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Cover Page Footnote

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Bounty Hunters For Algorithmic Cartels: An Old Solution for a New Problem

Aleksandra Lamontanaro*

In light of the reality that pricing algorithms allow commercial actors to perform all phases of their price-fixing conspiracies without leaving behind trails of traditional incriminating evidence, the scarcity of algorithmic cartels prosecutions is hardly surprising. Given well-documented evidence that the authorities struggle in their efforts to detect even conventional price-fixing cartels, it is imperative to come up with new tools for detecting algorithmic cartels, which have unprecedented potential to harm consumers if left ignored. This Note investigates algorithmic capabilities to collude, as well as legal and technical challenges that governmental authorities face in confronting such collusion. This Note then introduces two proposals to improve the detection of algorithmic cartels: cartel screening and a whistleblower bounty program. The Note argues that, although the optimal solution is to implement the whistleblower bounty program and cartel screening together, it would be more effective and efficient to launch the former before the latter. Importantly, by implementing the whistleblower bounty program before cartel screening, governmental authorities would gain the expertise necessary to enforce antitrust laws without impeding innovation.

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INTRODUCTION

On April 6, 2015, a former executive of an online *art deco* retailer, David Topkins, became the first—and to this day, the last—e-commerce seller that the Department of Justice ("DOJ" or "the Department") prosecuted for using algorithms to fix prices.[1] Topkins pled guilty to raising and fixing prices of decorative posters, prints, and other wall hangings sold in the United States through Amazon Marketplace.[2] According to the charge, Topkins conspired with other *art deco* sellers to eliminate or minimize any price differences among them.[3] To implement the conspiracy, Topkins wrote computer code on algorithm-based software that set prices according to this arrangement. Referring to the *Topkins* case, the DOJ noted that, "We will not tolerate anticompetitive conduct, whether it occurs in a smoke-filled room or over the Internet using complex pricing algorithms."[4] In light of the Department's expressed zeal to combat price-fixing conspiracies, casual observers might wonder why *Topkins*—involving relatively small retailers—is the only algorithmic price-fixing scheme that has ever been prosecuted in the United States.

This Note investigates this dearth of internet-based price-fixing prosecutions and focuses on the newly emerging challenge of detecting price-fixing schemes facilitated by algorithms, which this Note refers to as "algorithmic cartels." Although a number of scholars have examined antitrust challenges that pricing algorithms present, they have mainly focused on the legality of different types of algorithms, proposing legal frameworks such as standards for

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1 Press Release, Dep't of Just., Former E-Commerce Executive Charged with Price Fixing in the Antitrust Division's First Online Marketplace Prosecution (Apr. 6, 2015), https://www.justice.gov/opa/pr/former-e-commerce-executive-charged-price-fixing-antitrust-divisions-first-online-marketplace [https://perma.cc/DR4Y-V3HL] [hereinafter Press Release, Dep't of Just.].

2 *Id*. *See E-Retailers Beware: DOJ Files First Criminal Prosecution for Online Price Fixing*, PERKINS COIE (Apr. 27, 2015), https://www.perkinscoie.com/en/news-insights/e-retailers-beware-doj-files-first-criminal-prosecution-for.html [https://perma.cc/5WUD-8SES].

3 *See* Press Release, Dep't of Just., *supra* note 1.

4 *Id*.

algorithmic regulations[5] or means for outlawing algorithms that lead to tacit collusion.[6]

While this Note recognizes new issues that tacit algorithmic collusion has raised, it instead focuses on the limited detection of algorithmic cartels that are already illegal under the current antitrust framework. Such a choice of focus stems from the reality that the authorities struggle in their efforts to detect even regular price-fixing cartels; in fact, the DOJ is only aware of an estimated ten to seventeen percent of cartels currently active.[7] How can we address new challenges if we have not adequately handled the old ones? Given this low rate of cartel detection, it is safe to assume that *Topkins*' outlier status is not evidence of digital cartels' nonexistence but a testament to the difficulty of their detection.

Addressing the obscure nature of algorithmic cartels, this Note analyzes two proposals to improve such cartels' detection: (1) screening for cartels and (2) a whistleblower bounty program. The Note argues that, although the optimal solution is to implement the whistleblower bounty program and cartel screening together, it would be more effective and efficient to implement the former before the latter. By creating the whistleblower bounty program before launching cartel screening, governmental authorities will be

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5 *See* Ben Shneiderman, *Algorithmic Accountability*, YOUTUBE (June 22, 2017), https://www.youtube.com/watch?v=UWuDgY8aHmU [https://perma.cc/82NK-ZSA2] (proposing to establish a "National Algorithm Safety Board" that would audit, monitor, and license algorithms before firms are allowed to use them); *see also* Andrew Tutt, *An FDA for Algorithms*, 69 ADMIN. L. REV. 83, 91 (2017) (advocating for the launch of a new regulatory agency—similar to the U.S. Food and Drug Administration).

6 *See* Joseph E. Harrington, *Developing Competition Law for Collusion by Autonomous Artificial Agents*, 14 J. COMPETITION L. & ECON. 331, 350–54 (2018) (arguing that algorithms that use a reward-punishment scheme—that involves firms rewarding their rivals' inflated prices by maintaining such prices and punishing their rivals' deviation by undercutting them on price—should be deemed illegal *per se*).

7 *See* Maurice E. Stucke, *Morality and Antitrust*, COLUM. BUS. L. REV. 443, 459 (2006) (finding that the likelihood a cartel will be detected is less than ten percent); *see also* Christopher R. Leslie, *Trust, Distrust and Antitrust*, 82 TEX. L. REV. 515, 655 (2004) (stating that eighty percent of cartels in existence go undetected); Douglas H. Ginsburg & Joshua D. Wright, *Antitrust Sanctions*, COMPETITION POL'Y INT'L, Nov. 8, 2010, at 3, 9, https://www.law.gmu.edu/assets/files/publications/working_papers/1060 AntitrustSanctions.pdf [https://perma.cc/FD32-7YXP] ("The bulk of scholarly opinion is consistent with the view that despite ever-increasing levels of corporate fines and longer jail sentences, cartel activity is currently under-deterred.").

able to gain expertise in complex algorithmic features, which must be understood in order to perform effective cartel screening.[8] Because whistleblowers such as algorithms' developers, programmers, and computer technicians monitor algorithms on a daily basis, they are well-equipped to provide the authorities with valuable information about algorithmic properties that lead to collusion. Over time, via the investigation of cases of algorithmic cartels uncovered by whistleblowers, U.S. agencies will acquire the necessary expertise on this issue. This expertise, gained in practice, would help the authorities eliminate the risk of targeting benign algorithms, wasting resources, and potentially depressing innovation.

Part I of this Note gives a brief explanation of what pricing algorithms actually are before presenting three scenarios where pricing algorithms can facilitate anticompetitive collusion. Part I also analyzes the ability of U.S. antitrust law to deal with each of these scenarios. The three scenarios include circumstances where (1) competing firms[9] use algorithms to implement price-fixing agreements; (2) firms unilaterally program their algorithms to follow their rivals' prices; and (3) firms unilaterally employ pricing algorithms that learn on their own to collude. Part I examines Professor Michael S. Gal's argument that certain algorithmic features should give rise to the inference of an anticompetitive agreement.[10] Further, Part I summarizes the results of the experimental studies that demonstrate the low probability of successful cooperation between self-learning algorithms that lack an explicit design feature to collude. Part I concludes that, if such features have to be explicit, adopting Gal's proposal to consider certain algorithmic features as evidence from which a price-fixing agreement can be inferred would enable courts

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8 Ezrachi and Stucke propose to screen the digital markets for collusion. To better understand what factors are indicative of algorithmic collusion and, therefore, worth exploring further, Ezrachi and Stucke encourage enforcers to begin commissioning or internally conducting experimental research of pricing algorithms. *See* Ariel Ezrachi & Maurice E. Stucke, *Artificial Intelligence & Collusion: When Computers Inhibit Competition*, 2017 U. ILL. L. REV. 1775, 1806 (2017).

9 When this Note refers to the term "firms," it means entities or individuals that can set the prices of their products, including corporations, limited liability companies (LLC), and partnerships.

10 *See* Michal S. Gal, *Algorithms as Illegal Agreements*, 34 BERKELEY TECH. L.J. 67, 77 (2019).

to address tacit agreements—orchestrated with algorithms' help—within the current antitrust framework. Certainly, to develop case law as to what algorithmic features and circumstances surrounding their adoption would amount to circumstantial evidence of a price-fixing conspiracy, the agencies have to first detect such cartels.

Part II of this Note presents the challenges of detecting algorithmic cartels and explores possible solutions to such challenges. Particularly, Part II examines a proposal that tasks U.S. agencies with screening algorithms and digital markets to detect algorithmic cartels. Further, Part II identifies the passage of a whistleblower bounty statute as a solution to improve cartel detection. Analyzing the two solutions and determining that, ultimately, both are necessary, Part III of this Note concludes that implementing the whistleblower statute prior to cartel screening is the best course of action for U.S. agencies to take.

