly listed in Article 41 CFR, is generally understood as a key component of good administration'.[173]

Based on Article 296 TFEU, article 41(2)(c) CFR sets out 'the obligation of the administration to give reasons for its decisions'. This provision mirrors a general principle of EU law.[174] The European Ombudsman emphasises that civil servants should be 'willing to explain their activities and to give reasons for their actions'.[175] In addition,

161 Combe (n 74) 181. For the record, the probability was between 12.9 and 13.3 per cent in 2007 (Emmanuel Combe, Constance Monnier and Renaud Legal, 'Cartels: The Probability of Getting Caught in the European Union' (20 September 2007), available at https://papers.ssrn.com/abstract=1015061), and less than 20 per cent in 2013 (Peter L. Ormosi, 'A Tip of the Iceberg? The Probability of Catching Cartels' (2013) 29 Journal of Applied Econometrics 549).

162 Mario Monti, 'Fighting Cartels How and Why? (Third Nordic Competition Policy Conference, Stockholm, 11–12 September 2000).

163 See, *e.g.*, Kuang Chen and others, 'USHER: Improving data quality with dynamic forms' (2010) IEEE 26th International Conference on Data Engineering (ICDE), available at https://ieeexplore.ieee.org/document/5447832.

164 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, COM (2021) 206 final. At the time of writing, the AI Act is still discussed by the European Parliament and the Council.

165 Michael Veale and Frederik Zuiderveen Borgesius, 'Demystifying the Draft EU Artificial Intelligence Act: Analysing the good, the bad, and the unclear elements of the proposed approach' (2021) 4 Computer Law Review International 97, 103.

166 Nathalie Smuha and others, 'How the EU can achieve Legally Trustworthy AI: A Response to the European Commission's Proposal for an Artificial Intelligence Act' (5 August 2021), available at http://dx.doi.org/10.2139/ssrn.3899991.

167 AI Act (n 194) Explanatory Memorandum, 4.

168 Jerome De Cooman, 'Humpty Dumpty and High-Risk AI Systems: The Ratione Materiae Dimension of the Proposal for an EU Artificial Intelligence' (2022) 6 Market and Competition Law Review 49; Albert Sanchez-Graells, 'Where does the proposed EU AI Act place procurement?' (*How to Crack a Nut*, 21 October 2021), available at https://www.howtocrackanut.com/blog/2021/10/21/where-does-the-proposed-eu-ai-act-place-procurement.

169 Charter of Fundamental Rights of the European Union, OJ C326, 26 October 2012, 391–407.

170 T-217/11 *Claire Staelen v European Ombudsman*, EU:T:2015:238, para 84.

171 European Ombudsman, 'The European Code of Good Administrative Behaviour' available at https://www.ombudsman.europa.eu/pdf/en/3510.

172 *Ibid.*

173 Ian S. Forrester, 'Due process in EC competition cases: A distinguished institution with flawed procedures' (2009) 34 European Law Review 817; Herwig C.H. Hofmann and Bucura C. Mihaescu-Evans, 'The Relation between the Charter's Fundamental Rights and the Unwritten General Principles of EU Law: Good Administration as the Test Case' (2013) 9 European Constitutional Law Review 73, 92. See also Hanns Peter Nehl, 'Good Administration as Procedural Right and/or General Principle?' in Herwig C.H. Hofmann and Alexander H. Türk eds.), *Legal Challenges in EU Administrative Law: Towards an Integrated Administration* (Edward Elgar 2009); Rhita Bousta, 'Who Said There is a "Right to Good administration"? A Critical Analysis of Article 41 of the Charter of Fundamental Rights of the European Union' (2013) 19 European Public Law 481; Joana Mendes, 'Discretion, care and public interests in the EU administration: Probing the limits of law' (2016) 53 Common Market Law Review 419.

174 Joined Cases C-141/12 and C-372/12 *YS v Minister voor Immigratie, Integratie en Asiel and Minister voor Immigratie, Integratie and Asiel v M and S*, ECLI:EU:C:2014:2081, para 68.

175 European Ombudsman (n 203).

article 18 CGAB entails that every decision 'shall state the ground on which it is based by indicating clearly the relevant facts and the legal basis of the decision'. In this regards, civil servants shall not make decision 'based on brief or vague grounds, or which do not contain an individual reasoning'.[176] On the contrary, the duty to state reasons implies the administrative decision should contain the legal provision at stake, the relevant facts, and how the law was applied to the fact, including any 'factor that carried weight in the assessment'.[177]

The principle of good administration—and corollary the duty to state reasons—protects against arbitrariness of public power.[178] The ECJ has emphasised the duty to state reasons is a condition for an effective judicial review guaranteed by Article 47 CFR.[179] The General Court confirmed the EC has to respect the general principles of EU law, including the duty to state reasons,[180] during both the preliminary investigations[181] and the administrative procedure.[182] This has its importance, as a subsequent review of full jurisdiction (*i.e.*, 'the power to quash in all respects, on questions of fact and law, the decision on the body below'[183]) of the EC decisions 'ensures that the requirements of a fair process, as enshrined in Article 6(1) of the ECHR (. . .) are satisfied'.[184]

