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Artificially Intelligent and Free to Monopolize: A New Threat to Competitive Markets Around the World

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ARTIFICIALLY INTELLIGENT AND FREE TO MONOPOLIZE: A NEW THREAT TO COMPETITIVE MARKETS AROUND THE WORLD

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I. INTRODUCTION

The Organization for Economic Cooperation and Development (OECD),¹ which represents some of the world's largest economies, believes computers can possibly commit crimes for which humans could be held liable. Specifically, the OECD and its member nations have identified algorithmic collusion² in oligopolistic markets as a potential source of anticompetitive concerns.³ However, the OECD's *Recommendation of the Council Concerning Effective Action Against Hard Core Cartels* (OECD Recommendation or Recommendation),⁴

1. "The Organization for Economic Cooperation and Development (OECD) is a unique forum where the governments of 34 democracies with market economies work with each other, as well as with more than 70 non-member economies to promote economic growth, prosperity, and sustainable development. The Organization provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and coordinate domestic and international policies." *What is the OECD?*, U.S. MISSION TO THE ORG. FOR ECON. COOPERATION & DEV., <https://usoecd.usmission.gov/our-relationship/about-the-oecd/what-is-the-oecd/> (last visited Mar. 1, 2019).

2. Antonio Capobianco et al., *Algorithms and Collusion*, 14 OECD (2017), <http://www.oecd.org/competition/algorithms-and-collusion.htm> ("Algorithmic collusion consists of any form of an anti-competitive agreement or coordination among competing firms that is facilitated or implemented through means of automated systems.").

3. Org. for Econ. Cooperation & Dev. [OECD], *Algorithms and Collusion: Competition Policy in the Digital Age*, at 33 (2017), www.oecd.org/competition/algorithms-collusion-competition-policy-in-the-digital-age.htm [hereinafter *Competition Policy in the Digital Age*] (explaining that the current growth in the use of algorithms combined with developments in machine learning have induced many changes in digital markets and fueled a wide debate on what such developments may mean for competition agencies and their enforcement activities).

4. See generally Org. for Econ. Cooperation & Dev. [OECD], *Recommendation of the Council Concerning Effective Action Against Hard Core Cartels*,

established two decades ago and adopted successfully by member and non-member OECD nations, does not suffice to effectively promote international comity with the novel challenges algorithmic collusion presents to competition authorities.⁵ More needs to be done to safeguard against the risks posed by deep-learning artificial intelligence (AI) in digital markets.

The call within the international community to close the gap in antitrust enforcement has grown exponentially in past years, and algorithmic collusion is no exception.⁶ The OECD and its member nations have expressed concerns and explored how their national competition authorities are equipped to tackle this problem—if they are even willing to assign liability to robotically created collusion.⁷ Although most competition authorities around the world have designated tacit collusion⁸ as legal, it remains unclear whether that should still be the case when implemented through AI pricing algorithms—especially where the outcome is predictable.⁹ If

OECD/LEGAL/0294, <https://legalinstruments.oecd.org/api/print?ids=193&lang=en> [hereinafter *Recommendation*].

5. The OECD, in a 2016 report, commented that these strategies “may pose serious challenges to competition authorities in the future, as it may be very difficult, if not impossible, to prove an intention to coordinate prices, at least using current antitrust tools.” Ariel Ezrachi & Maurice E. Stucke, Org. for Econ. Cooperation & Dev. [OECD], *Algorithmic Collusion: Problems and Counter-Measures*, at 19, DAF/COMP/WD(2017)25 (May 31, 2017), <https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DAF/COMP/WD%282017%2925&dolanguage=en> [hereinafter Ezrachi & Stucke, *Problems and Counter-Measures*].

6. See C. Paul Rogers III, *The Incredible Shrinking Antitrust Law and the Antitrust Gap*, 52 U. LOUISVILLE L. REV. 67, 67 (2013) (discussing how substantive antitrust law began shrinking in the 1970s and has steadily continued to do so).

7. See generally Org. for Econ. Cooperation & Dev. [OECD] Directorate for Fin. & Enter. Aff. Competition Comm., *Algorithms and Collusion—Summaries of Contributions*, DAF/COMP/WD(2017)2 (June 16, 2017), www.oecd.org/daf/competition/algorithms-and-collusion.htm (citing national reports on approaches to algorithmic collusion submitted to the OECD for roundtable discussion); *Competition Policy in the Digital Age*, *supra* note 3, at 39 (highlighting challenges in assigning liability).

8. Tacit collusion refers to decisions made in “conscious parallelism,” which in oligopolistic markets, can lead to potentially anti-competitive coordination without any explicit agreements. Competitors maintain this behavior by recognizing their mutual interdependency. *Competition Policy in the Digital Age*, *supra* note 3, at 19.

9. ARIEL EZRACHI & MAURICE E. STUCKE, *VIRTUAL COMPETITION: THE PROMISE AND PERILS OF THE ALGORITHM DRIVEN ECONOMY* 80 (2016) [hereinafter

computers replace traditional cartels,¹⁰ algorithms can be programmed or self-learn to collect market data, monitor price variations, and automatically retaliate against any deviation. As a result, market equilibrium (viz. competitive output and price) could be reset (viz. lower output and higher price) entirely “automatically.”¹¹ When output adjusts through AI and the machines self-learn to collude, there is a high probability, under current antitrust laws, that extreme anticompetitive behavior could remain undetected and unpunished.¹²

This paper covers the OECD Recommendation’s inability to facilitate international comity and enforcement cooperation in scenarios of AI algorithmic collusion.¹³ The introduction of AI deep-learning algorithms in Part II addresses both the efficiencies and the potential for the creation of permanent “algorithmic cartels.”¹⁴ The background of Part II concludes by covering the 1998 OECD legal instrument, *Recommendation of the Council Concerning Effective Action Against Hard Core Cartels*, and its adoption by OECD member and non-member nations.¹⁵ Part III highlights that the OECD Recommendation captures the same collusive behaviors and outcomes algorithmic collusion generates but proves insufficient to promote international enforcement cooperation and comity in scenarios of AI collusion.¹⁶ This paper concludes, in Part IV, with several

EZRACHI & STUCKE, VIRTUAL COMPETITION].

10. See *Recommendation*, *supra* note 4 (discussing the “convergence and effectiveness of laws prohibiting hard core cartels”).

11. See Terrell McSweeney & Brian O’Dea, *The Implications of Algorithmic Pricing for Coordinated Effects Analysis and Price Discrimination Markets in Antitrust Enforcement*, 32 ANTITRUST 75, 76 (2017) (suggesting algorithmic collusion could lead to near monopolistic pricing).

12. See Antonio Capobianco & Pedro Gonzaga, *Algorithms and Competition: Friends or Foes?*, CPI ANTITRUST CHRON. 1 (Aug. 2017) (explaining that machine learning and pricing algorithms allow firms to develop sophisticated strategies to collude under the radar of competition authorities); see also McSweeney & O’Dea, *supra* note 11, at 79 (noting the ability of algorithms to facilitate an increase in tacit collusion and the lack of protection the Sherman Act offers).

13. See discussion *infra* Part II.

14. See *id.*

15. See *id.* (focusing on non-signatories to the agreement—China, India, and Russia, as well as signatories to the agreement—the United States, European Union, and Brazil (which is a nonmember state to the OECD)); see also *Recommendation supra* note 4.

16. See discussion *infra* Part III (arguing that there will be a negative trickle-

recommendations for the proper adoption of the OECD Recommendation by national competition authorities in light of the challenges algorithmic collusion poses.¹⁷

II. BACKGROUND

This section provides background on cartels in the digital economy and the OECD's response. Part A introduces the problem of interdependence among firms in oligopolistic markets and how the proliferation of the digital economy heightens these concerns. Part B explains how the use of algorithms, particularly AI, intensifies existing problems in oligopolistic markets. Part C introduces the OECD Recommendation which was intended to address these problems.

A. DIGITIZED OLIGOPOLISTIC MARKETS

Economists and competition authorities face a century-old problem with no identified adequate solution: interdependence in oligopolistic markets.¹⁸ When a market consists of very few sellers of homogenous products, they may be able to set output below, and prices above, the competitive level with no formal agreement.¹⁹ Competitive markets are most vulnerable to manipulation when they are highly concentrated.²⁰ In these markets, economists observe high interdependence and mutual self-awareness between sellers, which makes parallel decision-making more likely (the so-called “oligopoly problem”).²¹ This results in tacit collusion — an undesirable outcome

down effect on international comity due to the increasing gaps in global competition authorities' approaches in regulating the growing presence of AI).

17. See discussion *infra* Part IV.

18. See Richard A. Posner, *Oligopoly and the Antitrust Laws: A Suggested Approach*, 21 STAN. L. REV. 1562, 1562 (1968) (analyzing the persistent and difficult oligopoly problem in antitrust policy).

19. *Id.*

20. See, e.g., *id.* at 1591 (recognizing that even express collusion, not only tacit, is rarely practicable in non-oligopolistic market structures); Ashwin Ittoo & Nicolas Petit, *Algorithmic Pricing Agents and Tacit Collusion: A Technological Perspective 2* (Oct. 2, 2017) (unpublished manuscript) (on file with SSRN: <https://ssrn.com/abstract=3046405>) (conceding that tacit collusion is only sustainable in concentrated markets).

21. See *Competition Policy in the Digital Age*, *supra* note 3, at 35 (noting efforts of competition authorities to attempt to extend antitrust tools to address the oligopoly

for consumers, but a profit-maximizing outcome for firms, and in most cases entirely within the law.²²

Today's online and data-driven economy allows for increased market transparency and flow of information.²³ Economists recognize

problem). Essentially, this small group of sellers recognizes they are offering near identical products for the same group of consumers and, further, are aware that entrants are unlikely because of high barriers. They decide to act in parallel to maximize profits and not lose their share of customers or profits. The interdependence theory, however, is thought to be overstated in primary factual assertions—that all players in an oligopolistic market are operating at the same or very similar cost levels, that there is no meaningful lag time between the price cut and the response, and that all players have the same capacity to expand. Posner, *supra* note 18, at 1563-64, 1566. *See also* ORG. FOR ECON. COOPERATION & DEV. [OECD], GLOSSARY OF INDUSTRIAL ORGANIZATION ECONOMICS AND COMPETITION LAW 26 (1993), <http://www.oecd.org/regreform/sectors/2376087.pdf> (defining conscious parallelism).

22. *See* Capobianco & Gonzaga, *supra* note 12, at 3 (recognizing that collusive outcomes through conscious parallelism hardly amount to an antitrust violation in any international jurisdiction — which is an incredible obstacle for competition authorities when looking at homogenous markets); *Pricing Algorithms: The Digital Collusion Scenarios*, FRESHFIELDS BRUCKHAUS DERINGER 5 (2017), <https://www.freshfields.com/globalassets/our-thinking/campaigns/digital/mediainternet/pdf/freshfields-digital---pricing-algorithms---the-digital-collusion-scenarios.pdf> (addressing German and French authorities' joint report in which they noted the lack of legal basis for any intervention by competition authorities); Bruno Salcedo, *Pricing Algorithms and Tacit Collusion* 5 (Nov. 1, 2015) (unpublished manuscript) (on file with Pennsylvania State University), <http://www.brunosalcedo.com/docs/collusion.pdf> (noting collusion without an explicit agreement or direct communication falls outside the scope of regulatory framework); *cf.* Posner, *supra* note 18, at 1571 (conceding that Section 1 of the Sherman Act under United States law was meant to deter the outcomes that tacit collusion creates and thus should be treated as such an instrument).

23. *See* Capobianco & Gonzaga, *supra* note 12, at 2-3; *Competition Policy in the Digital Age*, *supra* note 3, at 21-22; *accord* EZRACHI & STUCKE, VIRTUAL COMPETITION, *supra* note 9, at 4 (identifying market transparency and the increased flow of information as a driver in market efficiency and shift in seller offerings and consumer purchase behaviors). In unconcentrated markets where sellers offer heterogeneous products, market transparency has a positive impact. *See* Damien Geradin, *Algorithmic Tacit Collusion and Individualized Pricing: Are Antitrust Concerns Justified?*, 6 COPENHAGEN ECON. (June 19, 2017), <https://www.copenhageneconomics.com/dyn/resources/Filelibrary/file/6/66/1498204706/geradin.pdf> (arguing that an increase in product heterogeneity should decrease the likelihood of tacit collusion). *But see* David J. Lynch, *Policing the Digital Cartels*, FIN. TIMES (Jan. 8, 2017), <https://www.ft.com/content/9de9fb80-cd23-11e6-864f-20dcb35cede2> (discussing *U.S. v. Topkins*, where there was a price-fixing agreement for the poster market on Amazon—a market that should have been

the undistorted flow of information in markets as a component of “perfect competition.”²⁴ Consumers no longer have to enter every big-box store to price shop but can monitor and compare prices in real time behind a screen, driving lower consumer search costs.²⁵ Sellers are also able to communicate with consumers easier than before and compare their offerings to competitors, creating a competitive dynamic previously absent from the market.²⁶ This competitive dynamic drives more entry by reducing barriers—a brick and mortar store is no longer necessary to enter a market where it was previously required, traditional advertising transforms into services where sellers only pay per click,²⁷ and it attracts sellers who would otherwise be risk-averse and have an ill-perceived acuity of entry costs.²⁸

a poor candidate for price fixing because the products are heterogeneous and hard to compare).

24. E.g., Org. for Econ. Cooperation & Dev. [OECD], *Unilateral Disclosure of Information with Anticompetitive Effects*, at 11, DAF/COMP(2012)17 (Oct. 11, 2012), www.oecd.org/daf/competition/Unilateraldisclosureofinformation2012.pdf (conceding perfect competition requires the existence of market transparency in order for firms to benchmark performance and pricing alongside competitors).

25. See, e.g., EZRACHI & STUCKE, VIRTUAL COMPETITION, *supra* note 9, at 5 (comparing price transparency online with the effort it would take to visit 5,000 grocery stores around town—no one has time to visit every store to compare prices, but they have time to do a single online search). In turn, consumers can dispel irrelevant information easily and receive a far greater volume of relevant information that was before unachievable. See McSweeney & O’Dea, *supra* note 11, at 75 (noting the presence of algorithms as key to firms’ competitive behavior in the marketplace and to deliver meaningful consumer benefits, such as product recommendations); see also *Competition Policy in the Digital Age*, *supra* note 3, at 15-17 (analyzing the supply-side and demand-side efficiencies of algorithm use in business operations).

26. See EZRACHI & STUCKE, VIRTUAL COMPETITION, *supra* note 9, at 7 (recognizing that one of the promises of online markets is to more efficiently match buyers and sellers, further promoting allocative efficiency); Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 32 (describing firms’ ability to undercut prices of competitors through direct communications with buyers).

27. Google AdWords is an advertising system in which advertisers bid on certain keywords in a pay-per-click system and can reach consumers through the Google search network or Google display network. See Jacob Baadsgaard, *What is Google AdWords and Why Do I Need It?*, DISRUPTIVE ADVERT. (Jan. 1, 2018), <https://www.disruptiveadvertising.com/adwords/what-is-google-adwords/>.

28. E.g., EZRACHI & STUCKE, VIRTUAL COMPETITION, *supra* note 9, at 6-7 (identifying sellers, Airbnb and Uber, who have entered markets that otherwise would not have without the reduced barriers where the sellers are backed by “guarantees” which reduce the risks of entry).

In the burgeoning digital economy, the danger of interdependence in oligopolistic markets is heightened.²⁹ Competition law enforcers find interdependence among firms in concentrated markets undesirable, as their parallel decision-making results in tacit collusion.³⁰ Tacit collusion alone is not illegal because competition authorities recognize that placing limitations on a firm's profit-maximizing behavior and pricing strategy can generate more negative effects on the market than positive effects.³¹ A firm engaging in rational economic behavior through profit maximization, typically, increases total and consumer welfare in the market by achieving economies of scale and decreasing marginal cost, driving innovation, and better serving consumer needs.³² Thus, tacit collusion separates criminal behavior from non-criminal behavior to optimize the competitive landscape.