I. ABILITY OF THE SHERMAN ACT TO ADDRESS ALGORITHMIC COLLUSION

This Part of the Note examines three scenarios where pricing algorithms can facilitate anticompetitive collusion.[11] First, competing firms can use algorithms to implement explicit price-fixing agreements.[12] Second, firms may unilaterally instruct their algorithms to fix prices: for example, by using the same or similar algorithms as their competitors and feeding such algorithms the same data.[13] Third, firms can unilaterally employ self-learning algorithms.[14] Programmed to maximize profits, these algorithms learn on their own that collusion is the best way to accomplish their designated goal.[15] However, before delving into the legal analysis of each of the above scenarios, a brief explanation of what algorithms actually are is warranted.

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11 *See* Ezrachi & Stucke, *supra* note 8, at 1782.

12 *Id*.

13 *Id.* at 1783.

14 *Id*.

15 *Id.* at 1783–84.

A. What Is a Pricing Algorithm?

An algorithm is a sequence of rules that should be applied in precise order to perform a certain task.[16] We all use (non-automated) algorithms in our daily lives: when we decide what time to leave the house, we use data inputs like destination, desired time of arrival, weather, and traffic conditions.[17] Algorithmic computer codes do the same: the algorithms of a web-mapping service such as Google Maps perform tasks for individual users based on those users' inputs (destination) and a variety of online sources (weather or traffic conditions).[18] Besides assisting consumers in solving day-to-day tasks, algorithms are also used for pricing decisions.[19] For example, ride-sharing companies such as Uber and Lyft use algorithms to set prices of car rides in real time based on the demand for rides and the supply of drivers.[20] Algorithms allow computers to solve complex problems, and recent achievements in artificial intelligence (AI) and machine learning have further developed algorithmic capabilities.[21] Nowadays, algorithms can actually learn on their own.[22]

Algorithms can learn through examples (supervised learning) where developers teach them with a training sample.[23] To illustrate, imagine that Target wants to discount women's shirts it sells online; a developer of Target's algorithm can select a sample data set of different types of shirts and classify the items with the buttons on the left side as "women's shirts on sale."[24] After the algorithm learns

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16 Gal, *supra* note 10, at 77.

17 *See id*.

18 Michal S. Gal & Niva Elkin-Koren, *Algorithmic Consumers*, 30 HARV. J.L. & TECH. 309, 310 (2017).

19 Gal, *supra* note 10, at 80–81.

20 *See* Sheng Li & Claire Chunying Xie, *Automated Pricing Algorithms and Collusion: A Brave New World or Old Wine in New Bottles?* 18 ANTITRUST SOURCE 1, 1 (2018).

21 ORG. ECON. CORP. DEV., Algorithms and Collusion: Competition Policy in the Digital Age 9 (2017), http://www.oecd.org/daf/competition/Algorithms-and-colllusion-competition-policy-in-the-digital-age.pdf [https://perma.cc/C348-JD9H] [hereinafter OECD].

22 *Id*.

23 Ai Deng, *Litigation Practicean Antitrust Lawyer's Guide to Machine Learning*, 32 ANTITRUST ABA 82, 83 (2018).

24 *See id*.

this classification feature, it can apply the same criteria to the rest of Target's clothes.[25]

Conversely, if Target wants to discount women's shirts only if Walmart does, Target can apply the second type of learning technique: learning through differences.[26] This technique would involve Target's algorithm tracking online prices of Walmart for a period until it can characterize certain pricing behavior of Walmart as the "norm."[27] When Walmart deviates from that norm, the algorithm will flag such abnormality.[28]

The third type of learning is learning through trial and error (reinforcement learning).[29] Using this technique, the developer of Target's algorithm would not provide the algorithm with any examples.[30] Rather, the algorithm would act on its own by assessing its decisions based on the outcomes and using the learned lessons to make better decisions in the future.[31] For example, programmed to "maximize profits," Target's algorithm can learn, through trial and error, that certain pricing decisions are more profitable than others; via this "machine learning," the algorithm is taught to employ the best performing strategies in the future.[32]

This tremendous power and utility provided by pricing algorithms have brought enormous benefits to both businesses and consumers.[33] Algorithms can personalize customers' shopping experiences based on their past purchases, preferences, and demographic information.[34] Using algorithms, businesses can better identify profit-maximization prices by analyzing historical sales perfor-

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25 *Id*.

26 *See id* at 84.

27 *See id.* (explaining that the identification of anomaly is widely used in fraud detection).

28 *See id*. For example, after an algorithm tracks a credit card user's spending behavior, the algorithms are able to characterize certain behavior as the "norm"; when the card is used in a new geographic location, the algorithm will flag such transaction, raising a fraud alert. *Id*.

29 *Id.* at 85.

30 *Id*.

31 *Id*.

32 Gal, *supra* note 10, at 78.

33 *Id.* at 78–79.

34 *Id.* at 80.

mance data.[35] Moreover, algorithms allow firms to offer more accurate market prices for products and services by balancing supply and demand in real time.[36] Such dynamic pricing enables firms to adjust their prices as soon as new information—such as rival firms' prices or changes in sales and inventories—is received.[37] For instance, brick-and-mortar stores increasingly adapt dynamic pricing algorithms to match the latest offers from online competitors.[38] Notably, this trend correlates with the physical stores' 4.2-percent increase in 2019 Black Friday sales compared to 2018, which suggests that dynamic pricing can save brick-and-mortar businesses from going extinct in light of the ever-growing and increasingly dominant online retail sector.[39]

One fact is clear: humans cannot possibly collect, organize, and analyze data as rapidly as algorithms do.[40] As innovator Elon Musk observed, "[a] computer can communicate at a trillion bits per second, but your thumb can maybe do . . . ten bits per second or a hundred if you're being generous."[41] Giving these clear advantages of pricing algorithms, it is not surprising that more and more firms employ them to make commercial decisions.[42] Because pricing algorithms can be of economic advantage not only to businesses but also consumers, the widespread use of these algorithms are here to stay. Thus, it is imperative to find the optimal method to enhance the detection of algorithms that are used to carry out price-fixing conspiracies that harm consumers and violate antitrust law.

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35 Harrington, *supra* note 6, at 353.

36 Li & Xie, *supra* note 20, at 1.

37 Harrington, *supra* note 6, at 353.

38 Li & Xie, *supra* note 20, at 1.

39 *See Black Friday Brick-and-Mortar Sales Up 4.2% According to SpendTrend Data*, BUS. WIRE (Dec. 1, 2019, 12:30 PM), https://www.businesswire.com/news/home/20191201005183/en/Black-Friday-Brick-and-Mortar-Sales-4.2-SpendTrend-Data [https://perma.cc/3PTE-87C8].

40 Harrington, *supra* note 6, at 353.

41 Steve Renick, *Elon Musk at the World Government Summit 2017 in Dubai: Conversation with Mohammad AlGerga*, YOUTUBE (June 22, 2017), https://www.youtube.com/watch?v=R5dHlLjOdjk [https://perma.cc/G4RQ-SJJN].

42 Gal, *supra* note 10, at 79.

B. Scenario #1: Use of Algorithms to Implement Price-Fixing Agreements

Algorithmic cartels—schemes that involve the firms' use of algorithms to implement their explicit price-fixing agreements—are illegal under Section 1 of the Sherman Act.[43] Section 1 is interpreted as outlawing only unreasonable restraints of trade.[44] The agreement between two competitors to fix prices—whether to raise, depress, or stabilize them—is *per se* illegal, even if unsuccessful.[45] Under the Supreme Court's doctrine of *per se* illegality rather than the typical "rule of reason" analysis, courts do not examine the anticompetitive effects of such agreements.[46] Rather, the *per se* rule operates as a "conclusive presumption that the restraint is unreasonable."[47]

The use of algorithms as a tool to implement, monitor, police, or strengthen an explicit price-fixing agreement among competitors by using pre-loaded data and orders falls easily under Section 1 of the Sherman Act.[48] *Topkins* illustrates such a scheme; there, Topkins and other online *art deco* sellers used pricing algorithms as a tool to eliminate any online price differences between these retailers.[49] Similarly, in 2018, the European Commission ("Commission") fined Trod Limited and GB Eye over €111 million for fixing prices using an algorithm.[50] There, the parties agreed to fix online prices on decorative picture frames and carried out their conspiracy using

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[43] Section 1 of the Sherman Act prohibits "[e]very contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States." 15 U.S.C. § 1 (1988).

[44] *See* Ohio v. Am. Express Co., 138 S. Ct. 2274, 2283 (2018).

[45] *See* Broad. Music, Inc. v. Columbia Broad. Sys., Inc., 441 U.S. 1, 8–9 (1979).

[46] Most restraints of trade are analyzed under the "rule of reason," which "requires courts to conduct a fact-specific assessment of market power and market structure . . . to assess the [restraint]'s actual effect on competition." *Am. Express*, 138 S. Ct. at 2284 (internal citations and quotations omitted).

[47] Arizona v. Maricopa Cty. Med. Soc'y, 457 U.S. 332, 344 (1982).

[48] Ezrachi & Stucke, *supra* note 8, at 1787.