As hinted above, cartel screening will be of utmost interest in preliminary stages by indicating cases worthy of further investigations and hence triggering the need for a dawn raid. The duty to state reasons applies to the EC's decision authorising dawn raid—at least to a certain extent.[185] The ECJ held on numerous occasions that, for a dawn raid to be legal, the EC has to be in possession of 'information and evidence providing reasonable grounds for suspecting infringement of the competition rules by the undertaking concerned'.[186] In this context, there is, more precisely, an 'obligation to state specific reasons' pursuant to Article 20(4) of Regulation 1/2003.[187] The decision authorising the dawn raid has to describe the features and nature of the suspected infringement, as well as the presumed facts the EC intends to investigate.[188] It must also indicate the sectors and the market thought to be affected[189] to enable the concerned undertakings to 'assess the scope of their duty to cooperate while at the same time safeguarding the rights of the defence'.[190] In practice, the ECJ held that even a decision authorising a daw raid written 'in very general terms' might still contain 'the essential indications prescribed by Article [20(4)] of Regulation [1/2003]'.[191] In both *Nexans* and *Prysmian* for instance, the General Court held that even if the decision actually covered a very wide product scope (*i.e.*, any sort of electrical cable, from telephone wires to high voltage cable), it cannot be considered too vague as long as it clearly indicates it covers all sort of electric cables.[192] However, the General Court considered the EC 'has not

176 *Ibid*.
177 Melanie Fink and Michèle Finck, 'Reasoned A(I)dministration: Explanation Requirements in EU Law and the Automation of Public Administration' (2022) 3 European Law Review 376, 383.
178 Nehl (n 205).
179 Case C-277/11 *M. M. v Minister for Justice, Equality and Law Reform and Others*, ECLI:EU:C:2012:744, para 88; Case C-249/13 *Khaled Boudjlida v Préfet des Pyrénées-Atlantiques*, ECLI:EU:C:2014:2431, para 38; Case C-230/18 *PI v Landespolizidirektion Tirol*, ECLI:EU:C:2019:383, para 57; Joined Cases C-225/19 and C-226/19 *R.N.N.S. and K.A. v. Minister van Buitenlandse Zaken*, ECLI:EU:C:2020:951, para 43.
180 Case T-67/11 *Martinair Holland NV v. European Commission*, ECLI:EU:T:2015:984, para 31.
181 Joined cases C-46/87 and C-227/88 *Hoechst AG v Commission of the European Communities*, ECLI:EU:C:1989:337, para 15; Case C-94/00, *Roquette Frères*, EU:C:2002:603, paras 44–50; Case C-583/13 P *Deutsche Bahn AG and Others v European Commission*, ECLI:EU:C:2015:404.
182 Case T-11/89 *Shell International Chemical Company Ltd v Commission of the European Communities*, ECLI:EU:T:1992:33, para 39; Case T-25/95 *Cimenteries CBR and Others v. Commission of the European Communities*, ECLI:EU:T:2000:77, para 718; Case T-9/99 *HFB Holding für Fernwärmetechnik Beteiligungsgesellschaft mbH & Co. KG and Others v Commission of the European Communities*, ECLI:EU:T:2002:70, para 391; Case T-138/07 *Schindler v. European Commission*, ECLI:EU:T:2011:362, para 54.
183 *Valico S.r.l. v. Italy* App no. 70074/01 (ECtHR, 21 mars 2006) 20.
184 *Schindler* (n 214) para 55. See similarly Joined cases 100 to 103/80 *SA Musique Diffusion française and others v. Commission of the European Communities*, ECLI:EU:C:1983:158; Cases T-56/09 and T-73/09 *Saint Gobain v. European Commission*, ECLI:EU:T:2014:160; Case C-702/19 P *Silver Plastics GmbH & Co. KG and Johannes Reifenhäuser Holding GmbH & Co. KG v. European Commission*, ECLI:EU:C:2020:857; Case C-311/18 *Data Protection Commissioner v. Facebook Ireland Ltd and Maximilian Schrems*, ECLI:EU:C:2020:559.
185 *Hoechst* (n 213), para 15. See also Imran Aslam and Michael Ramsden, 'EC Dawn Raids: A Human Rights Violation?' (2008) 5 The Competition Law Review, 61; Riina Autio, 'Explaining Dawn Raids: A Soft Law Perspective into European Competition Authorities' Explanatory Notes on Unannounced Inspections' (2020) 11 Journal of European Competition Law & Practice, 475; Jérémie Jourdan and Henry Gafsen, 'Competition Law and Fundamental Rights: Survey of Recent Developments Concerning the Right to Good Administration, Dawn Raids, Legal Professional Privilege, and Other Procedural Rights' (2022) 13 Journal of European Competition Law & Practice, 304.
186 *Roquette Frères* (n 213), EU:C:2002:603, para 61; Case T-340/04, *France Télécom SA v Commission of the European Communities*, EU:T:2007:81, para 53. The concept of reasonable suspicion is similarly found in national competition law. See Jorge G. Contreras Condezo, Annabel Kingma and Miroslava Scholten, 'Putting Dawn Raids under Control' (2020) 22 Yearbook of Antitrust and Regulatory Studies, 145.
187 Case C-37/13 P, *Nexans and Nexans France v Commission*, EU:C:2014:2030, para 34; Case C-247/14 P *HeidelbergCement AG v European Commission*, ECLI:EU:C:2016:149, para 19.
188 Joined cases C-97/87 to C-99/87 *Dow Chemical Ibérica and Others* v *Commission*, EU:C:1989:380, para 45; Case 85/87 *Dow Benelux v Commission* ECLI:EU:C:1989:379, para 10.
189 Case T-339/04 *France Télécom v Commission*, EU:T:2007:80, paras 58–59; Joined cases T-289/11, T-290/11 and T-521/11 *Deutsche Bahn and Others v Commission*, EU:T:2013:404, paras 75–77.
190 *Hoechst* (n 213) para 29.
191 *Dow Benelux* (n 221), para 11; Case T-249/17, *Casino and Achats Marchandises Casino SAS (AMC) v European Commission*, ECLI:EU:T:2020:458, para 112.
192 Case T-135/09 *Nexans France and Nexans* v *Commission*, EU:T:2012:596, paras 52–59; Case T-140/09 *Prysmian SpA and Prysmian Cavi e Sistemi Energia Srl v European Commission*, ECLI:EU:T:2012:597, paras 43–52.