29. See Capobianco & Gonzaga, *supra* note 12, at 3 (“[W]hen markets are sufficiently transparent and the retaliation lag is sufficiently small, collusion can always be sustained as an equilibrium strategy, no matter the market structure.”). *But see Price-bots Can Collude Against Consumers*, ECONOMIST (May 6, 2017), <https://www.economist.com/finance-and-economics/2017/05/06/price-bots-can-collude-against-consumers> (recognizing that transparent pricing renders any attempt to steal business by lowering prices self-defeating). The information that firms share with consumers on open digital platforms, they also share with other firms—indirectly becoming a part of each other's pricing and output decision making. *E.g.*, Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 20 (explaining that market manipulation can come in the form of sharing data pools).

30. See Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 5 (noting markets previously unable to engage in tacit collusion now experience interdependence due to the data availability and the innate nature of electronic markets); see generally Posner, *supra* note 18, at 1564-65 (discussing the theory of oligopolistic interdependence); Maurice Stucke & Ariel Ezrachi, *Artificial Intelligence & Collusion: When Computers Inhibit Competition*, 2017 U. ILL. L. REV. 1775, 1800, 1805 (2017) [hereinafter Stucke & Ezrachi, *Computers Inhibit Competition*] (explaining that tacit collusion counterweighs overall efficiencies and creates super competitive prices).

31. See Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 19-20 (discussing the inability to condemn a firm for behaving rationally; traditional tacit collusion is not viewed as market manipulation); McSweeney & O'Dea, *supra* note 11, at 77 (profitable price discrimination); see, e.g., Lynch, *supra* note 23 (explaining that Uber uses surge pricing to reap artificially high profits).

32. See Posner, *supra* note 18, at 1564 (quoting Professor Donald Turner (“[T]he rational oligopolist is behaving in exactly the same way as is the rational seller in a competitively structured industry; he is simply taking another factor into account. . . .”).

The line between express collusion and tacit collusion blurs when tacit collusion generates the same negative outcomes as cartels.³³ Companies engage in cartels by price fixing, restricting output, allocating markets, and bid rigging via an agreement.³⁴ Hard core cartels are typically regarded as one of the most serious violations of competition law and found *per se* illegal by most competition authorities around the world.³⁵ Despite the increase in sanctions against cartelists, they persist and firms continue to collude in a variety of markets.³⁶ Presumably, firms agree to engage in cartels because it is easier than competing.³⁷ When companies collectively agree to stabilize their prices at a confident level, then all of the companies can independently earn greater profits, even with the reduced output due to lost consumers.³⁸ These arrangements injure consumers because increased prices and restricted supply creates a deadweight loss to society.³⁹

33. See *id.* at 1576 (noting the dictionary is no longer acceptable for statutory interpretation when analyzing concerted activity because of the importance of context and further arguing that a tacit colluder should be punished the same as an express colluder when identical outcomes are created—particularly because tacit collusion is voluntary behavior and thus should be deterred).

34. EZRACHI & STUCKE, *VIRTUAL COMPETITION*, *supra* note 9, at 35.

35. See *Recommendation*, *supra* note 4; EZRACHI & STUCKE, *VIRTUAL COMPETITION*, *supra* note 9, at 35; Stucke & Ezrachi, *Computers Inhibit Competition*, *supra* note 30, at 1777.

36. See EZRACHI & STUCKE, *VIRTUAL COMPETITION*, *supra* note 9, at 36 (finding that cartels persist despite rising fines and prison sentences); see also John M. Connor & C. Gustav Helmers, *Statistics on Modern Private International Cartels 1990-2005* 23 (Purdue U., Working Paper No. 06-11, 2006), https://www.agecon.purdue.edu/working_papers/workingpaper.connor.11.10.06.pdf (noting 174 documented instances of cartel recidivism in international cartels studied, of which eighty-six companies recorded three or more cartel violations).

37. EZRACHI & STUCKE, *VIRTUAL COMPETITION*, *supra* note 9, at 35.

38. Posner, *supra* note 18, at 1568.

39. “When algorithms absorb most or all consumer surplus in a relevant market, they create an income constraint on consumers, which shifts the demand curve inward on an indeterminate number of other markets. This, in turn, reduces the sales opportunities of other producers, and shrinks a range of (*ir*-relevant) markets, which is a deadweight loss. From a policy perspective, this rationale could legitimise antitrust remediation against perfect behavioural discrimination (correcting for efficiencies), but would leave untouched personal data extraction, given the non-rival and imperfectly appropriable nature of data (no income constraint).” Nicolas Petit, *Antitrust and Artificial Intelligence: A Research Agenda*, 8 J. EUR. COMPETITION L. & PRAC. 361, 362 (2017) (recognizing that a deadweight loss

The existence of an anticompetitive agreement differentiates tacit collusion from cartels or express collusion.⁴⁰ Authorities must identify the agreement to enforce the law against collusion.⁴¹ The concept of agreement is broad, but the factors courts and enforcers use to determine whether one exists historically focus on human behavior.⁴² Competing firms use an anticompetitive “agreement” to “govern” their cartel to maintain a supra-competitive price equilibrium (reduced output); thus, the firms typically agree on a common policy, a way to monitor adherence to the common policy, and enforcement against those who deviate from the common policy.⁴³ Today, courts

creates an entire group of consumers underserved in the market).

40. Traditional antitrust laws view an agreement as a process of multiple communications, including negotiations and assurances, not an outcome. ANDREW I. GAVIL ET AL., *ANTITRUST LAW IN PERSPECTIVE: CASES, CONCEPTS AND PROBLEMS IN COMPETITION POLICY* 379 (3d ed. 2017). An agreement generally requires the conscious decision to engage in a common scheme or what is judicially referred to as a “meeting of the minds.” An “agreement” need not be reduced to writing. Courts may infer the existence of an agreement based on the parties’ behavior. However, something more than mere parallelism is required. Observing and matching a competitor’s price by itself is not enough. *See infra* notes 41-46.

41. Capobianco et al., *supra* note 2, at 31-32; *see Pricing Algorithms: The Digital Collusion Scenarios, supra* note 22, at 5 (noting the absence of an agreement leaves authorities with a lack of legal basis for intervention).

42. *See* McSweeney & O’Dea, *supra* note 11, at 75 (arguing that concepts such as “intent” and “meeting of the minds” presuppose human mental states and decision-making); *see also* Capobianco et al., *supra* note 2, at 31 (discussing agreement as a broad term, which in the European Union requires a common will or some manifestation of a mental state).

43. *Competition Policy in the Digital Age, supra* note 3, at 19. Cartels originated in smoke-filled rooms, where industrialists would gather to decide on fixed prices. *Accord* Lynch, *supra* note 23 (highlighting the United States’ steel industry price-fixing in 1907 compared to algorithmic price-fixing today); Stucke & Ezechia, *Computers Inhibit Competition, supra* note 30, at 1776 (quoting the United States Department of Justice) (“We will not tolerate anticompetitive conduct, whether it occurs in a smoke-filled room or over the Internet using complex pricing algorithms. American consumers have the right to a free and fair marketplace online, as well as in brick and mortar businesses.”). Due to technological advancements, agreements are not as simply formed and less likely to be outright and express. *See* Salcedo, *supra* note 22, at 6 (“Absent the presence of an agreement to change market dynamics, most competition agencies may lack enforcement tools, outside merger control, that could effectively deal with the change of market dynamics to facilitate tacit collusion through algorithms.”); *see generally* Capobianco et al., *supra* note 2, at 33 (citing Severin Borenstein, *Rapid Price Communication and Coordination: The Airline Tariff Publishing Case (1994)*, in *THE ANTITRUST REVOLUTION* 223

predominately look for “plus factors” to support an inference of an agreement from circumstantial evidence.⁴⁴ “Plus factors” take many forms and have acted as the counterweight to requiring direct evidence of an agreement between all of the firms in the cartel.⁴⁵ Enforcement authorities examine factors tending to distinguish an agreement from conscious parallelism directly and factors suggesting the industry is conducive to coordination.⁴⁶

Agreements among human cartelists most often self-destruct because of a lack of trust among competing firms and individuals⁴⁷—the “prisoner’s dilemma” game theory model most accurately portrays this.⁴⁸ Every cartel faces the risk that its members will start cheating

(John E. Kwoka & Lawrence J. White eds., 3d ed. 1999)).

44. See Capobianco & Gonzaga, *supra* note 12, at 4 (noting algorithms could be considered “plus factors” as an adjustment to current antitrust laws).

45. See, e.g., Capobianco et al., *supra* note 2, at 29-30 (establishing parallel conduct can infringe competition law alongside “plus factors” which include communication, information exchanges, signaling, etc.).

46. For cases of proving conspiracy, “plus factors” are synthesized into two categories. (1) Factors tending to distinguish agreement from conscious parallelism directly: communication or opportunity to communicate; conduct too complicated to be explained by mere parallel behavior; and conduct lacking an evident efficiency explanation. (2) Factors suggesting the industry is conducive to coordination: industry features; past history of industry coordination; rational motive to behave collectively; factors suggesting firms are exercising market power; facilitating factors; and actions contrary to self-interest unless pursued collectively. GAVIL ET AL., *supra* note 40, at 370-71.

47. See Posner, *supra* note 18, at 1570 (cartelists may cheat solely because they suspect other members are cheating); see also *Competition Policy in the Digital Age*, *supra* note 3, at 37 (noting “[S]ection 1 of the Sherman Act refer[s] to an agreement including ‘contract’, ‘combination in the form of trust’ . . .”). But see Maurice E. Stucke & Ariel Ezrachi, *How Pricing Bots Could Form Cartels and Make Things More Expensive*, HARV. BUS. REV.: BUS. L. (Oct. 27, 2016), <https://hbr.org/2016/10/how-pricing-bots-could-form-cartels-and-make-things-more-expensive> [hereinafter Stucke & Ezrachi, *Pricing Bots*] (“Computers do not exhibit trust. Instead, algorithms engage in cold, profit-maximizing calculations. If algorithms are less likely than humans to trust one another, maybe they’re less likely to collude, too.”).

48. “The police are interrogating the suspects about their role in the major crime. Neither of the prisoners has confessed, but the confession of either would be enough to convict the other of the major crime. The police want to convict at least one—and hopefully both—of the prisoners for the major crime, so they offer each the same deal: ‘If you confess and provide evidence against your partner, then you’ll get no jail time for either the minor or major crime and he’ll get a three-year sentence. However, if he confesses and you don’t, you’ll get the three-year sentence and he’ll

each other as well as the public.⁴⁹ The more quickly other members of the cartel respond to any deviation from the “common plan,” the less likely an individual firm is to cheat.⁵⁰ Notably, digital markets’ characteristics dispel any previous lag time that existed between firm pricing decisions and the reaction of competitors.⁵¹ The more transparent the competitive landscape, the easier it becomes for firms to monitor and understand one another’s actions and interactions with customers.⁵²

walk. But, if both of you confess, we won’t need your testimony and both of you will get a two-year sentence. Finally, if neither of you confesses, then you’ll each get one year in prison on the minor crime. Your partner is being offered the same deal.” Christopher R. Leslie, *Antitrust Amnesty, Game Theory, and Cartel Stability*, J. CORP. L. 453, 455 (2006) (noting the suspects are both likely to turn on one another, due to a lack of trust in the other, and each create the least optimal situation for himself).

49. Posner, *supra* note 18, at 1591. Cartelists are more incentivized to cheat the less likely they are to be detected by competitors—this is due to the profits and customers to be gained as a result of deviating from the “common plan” set by cartel members. If everyone else’s prices are set artificially high, then an individual firm has a lot to gain in short-term customers and profits by undercutting co-cartelists—also noted by critics of the interdependence theory within oligopolistic markets when referring to the claim that oligopolies will maintain a supra-competitive price. *See generally id.* at 1568 (explaining an oligopolist should not hesitate to undertake price experiments assuming that he either suspects his deviation will not be detected when he lowers prices or competitors will engage in price followership when he raises prices); *cf.* Capobianco et al., *supra* note 2, at 16 (the payoff to deviation is nonexistent if it can be instantaneously detected and competitors are able to react). So, whether a cartel survives becomes dependent on the how quickly other firms in the cartel can spot these lower prices and retaliate by further undercutting prices. *See Ittoo & Petit, supra* note 20, at 1 (without effective detection of cheating, oligopolists will always have an incentive to cheat).

50. *See* Ezrachi & Stucke, *Problems and Counter-Measures, supra* note 5, at 3-4 (“Unique to an algorithmic environment is the speed of retaliation.”); McSweeney & O’Dea, *supra* note 11, at 75 (pointing to the United States 2010 Horizontal Merger Guidelines which note that speed in identifying deviation among competitors from the agreement makes markets more vulnerable to coordination).

51. *See* Ezrachi & Stucke, *Problems and Counter-Measures, supra* note 5, at 29; Stucke & Ezrachi, *Computers Inhibit Competition, supra* note 30, at 1805 (regulators could impose a time lag for price increases to better monitor a transparent market); *see also* Capobianco et al., *supra* note 2, at 10 (recognizing it becomes less useful for consumers to engage in price matching when all sellers make their pricing strategies reliant on one another; thus, transferring consumer power to seller power).

52. *See Pricing Algorithms: The Digital Collusion Scenarios, supra* note 22, at 5 (addressing the possibility that authorities may attempt to prevent the creation of excessively transparent markets); *e.g.*, Capobianco & Gonzaga, *supra* note 12, at 2

While cartels struggle to maintain trust internally and carry out their anticompetitive agreement, enforcers of competition law struggle to detect an “agreement” among the cartelists, especially as cartels involve more firms.⁵³ When tacit collusion and express collusion generate the same outcome, the difficulty in identifying cartelists versus conscious parallelism becomes incredibly difficult.⁵⁴ Further, large international cartelists impose different distortions on different nations, adversely impacting markets within particular countries at a greater or lesser level, making it difficult for some nations to detect an existing cartel or to understand the magnitude of the distortions the cartel is creating.⁵⁵ OECD member nations’ adoption of enforcement tools under current competition law becomes essential in detecting hard core cartels.⁵⁶ Looking to the challenges of future cartel enforcement, “the risk that automated systems could lead to more effective cartels” presents one of the biggest obstacles for authorities.⁵⁷

(noting the increased transparency in financial markets has led to market distortions).

53. See *Cartels and Anti-Competitive Agreements*, OECD, <http://www.oecd.org/daf/competition/cartels/> (last visited Nov. 28, 2018); see generally Org. for Econ. Cooperation & Dev. [OECD], *Prosecuting Cartels Without Direct Evidence of Agreement*, at 9, DAF/COMP/GF(2006)7 (Sept. 11, 2006) (often there is no direct evidence available of an agreement).

54. See Stucke & Ezrachi, *Pricing Bots*, *supra* note 47 (noting that collusion scenarios that result in anticompetitive outcomes necessitate a second look at enforcement strategies); Posner, *supra* note 18, at 1562 (arguing that both tacit and express collusion fall under section one of the Sherman Act). *But see* Capobianco et al., *supra* note 2, at 29 (“Competition rules do not forbid collusive outcomes but only the means to achieve collusion.”).

55. See Org. for Econ. Cooperation & Dev. [OECD], *Hard Core Cartels: Third Report on the Implementation on the 1998 Council Recommendation*, at 12 (2005), <https://www.oecd.org/competition/cartels/35863307.pdf> [hereinafter *Third Report*] (“International cartels are especially difficult to detect as they use the most sophisticated measures to conceal their activities, the amount of commerce affected by these cartels is disproportionately large, and widely considered the most harmful type of cartel because of the magnitude of the harm that they inflict on businesses and consumers.”).

56. See Stucke & Ezrachi, *Computers Inhibit Competition*, *supra* note 30, at 1795 (recognizing a restricted range of enforcement tools without an “agreement”); see also Geradin, *supra* note 23, at 6 (conceding current competition rules and tools are sufficiently flexible to detect and enforce against anticompetitive behavior).