[49] *See* Press Release, Dep't of Just., *supra* note 1.

[50] Noel Beale & Sandra Mapara, *Competition Law and Ecommerce: 'It Wasn't Me, It Was the Algorithm!'*, BURGES SALMON (Nov. 26, 2018), https://www.burges-salmon.com/news-and-insight/legal-updates/competition-law-and-ecommerce-it-wasnt-me-it-was-the-algorithm [https://perma.cc/V8JB-T4QS].

an algorithm that monitored and adjusted their prices to ensure that they did not undercut each other.[51]

Another variation of the digital cartel scenario is a "hub-and-spoke" scheme, where competitors (spokes) use a common pricing algorithm (hub) to execute their price-fixing agreement.[52] The *Meyer v. Kalanick* case illustrates this variety of conspiracy.[53] Alleging that Uber's algorithm (hub) established inflated surge pricing, which drivers (spokes) charged while knowing that other Uber drivers would not be undercutting that price, Spencer Mayer, an Uber customer, filed a complaint against the massive ride-sharing corporation and its then-CEO in the Southern District of New York.[54] Noting that "[a]utomation is effected through a human design," Judge Jed S. Rakoff found that Meyer's allegations were sufficient to withstand Uber's motion to dismiss.[55]

Although Uber ultimately removed the case to arbitration,[56] the District Court reached its decision that the complaint contained sufficient allegations of a conspiracy by applying well-settled case law interpreting the Sherman Act.[57] The court explained that the drivers had signed up for Uber with the understanding that they all were agreeing to the same pricing determined by Uber's algorithm.[58] Judge Rakoff pointed out that if Uber drivers were working independently, it would have been against their own interest not to compete on prices.[59] The court rejected Uber's argument that its drivers, who are independent contractors, had joined Uber's platform in order to take advantage of its services rather than fix prices.[60] As the

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51 *Id*.

52 *See generally* Gal, *supra* note 10, at 105.

53 *See generally* Meyer v. Kalanick, 174 F. Supp. 3d 817 (S.D.N.Y. 2016).

54 *See id.* at 819.

55 *Id.* at 826.

56 *See generally* Meyer v. Uber Techs., Inc., 868 F.3d 66 (2d Cir. 2017).

57 Sonia Kuester Pfaffenroth, *Pricing Algorithms: The Antitrust Implications*, ARNOLD & PORTER (Apr. 17, 2018), https://www.arnoldporter.com/en/perspectives/publications/2018/04/pricing-algorithms-the-antitrust-implications [https://perma.cc/34KE-3JPR].

58 *Id*.

59 *Id*.

60 *Id*. The Luxembourg's Competition Authority (LCA) also investigated the use of a pricing algorithm to orchestrate a hub-and-spoke conspiracy. Michele Giannino, *Webtaxi: The Luxembourg Competition Authority Exempts an Algorithmic Price-Fixing Arrangement on Efficiency Grounds*, CORE BLOG (July 10, 2018), https://coreblog.

court's analysis in *Meyer* demonstrates, the hub-and-spoke scheme is not new to the antitrust community: competitors have been using a common third party to coordinate their conspiracies long before the emergence of algorithms.[61] The then-head of the Federal Trade Commission ("FTC") Maureen Ohlhausen suggested a simple test that captures cases like *Meyer* and *Topkins*: "If it isn't ok[ay] for a guy named Bob to do it, then it probably isn't ok[ay] for an algorithm to do it either."[62]

C. Scenario #2: Unilateral Use of Algorithms to Achieve Parallel Pricing

Rival firms' unilateral adoption of algorithms to mirror each other's prices—thereby achieving equilibrium of inflated prices—is

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lexxion.eu/webtaxi-the-luxembourg-competition-authority-exempts-an-algorithmic-price-fixing-arrangement-on-efficiency-grounds/ [https://perma.cc/WW5V-2CJT]. The case involved a booking platform—Webtaxi—that used an algorithm to set nonnegotiable taxi prices for all the participating drivers. *Id*. In 2018, although the LCA found the arrangement to constitute a price-fixing agreement, the LCA exempted the arrangement due to the efficiencies it generated, including lower prices to some customers and the reduction of wait time. *Id*.

[61] "[C]ourts have long recognized the existence of 'hub-and-spoke' conspiracies in which an entity at one level of the market structure, the 'hub,' coordinates an agreement among competitors at a different level, the 'spokes.' These arrangements consist of *both* vertical agreements between the hub and each spoke and a horizontal agreement among the spokes to adhere to the [hub's] terms, often because the spokes would not have gone along with [the vertical agreements] except on the understanding that the other [spokes] were agreeing to the same thing." *Meyer*, 174 F. Supp. 3d at 824 (quoting Interstate Circuit v. United States, 306 U.S. 208, 226–27 (1939)). *U.S. v. Apple Inc.* is a relatively recent case involving hub-and-spoke conspiracy. 791 F.3d 290 (2d Cir. 2015). To ensure that Amazon does not undercut Apple on e-book prices, Apple got publishers to change their pricing arrangements with Amazon. The court found that Apple (hub) conspired with the publishers (spokes) to raise the price of e-books in violation of Section 1 of the Sherman Act. *Apple*, 791 F.3d at 335. Although the court found the conspiracy illegal *per se*, the court also held that the agreement would have been illegal even under the rule of reason analysis. *See id.* Addressing Apple's argument that the arrangement was needed to bring iPad to market, the court refused to "score these hardware innovations as procompetitive benefits of the agreement between Apple and the Publishers to raise prices." *Id*.

[62] Maureen K. Ohlhausen, *Should We Fear the Things That Go Beep in the Night? Some Initial Thoughts on the Intersection of Antitrust Law and Algorithmic Pricing*, FED. TRADE COMM'N 10 (May 23, 2017), https://www.ftc.gov/system/files/documents/public_statements/1220893/ohlhausen_-_concurrences_5-23-17.pdf [https://perma.cc/MVK7-QR24].

known as parallel pricing strategy, or conscious parallelism, and is legal under the current antitrust framework.[63] Professors Ariel Ezrachi and Maurice E. Stucke refer to such a parallel pricing scenario as the "Predictable Agent."[64] Parallel pricing typically occurs among rival firms in an oligopoly[65] without any agreement among the firms.[66] In highly concentrated markets, "economists observe high interdependence and mutual self-awareness between sellers, which makes parallel decision-making more likely."[67] Competitors independently mirror each other's prices and come to a mutual tacit understanding that they all are better off in the long term by maintaining inflated prices rather than engaging in a price war.[68] This concern that oligopolies engaging in parallel pricing can raise their prices above competitive levels is known as the "oligopoly problem."[69]

Algorithmic parallel pricing can also occur where rival firms, without any illegal communication, use the same third-party algorithm by electronically sending it their cost data, which leads to price equilibrium.[70] For example, if competing retailers contribute data to the same third-party algorithm, that algorithm can determine that parallel pricing is the best profit-maximizing strategy because stabilizing inflated prices increases profits for retailers and the algorithm's vendor.[71] Therefore, although rival retailers used the same algorithm, they did not necessarily agree to fix their prices.[72] The Supreme Court "has never held that proof of parallel business

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63 *See* Ezrachi & Stucke, *supra* note 8, at 1783.

64 *Id.* at 1783.

65 Oligopoly is "the market condition that exists when there are few sellers, as a result of which they can greatly influence price and other market factors." *Oligopoly*, DICTIONARY, https://www.dictionary.com/browse/oligopoly [https://perma.cc/WB96-Z99V].

66 *See* Ezrachi & Stucke, *supra* note 8, at 1790.

67 Kaylynn Noethlich, *Artificially Intelligent and Free to Monopolize: A New Threat to Competitive Markets Around the World*, 34 AM. U. INT'L L. REV. 923, 927 (2019).

68 *See* Ezrachi & Stucke, *supra* note 8, at 1790.

69 Jonathan B. Baker, *Two Sherman Act Section 1 Dilemmas: Parallel Pricing, the Oligopoly Problem, and Contemporary Economic Theory*, 38 ANTITRUST BULL. 143, 144–45 (1993).

70 *See* Ezrachi & Stucke, *supra* note 8, at 1783–84, 1788.

71 *See id.* at 1783–84, 1787–88.

72 *See id.* at 1783–84, 1788.

behavior conclusively establishes an agreement or, phrased differently, that such behavior itself constitutes a Sherman Act offense."[73] Independent conduct (when competitors act in parallel without regard to one another's actions) and interdependent conduct, so-called conscious parallelism (when firms take into account how other firms are expected to react), do not constitute "agreement."[74]

Although the Supreme Court has ultimately declined to address the oligopoly problem by deeming parallel pricing unlawful, the issue was highly debated.[75] Professor and former Judge Richard A. Posner once argued that the oligopoly problem could be addressed by the Sherman Act.[76] Posner explained that a concentrated market structure and voluntary parallel pricing strategies—such as signaling and responding with prices—could permit an inference of a tacit conspiracy.[77] To the contrary, Professor Donald Turner argued that tacit coordination by an oligopoly should not be regarded as "agreement" in violation of the Sherman Act.[78] Turner warned that courts would not be able to communicate a clear and effective standard that would identify illegal conduct that must be enjoined because it was unreasonable to expect firms to ignore the prices of their rivals.[79]

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73 Theatre Enters., Inc. v. Paramount Film Distrib. Corp., 346 U.S. 537, 540–41 (1954).