demonstrated that it had reasonable grounds for ordering an inspection covering all electric cables'.[193] To sum up, whilst it might be easy for the EC to comply with the duty to state specific reasons of Article 20(4), the decision authorising the dawn raid may still be challenged on the ground of insufficient reasonable suspicion.

B. Opaqueness

The question is therefore whether red flags raised through cartel screening may be considered a reasonable ground for suspicion. In *HeidelbergCement*, the ECJ annulled the EC's decision because its statement of reasons was 'excessively succinct, vague and generic'.[194] It is fair to assume an EC's decision authorising a dawn raid that merely relies a ground such as 'the AI system said so' will definitely be similarly qualified as unreasonable.[195] This is where the problem lies. AI-driven cartel screening challenges the principle of good administration and the duty to state reasons.[196] Civil servants should provide 'human-interpretable information about the factors used in a decision and their relative weight'.[197] When an administrative decision is (at least partially) based on an algorithmic recommendation, then the duty to state reasons will be satisfied if the human operator is able to disclose how the different parameters were weighted and to what extent that recommendation was decisive for the final decision.[198] This is, however, not always possible given AI system's opacity. Opacity may come from public servants' illiteracy (*i.e.*, the system is understandable for AI experts only), or may be intrinsic to the system.[199] The latter case is known as the 'black box problem'.[200] Father of cybernetics Norbert Wiener defined a 'black box' as an 'internal structure inaccessible to us and which we do not know'.[201] Its origin is technological. AI does not rely on causation but on correlation. AI-driven cartel screening 'cannot support causal explanations of the kind that underlie the reasons traditionally offered to justify governmental action'.[202] In such situation, public officers cannot motivate their decisions by taking into consideration the relevant factors and weighting them appropriately because neither the factors nor their weight are known. A mere reference to the AI system's recommendation cannot fulfil the duty to state reasons as its opacity does not allow an effective judicial review of the administrative decision and hence infringes the right of the defence.[203]

C. Transparency and human autonomy

AI-driven cartel screening has therefore to be explicable.[204] The independent high-level expert group on AI set up by the EC (hereafter, HLEG) emphasised that 'the degree to which explicability is needed is highly dependent on the context and the severity of the consequences if that output is erroneous or otherwise inaccurate'.[205] In this regard, it should be noted that dawn raid is a highly intrusive tool that interferes with the rights and freedoms of undertakings 'by the means of coercion, compulsion and threats of pecuniary sanctions'[206] and that is 'likely to be traumatic for staff' of the raided undertaking.[207] Moreover, dawn raids are sometimes conducted without an *ex ante* judicial warrant.[208] Yet it is precisely the duty to state reason in the decision and the *ex post* judicial

193 *Nexans France* (n 225), para 91; *Prysmian* (n 225), para 89.

194 *HeidelbergCement* (n 220), para 39. This case concerned a request for information under Article 18(3) of Regulation 1/2003 but it has been argued its conclusion may be applied *mutatis mutandis* to dawn raid. Helene Andersson, *Dawn Raids Under Challenge: Due Process Aspects on the European Commission's Dawn Raid Practices* (Hart Publishing 2018) 86.

195 Fink and Finck (n 209) 385.

196 Frank Pasquale, 'Inalienable Due Process in an Age of AI: Limiting the Contractual Creep toward Automated Adjudication' in Hans-W. Micklitz and others, *Constitutional Challenges in the Algorithmic Society* (Cambridge University Press 2021). See also Bryce Goodman and Seth Flaxman, 'European Union Regulations on Algorithmic Decision Making and a "Right to Explanation"' (2017) 38 AI Magazine 50; Jenifer Cobbe, 'Administrative law and the machines of government: judicial review of automated public-sector decision-making' (2019) 39 Legal Studies 636.

197 Finale Doshi-Velez and others, 'Accountability of AI Under the Law: The Role of Explanation' (2019) arXiv working paper, available at: https://arxiv.org/abs/1711.01134.

198 Karen Yeung, 'Why Worry about Decision-Making by Machine?' in Karen Yeung and Martin Lodge (eds.), *Algorithmic Regulation* (Oxford University Press 2019)

199 Fink and Finck (n 209).

200 Frank Pasquale, *The Black Box Society: The Secret Algorithms That Control Money and Information* (Harvard University Press 2016); Henrik P. Olsen, Jacob L. Slosser and Thomas T. Hildebrandt, 'What's in the Box? The Legal Requirement of Explainability in Computationally Aided Decision-Making in Public Administration' in Hans-W. Micklitz and Others (eds.), *Constitutional Challenges in the Algorithmic Society* (Cambridge University Press 2022).

201 Norbert Wiener, *God and Golem, Inc.: A Comment on Certain Points where Cybernetics Impinges on Religion* (The MIT Press 1964) 42.

202 Cary Coglianese and David Lehr, 'Regulating by Robot: Administrative Decision Making in the Machine Learning Era' (2017) 105 Georgetown Law Review 1147, 1167; Lehr and Ohm (n 95).