57. See Margrethe Vestager, European Comm’r for Competition, Remarks at Bundeskartellamt 18th Conference on Competition: Algorithms and Competition, at 5 (Mar. 16, 2017), (transcript available at <https://ec.europa.eu/commission/>

B. ALGORITHMIC COLLUSION

The fear of automated cartels is unfortunately no longer science fiction.⁵⁸ The use of algorithms, particularly AI,⁵⁹ intensifies the risk of cartels in oligopolistic markets.⁶⁰ “Deep-learning” algorithms, a subfield of AI, enable computer systems to create an artificial neural network and thus replicate the activity of human neurons.⁶¹ Deep-learning enables computers to learn faster and more accurately than any other form of machine learning and has the ability to solve incredibly complex problems.⁶² Regardless of the result the machine produces, programmers cannot understand the decision-making process behind it.⁶³

To be sure, algorithms create market efficiencies that human beings cannot achieve.⁶⁴ For supply side efficiencies, algorithms enable

commissioners/2014-2019/vestager/announcements/bundeskartellamt-18th-conference-competition-berlin-16-march-2017_en) (stating automated systems deter deviation among cartelists, making cartels more sustainable).

58. See *id.* at 6 (noting both the United States and United Kingdom have taken on investigations against the use of automated systems to price fix); *Competition Policy in the Digital Age*, *supra* note 3, at 7 (noting the importance of algorithms in firms today cannot be understated); Kevin W. Christensen, *The Next Frontier of Antitrust?*, ANTITRUSTSOURCE (2017), http://app.antitrustsource.com/antitrustsource/october_2017/MobilePagedReplica.action?pm=1&folio=B-1#pg18 (reviewing ARIEL EZRACHI & MAURICE E. STUCKE, *VIRTUAL COMPETITION: THE PROMISE AND PERILS OF THE ALGORITHM-DRIVEN ECONOMY* (2016)) (explaining that industry wide usage of pricing algorithms has contributed to increased market transparency and frequency of interaction). *But see* Capobianco & Gonzaga, *supra* note 12, at 5 (recognizing most algorithms still operate today on the instructions of human beings).

59. *Competition Policy in the Digital Age*, *supra* note 3, at 9 (“Artificial intelligence refers to the broad branch of computer science that studies and designs intelligent agents, who should be able to carry out tasks of significant difficulty in a way that is perceived as ‘intelligent’ (Swarup, 2012).”).

60. See discussion *infra* Part II(B). The evolution of pattern and recognition theory developed AI into a more effective tool for scientists and mathematicians through the development of algorithms that teach machines how to learn, establishing a new branch of machine learning. *Competition Policy in the Digital Age*, *supra* note 3, at 9.

61. *Competition Policy in the Digital Age*, *supra* note 3, at 11.

62. See *id.* (noting deep-learning algorithms are structured in a hierarchy of increasing complexity and abstraction, different from the traditional linear algorithms typically employed by firms).

63. See *id.*

64. See Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 24

companies to optimize their commercial strategies instantaneously, particularly in planning, trade, and logistical operations.⁶⁵ Further, they allow firms to optimize outputs and reach near perfect price discrimination which allows companies to supply services at lower prices to consumers who were previously underserved, generating market efficiencies.⁶⁶ For demand side efficiencies, algorithms create “algorithmic consumers”⁶⁷ who use the data-driven economy to their advantage in making purchase decisions—comparing prices and quality, reducing search costs, overcoming biases and making more rational decisions, and an overall strengthening of buyer power.⁶⁸

Nonetheless, algorithms have the potential to be a powerful tool for anticompetitive behaviors even with all the efficiencies they create.⁶⁹ The focal point for competition authorities in regulating algorithmic

(noting algorithms have evolved beyond human decision making); Lynch, *supra* note 23 (explaining that automation makes pricing strategies possible that are unachievable by humans).

65. See generally *Competition Policy in the Digital Age*, *supra* note 3, at 15-16 (discussing various supply-side efficiencies through pricing algorithms and dynamic pricing); see also Capobianco et al., *supra* note 2, at 10-11 (noting a positive impact on static and dynamic efficiency).

66. Perfect price discrimination, also referred to as first-degree price discrimination, allows sellers to capture all consumer surplus in a market by pricing their products and services at the exact price that each individual buyer values it. It is extremely difficult, if not impossible, to achieve. McSweeney & O’Dea, *supra* note 11, at 76-77. Perfect price discrimination means no consumer would be paying more or less for products and services than the point at which they value them. See Christensen, *supra* note 58, at 5 (recognizing self-learning computer algorithms bring markets closer to perfect price discrimination); Geradin, *supra* note 23, at 4 (arguing the same factors that allow algorithmic pricing also can enable sellers to engage in first degree price discrimination).

67. A shift in the decision-making process from sellers to consumers in data-driven markets allows buyers to outsource purchasing decisions to algorithms and reduce search costs. *Competition Policy in the Digital Age*, *supra* note 3, at 17.

68. See generally *id.* (discussing demand side efficiencies); EZRACHI & STUCKE, VIRTUAL COMPETITION, *supra* note 9, at 3-10 (discussing the promise of a better competitive environment in the digital age); Geradin, *supra* note 23, at 2 (explaining buyers can utilize technology to undermine anticompetitive market outcomes).

69. See *Competition Policy in the Digital Age*, *supra* note 3, at 18 (stating developments of new technological tools impact the way market players interact and communicate, creating risk that some will achieve enhanced market power to further their private interests); Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 22 (recognizing automated trading can lead to increased efficiencies as well as market manipulation).

collusion should center on understanding the potential they have to create an extreme form of tacit collusion that could surpass market distortions traditional hard core cartels create, not on whether algorithms should be banned or restricted.⁷⁰ The international community needs to collectively address the risks created through the use of AI pricing algorithms and identify solutions to combat negative outcomes, as algorithms make it easier than ever for cartels to operate effectively across borders without detection.⁷¹

Competition law enforcers' concerns center on two characteristics of AI deep-learning algorithms as they become tomorrow's cartelists.⁷² First, a programmed computer can achieve a God-like view of the marketplace by processing data beyond any human capacity.⁷³ These computers can also create joint efforts in data extraction and sharing, demonstrating speed and efficiency in communication that would be deemed impossible if left solely to humans.⁷⁴ Second, a concern exists with respect to the increasing sophistication of algorithms, as they engage in autonomous decision-

70. See *Competition Policy in the Digital Age*, *supra* note 3, at 18-19.

71. See Capobianco & Gonzaga, *supra* note 12, at 3 (serving as an effective mechanism to coordinate a tacit agreement); McSweeney & O'Dea, *supra* note 11, at 76 (proposing algorithmic tacit collusion may lead to near-monopolistic pricing).

72. See Vestager, *supra* note 57, at 3 (discussing the recent approaches taken by competition authorities to learn more about algorithmic pricing); see also Capobianco & Gonzaga, *supra* note 12, at 1 (emphasizing that the OECD roundtable discussions in 2017 was one of the first times antitrust practitioners came together to discuss the threats algorithms pose to competitive markets). AI comes with two particularly concerning technological advancements that are likely to amplify, if not surpass, the outcome of ordinary tacit collusion, amounting to the market distortions caused by traditional cartels. See generally EZRACHI & STUCKE, VIRTUAL COMPETITION, *supra* note 9, at 56-60 (referring to algorithmic collusion scenarios as "tacit collusion on steroids").

73. EZRACHI & STUCKE, VIRTUAL COMPETITION, *supra* note 9, at 71. Big data typically refers to the ability to collect and analyze a large volume of data which contains a variety of information in a timely manner, measured in value by velocity, volume, and variety. *Id.* at 15. This definition adds a dynamic component to markets that are unmistakably dynamic in their nature. Xavier Boutin & Georg Clemens, *Defining "Big Data" in Antitrust*, COMPETITION POLICY INT'L 3 (2017), <https://www.competitionpolicyinternational.com/wp-content/uploads/2017/08/CPI-Boutin-Clemens.pdf>.

74. See Christensen, *supra* note 58, at 6-7; Petit, *supra* note 39, at 362; see also Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 20 (suggesting condemning manipulative actions taken through the sharing of data pools).

making and have the ability to self-learn.⁷⁵ Computers can easily anticipate and understand each other's moves, responding to one another with no lapse in real time.⁷⁶

The rapid reactions by algorithmic pricing means sellers can coordinate price rises more quickly and efficiently than humans could ever aspire to.⁷⁷ Further, price-bots can execute multiple rounds of price changes and test any relevant market without any one supplier being at risk of losing customers, resulting in companies having the ability to "set" higher prices in moments rather than weeks.⁷⁸ The advanced capabilities of AI-enhanced price-bots creates a plausible scenario where their programmed algorithms hatch a method of colluding that even their programmers are not able to understand, let alone be held responsible for.⁷⁹ European Commissioner for Competition Margrethe Vestager alluded to this concern in a recent speech: "What businesses can and must do is to ensure antitrust compliance by design. That means pricing algorithms need to be built in a way that doesn't allow them to collude."⁸⁰

AI deep-learning algorithms have the potential to create more durable cartels, outside of oligopolistic markets, at consumers'

75. EZRACHI & STUCKE, *VIRTUAL COMPETITION*, *supra* note 9, at 71. Artificial intelligence communicating and colluding through their own self-learning processes and without any intervention by humans, except their creation, is an incredibly sophisticated scenario that competition authorities have not yet witnessed. *See generally* Christensen, *supra* note 58, at 3, 5; Stucke & Ezrachi, *Computers Inhibit Competition*, *supra* note 30, at 1795.

76. *See, e.g.*, Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 8 (discussing increased prices in the petroleum industry as a result of increased market transparency and the ability of firms to respond almost instantaneously to competitors' price changes).

77. *See* Capobianco et al., *supra* note 2, at 24 (diagramming the risks of algorithmic collusion, including the governing collusive structure that replaces explicit communication); Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 26 (discussing a recent experiment set to identify the dominant strategy of AI in joint profit maximization).

78. Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 9; *see Price-bots Can Collude Against Consumers*, *supra* note 29.

79. *See Price-bots Can Collude Against Consumers*, *supra* note 29.

80. *See Pricing Algorithms: The Digital Collusion Scenarios*, *supra* note 22, at 3 (quoting Commissioner Vestager) ("What businesses need to know is that when they decide to use an automated system, they will be held responsible for what it does. So, they had better know how that system works.").

expense and in defiance of traditional enforcement regimes that lack the capabilities of detection.⁸¹ The use of basic price fixing algorithms, not AI, already suggests that algorithms make collusion more sustainable in a wider range of circumstances than before, possibly even in markets that were in the past characterized by fierce competition.⁸² The oligopoly problem will thus encompass a larger group of firms than previously anticipated by economists.⁸³ This reality exists due to incredibly fast processing and intelligent machines acting as the decision-makers within markets, not humans.⁸⁴

Due to AI pricing algorithms' "increased accuracy in detecting changes in price, greater speed in pricing response, and reduced irrationality in discount rates[,]” they will likely surpass humans in their ability to achieve and sustain elevated prices through coordinated interaction and result in robo-sellers more skillful than human oligopolists in gaining competitive intelligence.⁸⁵ Also, uncertainty and misperception diminishes greatly—two factors which are

81. See Lynch, *supra* note 23; see also Stucke & Ezrachi, *Computers Inhibit Competition*, *supra* note 30, at 1802 (bypassing regulation and enforcement safeguards which typically deter price fixing or collusion).

82. See Capobianco & Gonzaga, *supra* note 12, at 3 (emphasizing algorithms could collude in markets that were previously characterized by fierce competition); see generally Plea Agreement at 2, United States v. Topkins, No. CR 15-00201 WHO (N.D. Cal. Apr. 30, 2015) (applying pricing algorithms to fix online poster prices; the poster market in the past was not susceptible to collusion because it is not an oligopolistic market and offers heterogeneous products).

83. See Capobianco & Gonzaga, *supra* note 12, at 3 (discussing the ability of algorithms to collude in a wider spectrum of market structures—beyond concentrated markets of homogenous products); *Competition Policy in the Digital Age*, *supra* note 3, at 21-23 (expanding the oligopoly problem to non-oligopolistic market structures).

84. See McSweeney & O’Dea, *supra* note 11, at 75 (recognizing that under current law it will be difficult to challenge conduct where the role of humans is unclear); Stucke & Ezrachi, *Computers Inhibit Competition*, *supra* note 30, at 1779 (explaining algorithms are able to autonomously make decisions). “We’re talking about a velocity of decision-making that isn’t really human,” says Terrell McSweeney, a commissioner with the United States Federal Trade Commission (FTC). “All of the economic models are based on human incentives and what we think humans rationally will do. It’s entirely possible that not all of that learning is necessarily applicable in some of these markets.” Lynch, *supra* note 23; see Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 4-5.

85. See McSweeney & O’Dea, *supra* note 11, at 76 (quoting Professor Salil Mehra).

commonly relied upon to suppress cartels.⁸⁶ Human emotions—fear, greed, and distrust—do not inhibit machines, reducing the effects of the prisoner’s dilemma dramatically and giving AI cartels the ability to persist indefinitely.⁸⁷

Because of algorithmic software’s inherent nature, the algorithmic cartel organization has the potential to distort markets by raising pricing and restricting supply in economies throughout the world, with no inhibiting borders.⁸⁸ Additionally, AI deep-learning algorithms’ decision-making process cannot be tracked.⁸⁹ Thus, it becomes incredibly difficult to satisfy the agreement requirement of express collusion—disguising algorithmic cartels as firms’ rational economic behavior.⁹⁰ The global effects of AI algorithmic cartels highlight the OECD’s role to draft recommendations for member nations to properly approach international cooperation and comity.⁹¹

C. THE OECD RECOMMENDATION

Two decades ago, the OECD developed and implemented its *Recommendation of the Council Concerning Effective Action Against*

86. See EZRACHI & STUCKE, VIRTUAL COMPETITION, *supra* note 9, at 77; Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 9.

87. See EZRACHI & STUCKE, VIRTUAL COMPETITION, *supra* note 9, at 77 (recognizing unlike their human counterparts, computers do not fear incarceration; do not respond in anger; rely on deliberative analysis and not intuition; and minimize biases such as loss aversion, the sunk costs fallacy, and framing effects); Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 4 (emphasizing computer algorithms are unlikely to exhibit human biases, although it may be reflected in programming code).

88. See Org. for Econ. Cooperation & Dev. [OECD], *Big Data: Bringing Competition Policy to the Digital Era*, at 17, DAF/COMP(2016)14 (Oct. 27, 2016), www.oecd.org/daf/competition/big-data-bringing-competition-policy-to-the-digital-era.htm [hereinafter *Big Data*] (noting firms’ big data strategies lead to cross-border transactions and implications for competition authorities).

89. *Competition Policy in the Digital Age*, *supra* note 3, at 11.

90. See *id.* (explaining deep-learning algorithms do not provide any information about the decision making process of their results); see also Capobianco et al., *supra* note 2, at 32, 34 (discussing the meaning of “agreement” produces uncertainty in cases of algorithmic communication).

91. The evolution of markets towards global digitalization has already triggered a domino effect in firms’ deployment of algorithms and many of these firms operate beyond national borders. See *Competition Policy in the Digital Age*, *supra* note 3, at 12, 46, 49 (suggesting the creation of a global digital regulator to address the risks associated with algorithms and AI).

Hard Core Cartels.⁹² The OECD Recommendation's purpose centers on regulation of express collusive behavior that results in distorted international markets and world trade, which further creates market power, waste, and inefficiency in countries whose markets would otherwise be competitive.⁹³ The OECD Recommendation laid the foundation for all nations to take a second look at their enforcement procedures against hard core cartels and created a ripple effect in which many nations adjusted their approach.⁹⁴ The Recommendation also pushed nations towards creating international cooperation agreements to share information during investigations and more effectively target hard core cartels.⁹⁵ International comity lies at the core of the agreement as the OECD recognizes the egregious harm caused by hard core cartels rarely takes place inside one nation or economic region.⁹⁶

Two primary concerns divide the OECD Recommendation—each encompassed under the overarching idea of achieving the most effective enforcement approach to hard core cartels.⁹⁷ The first Part calls for effective sanctions to deter participation in hard core cartels, as well as designating institutions with adequate enforcement power to detect and remedy hard core cartels, including powers to force

92. See generally *Recommendation*, *supra* note 4 (outlining international cooperation and comity in enforcing laws prohibiting hard core cartels).