74 Gal*, supra* note 10, at 99.

75 *See id.* at 99–100.

76 *Id*.

77 *See generally* Richard A. Posner, *Oligopoly and the Antitrust Laws: A Suggested Approach*, 21 STAN. L. REV. 1562 (1968). Posner's approach to the oligopoly problem has not prevailed in the courts, even in the opinion of Judge Posner. *See* DOUGLAS A. MELAMED ET AL., ANTITRUST LAW AND TRADE REGULATION: CASES AND MATERIALS 202 (Robert C. Clark et al. eds., 7th ed. 2018). Judge Posner commented that "it is not a violation of antitrust law for a firm to raise its price, counting on its competitors to do likewise (but without any communication with them on the subject) and fearing the consequences if they do not." *Id.*; *see* Richard A. Posner, *Review of Kaplow, Competition Policy and Price Fixing*, 79 ANTITRUST L.J. 761, 766 (2014) (repudiating his earlier view); *see also* Gal, *supra* note 10, at 100 (finding that Posner's early view has recently been supported by Harvard University Law Professor Louis Kaplow who argues that the distinction between express collusion and conscious parallelism "does not serve social welfare" and the definition of "agreement" should include both).

78 *See generally* Donald Turner, *The Definition of Agreement Under the Sherman Act: Conscious Parallelism and Refusals to Deal*, 75 HARV. L. REV. 655 (1962).

79 Gal, *supra* note 10, at 100; Baker, *supra* note 69, at 171.

Courts have ultimately adopted the Turner practical approach that focuses on identifying conduct that can sensibly be prohibited.[80] As then-Judge Stephen Breyer stated, "[I]ndividual pricing decisions (even when each firm rests its own decisions upon its belief that competitors do the same) do not constitute an unlawful agreement under Section 1 of the Sherman Act . . . ."[81] Supreme Court Justice Breyer later explained that such reading of the Sherman Act is not because "[parallel] pricing is desirable (it is not), but because it is close to impossible to devise a judicially enforceable remedy for 'interdependent' pricing."[82] Particularly, courts cannot reasonably order "a firm to set its prices without regard to the likely reactions of its competitors."[83]

Accordingly, firms that unilaterally adopt pricing algorithms and program them to follow the price increase of their competitors do not violate Section 1 of the Sherman Act; under the law as currently interpreted, the firms do not explicitly agree to anything.[84] Each firm independently makes a decision, based on its self-interest, to adopt a particular algorithm; and the adopted algorithm does not "agree," as is conventionally understood, to collude with other algorithms.[85] Rather, each firm, like in a classic parallel-pricing scenario, realizes on its own that the best profit-maximizing strategy is to follow the price increase of others.[86]

D. Parallel Pricing with "Plus Factors"

Conscious parallelism—where firms code their algorithms to look out for the opportunity to establish the interdependence of prices without taking part in any concerted illegal action—is perfectly legal.[87] In *Theatre Enterprises, Inc. v. Paramount Film Distributing Corp.*, the Supreme Court held that conscious parall-

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80 Baker, *supra* note 69, at 171 ("This argument for deeming parallel pricing among oligopolists a violation of § 1 was ultimately rejected by the antitrust mainstream, for the reasons set forth in Donald Turner's influential 1962 article on conscious parallelism.").

81 Clamp-All Corp. v. Cast Iron Soil Pipe Inst., 851 F.2d 478, 484 (1st Cir. 1988).

82 *Id*.

83 *Id*.

84 Ezrachi & Stucke, *supra* note 8, at 1790.

85 *Id*.

86 *Id.* at 1791.

87 *Id*.

elism is not equivalent to an illegal agreement; the Court further stated that "[t]he crucial question is whether respondents' conduct toward petitioner stemmed from independent decision or from an agreement, tacit or express."[88] In a more recent decision, *Bell Atlantic Corp. v. Twombly*, the Supreme Court confirmed that "agreement" must involve either express or tacit (implicit) formulation.[89]

Thus, in parallel pricing cases, the focus is on identifying the existence of a tacit agreement.[90] As the term suggests, a tacit agreement refers to an agreement that is not explicitly expressed but rather is implied or indicated.[91] The Supreme Court has held that business behavior is admissible circumstantial evidence from which the factfinder may infer "agreement."[92] For instance, in *Interstate Circuit, Inc. v. U.S.*, decided in 1939, the Court inferred "agreement" where a firm communicated a proposed course of conduct to its rivals as well as to customers and the conduct was subsequently adopted by the industry with minor modifications.[93] In affirming the illegality of the arrangement, the Supreme Court reasoned that "an unlawful conspiracy may be and often is formed without simultaneous action or agreement on the part of the conspirators."[94] The Court further explained that acceptance of an invitation to participate in a price-fixing conspiracy is sufficient to establish a violation of Section 1 of the Sherman Act.[95] Seven years later, in *American Tobacco Co. v. U.S.*, the Court found the existence of an "agree-

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88 Theatre Enters., Inc. v. Paramount Film Distrib. Corp., 346 U.S. 537, 540–41(1954) (holding that distributors' action violated Section 1 where distributors, knowing that concerted action was contemplated and invited, gave their adherence to the scheme and participated in it).

89 Bell Atlantic Corp. v. Twombly, 550 U.S. 544, 553 (2007).

90 Gal, *supra* note 10, at 105–06.

91 *Id.*

92 *Id.*

93 306 U.S. 208, 226 (1939) (finding "agreement" based on evidence that the distributors met individually with the exhibitors and each distributor was aware that the others had received identical letters proposing the new marketing procedures; but no evidence was offered that distributors ever met to discuss the arrangement); *accord* United States v. Paramount Pictures, Inc., 334 U.S. 131, 142 (1948) (holding that, in order to find a conspiracy, "[i]t is not necessary to find an express agreement" . . . [i]t is enough that a concert of action is contemplated and that the defendants conformed to the arrangement.").

94 *Interstate Circuit*, 306 U.S. at 226.

95 *Id*.

ment" where the parties' actions could not be explained by their self-interest, as their prices rose when costs declined.[96] The subsequent Supreme Court's decision in *Monsanto Co. v. Spray-Rite Service Corp.*—addressing minimum-resale price-maintenance conspiracy allegations—noted that "[t]he correct standard is that there must be evidence that tends to exclude the possibility of independent action by the [parties]."[97]

The above-described Supreme Court jurisprudence indicates two conceptual points of reference. First, the Court can find "agreement" even when coordination among firms lacks a direct exchange of assurances. Second, the Court entertains the inference of "agreement" where circumstantial evidence suggests that parallel pricing was more likely than not an outcome of concerted action. To assist in separating conscious parallelism from a tacit agreement, lower courts have endorsed the concept of "plus factors," which refers to circumstantial evidence that permits the inference of an actual agreement as opposed to independent actions.[98] Recognizing that "a knowing wink [could] mean more than words," the Ninth Circuit gave an example of circumstances that would warrant the court to submit the question regarding the existence of a conspiracy to a jury:

> Let us suppose five competitors meet on several occasions, discuss their problems, and one finally states—'I won't fix prices with any of you, but here is what I am going to do—put the price of my gidget at X dollars; now you all do what you want' . . . . All leave and fix 'their' prices at 'X' dollars. We do not say the foregoing illustration compels an inference in this case that the competitors' conduct constituted a price-fixing conspiracy, including an agreement to so

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96 Am. Tobacco Co. v. United States, 328 U.S. 781, 805 (1946). In markets free of collusion, when costs of production decrease, it is against a firm's self-interest to increase the end-price of its product because the firm risks to lose its customers who would start buying the same or similar product cheaper from other competing firms. *See generally* U.S. DEP'T OF JUST. & FED. TRADE COMM'N, HORIZONTAL MERGER GUIDELINES (Aug. 2010), *available at* http://www.justice.gov/atr/public/guidelines/hmg-2010.html [https://perma.cc/PX2C-945H].

97 Monsanto Co. v. Spray-Rite Serv. Corp, 465 U.S. 752, 768 (1984).

98 Gal, *supra* note 10, at 105–06.

> conspire, but neither can we say, as a matter of law, that an inference of no agreement is compelled.[99]

Besides conduct that conveys mutual assurances, firms' practices that facilitate coordination have also been deemed "plus factors" in certain circumstances.[100] As then-Judge Sotomayor wrote, "in the absence of direct 'smoking gun' evidence, a horizontal price-fixing agreement may be inferred on the basis of conscious parallelism, when such interdependent conduct is accompanied by circumstantial evidence and plus factors such as defendants' use of facilitating practices."[101] Facilitating practices and circumstantial evidence may include conspirators' communication in person, via emails, or via phone calls, and an indication that such communication was not conducted in the ordinary course of business.[102] Thus, under certain circumstances, courts treat the adoption of practices that facilitate coordination as a "plus factor" that serves as an indirect indication of "agreement."