203 *PI v Landespolizidirektion Tirol* (n 211) para 57.

204 For a discussion on the effectiveness of explicability, see Sandra Wachter, Brent Mittelstadt and Luciano Floridi, 'Why a Right to Explanation of Automated Decision-Making Does Not Exist in the General Data Protection Regulation' (2017) 7 International Data Privacy Law 76; Lilian Edwards and Michael Veale, 'Slave to the Algorithm? Why a "Right to an Explanation" Is Probably Not the Remedy You Are Looking For' (2017) 16 Duke Law & Technology Review Journal 18.

205 Independent High-Level Expert Group on Artificial Intelligence set up by the European Commission, 'Ethics Guidelines for Trustworthy AI' (8 April 2019) 13.

206 Aslam and Ramsden (n 218) 61.

207 Costanza Nicolosi, 'No fishing at dawn (raids): defining the scope of the commission's inspection power in antitrust proceedings' (2016) 7 Queen Mary Law Journal, 53, 54.

208 Contreras Condezo, Kingma and Scholten (n 229) 145.

review of that decision that make prior judicial authorisation unnecessary.[209] As such, the degree of explicability is expected to be high.

Once again, the AI Act constitutes a relevant source of inspiration. The whole purpose of explainability is to ensure human autonomy, *i.e.*, the capacity 'to keep full and effective self-determination' that leaves 'meaningful opportunity for human choice'.[210] The HLEG explained the requirements of human agency and oversight epitomise this principle.[211] They were both crystallised in the AI Act.

Human agency means human beings must be able to make informed choice, hence the intertwining with human autonomy. The AI Act actualises Louis Brandeis' maxim on transparency, namely 'sunlight is said to be the best of disinfectants; electric light the most efficient policeman'.[212] AI-driven cartel screenings should be designed 'in such a way to ensure that their operation is sufficiently transparent to enable users to interpret the system's output and use it appropriately' (art. 13(1) AI Act). This requires two things. First, AI-driven cartel screening should be designed to reveal to their operators the probability of their conclusions.[213] Second, public officers should receive 'appropriate knowledge and tools to comprehend and interact with AI systems to a satisfactory degree and, where possible, be enabled to reasonably self-assess or challenge the system'.[214] As the father of jurimetrics, Lee Loevinger, explained, 'it is not the invention of tools, however subtle, complex, or powerful, that constitutes man's greatest achievement, but the skill in using the tools that man has developed in himself'.[215] Education is key, as 'it is not easy for humans to understand or intuitively explain how these algorithms reach their predictions'.[216] Public officers should therefore receive 'instructions for use in an appropriate digital format or otherwise that include concise, complete, correct and clear information that is relevant, accessible and comprehensible to users' (art. 13(2)).

Human oversight ensures AI system does not undermine human autonomy by keeping a human-in-the-loop (at every stage of the AI system), on-the-loop (during the design cycle or system's operation), or in-command (overseeing the overall activity of the AI system).[217] The design of AI systems has to ensure 'they can be effectively overseen by natural persons during the period in which the AI system is in use' (art. 14(1)). The upshot is that human operators have to 'fully understand the capacities and limitations' of the AI systems (art. 14(4)(a)) and to be able to interpret the system's output (art. 14(4)(c) and 13(1)), and to be able to choose when (not) to use the AI system and when to disregard, override, or reverse its output (14(4)(d)). Quite interestingly, the HLEG emphasised human oversight also implies 'public enforcers have the ability to exercise oversight in line with their mandate' hence referring, to some extent, to Article 41 CFR.[218] The European Group on Ethics in Science and New Technologies added the human control on decision-making process has to remain effective.[219] This means AI systems should not 'become the primary decision makers' that 'take human decision making out of the process'.[220] A concrete human oversight requirement therefore constitutes a '"dead-driver" vigilance device [that] prevents the mindless rubberstamping of AI-generated proposed decisions'.[221]

V. A human challenge

A. Automation bias

Debates on black box and explainability are paradoxical. On the one hand, algorithms are criticised because opaque.[222] On the other hand, they are heralded as a neutral solution addressing flaws in human decision-making.[223] Sociologists of science and technology demonstrate over and over again that public institutions *are* black boxes. Revisiting the Hobbesian Leviathan, Michel Callon and Bruno Latour explained that each institution is 'a flowchart in which each black box, each carefully delimited island, is linked by a set or

209 Adam Steene, 'Nexans, Deutsche Bahn, and the ECJ's Refusal to Follow ECHR Case Law on Dawn Raids' (2016) 7 Journal of European Competition Law & Practice, 180.
210 HLEG (n 240) 12.
211 *Ibid*.
212 Louis D. Brandeis, *Other People's Money and How the Bankers Use It* (Stokes 1914) 92.
213 Huber and Imhof (n 16); Supreeth P. Shashikumar and others, 'Artificial intelligence sepsis prediction algorithm learns to say "I don't Know"' (2021) 4 npj Digital Medicine https://www.nature.com/articles/s41746-021-00504-6#citeas.
214 HLEG (n 240) 16.
215 Jurimetrics is the discipline that use probability and statistics to answer legal question. See Lee Loevinger, 'Jurimetrics: Science and Prediction in the Field of Law' (1961) 46 Minnesota Law Review 255, 275.
216 Coglianese and Lai (n 1(n1) 18; Harrington and Imhof (n 17) 144.
217 *Ibid*.
218 *Ibid*.
219 European Group on Ethics in Science and New Technologies, 'Statement on Artificial Intelligence, Robotics and "Autonomous" Systems' (March 2018) available at https://op.europa.eu/en/publication-detail/-/publication/dfebe62e-4ce9-11e8-be1d-01aa75ed71a1/language-en/format-PDF/source-78120382.
220 Danielle Keats Citron, 'Technological Due Process' (2008) 85 Washington University Law 1249, 1252.
221 Sanchez-Graells (n 52).
222 Madalina Busuioc, 'Accountable Artificial Intelligence; Holding Algorithms to Account' (2022) 81 Public Administration Review 825.
223 Cass R. Sunstein, 'Governing by Algorithm? No Noise and (Potentially) Less Bias' (2022) 71 Duke Law Journal 1175.