93. Estimates in the United States suggest that some hardcore cartels can result in price increases of up to sixty to seventy percent, while other nations note that the pricing matches that of a monopolized market. *Third Report*, *supra* note 55, at 25. OECD made its Recommendation considering that hard core cartels are the most egregious violators of competition law and that they injure consumers in many countries by raising prices and restricting supply, thus making goods and services completely unavailable to some purchasers and unnecessarily expensive for others. *Recommendation*, *supra* note 4.

94. See *Third Report*, *supra* note 55, at 3 (reporting the progress of member and observer countries in their cartel enforcement within seven years of the implementation of the Recommendation).

95. See *Recommendation*, *supra* note 4 (encouraging national legislation and bilateral or multilateral agreements to effectively achieve common interests in deterring cartels).

96. See *id.* (noting enforcement activities should be in accordance with comity principles when they affect other countries' interests).

97. See *id.* (advising Adherents to ensure that their competition laws effectively halt and deter hard core cartels by providing for effective sanctions and adequate enforcement procedures and institutions to detect and remedy hard core cartels).

compliance on firms.⁹⁸ This Part includes the OECD's definition of a "hard core cartel" and what the term does and does not encompass.⁹⁹ A "hard core cartel" is defined as "an anticompetitive agreement, anticompetitive concerted practice, or anticompetitive arrangement by competitors to fix prices, make rigged bids (collusive tenders), establish output restrictions or quotas, or share or divide markets by allocating customers, suppliers, territories, or lines of commerce."¹⁰⁰

The second Part of the OECD Recommendation calls for international cooperation and comity in enforcing laws prohibiting hard core cartels.¹⁰¹

1. Member countries have a common interest in preventing hard core cartels and should co-operate with each other in enforcing their laws against such cartels. In this connection, they should seek ways in which co-operation might be improved by positive comity principles applicable to requests that another country remedy anticompetitive conduct that adversely affects both countries, and should conduct their own enforcement activities in accordance with principles of comity when they affect other countries' important interests. 2. Co-operation between or among Member countries in dealing with hard core cartels should take into account the following

98. "Member countries should ensure that their competition laws effectively halt and deter hard core cartels. In particular, their laws should provide for: a) Effective sanctions, of a kind and at a level adequate to deter firms and individuals from participating in such cartels; and b) Enforcement procedures and institutions with powers adequate to detect and remedy hard core cartels, including powers to obtain documents and information and to impose penalties for non-compliance." *Id.* ("Convergence and Effectiveness of Laws Prohibiting Hard Core Cartels").

99. "The hard core cartel category does not include agreements, concerted practices, or arrangements that (i) are reasonably related to the lawful realization of cost-reducing or output-enhancing efficiencies, (ii) are excluded directly or indirectly from the coverage of a Member country's own laws, or (iii) are authorized in accordance with those laws. However, all exclusions and authorizations of what would otherwise be hard core cartels should be transparent and should be reviewed periodically to assess whether they are both necessary and no broader than necessary to achieve their overriding policy objectives. After the issuance of this Recommendation, Members should provide the Organization annual notice of any new or extended exclusion or category of authorization." *Id.*

100. *Id.*

101. "In order to establish a framework for their co-operation in dealing with hard core cartels, Member countries are encouraged to consider entering into bilateral or multilateral agreements or other instruments consistent with these principles." *Id.*

principles. . . .¹⁰²

The OECD does not explicitly call for member nations to adopt or change their laws because the OECD does not operate as an enforcement body, but instead operates as a forum for governments to seek solutions to common problems.¹⁰³ Additionally, it emphasizes that a hindrance to cooperation may result from inconsistencies among countries' approaches to the same problem.¹⁰⁴ These inconsistencies could explain why the OECD calls for member countries to enter into bilateral or multilateral agreements, urging a close in the gap of hard core cartel enforcement.¹⁰⁵

Despite the gaps in competition law in the international community, this Recommendation undoubtedly has been a factor in driving international comity and cooperation in the enforcement against hard core cartels.¹⁰⁶ The OECD's most recent report on the implementation

102. "The common interest in preventing hard core cartels generally warrants co-operation to the extent that such co-operation would be consistent with a requested country's laws, regulations, and important interests; To the extent consistent with their own laws, regulations, and important interests, and subject to effective safeguards to protect commercially sensitive and other confidential information, Member countries' mutual interest in preventing hard core cartels warrants co-operation that might include sharing documents and information in their possession with foreign competition authorities and gathering documents and information on behalf of foreign competition authorities on a voluntary basis and when necessary through use of compulsory process; A Member country may decline to comply with a request for assistance, or limit or condition its co-operation on the ground that it considers compliance with the request to be not in accordance with its laws or regulations or to be inconsistent with its important interests or on any other grounds, including its competition authority's resource constraints or the absence of a mutual interest in the investigation or proceeding in question; Member countries should agree to engage in consultations over issues relating to co-operation." *Id.*

103. *About the OECD*, OECD, <http://www.oecd.org/about/> (last visited Jan. 20, 2019); see also *Recommendation*, *supra* note 4 (recommending nations maintain effective safeguards but recognize that this will be achieved to the extent it is consistent with their own laws).

104. See *Recommendation*, *supra* note 4 (recognizing a country may decline to engage in cooperation due to inconsistencies in national laws and interests).

105. See *id.* ("Member countries are encouraged to review all obstacles to their effective co-operation in the enforcement of laws against hard core cartels and to consider actions, including national legislation and/or bilateral or multilateral agreements or other instruments, by which they could eliminate or reduce those obstacles in a manner consistent with their important interests.").

106. See *Third Report*, *supra* note 55, at 9 (noting the significant progress towards

of the Recommendation, published in 2005, notes progress for sixteen economic areas in their sanctioning and deterrence of cartelists.¹⁰⁷ The report praises the increase in international agreements, particularly in enforcement cooperation and the implementation of effective sanctions and attractive leniency programs.¹⁰⁸

In 2004, the United States, alongside its enforcement body, the Department of Justice (DOJ), reformed its Antitrust Criminal Penalty Enforcement and Reform Act to increase maximum corporate fines from \$10 million to \$100 million; maximum individual fines from \$350 thousand to \$1 million; and maximum jail time from three years to ten years.¹⁰⁹ The European Union established the European Competition Network,¹¹⁰ which strengthened the investigative powers of the European Commission (EC),¹¹¹ and adopted a new leniency policy.¹¹² Most recently, the EC has implemented the General Data Protection Regulation (GDPR), addressing challenges to competition law authorities that endanger consumer protection as a result of data sharing.¹¹³ Brazil, one of the original signatories to the Recommendation despite its status as an OECD non-member, created

winning the support of lawmakers to strengthen enforcement tools; at the time of the implementation of the agreement, most competition authorities did not have the authority to share investigatory information with foreign competition authorities).

107. *Id.* at 9-11.

108. *Id.* at 8.

109. “The Act also strengthened the DOJ Antitrust Division’s Amnesty Program by limiting a corporate amnesty applicant’s private damages exposure to the damages actually inflicted by the applicant’s conduct, provided the applicant cooperates with private plaintiffs in their damage actions against remaining cartel members.” *Id.* at 11.

110. *European Competition Network (ECN)*, OECD (2015), <https://www.oecd.org/daf/competition/competition-inventory-european-competition-network.pdf>.

111. “The investigation powers of the European Commission were strengthened by introducing the rights to seal any business premises and books or records, inspect other than business premises (for instance private homes), interview any person who may be in possession of useful information and record the answers, as well as by extending the right to ask oral questions during an inspection to a right to question any member of staff.” *Third Report*, *supra* note 55, at 12.

112. The ECN’s new leniency policy adopted the practice of taking oral statements in leniency applications. *Id.*

113. Aysem Vanberg & Mehmet Ünver, *The Right to Data Portability in the GDPR and EU Competition Law: Odd Couple or Dynamic Duo?* 8 EUR. J.L. TECH. 1, 6 (2017).

an intelligence center for cartel investigations within one of its antitrust agencies, which works closely alongside prosecutors and federal police to use new investigatory techniques, namely dawn raids and wiretapping.¹¹⁴

India, Russia, and China, albeit not original parties to the Recommendation, have followed suit and upended their previous approaches to regulating competition and implemented new enforcement procedures within the past two decades.¹¹⁵ The Competition Commission of India (CCI) was created in 2003, and its Competition Act was modified in 2007 to prohibit anti-competitive agreements and the abuse of dominant positions by enterprises.¹¹⁶ Russia established the Federal Antimonopoly Service (FAS) in 2004, which gave the agency control over public procurement, foreign investments and advertising law compliance, and observation of competition rules by the public authorities.¹¹⁷ Most recently, FAS fined \$179 million RUB (\$2,840,923 USD) to a group of computer suppliers found guilty of collusion.¹¹⁸ In 2007, China promulgated the Anti-Monopoly Law,¹¹⁹ the legal framework for the prohibition of cartels, enforced by the National Development and Reform Commission (NDRC) and the State Administration for Industry and Commerce (SAIC).¹²⁰ In 2017, the NDRC and the SAIC exercised their respective investigative authority to end six national cartels and impose over \$73 million USD in fines.¹²¹

114. *Third Report*, *supra* note 55, at 9.

115. *See* sources cited *infra* notes 116-121.

116. *About CCI*, COMPETITION COMM'N OF INDIA, <https://www.cci.gov.in/about-cci> (last visited Jan. 20, 2019); *Competition Act*, COMPETITION COMM'N OF INDIA, <https://www.cci.gov.in/competition-act> (last visited Jan. 20, 2019).

117. Igor Artemiev, *What We Do*, FED. ANTIMONOPOLY SERV. OF THE RUSS. FED'N, <http://en.fas.gov.ru/about/what-we-do/> (last visited Jan. 20, 2019).

118. Press Release, Federal Antimonopoly Service of the Russian Federation, *Fines to Computer Suppliers Guilty of Collusion* (June 22, 2018), <https://en.fas.gov.ru/press-center/news/detail.html?id=53103>.

119. *Overview of the Law and Enforcement Regime Relating to Cartels*, GLOBAL LEGAL INSIGHTS, <https://www.globallegalinsights.com/practice-areas/cartels-laws-and-regulations/china#chaptercontent1> (last visited Jan. 20, 2019).

120. *See id.* (explaining the NDRC governs enforcement against anti-price monopolies while the SAIC handles all prohibition on monopoly agreements, abuse of market power, and the abuse of intellectual property rights).

121. *Overview of Cartel Enforcement Activity During the Last 12 Months*, GLOBAL LEGAL INSIGHTS, <https://www.globallegalinsights.com/practice-areas/>

Within the two decades following the implementation of the Recommendation, the United States entered into bilateral cooperation agreements with Russia (2009),¹²² Brazil (1999),¹²³ India (2012),¹²⁴ China (2011),¹²⁵ and the European Union (1998),¹²⁶ all of which center on cooperating in investigations to preserve competitive markets. This paper focuses on these economic areas.¹²⁷

cartels-laws-and-regulations/china#chaptercontent3 (last visited Jan. 20, 2019).

122. *See generally* Memorandum of Understanding on Antitrust Cooperation Between the United States Department of Justice and the United States Federal Trade Commission, on the One Hand, and the Russian Federal Anti-Monopoly Service, on the Other Hand, U.S.-Russ., Nov. 10, 2009, <https://www.justice.gov/sites/default/files/atr/legacy/2009/11/12/251836.pdf>.

123. *See generally* Agreement Between the Government of the United States of America and the Government of the Federative Republic of Brazil Regarding Cooperation Between Their Competition Authorities in the Enforcement of their Competition Laws, U.S.-Braz., Oct. 26, 1999, <https://www.justice.gov/sites/default/files/atr/legacy/2006/08/10/3776.pdf>.

124. *See generally* Memorandum of Understanding on Antitrust Cooperation Between the United States Department of Justice and the United States Federal Trade Commission, and the Ministry of Corporate Affairs (Government of India) and the Competition Commission of India, U.S.-India, Sept. 27, 2012, <https://www.justice.gov/sites/default/files/atr/legacy/2012/10/24/287457a.pdf>.

125. *See generally* Guidance for Case Cooperation Between the Ministry of Commerce and the Department of Justice and Federal Trade Commission on Concentration of Undertakings (Merger) Cases, U.S.-China, Nov. 29, 2011, <https://www.justice.gov/sites/default/files/atr/legacy/2011/11/29/277772.pdf>.

126. *See generally* Agreement Between the Government of the United States of America and the European Communities on the Application of Positive Comity Principles in the Enforcement of Their Competition Laws, U.S.-Eur. Communities, June 4, 1998, <https://www.justice.gov/sites/default/files/atr/legacy/2006/04/27/1781.pdf>.

127. The methodology for choosing these economic regions included taking the world's ten largest economies, based solely on nominal GDP, and cross-checking that list with the regions that have the highest estimated global growth in real GDP through 2019. *See generally* Rob Smith, *The World's Biggest Economies in 2018*, WORLD ECON. FORUM (Apr. 18, 2018), <https://www.weforum.org/agenda/2018/04/the-worlds-biggest-economies-in-2018/>. Cartels distort the distribution of welfare in an economy and the flow of goods in world trade, so I wanted to zero in on the countries that are most likely to be affected. At this point, the listed economies were: China, the United States, the European Union, India, Indonesia, Brazil, and Russia. Japan and the United Kingdom did make the cut because they are falling and expected to continue to fall in their economic growth and global worth—they are projected to be replaced by Indonesia at fourth, Brazil at fifth, and Russia at sixth in the world's largest economies. These economic areas were then cross-checked with the United States' largest trading partners and the nations that have identified algorithmic collusion as a problem in the context of OECD discussions. This cross-

The OECD most recently reports that “international cooperation in discovering, investigating, and prosecuting international cartels has reached unprecedented levels.”¹²⁸ The need for international comity and greater cooperation will grow as cartels become more automated and difficult to detect.¹²⁹ The OECD recognizes that the Competition Committee’s “next steps” include continuing to promote “enhanced opportunities for competition authorities to exchange information in cartel investigations.”¹³⁰

III. ANALYSIS

This Section argues that the OECD’s Recommendation encompasses algorithmic collusion and that member nations’ antitrust and competition enforcement authorities must recognize the ability of computers to form hard core cartels. Part A addresses the threat to the global economy that algorithmic collusion poses.¹³¹ Part B focuses on the Recommendation’s insufficiency in promoting international enforcement cooperation in cases of robotic cartels.¹³² Part B identifies the potential gaps in algorithmic collusion enforcement and the overall effects of the global antitrust community taking divergent approaches.¹³³ Section B concludes by explaining the OECD’s present inability to fulfill its role of facilitating international comity.

checking process took Indonesia off the list. Although Russia, China, India, and Brazil are not OECD member nations, they are highly engaged with OECD roundtable discussions and vital to the global economy.

128. *Third Report*, *supra* note 55, at 30.

129. *See id.* (noting mutual legal assistance agreements have played an important role in international cartel cases to obtain evidence in foreign jurisdictions); *see also* Vestager, *supra* note 57, at 6 (recognizing competition enforcers need to be prepared to deal with the challenges of algorithmic collusion enforcement, pointing towards recent cooperation between the United States and the United Kingdom).

130. *Third Report*, *supra* note 55, at 41.

131. *See* discussion *infra* Part III(A).

132. *See* discussion *infra* Part III(B) (identifying that this is due to the lack of detection cooperation, the absence of identifying liable behaviors and individuals, and the resulting trickle-down effects on enforcement cooperation).

133. *See* discussion *infra* Part III(B)(3).