E. Algorithmic Parallel Pricing Without Pro-Competitive Justifications as a "Plus Factor"

Professor Michael S. Gal argues that certain circumstances surrounding the use of algorithms can be treated as "plus factors" that establish the inference of "agreement" once parallel pricing is proven.[103] Gal suggests several situations where the use of algorithms should raise red flags and warrant further investigation of their legality.[104]

In each of Gal's contemplated scenarios, the firms engage in parallel pricing by using their algorithms in a non-optimal way, which reveals collusion to onlookers.[105] For instance, when competing firms use similar algorithms, although superior algorithms are

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99 Esco Corp. v. United States, 340 F.2d 1000, 1007 (9th Cir. 1965).

100 Gal, *supra* note 10, at 103–04.

101 Todd v. Exxon Corp., 275 F.3d 191, 198 (2d Cir. 2001) (Sotomayor, J.).

102 Anderson News, LLC v. Am. Media, Inc., 680 F.3d 162, 187–89 (2d. Cir. 2012).

103 Gal, *supra* note 10, at 110, 179–80 (arguing that "given the shortcomings of existing law in addressing algorithmic-facilitated coordination," courts should "treat[] the adoption of facilitating practices, by itself, as a basis for liability").

104 *Id.* at 113–15.

105 *Id.* at 115.

available to them, this suggests collusion.[106] Furthermore, firms might feed their algorithms similar data even though they can easily access better data sources.[107] Moreover, although better case studies are available, the firms may train their algorithms with similar case studies regardless.[108] Finally, by making their algorithms easily observable to their competitors, firms can enable their algorithms to signal to competitors how the firms will react to market conditions, thereby communicating intent and commitment.[109] According to Gal, if such acts lead to parallel pricing, the authorities should investigate them further to make sure that these algorithms' possible beneficial effects do not tilt the balance toward their anticompetitive outcomes.[110] Given that it is often the case that algorithmic functions—such as gathering and analyzing data—create efficiencies that reduce costs or increase the quality of production, they should be allowed.[111] However, other functions—such as making pricing data transparent to everyone—may be used to enable coordination.[112] Thus, it is important to analyze all these functions together to see whether it is possible to achieve the benefits of the former without the harm of the latter.[113]

Gal explains that an easy case would involve one firm rendering its algorithms transparent only to its rivals, by, for example, encrypting its information so that only competitors can read it.[114] Because such discriminatory access clearly serves neither consumers nor the firm acting unilaterally, the collusion is evident. Gal has also hypothesized that even if a firm makes its algorithm transparent to everybody, such action, depending on the circumstances, can still be considered as a "plus factor" for facilitation of unlawful comm-unication.[115] The relevant questions would be whether the transparency benefits consumers and whether the firm otherwise has an interest

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106 *Id.* at 113.
107 *Id.* at 113–14.
108 *Id.* at 114.
109 *Id.*
110 *Id.* at 113.
111 *Id.*
112 *Id.*
113 *Id.*
114 *Id.* at 114.
115 *Id.*

in preserving the content of its algorithm or the database as a trade secret, as an answer in the negative to the former and in the affirmative to the latter would indicate that there is collusion with the firm's competitors.[116]

Gal's proposed "plus factors" fit neatly into the current jurisprudence on tacit price-fixing agreements. These "plus factors" encompass the conceptual points established by the Supreme Court and further developed by lower courts. First, all of the circumstances addressed by Gal involve firms that use their algorithms to communicate their intentions to act in a certain way and their reliance on others to follow in their steps.[117] Second, the fact that the firms' avoidable acts have no competitive rationale excludes the possibility that they acted independently.[118]

F. Scenario #3: Unilateral Use of Self-Learning Pricing Algorithms

The third scenario involves firms that unilaterally employ self-learning algorithms that establish price equilibrium after learning on their own that it is the best profit-maximizing strategy. Ezrachi and Stucke refer to this category of algorithms as "Digital Eye."[119] "Digital Eye" algorithms use "Deep Learning," which is a highly sophisticated method of reinforcement learning that "mimic[s] the brain's cognitive and computational mechanisms."[120] A deep learning algorithm "processes raw data in a complex, fast, and accurate way . . . and delivers an optimal output without revealing the relevant features that were behind the decision process."[121] Accordingly, firms that use deep learning algorithms can genuinely reach collusive outcomes without even knowing about it, which raises a challenging question of whether the authorities can impose any liability on such firms.[122]

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116 *Id*.

117 *See id.* at 115.

118 *See id*.

119 Ezrachi & Stucke, *supra* note 8, at 1783–84.

120 Ariel Ezrachi & Maurice E. Stucke, *Algorithmic Collusion: Problems and Counter-Measures*, OECD 23 (June 2017) (unpublished Note for the 127th meeting of OECD Roundtable on Algorithms and Collusion).

121 OECD, *supra* note 21, at 32.

122 *Id*.

Currently, collusion reached by self-learning algorithms is perfectly legal. Because courts concur that to find "agreement" in violation of the Sherman Act, "there must be some overt act of communication to create or sustain that mutual understanding,"[123] firms that collude by merely employing autonomous algorithms do not violate Section 1.[124] Absent a fundamental change in antitrust jurisprudence, it is very unlikely that even a well-elaborated argument—e.g., that algorithms can "communicate the requisite mutual understanding" to collude in violation of the Sherman Act—can convince the courts that algorithms, like humans, can reach an agreement to fix prices.[125] This view is supported by DOJ Antitrust Division officials, who maintain that "tacit collusion through [algorithms] . . . is not illegal without an agreement among participants."[126] Yet, despite their current legality, "self-learning algorithms can more easily determine the price that maximizes joint profits and which harms consumers the most."[127]

In light of the potential threat that self-learning algorithms pose to consumers, Professor Joseph E. Harrington proposes a change to antitrust law.[128] Harrington argues that the authorities should outlaw pricing algorithms that use a reward–punishment scheme, which involves firms rewarding their rivals' inflated prices by maintaining such prices and punishing their rivals' deviation by undercutting them on price.[129] Harrington contends that properties of learning algorithms that produce efficiencies—such as estimating supply and demand, identifying most profitable price under given market conditions, swiftly adjusting to changes in market conditions, and personalizing prices for consumers—are not relevant to the establishment of a reward–punishment scheme that generates collusion.[130]

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123 Harrington, *supra* note 6, at 346.

124 *Id*.

125 *Id.* at 348.

126 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 [https://perma.cc/9B8F-9RY5].

127 OECD, *supra* note 21, at 33.

128 *See* Harrington, *supra* note 6, at 350.

129 *Id*.

130 *Id.* at 354.

According to Harrington, since the properties of pricing algorithms that generate efficiency are distinct from the features that promote collusion, it is possible to identify a set of pricing algorithms that should be illegal *per se*.[131] Meanwhile, Harrington also humbly admits that "[w]e know far too little about algorithmic collusion . . . ."[132]

However, the fact that we know very little about algorithmic collusion, coupled with efficiencies generated by pricing algorithms which benefit consumers, is precisely why it is very unlikely that courts will entertain Harrington's proposal of deeming certain algorithms *per se* illegal. From an antitrust policy standpoint, the U.S. courts remain largely dedicated to the Chicago School of thinking that gained mainstream prominence in the 1970s and 1980s.[133] The Chicago School philosophy focuses on efficiencies in the market and consumer welfare (in the sense of harms and benefits to ultimate consumers).[134] Moreover, the Supreme Court, over the past forty years, has been moving away from its application of the *per se* rule because the rule "can . . . prohibit[] procompetitive conduct [that] the antitrust laws should encourage."[135]

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131 *Id*.

132 *Id.* at 358.

133 *See* Lina Khan, *Amazon's Antitrust Paradox*, 126 YALE L.J. 710, 718–19, 720, 722 (2017) (arguing against the Chicago School approach to antitrust in the context of Section 2 of the Sherman Act that—unlike Section 1 that is concerned with concerted conduct between rivals—addresses unilateral anticompetitive conduct). Khan explains that the Chicago School's view that "market power is always fleeting—and hence antitrust enforcement rarely needed" does not reflect the true dynamics of a powerful online platform, such as Amazon Marketplace, that can maintain its monopoly indefinitely due to a strong network effect and Amazon's ability to drive competitors out by engaging in predatory pricing rather than competing on the merits. *Id*.

134 James Keyte, *Why the Atlantic Divide on Monopoly/Dominance Law and Enforcement Is So Difficult to Bridge*, 33 ANTITRUST ABA 113, 115 (2018).