arrows to other boxes' and that 'the islands are closed and the arrows are univocal'.[224] Each cell of this Leviathan, *i.e.*, the individuals who make it up, are subject to bounded rationality. Human decision is, indeed, not 'significantly more accountable than AI',[225] nor is AI 'completely devoid of many of the "failures" that are common in human-made decisions'.[226]

Explicability goes beyond the algorithmic challenge. The duty to state reasons requires an explanation of the algorithmic operation *and* an explanation of 'the influence that algorithm results have on (constraining) human decision-making'.[227] AI-driven cartel screening is an 'interactive computing system designed to change people's attitudes'.[228] Karen Yeung labels them 'algorithmic regulatory systems' and distinguishes between automated enforcement and recommender system.[229] AI-driven cartel screening belongs to the latter category. AI-driven cartel screening neither makes 'the offense literally impossible to carry out' nor automatically sanction collusion.[230] AI-driven cartel screening solely recommends further investigation.[231] An omniscient and omnipotent AI-based 'Big Brother' capable of 'automatically and autonomously detecting and sanctioning' any anticompetitive behaviour 'simply remains science-fiction'.[232]

Yet recommender systems should not be underestimated. Going against the recommendation would require a well-written reasoned decision that renders 'the exercise of discretion costlier'.[233] This is because the EC officials should not only explain why they took a particular decision but also why they did not follow the recommendation. On the contrary, following that recommendation will facilitate the duty to state reasons as public servants will have the conclusions of the algorithm at their disposal. In addition, a public officer could legitimately fear to make a mistake—the AI system being statistically more often right than wrong. As explained by Danielle Keats Citron, 'a hearing officer's belief that computer decisions are error-resistant increases the likelihood of inaccurate outcomes'.[234]

This is partly due to the *automation bias* (or 'algorithmic dumbfounding'[235]), that is the (very well-documented) irrational tendency to rely on automated decision even when the operator suspect malfunction.[236] This bias leads to complacency on the part of officials who then fall 'asleep at the wheel' by mindlessly following the recommendation 'without engaging in a substantive analysis of their (perceived) correctness in the specific instance'.[237] Behavioural economy helps us carrying the point as the automation bias is the digital update of search satisfying (stop searching once a first plausible

224 Michel Callon and Bruno Latour, 'Le grand Léviathan s'apprivoise-t-il?' in Madeleine Akrich, Michel Callon and Bruno Latour, *Sociologie de la traduction: Textes fondateurs* (Presses des Mines 2006) 16 (free translation). The black box argument was updated to fit the philosophy of technology. See Langdon Winner, 'Social constructivism: Opening the black box and finding it empty' (1993) 3 Science as Culture 427; Langdon Winner, 'Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology' (1993) 18 Science, Technology, & Human Values 362; Noemi Waight and others, 'Towards Equitable, Social Justice Criticality: Re-Constructing the "Black" Box and Making it Transparent for the Future of Science and Technology in Science Education' (2022) Science & Education, https://doi.org/10.1007/s11191-022-00328-0.

225 Lim (n 106); Cary Coglianese and Alicia Lai, 'Algorithm vs. Algorithm' (2022) 72 Duke Law Journal 1281; Köbis, Starke and Rahwan (n 104).

226 Mattiuzzo and Machado (n 120) 31.

227 Busuioc (n 259) 832.

228 Brian J. Fogg, *Persuasive Technology: Using Computers to Change What We Think and Do* (Elsevier 2003).

229 Karen Yeung, 'Algorithmic regulation: A critical interrogation' (2018) 12 Regulation and Governance 505.

230 *I.e.*, is not an automated enforcement system. See Gary T. Marx, 'The Engineering of Social Control: The Search for the Silver Bullet' in John Hagan and Ruth Peterson (eds.), *Crime and Inequality* (Stanford University Press 1995).

231 Yeung (n 266) 516; Simon Chesterman, *We, the Robots? Regulating Artificial Intelligence and the Limits of the Law* (Cambridge University Press 2021).

232 Sanchez-Graells (n 52).

233 Nicolas Petit, 'Artificial Intelligence and Automated Law Enforcement: A Review Paper' (21 March 2018) available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3145133. For the usefulness of administrative discretion, see Sofia Ranchordas, 'Empathy in the Digital Administrative State' (2022) 71 Duke Law Journal 1341.

234 Citron (n 257) 1254.

235 Nils Köbis, Jean-François Bonnefon, and Iyad Rahwan, 'Bad machines corrupt good morals' (2021) 5 Nature Human Behavior 679.