A. THE OECD'S RECOMMENDATION CAPTURES THE COLLUSIVE BEHAVIOR AND AMPLIFIED OUTCOMES CREATED BY ALGORITHMIC COLLUSION.

The core of the Recommendation calls for international comity and enforcement cooperation in regulating hard core cartels.¹³⁴ Although the Recommendation evidently frames hard core cartels in the traditional context of their 20th century existence, its overall purpose is to deter and prohibit the anti-competitive behaviors of cartels.¹³⁵ As technology's presence, scalability, and capabilities advance, so does the sophistication of hard core cartels—from making agreements in a smoke-filled room to collaboration over the phone.¹³⁶ These technological advancements now encompass AI deep-learning algorithms, and the OECD's Recommendation must capture these advancements and their amplified anticompetitive outcomes.¹³⁷

The damage hard core cartels inflict on international consumer welfare and world trade does not discriminate against digital markets, and neither should competition authorities.¹³⁸ What becomes essential for the OECD's member nations to formally address is the ability of

134. See *Recommendation*, *supra* note 4 (considering that hard core cartels are particularly important from an international perspective because of their distortion of world trade while operating in secret, and relevant evidence is located in foreign jurisdictions).

135. See *id.* (“Effective sanctions, of a kind and at a level adequate to deter firms and individuals from participating in such cartels. . .”).

136. See Salcedo, *supra* note 22, at 2 (“Optimal pricing algorithms can be highly profitable, as they would be sophisticated enough to recognize and take advantage of profitable collusion opportunities.”); SHEARMAN & STERLING, KEY ANTITRUST ENFORCEMENT TRENDS: 2018 ANTITRUST ANNUAL REPORT 44 (2018), <https://www.shearman.com/perspectives/2018/04/2018-antitrust-report/artificial-intelligence-and-algorithms-in-cartel-cases> (noting the use of a more sophisticated tool to monitor the implementation of an agreement).

137. See *Third Report*, *supra* note 55, at 15 (recognizing that cartel participants devise sophisticated regimes to operate their cartels). *But see* Capobianco et al., *supra* note 2, at 29 (highlighting that competition rules do not forbid collusive outcomes, but only collusive behavior—AI could be considered collusive behavior under current regulation if viewed as a “plus factor”).

138. See Lynch, *supra* note 23 (emphasizing the central assumption that the digital economy lowers prices and expands choices would be upended by increasing ease to engage in anticompetitive behaviors; Vestager, *supra* note 57, at 8 (stating the digital age has led to the European Union creating new rules on data protection to ensure protection by design)).

technology to transform traditional cartels into nearly any form they see fit to most effectively escape regulators, which includes masking a hard core cartel as what is recognized to be another form of tacit collusion.¹³⁹ Further, AI's capabilities develop more sustainable and destructive cartels than distrusting individuals.¹⁴⁰ The OECD and its member nations have recognized this potential level of harm, making it even more inconceivable that the OECD excludes algorithmic cartels from its Recommendation.¹⁴¹

The responsive behavior of deep-learning algorithms equates to that of an anticompetitive agreement, which the Recommendation directly addresses under the definition of a hard core cartel.¹⁴² Ultimately, viewing an anticompetitive "agreement" in antitrust laws as solely human-centric must be overcome, as it presupposes human mental states and proves less useful in dealing with computer software.¹⁴³ In essence, rather than a "meeting of the minds," antitrust enforcers face a "meeting of the algorithms" in which algorithms' responses to activities (e.g., reducing prices) by other members of the algorithmic cartel are used to track the "acceptance" of an anticompetitive

139. See Salcedo, *supra* note 22, at 5 (stating findings suggest that pricing algorithms are seen as an effective tool for tacit collusion, meaning it will likely fall outside the scope of current regulation); see also Capobianco & Gonzaga, *supra* note 12, at 5 (recognizing the subtlety of anti-competitive behaviors enabled by algorithms).

140. See *Pricing Algorithms: The Digital Collusion Scenarios*, *supra* note 22, at 5 (noting market players are now more easily able to sustain a supra-competitive price equilibrium); see also Stucke & Ezrachi, *Computers Inhibit Competition*, *supra* note 30, at 1778 (discussing the greater risk of sustainable tacit collusion); cf. Capobianco & Gonzaga, *supra* note 12, at 2 (arguing that if algorithms are being used for firms to customize their service and product offerings, then collusion might be harder to sustain due to low incentives for low-cost firms to engage in collusion).

141. See generally *Competition Policy in the Digital Age*, *supra* note 3, at 7 (emphasizing "how algorithms can make tacit collusion more likely, both in oligopolistic markets with high barriers to entry and a high degree of transparency, and in markets where traditionally tacit collusive outcomes would be difficult to achieve and sustain over time, widening the scope of the so-called 'oligopoly problem'").

142. See *Recommendation*, *supra* note 4; see also Salcedo, *supra* note 22, at 4 (explaining that pricing algorithms are responsive to market outcomes); cf. *Big Data*, *supra* note 88, at 10 (recognizing that the responsive behavior of algorithms benefits both consumers and firms by lowering search costs).

143. See McSweeney & O'Dea, *supra* note 11, at 75, 79 (noting concepts such as "intent" and "meeting of the minds" presuppose a human mental state).

arrangement.¹⁴⁴ Markets comprised of sufficiently homogenous products easily demonstrate this—firms can simply program pricing algorithms to follow a market leader by imitating in real time any price deviations.¹⁴⁵ Yet, if the leader realizes what is happening without communicating with the remaining companies, this will likely result in a collusive outcome that, today, would hardly amount to an antitrust violation in any jurisdiction in the world.¹⁴⁶

Image A: Meeting of the Algorithms¹⁴⁷

Offer	Acceptance
(1) Firm intermittently sets a higher price for brief seconds (costless signal)	Competitor increases price to the value signaled
(2) Firm programs algorithm to mimic the price of a leader	The leader, recognizing this behavior, increases the prices
(3) Firm publicly releases a pricing algorithm	Competitor downloads and executes the same pricing algorithm
(4) Firm programs an anti-competitive price to be triggered whenever the competitor's price is below a threshold	Recognizing the algorithm, the competitor always keeps the price above the threshold
(5) Firm uses ML algorithm to maximize joint profits (for instance, by accounting for the spillover on competitors' profits)	Competitor reacts with the same strategy

144. See *infra* Image A: Meeting of the Algorithms; e.g., Capobianco & Gonzaga, *supra* note 12, at 4 (“[I]f firms program prices to replicate the price of a market leader, this could be seen as an offer to collude, which would be accepted when the leader raised the price.”). But see Capobianco et al., *supra* note 2, at 34 (questioning whether a meeting of the algorithms can amount to anticompetitive agreement).

145. Capobianco & Gonzaga, *supra* note 12, at 3-4; see, e.g., Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 8-9 (major oil firms that dominate Perth, Australia’s concentrated retail petrol market used price transparency to facilitate tacit collusion which “sustainably improved retail margins, created price stability in the presence of aggregate shocks, and enabled firms to resolve conflict quickly”).

146. See Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 20 (observing that “pure” forms of tacit collusion result from the rational behaviors by firms in reaction to market characteristics and do not trigger liability); e.g., Lynch, *supra* note 23 (stating German regulators have warned that anticompetitive effects of sophisticated algorithms (AI) could be difficult to prosecute); see also Capobianco & Gonzaga, *supra* note 12, at 5 (explaining AI has become associated with many risks outside of the scope of antitrust—privacy, information bias, and discrimination in some cases).

147. Capobianco et al., *supra* note 2, at 34; Capobianco & Gonzaga, *supra* note 12, at 5.

Global competition authorities cannot let firms hide behind the Recommendation's exception for agreements "reasonably related to the lawful realisation of cost-reducing or output-enhancing efficiencies."¹⁴⁸ Firms tend to program AI algorithms for profit maximization, and that profit maximization, particularly within oligopolistic markets, is most easily achieved when "competitors" no longer compete—a realization humans have always had and one that will not take long for deep-learning algorithms to realize.¹⁴⁹ The subsequent realizations of reduced costs could be an outcome, but likely not the target, of profit maximizing algorithms.¹⁵⁰ Further, this exception was never meant to serve as an "out" for price-fixing firms significantly harming the competitive landscape, and it should not be treated as such just because cartels learn to communicate in novel ways.

It would be inadequate to conclude that the Recommendation, which recognizes hard core cartels as one of the largest threats to fair global trade and competition, is not intended to address cartels attempting to pass as tacit collusion in the form of advanced technology. Recognizing such cartels as just a modern version of tacit collusion rather than actual cartels leaves all digital markets, even those outside the traditional "oligopoly problem," vulnerable to vast manipulation and anticompetitive outcomes.¹⁵¹ AI algorithmic cartels

148. *Recommendation*, *supra* note 4.

149. *See* Stucke & Ezrachi, *Computers Inhibit Competition*, *supra* note 30, at 1783 (illustrating profit maximization as "competitors unilaterally create and use computer algorithms to achieve a given target"); *see also* *Big Data*, *supra* note 88, at 23 (proposing that machine-learning allows algorithms to achieve tacit collusion in scenarios where the programmer may not have foreseen such an outcome).

150. *See, e.g.*, EZRACHI & STUCKE, *VIRTUAL COMPETITION*, *supra* note 9, at 73-74 ("Amazon, in 2015, was developing a platform for the Internet of Things, where a 'whole ecosystem of manufacturers, service providers, and application developers [can] easily connect their products to the cloud at scale, take action on the data they collect, and create a new class of applications that interact with the physical world.'").

151. *See, e.g.*, *Competition Policy in the Digital Age*, *supra* note 3, at 25 ("One of the main risks of algorithms is that they expand the grey area between unlawful explicit collusion and lawful tacit collusion, allowing firms to sustain profits above the competitive level more easily without necessarily having to enter into an agreement.").

can respond to other firms' decisions more accurately with greater speed and likely maintain the most sustainable cartels the global antitrust community has ever faced.¹⁵²

The market impact of AI cartels requires a sustained commitment to international comity. The lack of borders in limitlessly reaching economic regions makes these cartels even more difficult to detect and monitor than traditional ones.¹⁵³ International comity and cooperation becomes more vital under this scenario than the global antitrust community has before experienced.¹⁵⁴ Excluding AI algorithmic collusion from the Recommendation would be a signal to the international antitrust community that only humans have the ability to collude and engage in anticompetitive behavior, which competition authorities no longer recognize as truth.¹⁵⁵ The OECD's Recommendation addresses the same type of anticompetitive behavior that AI is capable of, as well as the challenges to competition authorities presented by these types of advanced, wide-spread cartels.¹⁵⁶ Thus, member nations must recognize the Recommendation

152. See Geradin, *supra* note 23, at 1 (stating retaliation via algorithms will be much faster, and thus less profitable for firms—making them more sustainable); Lynch, *supra* note 23, at 1 (acknowledging that pricing tools are far faster than any human merchant); McSweeney & O'Dea, *supra* note 11, at 77 (noting faster analytics enable companies to sort customers into more targeted groups).

153. See Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 17 (recognizing “algorithms may make price fixing attempts more frequent and more difficult to detect.”); cf. Posner, *supra* note 18, at 1590 (conceding that because tacit collusion is more difficult to detect than express collusion, it should be punished just as, if not more, severely).

154. See *Competition Policy in the Digital Age*, *supra* note 3, at 43 (recognizing that big online companies' increasing reliance on secret algorithms poses a concern that the organization of the world's information today is, to some extent, controlled by automated systems in the hands of a few market players across all industries).

155. See *Pricing Algorithms: The Digital Collusion Scenarios*, *supra* note 22, at 4 (emphasizing that algorithms provide a breeding ground for tacit collusion as market data becomes more accessible and market transparency increases); see also Capobianco et al., *supra* note 2, at 27 (discussing how nations individually are currently conducting market studies and investigations to obtain empirical evidence of the capabilities of algorithmic collusion).

156. See *Recommendation*, *supra* note 4 (defining hard core cartels as those engaging in an “anticompetitive agreement, anticompetitive concerted practice, or anticompetitive arrangement by competitors to fix prices, make rigged bids (collusive tenders), establish output restrictions or quotas, or share or divide markets by allocating customers, suppliers, territories, or lines of commerce. . . .”); Stucke &

as such and cannot afford to let AI fall on the same side of the line as tacit collusion and not cartels.

B. THE RECOMMENDATION IS INSUFFICIENT FOR EFFECTIVE AI ALGORITHMIC CARTEL ENFORCEMENT COOPERATION AMONG MEMBER AND NON-MEMBER NATIONS.

While the OECD's Recommendation encompasses AI algorithmic collusion, it insufficiently advances international comity and enforcement cooperation in the context of AI algorithmic collusion.¹⁵⁷ Based on its Recommendation, the OECD clearly did not anticipate such rapid improvements in cartel formation, operational efficiencies, and sustainable execution.¹⁵⁸ Nor did the OECD anticipate that the division between tacit collusion and express collusion would become nearly impossible to identify.¹⁵⁹ The world's largest economies' divergent approaches to algorithmic cartel enforcement highlight this problem.¹⁶⁰

1. *Lack of Detection Cooperation*

The Recommendation lacks focus on the detection of hard core

Ezrachi, *Computers Inhibit Competition*, *supra* note 30, at 1784 (explaining that classic cartel arrangements include fixing prices—here, humans leave it to the computer algorithms to collude in secrecy and fix prices).

157. See discussion *infra* Part III(B)(1-3).

158. See *Big Data*, *supra* note 88, at 8 (recognizing that big data is a large factor in operational efficiencies); Vestager, *supra* note 57, at 8 (warning competition enforcers to keep an eye out for cartels that use software (algorithms) to operate more effectively); see generally *Recommendation*, *supra* note 4 (lacking any mention of possible advancements in cartel formation—particularly in the digital age).

159. *Competition Policy in the Digital Age*, *supra* note 3, at 25; see EZRACHI & STUCKE, *VIRTUAL COMPETITION*, *supra* note 9, at 36-37 (arguing that adoption of the same pricing technology, and thus identical reactions to changing market conditions by competitors, creates the same results as if executives had expressly colluded on prices).

160. The Recommendation makes no mention, outside of the OECD's definition of hard core cartels, of what behaviors directly and indirectly trigger liability (i.e., facilitating market manipulation). Further, the part of the Recommendation (Part B) devoted to international comity and cooperation makes no mention of cooperation in the detection phase—rather the OECD jumps directly to enforcement. See generally *Recommendation*, *supra* note 4 (calling for institutions with the “power” to detect cartels).

cartels.¹⁶¹ Competition authorities already face challenges in detecting global cartels created via human decision making; now enforcers are left with no theory of establishing an anticompetitive intent, no conversation to record, and no trade association to monitor.¹⁶² Further, member nations are left with an international recommendation calling for unification in sanctions and enforcement, but no understanding among nations on how to detect the most intelligent and sustainable cartels competition authorities have ever faced.¹⁶³

In practice, detection will likely pose more challenges for authorities than the actual enforcement against the cartel.¹⁶⁴ The position of competition authorities does not enable them to determine if any particular pricing outcome naturally results from a working market or an algorithm.¹⁶⁵ It would likewise be unrealistic for regional competition authorities to continuously monitor the market behavior of every algorithm.¹⁶⁶ Further, agencies are unequipped to analyze the

161. See generally *id.*

162. See *Competition Policy in the Digital Age*, *supra* note 3, at 11 (noting that regardless of the results generated, programmers are unable to dissect an algorithm's decision-making process); Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 5 ("Generally, for illegal cartels involving *express* collusion which were detected and prosecuted, the empirical research has that cartels involving a trade association were on average over twice as large than cartels without a trade association involved."); *Pricing Algorithms: The Digital Collusion Scenarios*, *supra* note 22, at 3 (averring that programmers may unintentionally omit safeguards to prevent communication from happening but are unable to track whether the algorithm has been engaging in communication in deciding if safeguards are necessary).