135 Leegin Creative Leather Prods., Inc. v. PSKS, Inc., 551 U.S. 877, 879 (2007); *see supra* Part I.B. It should be noted that the trend of moving away from the application of the *per se* rule is observed only in cases that deal with antitrust issues arising out of parties' unilateral anticompetitive conduct, such as unfair monopolization. *See, e.g.*, *Leegin*, 551 U.S. at 907 (overruling Dr. Miles Med. Co. v. John D. Park & Sons Co., 220 U.S. 373 (1911) and holding vertical price restraints subject to rule of reason); State Oil Co. v. Khan, 522 U.S. 3, 7, 22 (1997) (overruling Albrecht v. Herald Co., 390 U.S. 145 (1968) and holding vertical maximum price fixing is not subject to *per se* rule); Cont'l T.V., Inc. v. GTE Sylvania Inc., 433 U.S. 36, 58 (1977) (overruling United States v. Arnold, Schwinn & Co., 388 U.S. 365 (1967) and rejecting *per se* rule for vertical non-price restrictions).

The possibility that collusion of self-learning algorithms will lead to inflated prices has also generated an outcry among scholars and practitioners for regulatory measures.[136] Some observers argue that governmental authorities should create new regulatory bodies to oversee algorithms.[137] For instance, Professor Ben Shneiderman proposes to establish a "National Algorithm Safety Board" that would audit, monitor, and license algorithms before firms are allowed to use them.[138] Attorney Andrew Tutt advocates for the launch of a new regulatory agency— similar to the U.S. Food and Drug Administration—which would attempt to "prevent the introduction of algorithms into the market until their safety and efficacy has been proven through evidence-based premarket trials."[139] It should be noted that the SEC has already introduced efforts to regulate algorithmic trading.[140] While the assessment of the aforementioned regulatory measures is beyond the scope of this Note, regardless of whether certain properties of self-learning algorithms that lead to tacit collusion will ever be outlawed or regulated in the future, authorities would still face the challenges of detecting such collusion.

G. Addressing an Actual, Rather Than Theoretical, Threat of Algorithmic Collusion

Empirically, we have not seen a case where algorithms, either simply coded to maximize profits or explicitly programmed to

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136 *See, e.g.*, Tutt, *supra* note 5; Sandra Wachter, Brent Mittelstadt & Luciano Floridi, *Why a Right to Explanation of Automated Decision-Making Does Not Exist in the General Data Protection Regulation*, INT'L DATA PRIVACY L. 77 (2017); Elon Musk, *National Governors Association*, YOUTUBE (July 15, 2017), https://www.youtube.com/watch?time_continue=245&v=b3lzEQANdHk [https://perma.cc/363T-59S3].

137 Daniel Castro & Joshua New, Center for Data Innovation, Comment to the FTC on Competition and Consumer Protection in the 21st Century Hearings: Background on Algorithms, Artificial Intelligence, and Predictive Analytics, and Applications of the Technologies 5 (Feb. 15, 2019), https://www.ftc.gov/system/files/documents/public_comments/2019/02/ftc-2018-0101-d-0012-164560.pdf [https://perma.cc/L7BU-5HB5].

138 Shneiderman, *supra* note 5.

139 Tutt, *supra* note 5, at 91.

140 SEC. EXCHANGE ACT RELEASE No. 77175, 81 FR 9235 (Feb. 18, 2016), https://www.sec.gov/rules/sro/finra/2016/34-77175.pdf [https://perma.cc/B9X7-QNPR] (adopting a rule requiring "persons who are primarily responsible for the design, development[,] or significant modifications of algorithmic trading strategies" to register with the Financial Industry Regulatory Authority (FINRA)).

collude, led to collusion.[141] However, a number of experimental studies have demonstrated that such algorithmic collusion is possible.[142] In one study—that took several years to design—ten researchers from nine universities across four continents examined the behavior of twenty-five algorithms in a variety of contexts.[143] The study found that all of the examined algorithms learned to cooperate effectively.[144] Nevertheless, the researchers emphasized a number of technical challenges, such as algorithms' diminished ability to cooperate and elicit cooperation without prior knowledge of the other algorithms' behavior.[145] These and other challenges often led an algorithm to defect rather than to cooperate "even when doing so would be beneficial to the algorithm's long-term payoffs."[146] Moreover, most of the studies that have confirmed algorithmic capabilities to collude assumed an unchanging market environment: the rewards for algorithms and the environment in which algorithms operated were typically fixed.[147] In a real market environment, algorithmic cooperation can be significantly undermined because demand uncertainty and other variabilities make it hard for an algorithm to understand whether a lowering price is the result of declining demand or a deviation by another algorithm.[148]

After examining a number of experimental studies, Professor Ai Deng concluded that "to design an algorithm that has some degree of a guaranteed success in eliciting tacit collusion, the capability to collude most likely needs to be an explicit design feature."[149] If that is the case, and collusion is coded explicitly into the algorithm, then agencies and courts can address this actual, rather than theoretical, algorithmic collusion problem by adopting Gal's approach.[150] Particularly, the authorities can consider Gal's pro-

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141 Ai Deng, *What Do We Know About Algorithmic Tacit Collusion?*, 33 ANTITRUST 88, 89 (Fall 2018).

142 *Id.* at 90.

143 *Id*.

144 *Id*.

145 *Id*.

146 *Id*.

147 *Id*.

148 *Id*.

149 *Id.* at 90–91.

150 *See* Gal, *supra* note 10, at 77; *see also supra* Part I.E.

posed "plus factors" from which an agreement to collude can be inferred.[151] Because algorithmic parallel pricing has never been challenged in court, we have yet to see whether courts will consider Gal's proposed "plus factors" as evidence of a tacit agreement to fix prices. Nevertheless, as discussed above, Gal's "plus factors" fit well into the body of established case law that permits the inference of "agreement" from similar facilitating practices, albeit without an algorithmic spin.[152] There is no reason to suspect that such an algorithmic wrinkle would discourage the Supreme Court from applying its well-established legal framework to the digital market economy.

Indeed, the Supreme Court's recent decision in *Apple Inc. v. Pepper* indicates that it will not tolerate firms' attempts to evade antitrust claims by employing new arrangements in the digital markets.[153] The *Apple* case addressed unilateral anticompetitive conduct, which is captured under Section Two of the Sherman Act.[154] In *Apple*, purchasers of smartphone applications ("apps") created by independent developers claimed that Apple imposed inflated commissions on the developers who, in turn, were forced to set high prices for their apps.[155] In rejecting Apple's argument that under *Illinois Brick Co. v. Illinois*,[156] purchasers of third-parties' apps in the App Store had no standing to sue Apple because app developers, rather than Apple, set the retail price, the Court explained that "Apple's theory would provide a roadmap for monopolistic retailers to structure transactions with manufacturers or suppliers so as to evade antitrust claims by consumers and thereby thwart effective antitrust enforcement."[157] Conferring standing on the app purchasers, the Court declined to "create an unprincipled and economically senseless distinction among monopolistic retailers, and furnish mono-

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151 *See* Gal, *supra* note 10, at 101.

152 *See id*. at 103.

153 *See* Apple Inc. v. Pepper, 139 S. Ct. 1514, 1522–23 (2019).

154 *Id.* at 1525.

155 *See id.* at 1519.

156 *See generally* Illinois Brick Co. v. Illinois, 431 U.S. 720 (1977) (holding that indirect purchasers of products lacked standing to bring antitrust challenges against producers of such products).

157 *Apple Inc.*, 139 S. Ct. at 1523.

polistic retailers with a how-to guide for evasion of the antitrust laws."[158]

The Court's reasoning in *Apple* suggests that it would be unwilling to entertain claims that business behavior which has long been regarded as indirect evidence of tacit "agreement" should not be considered as unlawful collusion only because it is facilitated by algorithms. Otherwise, the firms would receive "a how-to guide" for conspiring via algorithms to fix prices with immunity, the immunity that the Court declined to provide in *Apple*.[159] Ultimately, the only way to find out whether courts would be willing to recognize certain algorithmic features and the circumstances under which such features are adopted as "plus factors" that warrant an inference of "agreement" is to actually litigate such cases. Therefore, this Note focuses on solving the preliminary problem: helping authorities detect algorithmic cartels so the government can bring cases challenging these cartels.

II. DETECTION OF ALGORITHMIC CARTELS

A. Challenges in Detecting Algorithmic Cartels

Algorithmic cartels are more challenging to detect than regular price-fixing schemes in part because traditional structural and behavioral approaches to cartels' screening can often be ineffective for algorithmic cartel detection. Involving the identification of markets and products that are vulnerable to collusion and cartel formation,[160] the structural approach can easily miss the firms that—while being outside of the traditional "oligopoly problem"—managed to create algorithmic cartels due to data transparency in the digital world.[161]

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158 *Id.* at 1524.

159 *See id.* at 1524–25.

160 "[I]t has been shown that structurally, cartel formation is more likely to exist where there are fewer firms, more homogeneous products, and more stable demand." Joseph E. Harrington, Jr., *Detecting Cartels* 1 (JOHNS HOPKINS U., DEP'T OF ECON., Working Paper No. 526, 2005), https://www.econstor.eu/bitstream/10419/72037/1/504388991.pdf [https://perma.cc/XDE4-VFMS].