236 Raja Parasuraman and Victor Riley 'Humans and automation: Use, misuse, disuse, abuse' (1997) 39 Human Factors 230; Kathleen Mosier and others, 'Automation bias and errors: Are teams better than individuals?' (1998) 42 Proceedings of the Human Factors and Ergonomics Society Annual Meeting 201; Linda J. Skikta, Kathleen L. Mosier and Mark D. Burdick, 'Does automation bias decision-making?' (1999) 51 International Journal of Human-Computer Studies 991; Linda J. Skikta, Kathleen L. Mosier and Mark D. Burdick, 'Accountability and automation bias' (2000) 52 International Journal of Human-Computer Studies 701; Linda J. Skikta and others, 'Automation bias and errors: Are crews better than individuals?' (2000) 10 The International Journal of Aviation Psychology 85; Kathleen Mosier and others, 'Aircrews and automation bias: the advantages of teamwork?' (2001) 11 The International Journal of Aviation Psychology 1; Dixon and Wickens (n 173); Mary L. Cummings, 'Automation and accountability in decision support system interface design' (2006) 32 The Journal of Technology Studies 23; Dixon, Wickens and McCarley (n 175); Parasuraman and Manzey (n 171); Kate Goddard, Abdul Roudsari and Jeremy C. Wyatt, 'Automation bias: a systemic review of frequency, effect mediators, and mitigators' (2012) 19 Journal of the American Medical Informatics Association 121; Christopher D. Wickens and others, 'Complacency and automation bias in the use of imperfect automation' (2015) 57 Human Factors and Ergonomics Society 728; David Lyell and Enrico Coiera, 'Automation bias and verification complexity: a systematic review' (2017) 24 Journal of the American Medical Informatics Association 423; Saar Alon-Barkat and Madalina Busuioc, 'Human-AI Interactions in Public Sector Decision Making: "Automation Bias" and "Selective Adherence" to Algorithmic Advice' (2022) Journal of Public Administration Research and Theory, available at https://doi.org/10.1093/jopart/muac007.

237 Sanchez-Graells (n 52); Wickens and others (n 273).

explanation is found), anchoring (premature decision-making based on limited information initially available), diagnosis momentum (pursuit of an action previously instigated, especially is started by a hierarchical supervisor) and confirmation biases (tendency to interpret information to fit preconceived opinion).[238]

In the context of EU competition law proceedings, there is a longstanding debate related to an alleged *prosecutorial bias* on the part of the EC. It has been shown that there is a risk 'staff members who might have spent years gathering information about the anti-competitive practices of the defendants would then be requested to act as prosecutors'.[239] At a later stage of the proceedings, those in charge also have to exercise adjudicative powers. Eva Lachnit explains 'investigatory teams that have dedicated months to finding enough evidence to support an infringement might suffer from the dreaded "tunnel vision", which could cause them to adopt an unfair or biased decision'.[240] The point is apt. The fact that EU law confers on it both investigative and decision-making powers raises the spectre of a biased investigation favouring information concluding to a collusive behaviour and discarding the others.[241] This bias is driven by the EC officials' tendency 'to push through what they perceived to be "their" case' and explains why 'arguments put forward by the parties often appear to fall on deaf ears'.[242] This is quite natural as the same team that 'so far cumulated investigative and prosecutorial powers' has also to 'exercise adjudicative powers'.[243] This leads to *commitment bias*, or escalation of commitment, *i.e.*, the unwillingness for EC officials to adopt a decision that contradict what they have done in the past due to the involvement of 'both the Commission's human resources and reputation capital'.[244] This create a momentum favouring the adoption of the decision.

Using AI-driven cartel screening could strengthen these biases. AI-driven cartel screening 'may seem a novelty, and technology may have changed, but basic human nature and institutional practice have not'.[245] Red flags constitute the first plausible explanation coming from an alleged superior authority (*diagnosis momentum*). After all, when it comes to persuasion, 'computers also benefit from their traditional reputation of being intelligent and fair, making them seem credible sources of information and advice'.[246] They deserve well their reputation. It is consensually admitted that AI systems improve decision-making.[247] While the reliability rate of traditional statistical models does not exceed 50 per cent,[248] that rate of AI-driven screening outdoes 80 per cent.[249] Officials will therefore be tempted to cease the scrutiny (*search satisfaction*). Even if further investigation were to be conducted, the recommendation would serve as an anchor as any new information gathered would be interpreted as strengthening the preconceived opinion (*anchoring and confirmation biases*). Upshot? The automation bias carries the risk of human discretion being abdicated to artificial discretion.[250]

The automation bias is particularly relevant given that all recommender systems (including AI-driven cartel screening) exhibit a side-effect of self-fulfilling prophecies and 'snowballing unfairness'.[251] The recommendations followed at time t become data on which the AI system bases its recommendations at time $t + 1$, which obviously reinforces the feedback loop.[252] A predictive algorithm based on past decisions of the competition authority will 'seek to mirror these decisions'.[253] AI-driven cartel

238 Daniel Kahneman, *Thinking Fast and Slow* (Farrar, Straus and Giroux 2011); Richard H. Thaler, *Misbehaving: The Making of Behavioral Economics* (W.W. Norton & Company, Inc. 2015); Daniel Kahneman, Olivier Sibony and Cass R. Sunstein, *Noise: A Flaw in Human Judgement* (Little, Brown Spark 2021).

239 Cristina Teleki, *Due Process and Fair Trial in EU Competition Law: The Impact of Article 6 of the European Convention on Human Rights* (Brill 2021) 264.