163. See *Big Data*, *supra* note 88, at 24 (recognizing the lack of clarity for how antitrust authorities can and will adjust their tools to fight digital cartels); Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 34 (recognizing that current legal challenges create the possibility of various counter-measures for nations to take in tackling algorithmic collusion); *cf.* Stucke & Ezrachi, *Computers Inhibit Competition*, *supra* note 30, at 1784 (noting in Table 1, the uncertainty, under current competition law, of whether the Digital Eye scenario (AI) can satisfy the requirements of agreement, intent, and liability).

164. See McSweeney & O'Dea, *supra* note 11, at 76 (averring that detection of AI cartels will require novel investigatory approaches and likely additional resources); Stucke & Ezrachi, *Pricing Bots*, *supra* note 47 (noting AI can expand tacit collusion beyond traditional oligopolistic markets and beyond easy detection).

165. Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 23. *But see* *Competition Policy in the Digital Age*, *supra* note 3, at 54 (scholars have suggested that this problem could be countered by auditing algorithms).

166. Competition authorities taking on the role of auditing and monitoring

behavior of deep-learning algorithms as they continuously learn based on their ever-changing environment, which is incredibly difficult to audit in a uniform fashion.¹⁶⁷

The complete inability to track the “thinking” of the computer and its decision-making process poses a greater challenge to international competition authorities, with no “trail” to follow in establishing anticompetitive intent or behaviors.¹⁶⁸ Rather, these deep-learning algorithms simply respond to their environment in the most profit maximizing way.¹⁶⁹ The level of human collaboration in an algorithmic cartel could be great or nearly nonexistent aside from the implementation of the algorithm.¹⁷⁰ The OECD frames this as an enforcement issue, but the implications on detection are just as great.¹⁷¹ Borderless cartels creating artificial market pricing without

algorithms creates a significant burden on regulators. This would require the auditing of a very large volume of algorithms and a high degree of technical expertise to understand their functions and effects. Further, in the initial stages of implementation, it will likely be difficult to tell if the algorithm that a firm submits is the one used in the marketplace. Additionally, in the case of neural networks, it may be impossible to actually effectively audit a complex system and its affects as the algorithm continuously learns based on its current environment and purpose of implementation. See Capobianco & Gonzaga, *supra* note 12, at 4; Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 23.

167. See *Competition Policy in the Digital Age*, *supra* note 3, at 54 (quoting Ezrachi and Stucke) (recognizing that the high technical expertise and amount of man-power required to audit deep-learning algorithms is outside the realm of what a typical government agency is equipped to take on).

168. *Id.* at 11 (“[R]egardless of the quality of the results produced, deep learning algorithms do not provide programmers with information about the decision-making process leading to such results.”).

169. See *Big Data*, *supra* note 88, at 23 (emphasizing that programmers do not necessarily foresee a tacit collusive outcome when utilizing AI solely for profit-maximizing—although it may be the result); Stucke & Ezrachi, *Computers Inhibit Competition*, *supra* note 30, at 1796 (explaining that collusive behavior is triggered by the AI’s self-learning nature in a transparent market occupied by similar minded agents that all have the same goal: to maximize profits).

170. See Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 25 (explaining that advanced technologies with the ability to act independently can completely lack human input post development and implementation); cf. Ittoo & Petit, *supra* note 20, at 1 (discussing the lack of clarity on the capabilities of AI to enter into tacit collusion strategies without any human intervention).

171. The OECD’s only roundtable discussion report on algorithmic collusion focuses the discussion around enforcement challenges presented to competition authorities and proper remedies, barely addressing the initial challenge of detection

the ability to scrounge up the slightest bit of communication between firms makes detection of these cartels nearly impossible.¹⁷² AI cartels manipulate global markets while competition authorities attempt to detect them regionally.¹⁷³

Algorithmic cartels test the boundaries of the OECD's Recommendation.¹⁷⁴ Where at one point it may have been enough to have international cooperation solely in enforcement investigations, this will no longer be the case. The OECD only addresses detection in the context of giving regional authorities the "power adequate to detect" and not in the context of international comity and cooperation.¹⁷⁵ The novel challenges to authorities that come with the increasing use of algorithms in day-to-day business practices requires novel approaches to international cooperation.¹⁷⁶ The OECD's Recommendation lacks acknowledgement of the importance of

before enforcement can ever take place. See *Competition Policy in the Digital Age*, *supra* note 3, at 3.

172. See Capobianco & Gonzaga, *supra* note 12, at 3 (averring that agencies can rely on the existing framework to assess algorithms for infringement of competition law, but the detection of such infringement will likely be complex); see also *Big Data*, *supra* note 88, at 22 (discussing the lack of literature about the implications of big data for the detection and investigation of cartels).

173. See Capobianco et al., *supra* note 2, at 10 (stating national governments are focused on detection, while the international community is focused on enforcement); e.g., *Third Report*, *supra* note 55, at 21 (noting that the United States published a checklist of suspicious behaviors and statements to assist foreign officials in their detection methods—but the list was nothing beyond simple advisement) (checklist available at <http://www.usdoj.gov/atr/public/guidelines/primer-ncu.htm>).

174. The largest challenge to the OECD's definition will come in the form of whether computers are able to create an anticompetitive agreement without human knowledge of said agreement. The consequences of acknowledging an anticompetitive agreement as reliant on human mental states could include incredibly sustainable, ever enduring cartels outside of the law's reach and enforcement. See Ittoo & Petit, *supra* note 20, at 2 ("[A]utomated pricing via algorithmic processing of collected mass data may tend to lead pricing above the competitive level, either via tacit collusion or more robust cartel formation. . ."). But see Stucke & Ezrachi, *Pricing Bots*, *supra* note 47 (noting algorithmic collusion as it is studied and known today does not amount to a hard core cartel, but rather extreme tacit collusion outside of the law's reach).

175. *Recommendation*, *supra* note 4.

176. McSweeney & O'Dea, *supra* note 11, at 79; cf. Posner, *supra* note 18, at 1565 (arguing that it is much easier to sell a novel doctrine in the antitrust field to the Court than to Congress—which may very well be the case when national authorities begin to investigate and prosecute against algorithmic collusion).

international detection cooperation, which will be vital before there is ever enforcement cooperation against algorithmic cartels.¹⁷⁷

2. *Lack of Identifying Liable Behaviors*

The Recommendation fails to identify liable behaviors.¹⁷⁸ This has led to legislative gaps across member nations, further reducing the ability to achieve effective international enforcement cooperation.¹⁷⁹ Foremost, an enduring question hangs over the international antitrust community—whether one should condemn a firm for behaving rationally and developing, unilaterally, an algorithm that accounts for publicly available information while operating interdependently on the market?¹⁸⁰ If humans do not know whether, when, or for how long

177. See *Third Report*, *supra* note 55, at 31 (highlighting that successful cooperation among global competition authorities includes tools and techniques for the detection of cartels); *Competition Policy in the Digital Age*, *supra* note 3, at 14 (noting algorithmic collusion will require a combination of both reactive and proactive detection measures to be most effective—competition authorities have typically relied on reactive tools such as leniency programs).

178. Current competition law forbids the means by which collusion is achieved—liable behaviors—and not the collusive outcome. Liable behaviors in global competition law include the “plus factors” in cases of parallel conduct, those who knowingly continue to benefit from an illegal source of income, any form of anticompetitive agreement, etc. See Capobianco et al., *supra* note 2, at 29; Stucke & Ezechri, *Computers Inhibit Competition*, *supra* note 30, at 1804. In cases of algorithmic collusion, parties may be liable for developing the algorithms or in seeing the effects of algorithms, if they were (1) motivated to achieve an anticompetitive outcome, or (2) aware of their actions’ natural and probable anticompetitive consequences. Another possibility is framing algorithmic collusion as an “abuse” of excessive transparency where there is apparent anticompetitive intent among the firms or within the industry. However, “abuse of excessive transparency” will require a more refined definition and understanding in order to ensure compliance while not suppressing the benefits algorithms provide to consumers and to the market. See Ezechri & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 21.

179. The original purpose of the OECD’s Recommendation included eliminating gaps in the coverage of competition law. *Recommendation*, *supra* note 4; *Third Report*, *supra* note 55, at 46. The OECD’s recent and only report on algorithmic collusion makes no reference to unification in approaches for detection, investigation, and enforcement against algorithmic cartels. This calls into question the likelihood and speed at which competition authorities will be able to come together in order to ensure international comity does not suffer because cartels have become more sophisticated. See generally *Competition Policy in the Digital Age*, *supra* note 3.

180. See EZRACHI & STUCKE, VIRTUAL COMPETITION, *supra* note 9, at 80

algorithms collude (assuming they do not), then is this even an area for competition law enforcers to address?¹⁸¹ The OECD's Recommendation for handling one of the most serious violations of competition law does not offer an answer to either of these questions.¹⁸²

The OECD must address two focal points of hard core cartel enforcement to achieve optimal international cooperation in deterring cartels. First, identifying illegal behavior—recognizing the line between rational profit maximizing decisions and illegal behavior¹⁸³—and second, what makes a person within a firm liable for anticompetitive conduct.¹⁸⁴ Under the current competition enforcement regimes, the absence of communication and an explicit agreement among firms may not satisfy the intent and awareness

(debating whether the focus of competition authorities in cases of AI should be on consumer welfare or the overall efficiencies and total welfare generated by the technology); *Competition Policy in the Digital Age*, *supra* note 3, at 19 (stating that supra-competitive pricing strategies can be the natural outcome of rational economic behavior by a single firm on the market).

181. See EZRACHI & STUCKE, VIRTUAL COMPETITION, *supra* note 9, at 78 (“We can no longer assume that humans intended to create the conditions of tacit collusion.”).

182. The OECD's Recommendation never addresses which welfare standard (i.e., consumer or total) is the most effective in maintaining optimal competitive markets. Further, it does not address “unconventional” cartels that are intentionally sophisticated, so as to escape regulation. Does the profit-maximizing rationality of the algorithm's development and implementation remove any possible liability to the programmer? The Recommendation oversimplifies the complexity these questions introduce in achieving international cooperation. See *generally Recommendation*, *supra* note 4.

183. *Competition Policy in the Digital Age*, *supra* note 3, at 20 (“There is a grey area of business behavior which goes beyond conscious parallelism but at the same time does not involve an express agreement between competitors.”).

184. It is not enough to only identify liable means/behaviors, those who are responsible for them must also be identified. This is easy in cases where a group of executives agree to collude in secret because those executives are clearly liable. However, this is much less clear in scenarios where no particular individual is carrying out the collusive behavior, nor are the colluders aware they are colluding. Yet, the collusive outcome—development, implementation, and execution—would not have been possible absent human intervention (i.e., the initial deployment of the algorithm). The Recommendation fails to clarify if there should be liability, and if there is, who it falls on, in these types of scenarios. See *generally Recommendation*, *supra* note 4.

conditions necessary for finding illegality.¹⁸⁵

OECD roundtable discussions frame potential AI collusive behaviors in various ways.¹⁸⁶ The highest standard a competition enforcer could set in classifying illegality would be requiring proof of the firm's "abuse" of the markets' excessive transparency, likely revealing anticompetitive intent.¹⁸⁷ This becomes an impossible standard because AI's decision-making cannot be tracked nor is there any clarity on the term "abuse" in this context.¹⁸⁸ Further, likely future capabilities of algorithms make this an unrealistic standard.¹⁸⁹ Some nations will likely consider AI collusion a strict liability crime because of the challenges in detection and potentially heightened cartel sustainability.¹⁹⁰ Framing illegality as any form of market manipulation or as any involvement in unfair competitive practices translates into a strict liability crime in algorithmic collusion scenarios.¹⁹¹ This greatly lowers the bar for enforcers. Because only

185. See *Big Data*, *supra* note 88, at 24 (screening algorithms is not a solution to algorithmic collusion because firms can only be condemned if there is some identifiable "intention" to collude); Stucke & Ezrachi, *Computers Inhibit Competition*, *supra* note 30, at 1795 (arguing that there is likely a lack of "intent" by developers and users to facilitate conscious parallelism—the firm is merely relying on an AI strategy to optimize their position in the market).

186. See *Competition Policy in the Digital Age*, *supra* note 3, at 39 (discussing the scope of liability assigned to individuals and firms for a robo-seller's actions under current antitrust law).

187. Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 21.

188. AI operates with the intent to maximize profits while recognizing mutual interdependency and readapting behavior to the actions of other market players—not with the intent to collude. Capobianco et al., *supra* note 2, at 23; see EZRACHI & STUCKE, *VIRTUAL COMPETITION*, *supra* note 9, at 37 (discussing how AI generates anticompetitive outcomes absent anticompetitive intent).

189. See Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 27 (recognizing deep-learning algorithms' significant ability to adjust to an ever-changing environment and to engage in cognitively intensive tasks, making them a superior tool for firms to determine market strategy); Stucke & Ezrachi, *Pricing Bots*, *supra* note 47 (stating that scholars still do not fully understand the changes to our markets and competitive ecosystem as we shift to the era of big data and analytics).

190. See Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 26 (noting that the European Commission is currently considering a strict liability regime); Stucke & Ezrachi, *Computers Inhibit Competition*, *supra* note 30, at 1803 (questioning whether companies can constrain their computer's actions to avoid less competitive outcomes if faced with strict liability for the computer's actions).

191. The focus here is on firms' use of advanced algorithms to transform market

the largest firms (i.e., Google and Facebook) utilize deep-learning AI due to its great cost, this results in high barriers to entry in particular markets and makes it impossible for existing firms to compete. This result alone could possibly be deemed an unfair competitive practice.¹⁹² Additionally, states with competition law enforcers authorized to conduct dawn raids will likely use this tactical advantage with algorithmic collusion scenarios—finding illegality through market or sector investigations.¹⁹³ The wide scope of behavioral and structural remedies under market investigations, that may otherwise be unavailable, open the flood gates in enforcement tactics for these nations.¹⁹⁴

conditions in a way that facilitates tacit collusion, thus creating a new market dynamic through “artificial” means. This approach would be most relevant for the United States under Section 5 of the FTC Act: “the FTC must show either (1) evidence that defendants tacitly or expressly agreed to use pricing algorithms to avoid competition, or (2) oppressiveness, such as (a) evidence of defendants’ anticompetitive intent or purpose or (b) the absence of an independent legitimate business reason for the defendants’ conduct.” Ezechri & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 20-21.

192. The biggest developers and implementers of AI include global technology companies such as Google, Amazon, and Facebook. These companies further strengthen their already strong market position by forcing competitors to adopt AI if they ever want to compete in the same markets. See EZRACHI & STUCKE, *VIRTUAL COMPETITION*, *supra* note 9, at 21 (“As more online sellers use AI and pricing algorithms, their rivals, to prevent being at a competitive disadvantage, will feel greater pressures to develop ‘smart’ pricing algorithms themselves.”)

193. “In 2017, Russia’s RAS initiated dawn raids of LG Electronics Rus Ltd., Philips Ltd. and Sangfily SES Electronics Rus Ltd. due to receiving complaints of concerted actions by these enterprises in the sales of equipment. As of now, this investigation continues.” Org. for Econ. Cooperation & Dev. [OECD], *Algorithms and Collusion - Note by the Russian Federation*, at 4, DAF/COMP/WD(2017)22 (May 15, 2017), [https://one.oecd.org/document/DAF/COMP/WD\(2017\)22/en/pdf](https://one.oecd.org/document/DAF/COMP/WD(2017)22/en/pdf) [hereinafter *Note by the Russian Federation*]. Dawn raids are not a tool available to United States competition authorities, but they are available in the jurisdictions of the European Union, Brazil, India, and China. The United States utilizes warrants for searches and seizures. See generally JONES DAY, *HOW TO SURVIVE DAWN RAIDS AND SEARCH WARRANT INVESTIGATIONS IN ANTITRUST AND COMPETITION LAW ENFORCEMENT ACTIONS* (2016), <https://www.jonesday.com/files/Publication/0ab2c15a-c068-4029-afc1-bb51990d9d1b/Presentation/PublicationAttachment/a1300b6e-ed88-4252-b6bf-37371e2f1ac7/How%20to%20Survive%20Dawn%20Raids.pdf>.