161 *See* OECD, *supra* note 21, at 21; *see also* Ezrachi & Stucke, *supra* note 8, at 1790 (explaining that in the digital world, a basic condition for tacit collusion/conscious parallelism is easily accomplished); Noethlich, *supra* note 67, at 952 ("All digital markets,

Meanwhile, the behavioral approach that entails flagging business conduct and market outcomes indicative of a cartel's existence may also prove ineffective because algorithms can help cartels eliminate suspicious behavior (such as temporary price wars and sudden price collapses at the end of cartels) that might have otherwise placed them on the radar of the authorities.[162] Furthermore, algorithms' ability to stabilize a cartel enables its members to respond quickly to an individual firm's attempt to cheat on its fellow cartelists.[163]

Every cartel faces this so-called prisoner's dilemma,[164] which entails the risk that its members will start deviating from the price-fixing scheme to gain market share.[165] To illustrate, imagine that the market price of a product is ten dollars and that a cartel's members all agree to charge an inflated price of twenty dollars.[166] While the parties are all better off complying with the agreement, it can be hard for a cartelist to resist a powerful temptation to cheat and charge fifteen dollars to increase its market share by winning over its competitors' customers.[167] Such temptation can be curtailed only by a high probability that other members of the cartel will detect cheating

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even those outside the traditional oligopoly problem," are "vulnerable to vast manipulation and anticompetitive outcomes.").

[162] *See* DIRECTORATE FOR FIN. & ENTER. AFFAIRS COMPETITION COMM., SUMMARY OF THE WORKSHOP ON CARTEL SCREENING IN THE DIGITAL ERA 3 (Jan. 30, 2018), https://one.oecd.org/document/DAF/COMP/M(2018)3/en/pdf [http://perma.cc/WFF6-9TYW] [hereinafter DIRECTORATE].

[163] Noethlich, *supra* note 67, at 933–34.

[164] *Id.* at 933. The prisoner's dilemma game theory illustrates self-destructive tendency of cartels' dynamics. *Id.* The game can be illustrated with two prisoners (A and B) who have been charged with a crime. Melamed, *supra* note 77, at 214–215. Neither of them knows whether the other would confess or keep silent because they are kept in separate cells. *Id.* If prisoner A keeps quiet it will go free only if B stays silent as well; if A keeps quiet while B confesses, A would get maximum sentence of 10 years; if A confesses while B stays silent, A would get a reduced sentence; if both prisoners confess, they both get reduction in their sentences. *Id.* Obviously A and B are better off not confessing, but, since none of them knows what another would do, the safest bet is to confess. *Id.* The prisoner's dilemma demonstrates that individually rational behavior in the absence of coordination leads to an outcome that is worse for each person. *Id*.

[165] Noethlich, *supra* note 67, at 933–34.

[166] *See* Terrell McSweeny & Brian O'Dea, *The Implications of Algorithmic Pricing for Coordinated Effects Analysis and Price Discrimination Markets in Antitrust Enforcement*, 32 ANTITRUST ABA 75, 75 (2017).

[167] *Id*.

quickly and retaliate by lowering their prices.[168] The more quickly other members of the cartel respond to any deviation from the common plan, the less likely the cartelist would try to stray off course.[169] Therein lies the value that algorithms bring to this context: they enable firms not only respond to cheating faster but also with more accuracy and less expenditure.[170] With precision and speed unattainable by any human, algorithms process competitors' prices, prowl databases, analyze all collected information, and arrive at pricing solutions within milliseconds.[171] However, such speed in managing algorithmic cartels heightens the detection problem for authorities, as it can drastically eliminate the possibility that the cartels will ever get on the radar of the authorities.

Moreover, the mere fact that algorithms can immediately flag any deviation from a common scheme is likely to prevent cartel members from any attempt to cheat in the first place.[172] The ability of algorithms to track and quickly flag cartel members' price changes eliminates a lack of trust among cartelists, which is often a reason behind cartels' demise.[173] Algorithms, which are computer programs after all, are not subject to human vices—such as fear, distrust, and greed—and can therefore render the effect of the cartel's prisoner's dilemma obsolete; free of this dilemma, cartels can operate without ever being detected.[174]

Further, because the use of algorithms allows cartels to execute their illegal schemes while leaving minimal evidence, it diminishes the likelihood of detection.[175] After agreeing to fix prices via algorithm, co-conspirators do not need to speak to their fellow cartelists

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168 *See id*.

169 *Id.*; *see also* U.S. DEP'T OF JUST. & FED. TRADE COMM'N, HORIZONTAL MERGER GUIDELINES § 7.2 (2010), http://ftc.gov/os/2010/08/100819hmg.pdf [https://perma.cc/4HFL-HR6A] (specifying that speed in identifying and responding to competitors' strategic initiatives renders markets more vulnerable to coordinated conduct).

170 McSweeny & O'Dea, *supra* note 166, at 76.

171 *See supra* Part I.A.

172 Noethlich, *supra* note 67, at 934.

173 *Id*.

174 *Id.* at 941.

175 David J. Lynch, *Policing the Digital Cartels*, FIN. TIMES (Jan. 8, 2017), https://www.ft.com/content/9de9fb80-cd23-11e6-864f-20dcb35cede2 [https://perma.cc/5PM7-BJWN] (subscription required).

ever again, either in person, on the phone, or via email.[176] Rather, the cartelists can conveniently rely on algorithms to perform all the aspects of their price-fixing scheme without leaving behind trails of traditional incriminating evidence.[177] Critically, the evidence of an illegal scheme that can be uncovered by examining an algorithm itself is not easy to access or analyze.[178] There are two kinds of access to algorithms' codes that the authorities can gain: black box and white box.[179] Black box access does not allow the authorities to examine the code itself; it only provides access to the algorithm's output.[180] Meanwhile, white box access enables the authorities to examine the algorithmic code.[181] However, companies may be unwilling to provide access to their codes due to potential infringement exposure of their algorithmic trade secrets.[182]

Another challenge that can affect the authorities' ability to discover evidence of price-fixing schemes by analyzing algorithms is access to data used by algorithms.[183] The importance of such access is twofold: it allows the authorities to discern algorithmic decision-making and perform repeatability analysis.[184] Repeatability is an empirical-science tool that the authorities can use to verify whether a specific outcome was, in fact, caused by the algorithm.[185] Specifically, repeatability analyzes the "closeness of the agreement between the results of successive measurements of the same measure and carried out under the same conditions of measurement."[186] In other words, the authorities, having procured the data used by a suspect algorithm, can run this data under the same conditions on

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176 *Id*.

177 *Id*.

178 Avigdor Gal, *It's a Feature, Not a Bug: On Learning Algorithms and What They Teach Us*, OECD 5–6 (June 2017) (unpublished note for the 127th meeting of OECD Roundtable on Algorithms and Collusion).

179 *Id*.

180 *Id*.

181 *Id*.

182 *Id.* (explaining that algorithms' "comparative advantage may not necessarily lie in the 'science' of the algorithm but rather in its 'engineering,' including the way the algorithm is tuned and the methods that it uses for improved performance.").

183 *Id*. at 6.

184 *Id*.

185 *Id*.

186 *Id*.

the same algorithmic code (if available) or a similar publicly accessible algorithm in order to see whether it produces the same inflated prices that sparked the authorities' interest.[187]

While repeatability provides a "sanity check," it still leaves the authorities with questions regarding the actual decision-making of the algorithm.[188] Where algorithmic decision-making is exposed through, for example, a decision tree that reveals the factors that an algorithm used in reaching its decision,[189] the authorities can determine whether the factors used raise antitrust concerns.[190] For instance, the enforcers may be concerned with a gas station's algorithm that uses the color of the flag of a neighboring gas station—which may be a covert channel for collusion—as a factor for determining its gasoline prices.[191] However, an algorithm's use of traffic and weather conditions to set gasoline prices would not raise antitrust concerns.[192] Where such factors are unclear or an algorithm is unavailable, the access to data used by an algorithm can enable the authorities to use publicly available algorithms to re-create the outcomes yielded by the algorithm at issue and discern the factors it used.[193] Moreover, such an indirect exposure of real-world algorithmic decision-making requires familiarity with state-of-the-art algorithms.[194] Certainly, the necessary know-how can be provided by experts that the DOJ commonly hires to prove price-fixing conspiracies in courts.[195] However, in order to open an investigation that warrants hiring such experts, the DOJ has to detect suspicious algorithmic activities in the first place.

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187 *See id*.
188 *Id*.
189 Gal, *supra* note 10, at 115.
190 Gal, *supra* note 178, at 5–6.
191 *Id.* at 6.
192 *Id*.
193 *Id*.
194 *Id*.
195 *See, e.g.*, Patrick F. Murphy et al., *Role of Technology Experts in Antitrust Litigation*, IDC Q. (Nov. 4, 2016), https://cdn.ymaws.com/www.iadtc.org/resource/resmgr/quarterly_v26-27/26.4.38.pdf [https://perma.cc/S92A-WU7P] (discussing the importance of experts in antitrust litigation).