240 Eva Lachnit, *Alternative Enforcement of Competition Law* (Eleven International Publishing 2016) 88.

241 Wouters. P. J. Wils, 'The Combination of the Investigative and Prosecutorial Function and the Adjudicative Function in EC Antitrust Enforcement: A Legal and Economic Analysis' (2004) 27 World Competition, 201.

242 *Ibid.*, 216.

243 Teleki (n 280) 266.

244 *Ibid.*

245 Dan L. Burk, 'Algorithmic Fair Use' (2019) 86 The University of Chicago Law Review 283, 306.

246 Fogg (n 265).

247 Nathalie De Marcellis-Warin and Thierry Warin, 'Les mégadonnées entre possibilités et risques: à la recherche d'un nouvel équilibre' (2017) 42 Gestion 72.

248 David Imhof, Yavuz Karagoek and Samuel Rutz, 'Screening for bid-rigging: does it work?' (2018) 14 Journal of Competition Law and Economics 235.

249 Wallimann, Imhof and Hubert (n 118).

250 Peter Busch and Helle Henriksen, 'Digital discretion: A systematic literature review of ICT and street-level discretion' (2018) 23 Information Polity, 3; Rik Peeters, 'The agency of algorithms: Understanding human-algorithm interaction in administrative decision-making' (2020) 25 Information Polity 507; Busuioc (n 259); Noortje de Boer and Nadine Raaphorst, 'Automation and discretion: Explaining the effect of automation on how street-level bureaucrats enforce' (2021) Public Management Review, available at https://doi.org/10.1080/14719037.2021.1937684.

251 Thomas Nachbar, 'Algorithmic Fairness, Algorithmic Discrimination' (2020) Virginia Public Law and Legal Theory Research Paper No. 2020-11, available at https://ssrn.com/abstract=3530053.

252 Marjolein Lanzing, '"Strongly Recommended" Revisiting Decisional Privacy to Judge Hypernudging in Self-Tracking Technologies' (2019) 32 Philosophy & Technology 549, 562. See also Xavier Amatriain and Justin Basilivo, 'Recommender Systems in Industry: A Netflix Case Study' in Francesco Ricci, Lior Rokach and Bracha Shapira (eds), *Recommender Systems Handbook* (2nd ed., Springer 2015) 391; Jonathan Cohn, *The Burden of Choice: Recommendations Subversion, and Algorithmic Culture*, New Brunswick, Rutgers University Press, 2019.

253 Casey and Niblett (n 103) 145; Isabelle Adam and Mihaly Fazekas, 'Are emerging technologies helping win the fight against corruption? A

screening may therefore well be path dependent. Decisions made in previous iterations may prompt 'a cascading search for purpose'.[254] Such a feedback loop can lead to dramatic consequences.[255] Officials evaluate the 'profile' of the case to retain only those of high importance when suggesting where to allocate the scarce resources of competition authorities. While such considerations are justified by the scarcity of public resources, they may however lead to self-fulfilling prophecies if AI-driven screening concludes the aforementioned evaluation is synonymous of systematic exclusion of some cases. This would create free-competition zone wherein some cartels would remain undisclosed because initially excluded from investigation by the AI system notwithstanding a potential 'significant impact on the functioning of competition in the internal market and risk of consumer harm'.[256] In other words, excessive or undue reliance upon AI-driven cartel screening during the initial assessment phase leads to an *enforcement bias*.[257] This last pitfall is, however, easily mitigated by-design by reducing the weight of output given in t used as input in $t + 1$ to reduce (but not erase) path dependency.[258]

B. Effective human oversight

The AI Act contains an avowed reference to the automation bias and requires recommender systems' users to 'remain aware of the possible tendency of automatically relying or over-relying on the output produced' by an AI system, in particular for systems 'used to provide information or recommendations for decisions to be taken by natural persons' (art. 14(4)(b) AI Act). Some commentators rightly noted that it is not enough to know that human operators 'are aware of the potential for automation bias'.[259] It is the absence of overreliance on the AI system that 'must be transparently demonstrated and ensured'.[260] Commentators therefore call on users 'to implement organisational non-technical measures to ensure robust human oversight'.[261] Such a solution is a 'four eyes principle' that mandates a second officer to approve both the decision and its underlying reasoning proposed by a first officer before it enters into force may well mitigate the automation bias.[262] This solution is not alien to competition law. US President Woodrow Wilson originally proposed the Federal Trade Commission be given an information-gathering mission only.[263] Within the EU, both the Belgian[264] and French[265] National Competition Authorities, amongst others, are bicephalic institutions that largely separate the investigation from the decision-making.

The French and Belgian current institutional organisation has inherent positive features. The strict distinction between investigation and prosecution enhances procedural fairness.[266] From a fundamental rights perspective, this bicephalic structure is, indeed, 'stronger than the "all in one" EC-like set-up'.[267] It improves internal independence by avoiding the Competition Authority to become 'the "judge, jury, and executioner" of its own cases'.[268] The whole point is to unbiased decision-making process.[269] AI-driven cartel screening—that raise the same 'dreaded tunnel' issue—might be mitigated the same way. Like the distinction between investigation and decision-making within a competition authority mitigates the confirmation and commitment biases, an independent team should scrutinise the red flags raised by AI-driven cartel screening during the investigation phase, especially if this triggers the need for a dawn raid. This should mitigate the automation bias encountered at the information-gathering phase by assessing the algorithmic recommendation with a 'fresh set of eyes'.[270]

The complexity of implementing this solution will depend on the structure of the competition authority

review of the state of evidence' (2021) 57 Information Economics and Policy https://doi.org/10.1016/j.infoecopol.2021.100950.