194. See e.g., Ezechri & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 22 (explaining how the United Kingdom Competition and Market Authority can impose structural or behavioral remedies).

Where to assign liability once collusive behavior has been identified creates another gaping issue.¹⁹⁵ The OECD barely touches the topic of assigning liability for traditional cartels, and the issue only amplifies when the guilty cartelists are robots and no human decision making is involved.¹⁹⁶ Most intuitively, liability under algorithmic cartels could be assigned to the algorithm's creators, users, or benefitters.¹⁹⁷ The Recommendation only identifies "firms" and "individuals" as liable actors, providing no direction on the most effective liability assignments to deter algorithmic cartels or any unconventional cartels.¹⁹⁸

As AI continues to develop, the links between the algorithm and the human developer become weaker and the ability of algorithms to act and price autonomously puts in question the liability of the individuals who benefit from the algorithms' autonomous decisions.¹⁹⁹ In such cases, liability will most likely be determined on a case-by-case basis with no real uniformity, but this is unsatisfactory when global competition authorities attempt to cooperate consistently.²⁰⁰

195. Capobianco et al., *supra* note 2, at 36.

196. Two possible legal approaches to a liability regime include: (1) a risk-generating approach—"liability would be assigned to the actors generating a major risk for others and benefitting from the relevant device, product or service"—and (2) a risk-management approach—"liability is assigned to the market actor which is best placed to minimize or avoid the realisation of the risk or to amortize the costs in relation to those risks"—both of which are being considered by the European Commission. Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 26.

197. Creators include programmers and third-party centers; users include general level managers and commercial applications; benefitters include shareholders and executives. Capobianco et al., *supra* note 2, at 36.

198. The only mention of liability—not expressly, but by reading in between the lines—assigns responsibility to "firms and individuals" by calling for effective sanctions to deter their engagement in cartels. *Recommendation*, *supra* note 4.

199. See Capobianco et al., *supra* note 2, at 35 (noting a weak link between the agent (algorithm) and the principal (human being)); Capobianco & Gonzaga, *supra* note 12, at 5 (discussing how the connection between humans and computers weakens as AI develops further and is able to act and price more autonomously).

200. See Posner, *supra* note 18, at 1601 (noting exceptional situations that have to be treated on a case-by-case basis because guidelines are not particularly helpful). Today, scenarios of algorithmic collusion are still rare (exceptional) and AI collusion has not yet been detected in any market, making a case-by-case analysis reasonable and expected. However, as AI proliferates in global markets, a case-by-case analysis will only further complicate enforcement as competition authorities

3. *The Trickle-Down Effects on Enforcement*

Finally, the Recommendation fails to develop a consistent approach to unconventional cartels, especially where conduct has cross-border implications.²⁰¹ Today, no clear line exists globally to separate a civil violation from a criminal one, thus creating inevitable gaps in enforcement.²⁰² When national competition authorities lack international cooperation in detecting and identifying liable parties, particularly in criminal investigations, challenges in international enforcement cooperation come as no surprise. Furthermore, the unanswered questions and unaddressed obstacles of the most effective enforcement to deter unconventional cartels formed via innovative methods (i.e., AI) results in not only unlikely, but nearly impossible, successful international cooperation.²⁰³

The various possible approaches to enforcement against AI algorithmic cartels have become apparent because countries are already taking them.²⁰⁴ OECD non-member nations Russia, Brazil, India, and China, have either recognized they have ineffective antitrust laws, are slowly attempting to pave the pathway to effective enforcement, or are entirely silent on the issue, begging the question

will completely lack any uniformity and have no cooperation guidelines for related investigations. *See generally Big Data, supra* note 88, at 15.

201. *See* Tom Madge-Wyld, *Unconventional Cartel Conduct Needs Harmonized Enforcement*, *Lawyers Say*, GLOBAL COMPETITION REV. (Apr. 11, 2018), <https://globalcompetitionreview.com/article/usa/1167828/unconventional-cartel-conduct-needs-harmonised-enforcement-lawyers-say> (quoting Cleary Gottlieb Hamilton & Steen partner Mark Nelson) (“It is critical, as much as possible, for antitrust enforcers globally to get on the same page, particularly in what we were referring to as unconventional cartel conduct . . . [e]specially where conduct is global in scope or has cross-border implications.”).

202. This makes it difficult for global firms to ensure compliance. *See id.*

203. When nations are unable to establish a common platform or even a common goal, competition regulation, then international cooperation, becomes less helpful and thus less common. The OECD’s failure to address the need to establish a common goal when new challenges arise to competition authorities, particularly when egregious harm could result, has been made apparent as competition authorities flounder to determine how and if they should regulate algorithmic collusion.

204. This Part III(B)(3), is devoted to addressing the gaps in antitrust regulation made apparent by the divergent approaches taken by each nation in relation to AI enforcement.

of whether these nations are addressing the issue at all.²⁰⁵ OECD member economic regions—the United States and the European Union—apparently have discussed the issues of algorithmic collusion enforcement but it does not appear they have discussed it with one another.²⁰⁶ Rather, the global gap in antitrust law enforcement continues to widen when authorities once celebrated it closing.²⁰⁷

Russia was the only non-member nation to submit a report to the OECD's roundtable discussion on algorithmic collusion.²⁰⁸ Russia's FAS report provides an optimal example of the current incapacity for effective international enforcement in AI algorithmic collusion scenarios. Current Russian antimonopoly legislation solely concerns "economic entities, organizations, authorities and individual persons" and thus collusion via algorithmic software surely results in more sustainable cartels than ever before because it falls outside the scope of current regulation.²⁰⁹ Further, Russia even points to the recurring difficulty of determining the responsibility of computer engineers when they program "intelligent" machines.²¹⁰

FAS's utilization of dawn raids via a market investigation of the giant global technology companies LG Electronics Rus Ltd., Philips Ltd. and Sangfiy SES Electronics Rus Ltd., is an unattainable method

205. See *infra* notes 208-224.

206. See Leah Nylen & Matthew Newman, *Views on Algorithms and Competition Law Expose EU-US divide*, MLEX (May 26, 2017), <https://mlexmarketinsight.com/insights-center/editors-picks/antitrust/cross-jurisdiction/views-on-algorithms-and-competition-law-expose-eu-us-divide> (arguing that the European Union has already drawn a tougher line on regulating technology, compared to the United States, which has taken a backseat approach in cases of AI).

207. As this section discusses, the world's largest economies are taking divergent approaches in their view of regulating AI algorithmic collusion. The Recommendation's Third Report celebrated the closing of the enforcement gap, when it comes to hard core cartels, and discussed nations trending in this direction. See *Third Report, supra* note 55, at 30 (highlighting that many of the trends in enforcement led to international cooperation reaching unprecedented levels).

208. Russia was the only non-member in the context of this paper to submit a report—other non-member nations included Ukraine and Singapore, with the Business and Industry Advisory Committee also submitting an individual report. See *generally Russian Federation, supra* note 193.

209. *Id.* at 2.

210. Russia's approach to this problem (whether humans are liable for "smart" computers' decisions) is not clarified, but it is singled out as one of the largest issues facing competition authorities. See *id.* at 4.

to many other global competition authorities.²¹¹ Thus, this cannot be the sole method relied upon to detect or enforce against algorithmic cartels if the hope is to push towards global enforcement cooperation. A hopeful light, however, on international enforcement cooperation comes from Brazil's Administrative Council for Economic Defense (CADE) expectation to strengthen enforcement over various competition issues being discussed by North American agencies and the EC, including the challenges of big data.²¹² CADE's recent investigations into online hotel booking platforms, such as Booking.com and Expedia, and three separate investigations into Google's practices in the Brazilian search market, highlights their drive towards international cooperation and alignment with international competition authority timing deadlines.²¹³

Despite CADE's notable developments in international enforcement cooperation and overall hard core cartel enforcement, the agency's complete silence on algorithmic collusion is deafening. CADE's Multiannual Plan, with detailed targets for 2016-2019 and identified initiatives, never once mentions algorithmic collusion and

211. See *id.* Although a majority of the jurisdictions analyzed in this paper (every economic region aside from the United States) are authorized to initiate dawn raids, this is not a uniform global approach to investigations into anticompetitive behaviors, and there is no evidence that it will ever become one—primarily because the United States utilizes warrants to conduct “search and seizures” when conducting criminal investigations. See generally JONES DAY, *supra* note 193.

212. Barbosa Müssnich Aragão, *Abuse of Dominance Enforcement—What's Next?*, LEXOLOGY (June 14, 2018), <https://www.lexology.com/library/detail.aspx?g=0e1af2d7-56c8-4bf9-9a0e-c94ab4faa7d7>; accord John Bodrug, *Interview with Alexandre Barreto, President of Brazil's Administrative Council for Economic Defense (CADE)*, AM. BAR ASS'N: ANTITRUST SOURCE 5 (Mar. 29, 2018), https://www.americanbar.org/content/dam/aba/multimedia/antitrust_law/jun18_barreto_intrvw_6_21f.authcheckdam.pdf (including commentary by Alexandre Barreto, President of CADE since 2017, on CADE's investment in big data, econometric, and other mining tools to improve investigative capacity, although all projects are still in the beta version).

213. Press Release, CADE, Booking, Decolar, and Expedia Reach Cease and Desist Agreement with CADE (Mar. 29, 2018), <http://en.cade.gov.br/press-releases/booking-decolar-and-expedia-reach-cease-and-desist-agreement-with-the-brazilian-administrative-council-for-economic-defense>; Jeff Zalesin, *Brazil Continues Google Antitrust Probe Without Microsoft*, LAW360 (May 5, 2016, 3:41 PM), <https://www.law360.com/articles/792935/brazil-continues-google-antitrust-probe-without-microsoft>.

innovative cartel development.²¹⁴ Brazil's absence from the algorithmic collusion "conversation" is especially concerning because it is a nation that prides itself on being the "best" competition regulator in the Americas for being the most innovative with soft law and most proactive in international cooperation.²¹⁵

India has been just as silent as Brazil, but not absent speculation. The CCI recently announced its intentions to open an investigation into the anticompetitive effects of algorithmic airline ticket pricing models—unsurprisingly, the details of the investigations are not public. Karan Singh Chandiok, a partner at Chadhiok & Associates in New Delhi, mentioned that this investigation is certainly raising questions of the proper legal standard and how to view the traditional ideas of an "agreement."²¹⁶ Chadhiok also mentioned that the CCI is looking to develop a cyber lab to better understand types of algorithmic pricing methods and their effects on various markets and overall competition.²¹⁷ The CCI has declined to comment on any of these observations.²¹⁸

Most recently, the CCI imposed heavy penalties on Google for abusing its dominant market position through promoting its own verticals at the expense of competitors.²¹⁹ The outcome of this

214. The initiative focuses on strengthening cartel combat policy through the integrated use of information and the institutionalization of partnerships with international bodies and other administrative bodies, but it never addresses the creative means by which these cartels are being formed, and divergent approaches by nations makes it more difficult to enter into effective agreements. See *Multiannual Plan-PPA*, CADE, <http://en.cade.gov.br/topics/actions-and-programs> (last visited Jan. 21, 2019) (noting the overall objective is "[t]o strengthen competition defense and consumer protection through the expansion of the scale and the effectiveness of public policies").

215. For the fifth consecutive year, CADE has received four stars in the annual ranking promoted by the British magazine *Global Competition Review* Rating Enforcement, which specializes in regulation and competition policy. Press Release, CADE, CADE Remains Among the Best Antitrust Agencies of the World (Aug. 21, 2017), <http://en.cade.gov.br/press-releases/cade-remains-among-the-best-antitrust-agencies-of-the-world>.

216. Malina McLennan, *India to Probe Airline Ticket Algorithms*, GLOBAL COMPETITION REV. (May 15, 2018), <https://globalcompetitionreview.com/article/1169614/india-to-probe-airline-ticket-algorithms>.

217. *Id.*

218. *Id.*

219. Avinash M. Tripathi, *Designing Competition Policies for the Age of AI*,

investigation raises further interest in how India will approach the problems AI algorithmic collusion poses, as Google leads the world in investing in and developing AI technology.²²⁰ India's approach to algorithmic collusion is likely to influence China's, and vice versa, making this massive global economy vital to the development of proper enforcement in this area.

The NDRC and SAIC have both been silent on China's approach to AI algorithmic collusion enforcement challenges and were absent from the most recent OECD roundtable discussions on the issue—which speaks volumes coming from one of the world's largest economies. The Chinese University of Hong Kong Business School, however, recently published Rob Nicholls's²²¹ work in relation to concerns that competition in digital markets could be compromised if AI bots take control of pricing. Yet, the article never addresses China's potential or suggested approaches but rather solely focuses on approaches discussed by Australian competition law enforcers.²²²

Despite the greatly intensified efforts of the NDRC and SAIC on non-merger antitrust enforcement, it is important to recognize the possible fatality to global markets resulting from their silence and lack of addressing the challenges AI algorithms pose. Manipulated Chinese markets almost certainly result in manipulated global trade—the NDRC and the SAIC's cooperation in enforcement is necessary.²²³

LIVEMINT (Mar. 9, 2018, 6:13AM), <https://www.livemint.com/Opinion/cgb8hI830DpAIzuLCQ2ZaP/Designing-competition-policies-for-the-age-of-AI.html>.

220. *Id.* (highlighting that CCI's investigation into Google may be used to broaden sectoral challenges and noting that smart regulation will be key to harnessing the benefits of AI for consumers and firms while optimizing the competitive environment).

221. Rob Nicholls is currently a senior lecturer and competition law expert at University of New South Wales (UNSW) business school and a research fellow at the Centre for Law, Market and Regulation at UNSW Law in Sydney, Australia. CUHK Business School, *What if Bots Collide and Collude in Setting Prices?*, CHINA BUS. KNOWLEDGE (Nov. 16, 2017), <https://cbk.bschool.cuhk.edu.hk/what-if-bots-collide-and-collude-in-setting-prices/>.

222. *See id.* (focusing on Australian competition authorities and their approach, lacking any acknowledgement of China's possible view of algorithmic collusion and the role of competition enforcement).

223. China is the world's second largest economy and the world's fastest growing economy. Specifically, China's digital economy has experienced a “boom” and

Current OECD members calling upon young competition authority agencies to immediately develop into leaders on issues of unconventional cartels simply will not suffice and will not be successful.²²⁴

The two OECD member regions discussed in this paper, the European Union and the United States, are far from being on the same page in their enforcement approaches to algorithmic collusion.²²⁵ The European Union consistently warns that algorithms and automated pricing bots create competition concerns.²²⁶ EC Commissioner Vestager stated that companies may face higher fines if they implement software to facilitate their cartel.²²⁷ Individual European Union nations, including France and Germany, identified algorithmic collusion as a top priority and the biggest challenge to competition authorities.²²⁸ German Chancellor Merkel has gone so far as to demand a firm's algorithms be made public in order to have the highest level

accounts for forty-two percent of the global e-commerce market. By 2050, it is predicted that both China and India will overtake the United States in economic size and growth. *See* Smith, *supra* note 127.

224. These young competition authorities (particularly China and India) have focused their efforts on developing the proper agencies, regulation, investigatory and regulatory techniques, and their role in international enforcement cooperation and comity. *See* discussion *supra* Part II(C) (describing the evolution of these competition authorities over the past decade). Asking these nations to be thought leaders in the area of AI collusion, when they only recently began regulating the most traditional and egregious forms of anticompetitive behavior, logically will not result in an effective and sustainable approach for the global antitrust community.

225. *See* Nylén & Newman, *supra* note 206 (explaining that European authorities have been much more active in their investigations by reviewing Google, Facebook, and Amazon algorithms and their effects on consumer markets, while the United States has taken the position that AI, as they know it today, is just another form of legal tacit collusion).

226. *See* Vestager, *supra* note 57.

227. *See id.* at 8 (“If those tools allow companies to enforce their cartels more strictly, we may need to reflect that in the fines that we impose.”); Nylén & Newman, *supra* note 206 (“Vestager warned companies in March that they may face higher fines if they use software tools as part of their cartels.”).