254 Nachbar (n 294).

255 Matthias Leese, 'The New Profiling: Algorithms, Black Boxes, and the Failure of Antidiscriminatory Safeguards in the European Union' (2014) 45 Security Dialogue 494; Brent Mittelstadt and others, 'The Ethics of Algorithms: Mapping the Debate' (2016) 3 Big Data & Society 1.

256 Commission notice on best practices (n 38) 13.

257 von Bonin and Malhi (n 49) 469.

258 George Alexandru Adam and others, 'Hidden Risks of Machine Learning Applied to Healthcare: Unintended Feedback Loops Between Models and Future Data Causing Model Degradation' (2020) 126 Proceedings of Machine Learning Research 710, 722. This solution is in line with art. 15(3) AI Act.

259 Smuha (n 196).

260 *Ibid*.

261 *Ibid*.

262 Fink and Finck (n 209) 387 n 69.

263 Frederic M. Scherer, *Competition Policies for an Integrated World Economy* (The Brookings Institution 1994) 92.

264 Dirk Vandermeersch, 'De mededingingsregels en hun handhaving: de hervorming van 2013', in Alex Tallon (ed.), *Le Nouveau Code de droit économique—Het Nieuwe Wetboek van Economisch Recht*, Brussels, Larcier, 2014, pp. 53–54; Norman Neyrinck, *Manuel de droit belge de la concurrence. Les pratiques restrictives de concurrence* (Larcier 2021). Belgian Competition Authority separates investigation (the *Auditorat*) and fining (*Collège de la concurrence*).

265 Loi de modernisation de l'économie n° 2008–776 du 4 août 2008; Ordonnance n° 2008–1161 du 13 novembre 2008. French Competition Authority separates investigation (*Service d'Instruction*) and fining (*College*).

266 Bruno Lasserre, 'The new French competition law enforcement regime', Competition Law International, Vol. 5, No. 3, 2009, pp. 15–20.

267 Wouter Devroe, Bruno Van den Bosch and Frances Van den Bogaert, 'Antitrust Enforcement in Belgium' in Tihamer Toth (ed.), *The Cambridge Handbook of Competition Law Sanctions* (Cambridge University Press 2022) 328.

268 Lachnit (n 281) 42.

269 *Ibid*., 87.

270 Lachnit (n 281) 342.

concerned. On the one hand, the proposed 'four-eyes principle' will be a little change for competition authorities that are already organised under a bicephalic model. The use of AI-driven cartel screening by the investigation department will be under the scrutiny of the decision-making department. This will prolong the proceedings duration, but that extra time will be wisely spent if this prevents any challenge of decision taken during the investigation phase. For instance, the annulment of a decision authorising a dawn raid will definitely lead to a much greater loss of time than the time lost ensuring the soundness of the stated reasons behind that decision. On the other hand, implementing the 'four-eyes principle' may be a little more complex for all-in-one competition authority like the EC. The good news is, however, that there is no need for an institutional split of DG Competition to achieve this objective. Unbiasing decision-making might be done through an extension of the Hearing Officer's role. At the EU level, this person already ensures the effective exercise of the procedural rights of the parties involved in competition proceedings.[271] She is an independent arbiter who has been entrusted with the safeguarding of procedural rights including, *inter alia*, the rights of undertakings subject to investigation measures.[272] The proposed 'four-eyes principle' perfectly fits her job function. This solution shares the same *rationale* as her existing powers, *i.e.*, the enhancement of procedural fairness. As such, this new prerogative could easily be added to her current power.

To sum up, the hearing officer may be the person ensuring that the human oversight requirement (Art. 14 AI Act) is met and well. To do so, she may control whether, beyond mere awareness of automation bias, public officials are trained to identify where and when the automation bias occurred. She may also require that the investigation department that relies on AI communicate 'how other available information or alternative outcomes were considered in reaching a decision'.[273]

VI. Conclusion

The EC is well aware digital technology raises structural competition problems. The modernisation of EU competition law proceedings is therefore amply justified. AI-driven cartel screening may play this role and lift the secrecy veil on Pac-Man's position. However, this does not constitute a silver bullet. This paper identifies three major pitfalls. First, the absence of reliable dataset challenges the quality of algorithmic recommendation. Second, limited explainability of AI systems infringes the principle of good administration and the duty to state reasons. Third, human cognitive biases (automation bias at the forefront) similarly challenge the duty to state reasons as explaining an administrative decision also means explaining how the algorithmic recommendation was weighted in the human decision-making process. None of these drawbacks constitute a dead-end. The AI Act provides useful (at least, embryonic) solutions, respectively data governance, transparency, and human oversight. To achieve effective human oversight and mitigate the automation bias, this paper proposes to organise a 'four-eyes' principle according to which an independent person would scrutinise the use of AI-driven cartel screening during the investigation phase.

Even if the AI Act is not applicable to EU competition law proceedings, AI-driven cartel screening's developers and users should be well advised to take inspiration from this Proposal. Endorsing the AI Act requirements (at least, voluntarily) may even be required to avoid any challenges of EC's decisions based on violation of the duty to state reasons. In the end, outsmarting Pac-Man cannot be done at the expense of fundamental rights.

https://doi.org/10.1093/jeclap/lpad017

271 Decision of the President of the European Commission of 13 October 2011 on the function and terms of reference of the hearing officer in certain competition proceedings, OJ L 275, 20 October 2011, pp. 29–37.

272 *Ibid*., Article 4.

273 For a similar argument, see Fink and Finck (n 209) 387.