228. *See* Nylén & Newman, *supra* note 206 (highlighting the French Competition Authority naming the digital economy as the number one problem in competition policy and Germany's cartel office referencing the impact of digital companies on the economy as a “new land” for competition agencies); *Pricing Algorithms: The Digital Collusion Scenarios*, *supra* note 22, at 5 (noting that French and German authorities issued a joint report on algorithmic pricing and its anticompetitive effects).

of accountability when it comes to the algorithms' deployed use cases.²²⁹ The European Union's recent implementation of the GDPR, which Commissioner Vestager points to as an important tool in properly deterring algorithmic cartels, highlights the region's productivity.²³⁰

The United States has taken the entirely opposite approach of "wait and see" while consistently noting the legality of tacit collusion in the United States.²³¹ United States Deputy Assistant Attorney General Barry Nigro explained that concerns around algorithmic price fixing stem from a lack of understanding of the technology.²³² He further said it would be difficult to imagine how a scenario of algorithmic collusion could be illegal without an agreement because it would almost always fall into the realm of legal conscious parallelism.²³³ This approach in light of AI's capabilities in facilitating collusion is incredibly concerning and lacks any urgency from the world's largest economy and a major player in global trade. The United States' "attempt" to match the European Union's productivity in deterring algorithmic cartels comes in the form of a new Federal Trade Commission (FTC) Office of Technology Research and Investigation responsible for studying algorithmic transparency.²³⁴ However, United

229. "The algorithms must be made public, so that one can inform oneself as an interested citizen on questions like: what influences my behavior on the internet and that of others? . . . These algorithms, when they are not transparent, can lead to a distortion of our perception, they narrow our breadth of information." Capobianco et al., *supra* note 2, at 43 (citing Chancellor Merkel's public statement).

230. "And I think the EU's new rules on data protection, which will come into force next year, give us valuable ideas about how we can face that challenge. The concept of 'data protection by design' makes clear that people's privacy can never be an afterthought. It has to be built into the way that services work from the very start. That's also how businesses need to think when they design and use algorithms. They may not always know exactly how an automated system will use its algorithms to take decisions. What businesses can—and must—do is to ensure antitrust compliance by design. That means pricing algorithms need to be built in a way that doesn't allow them to collude." Vestager, *supra* note 57, at 8.

231. Nylen & Newman, *supra* note 206.

232. Pallavi Guniganti, *US DOJ Deputy: Algorithmic Cartel Requires Agreement*, GLOBAL COMPETITION REV. (Feb. 5, 2018), <https://globalcompetitionreview.com/article/1153380/us-doj-deputy-algorithmic-cartel-requires-agreement> (quoting Barry Nigro).

233. *Id.*

234. Capobianco et al., *supra* note 2, at 43.

States FTC Chairman Maureen Ohlhausen expressed skepticism regarding the need for any intervention by antitrust enforcers in this area, bringing into question the role of the new FTC office.²³⁵

The gaps in enforcement approaches of the world's largest competition authorities are apparent and identifiable. Due to the introduction of algorithmic collusion, the OECD's role in facilitating international cooperation and comity becomes more necessary today than it was twenty years ago when the Organization formed its Recommendation. There cannot and will not be effective international enforcement cooperation until nations unify their approaches to algorithmic collusion detection and liability.

IV. RECOMMENDATIONS

Effective international cooperation and comity in the deterrence, detection, and enforcement against hard core cartels requires modifications to the OECD's current Recommendation. First, the OECD needs to adopt a formal definition of what encompasses an anticompetitive agreement, as it does with the term "hard core cartel." Second, it is vital to (1) push for international cooperation in detection, not just enforcement, and (2) identify liable behaviors and parties.

A. THE OECD NEEDS TO ADOPT A FORMAL DEFINITION OF WHAT ENCOMPASSES AN ANTICOMPETITIVE AGREEMENT, CONCERTED PRACTICE, AND ARRANGEMENT.

The defining boundaries of what constitutes an agreement lays the foundation for the various global approaches to algorithmic collusion. Any behavior in oligopolistic markets absent an agreement, whether or not firms generate an anticompetitive outcome, traditionally falls within the law (tacit collusion).²³⁶ An express agreement, however, is

235. "There is nothing inherently suspect about using computer algorithms to look carefully at the world around you before participating in markets," Ohlhausen said. "From my perspective, if conduct was unlawful before, using an algorithm to effectuate it will not magically transform it into lawful behavior. Likewise, using algorithms in ways that do not offend traditional antitrust norms is unlikely to create novel liability scenarios." Nylén & Newman, *supra* note 206.

236. See *Pricing Algorithms: The Digital Collusion Scenarios*, *supra* note 22, at

not so easily identified and courts across the world have accepted different interpretations in order to effectively deter anticompetitive outcomes in markets.²³⁷ This includes the “plus factors” taken with conscious parallelism in oligopolistic markets being interpreted equal to a formal agreement.²³⁸ But as technology continues to progress, agreements become more sophisticated and unique to each cartel and the “oligopoly problem” extends beyond traditional oligopolistic markets. National competition authorities now face more divergent paths in interpreting the meaning of an “anticompetitive agreement, concerted practice, and arrangement.” Specifically, nations have begun to diverge on whether a computer program is capable of forming an agreement, absent human intervention or knowledge — the Recommendation lends no hand to answering (or even discussing) this question.²³⁹

The first step in creating international cooperation in this area requires a unified understanding of the term “agreement” so countries know how to properly identify illegal AI algorithmic collusion scenarios. A nation that believes a computer can form an agreement has nothing to gain by cooperating with a nation that requires human intervention. The lack of unification leads to true divergence in the fundamental understanding of how to best protect a competitive ecosystem in the digital economy. The “agreement” among cartelists, human or AI, is the foundation of the criminality of the cartel and gives competition authorities the ability to effectively halt and deter the egregious harm done to world trade.²⁴⁰ Without a mutual goal and understanding among global competition authorities, while AI and

4 (“Under current rules, the tacit collusion scenario (i.e., ‘conscious parallelism’ which establishes itself without a need to collude actively) does not lead to an antitrust offence being committed, so companies do not have to worry about it just yet.”); *cf. Price-bots Can Collude Against Consumers*, *supra* note 29 (arguing that algorithmic pricing “is a recipe for tacit collusion of the kind found on Martha’s Vineyard”).

237. See Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 26 (emphasizing “antitrust enforcers (even with an attractive leniency policy) have had a hard time detecting *express* collusion”).

238. *Cf. Capobianco & Gonzaga*, *supra* note 12, at 4 (noting algorithms could be considered “plus factors” as an adjustment to current antitrust laws).

239. See generally *Recommendation*, *supra* note 4.

240. *Id.*; *Third Report*, *supra* note 55, at 14, 16, 26.

human cartelists maintain one, international enforcement cooperation will surely suffer, alongside global consumers.

Anticompetitive agreements can no longer exist only under the traditional “meeting of the minds” or fall under the traditional “plus factors” of industries susceptible to collusion. The increased market transparency and frequency of interaction in our digital economy inevitably makes more industries susceptible to collusion that authorities have not before faced.²⁴¹ AI replicates, possibly exceeds, human intelligence and makes decisions with incredible efficiency, without the hindrance of emotions, all while having a God-like view of the global market that a human would never be able to achieve.²⁴² A “meeting of the algorithms” serves as an effective definition for the OECD to analyze for its Recommendation.²⁴³

A “meeting of the algorithms” definition does not solely target computer behavior, but rather the anticompetitive behaviors committed by all cartels—responding to one another’s actions, completely aware of the anticompetitive outcome, and intentionally manipulating global markets.²⁴⁴ Cartels will only continue to become more sophisticated—an age-old concept to competition authorities. AI cartels’ potential manipulations to global markets demands proactive, not reactive, measures from authorities. This requires the OECD to begin facilitating international comity and cooperation now in fighting AI cartels, not after the world has witnessed how sustainable an AI cartel can be when national authorities take divergent approaches. Creating a unified definition for “agreement” on behalf of the international antitrust community begins to bridge divergent approaches.

241. *Competition Policy in the Digital Age*, *supra* note 3, at 7.

242. EZRACHI & STUCKE, VIRTUAL COMPETITION, *supra* note 9, at 71; *see also* Christensen, *supra* note 58, at 7.

243. *See* analysis *supra* Part III(A) (discussing a “meeting of the algorithms”).

244. *See generally* Capobianco et al., *supra* note 2, at 32-34 (discussing where the legal definition of an “agreement” fits into AI scenarios through a “meeting of the algorithms”).

B. THE OECD NEEDS TO ADOPT AMENDMENTS TO THEIR RECOMMENDATION INCLUDING: (1) LIABLE BEHAVIOR AND LIABLE PARTY IDENTIFIERS, AND (2) GUIDING INTERNATIONAL DETECTION COOPERATION.

Understanding how to identify the liable parties, and what behaviors create liability, proves to be another obstacle vital to overcome to effectively deter algorithmic cartels. The anticompetitive behaviors that define criminality, or even those that face high civil fines, lay the foundation for how national competition authorities believe their competitive environment is best maintained, for the benefit of firms and consumers. This also defines the level of responsibility expected of firms within an economic region to prevent anticompetitive outcomes.

In the case of algorithmic collusion, as mentioned in the analysis, European Commissioner Vestager believes that programmers must ensure “compliance by design”²⁴⁵ of algorithms, meaning safeguards must be put in place to ensure the implemented AI does not collude. The United States has made no indication of its willingness to assign such liability to AI programmers.²⁴⁶ Understanding what roles individuals play in a firm and what level of knowledge is required to be “liable” of illegal behavior will likely be a key point in cases of AI collusion.

This understanding is necessary to properly monitor and detect susceptible markets where algorithmic collusion will likely take place. A lack of mutual ground on what human behaviors involved with the implementation of AI makes them liable and at what level in a firm

245. *Pricing Algorithms: The Digital Collusion Scenarios*, *supra* note 22, at 3. “Compliance by design” parallels to the GDPR’s demand for “privacy by design”—the concept that whenever something new is created or developed with any relationship to personal data, it must be created in such a way that data privacy is intrinsic to it. See *GDPR Privacy by Design made Simple*, PRIVACY TRUST, <https://privacytrust.com/gdpr/gdpr-privacy-by-design-made-simple.html> (last visited Jan. 21, 2019). The origins of this lies in accessibility by design—personal data are not accessible without the individual’s intervention. See *Data Protection by Design and Default*, INFO. COMMISSIONER’S OFFICE, <https://ico.org.uk/for-organisations/guide-to-the-general-data-protection-regulation-gdpr/accountability-and-governance/data-protection-by-design-and-default/> (last visited Jan. 21, 2019).

246. See analysis *supra* Part III(B)(3) (discussing the United States’ seeming lack of concern about AI collusion and deeming it mere tacit collusion).

accountability should be held (i.e., programmers or executives) leads to regions taking, again, completely divergent approaches in their investigation and compromises the effectiveness of proper international enforcement.²⁴⁷

The manipulation of global markets requires the joint efforts of global authorities—not only in enforcement but also in detection.²⁴⁸ The OECD's Recommendation fails to address the importance of international cooperation in detection—a vital part of tackling an AI cartel. The world has yet to experience an AI cartel, but it is hard to imagine that it will be contained within conventional borders. Thus, the ability to detect an AI cartel domestically will likely impact many economic regions, and the ability to cooperate on these detection methods will be vital to understanding the extent and reach to which markets are manipulated.

The OECD approaching international detection cooperation via revamped and unified leniency programs is likely to be well received by competition authorities across the globe. It is also likely to be the most efficient approach to detecting AI collusion. Due to the anticipated difficulty in detecting AI's anticompetitive behaviors, leniency enforcement programs will play a vital role in algorithmic cartel detection.²⁴⁹ Since the implementation of the OECD's Recommendation, leniency programs have developed across national competition authority regimes.²⁵⁰ Increased incentives for knowledgeable parties to step forward in AI collusion scenarios will undeniably be relied upon by enforcers, as it has proven successful in the past.²⁵¹ These increased incentives could be effectively

247. See Capobianco & Gonzaga, *supra* note 12, at 5 (“Some commentators have suggested that when dealing with a robot engaging in anti-competitive conducts there are three possible ways of attributing responsibility: to the robot itself, to the humans who deploy it, or to no one.”).

248. *Third Report*, *supra* note 55, at 3.

249. See analysis *supra* Part III(B)(1).

250. See *Third Report*, *supra* note 55, at 9-12 (noting the improvements to leniency programs by signatories to the Recommendation).

251. Shortly after the adoption of a leniency program and the creation of the Special Unit for Combating Cartels, the German Cartel Office received information from the construction industry about suspected cartel activity among cement producers. Evidence seized during a nation-wide search of thirty cement companies in July 2002, and during further searches of several small and medium-sized cement

implemented by merging whistleblower rewards with current leniency programs used by competition authorities.²⁵² OECD reports consistently include leniency programs and there is no reason they should be absent from the OECD's enforcement Recommendation.²⁵³

The OECD's role, first and foremost, in the area of competition regulation and enforcement is to guide international cooperation and comity. Adopting amendments that unify liability identifiers and guide methods for detection cooperation across borders facilitates this role and leads to positive trickle-down results on enforcement. Thus, hopefully, further reducing the possibility for international gaps in antitrust laws.

V. CONCLUSION

The OECD's *Recommendation of the Council Concerning Effective Action Against Hard Core Cartels* is insufficient to effectively promote international comity with the novel challenges algorithmic collusion presents to competition authorities.²⁵⁴ Oligopolistic markets

manufacturers in 2003, confirmed that the investigated cement producers had operated anti-competitive market allocation and quota agreements. Some of them had been doing this since the 1970s, and continued to do so until 2002, in four regional cement markets in eastern Germany, Westphalia, northern Germany, and southern Germany. *Id.* at 14. Sanctions against individuals also can increase the effectiveness of leniency programs as they are a powerful incentive for individuals to reveal information about existing cartels and to cooperate in investigations. *Id.* at 26.

252. "Current leniency programs target guilty parties through offering amnesty, rather than targeting the rest of the population through positive rewards. The main virtue of private monitoring in antitrust is that it gives power to those closest to behavior that, by its nature, is secretive. Obtaining an insider's knowledge of cartel behavior would not only lead to an increase in prosecution numbers, but it would also enable a whistleblower to identify collusive behavior at a lower cost than external monitoring by competition enforcers." Jonathan Wright, *Blow the Whistle: How Bringing Whistleblower Rewards to Antitrust Would Help Cartel Enforcement*, 3 ADMIN. L. REV. 695, 716 (2017).

253. See generally Org. for Econ. Cooperation & Dev. [OECD], *Fighting Hard-Core Cartels: Harm, Effective Sanctions and Leniency Programs* (2002), <https://www.oecd.org/competition/cartels/1841891.pdf> (recognizing numerous leniency programs throughout report); see generally *Third Report*, *supra* note 55 (noting major improvements to national leniency programs and their role in preventing cartels).

254. The OECD, in a 2016 report, commented that these strategies "may pose serious challenges to competition authorities in the future, as it may be very difficult,

have become more vulnerable to tacit collusion as the digital economy grows due to increased market transparency and frequency of interaction among market players. Deep-learning AI algorithms amplify the negative outcomes of tacit collusion, causing more distortions in world trade and market power than traditional hard core cartels. The global nature of algorithmic cartels demands that the OECD fulfills its role of guiding effective international cooperation and comity, which is not possible under the current Recommendation. The already occurring gaps in approaching the detection and enforcement of algorithmic cartels could result in little to no possibility of timely and successful international enforcement cooperation. Unless the OECD addresses the need to unify competition law to effectively deter algorithmic cartels, international comity in cartel enforcement will suffer when it was just beginning to thrive, and our global economy will witness the most sustainable and destructive cartels that authorities have ever faced.

if not impossible, to prove an intention to coordinate prices, at least using current antitrust tools." See Ezrachi & Stucke, *Problems and Counter-Measures*, *supra* note 5, at 19 (describing firms' ability to undercut prices of competitors through direct communications with buyers).