B. Leniency Program Is Not a Panacea for Cartel Detection

The Leniency Program ("the Program"), first introduced in 1978, has become the backbone of the DOJ's cartel detection and enforcement.[196] Today, the Program provides corporations and individuals that come forward with information about their cartels an opportunity to avoid a criminal conviction and fines.[197] To be qualified for leniency, an entity must (1) be the first among the cartel members to come forward,[198] (2) stop its own participation in the cartel, (3) fully admit to its role in the conspiracy, (4) identify its co-conspirators, (5) make restitution where possible,[199] and (6) cooperate fully with the DOJ.[200] If the Division has not already started its own investigation into the reported cartel, leniency is automatic for qualified companies and individuals.[201] Additionally, leniency can still be available after the commencement of the investigation if the

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[196] *See* Scott D. Hammond, Deputy Assistant Att'y Gen., U.S. Dep't of Just. Antitrust Div., Presentation at the 24th Annual National Institute on White Collar Crime: The Evolution of Criminal Antitrust Enforcement Over the Last Two Decades 2–3, (Feb. 25, 2010), https://www.justice.gov/atr/file/518241/download [https://perma.cc/527K-KEYQ].

[197] U.S. DEP'T OF JUST. ANTITRUST DIV., *Frequently Asked Questions Regarding the Antitrust Division's Leniency Program and Model Leniency Letters* 1 (Nov. 18, 2008), https://www.justice.gov/atr/file/810001/download [https://perma.cc/435V-49RK]. For a brief history of the Division's Leniency Program, see Constance K. Robinson & Kilpatrick Stockton, *Get-Out-Of-Jail-Free Cards: Amnesty Developments in the United States and Current Issues*, 8 SEDONA CONF. J. 29, 30–33 (2007).

[198] *See* Bill Baer, Assistant Att'y Gen., U.S. Dep't of Just. Antitrust Div., Remarks at the Georgetown Law Center Global Antitrust Enforcement Symposium: Prosecuting Antitrust Crimes 5 (Sept. 20, 2014), https://www.justice.gov/atr/file/517741/download [https://perma.cc/MPL5-45GM] ("Even if a company is too late to qualify for leniency, we take early acceptance of responsibility and meaningful cooperation into account in determining the appropriate consequences for offending corporations and their executives.").

[199] The DOJ rarely seeks restitution in criminal antitrust cases because victims can obtain treble damages through civil actions. Meegan Hollywood & Dave Rochelson, *It Ain't Over Til It's Over: Can Making Acpera Restitution Conditional Help Fill A Gap In The Law?*, CPI ANTITRUST CHRON., June 2019, at 1, 2, https://www.competitionpolicyinternational.com/wp-content/uploads/2019/06/CPI-Hollywood-Rochelson.pdf [https://perma.cc/JKD3-HS53] (subscription required).

[200] *See* U.S. DEP'T OF JUST., *Corporate Leniency Policy* (Aug. 10, 1993), https://www.justice.gov/atr/corporate-leniency-policy [https://perma.ccJXZ2-R6W8]; *see also* U.S. DEP'T OF JUST., LENIENCY POLICY FOR INDIVIDUALS 1–2 (Aug. 10, 1994), https://www.justice.gov/sites/default/files/atr/legacy/2006/04/27/0092.pdf [https://perma.cc/83PA-7CL8].

[201] Hammond, *supra* note 196, at 2.

DOJ does not have enough information that is likely to result in conviction.[202]

The Leniency Program has been extremely successful, resulting in the detection and conviction of major international price-fixing cartels, billions of dollars in fines, and incarceration of cartel members.[203] Between 2005 and 2010, ninety percent of all fines recovered from cartels were tied to the participation of leniency applicants.[204] More than half of the DOJ's ongoing international cartel investigations are initiated or otherwise advanced by information from leniency applicants.[205] The Leniency Program is an effective tool in cartel detection because it destabilizes cartels by creating a race among conspirators to the prosecutor's door to be the first to confess.[206] Each cartelist knows that it can report others in exchange for full immunity. Accordingly, a firm is left wondering whether it can trust its fellow cartelists, who happen to be its business competitors, to look out for the firm's best interests.[207]

Nevertheless, even with the Leniency Program in place, some estimates suggest that the DOJ is only aware of approximately ten to seventeen percent of price-fixing cartels currently active.[208] For instance, professors Peter G. Bryant and Edwin Eckard, using data from 184 convictions secured by the Antitrust Division between 1961 and 1988, have estimated that the probability of cartel detection is between thirteen and seventeen percent.[209] Professors Emmanuel Combe, Constance Monnier, and Renaud Legal found, based on the data of eighty-six convictions handed down by the European Commission between 1969 and 2007, that the probability of cartel detection is approximately thirteen percent.[210] Because the

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202 *See id.*

203 *See id.* at 3.

204 *See id*.

205 *Id*.

206 *Id*.

207 *Id.* at 4.

208 *See supra* note 7 and accompanying text.

209 Marcel Boyer, Anne Catherine Faye & Rachidi Kotchoni, *Challenges and Pitfalls in Cartel Policy and Fining* 31 (Toulouse School of Econ., Working Paper No. 17-852, 2017), https://www.tse-fr.eu/sites/default/files/TSE/documents/doc/wp/2017/wp_tse_852.pdf [https://perma.cc/LGP5-4D3Y].

210 *Id*.

findings are based on the data of detected cartels, "they only represent the probability of a cartel being detected conditional on that cartel being detectable."[211] The actual probability of cartel detection is unknown and likely to be even lower than the paltry aforementioned estimates.[212]

Based on the low rate of cartel detection, it is safe to assume that even with the Leniency Program in place, the vast majority of cartels go unpunished. This reality speaks to certain key challenges facing the Leniency Program. Most important among these is how even cartelists that want to get out of their illegal schemes may forgo self-reporting for a number of reasons.[213] First, the Leniency Program does not provide immunity from criminal exposure beyond the Sherman Act.[214] A corporation that engaged in fraud along with price-fixing would still be on the hook for its fraudulent actions.[215] Second, after receiving leniency, a company remains exposed to civil liability and the fines that come with it.[216] Further, cooperation with the DOJ, which can last for years, requires a significant investment of time and resources.[217] In fact, many observers argue that leniency applications are slowing down because of the cost of obtaining

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211 *Id*.

212 *Id*.

213 *See* Baer, *supra* note 198, at 5.

214 *Id.* at 4.

215 *See id.* The leniency agreement binds only the Antitrust Division; "it does not bind other federal or state prosecuting agencies, including other components of the Department of Justice." U.S. DEP'T OF JUST. ANTITRUST DIV., *Frequently Asked Questions Regarding the Antitrust Division's Leniency Program and Model Leniency Letters* 7 (Jan. 26, 2017), https://www.justice.gov/atr/page/file/926521/download [https://perma.cc/VF8K-VB5X]. "The Division's Leniency Program does not protect applicants from criminal prosecution by other prosecuting agencies for offenses other than Sherman Act violations." *Id.* "For example, a leniency applicant that bribed foreign public officials in violation of the Foreign Corrupt Practices Act receives no protection from prosecution by any other prosecuting agency, regardless of whether the bribes were also made in furtherance of the reported antitrust violation." *Id*.

216 *See id.* It should be noted that, in 2004, Congress has enacted statutory changes to the Antitrust Division's Leniency Program that allow a successful amnesty applicant to be liable for only single, rather than treble, damages in a civil follow-on action, if that amnesty applicant cooperates with the civil plaintiffs. *See* 15 U.S.C. § 1 (2004).

217 *See* Robert Connolly, *It Is Time for an Antitrust Whistleblower Statute—Part I*, CARTEL CAPERS (Oct. 30, 2017), http://cartelcapers.com/blog/time-antitrust-whistleblower-statute-part/ [https://perma.cc/3JMK-7B95].

leniency, which includes attorney fees, corporate time, and the reality that, in an expanding universe of jurisdictions, the U.S. leniency applicants have to self-report in all the countries impacted by their illegal scheme.[218]

Thus, even without the challenge of detecting algorithmic cartels, the Leniency Program, while undoubtedly effective to a limited extent, is not a panacea even for the detection of regular cartels. The Program will likely prove even less effective in combating algorithmic cartels in light of their ability to stabilize a cartel's operations by eliminating the prisoner's dilemma.[219]

C. Solution #1: Screening for Algorithmic Cartels

Ezrachi and Stucke propose to screen the digital markets for collusion.[220] According to these scholars, agencies may "evaluate computerized market environments" and—if prices become unresponsive to costs or more tightly clustered across companies—"require companies to reveal the nature of their algorithms to ascertain whether these algorithms create excessive transparency or lead to interdependence."[221]

To better understand what factors are indicative of algorithmic collusion and, therefore, worth exploring further, Ezrachi and Stucke encourage enforcers to begin commissioning or internally conducting experimental research of pricing algorithms.[222] As part of such research, a regulatory agency would examine the available pricing algorithms and run simulations in a collusion incubator.[223] The agency could test which conditions, when included or excluded from the incubator, would raise the likelihood and longevity of collusion.[224] Ezrachi and Stucke admit that such an incubator is far

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218 *See id*.

219 *See supra* Part II.A. As explained in Part II.A, every cartel faces the prisoner's dilemma, that entails the risk that its members will start deviating from the price-fixing scheme to gain market share. The more quickly other members of the cartel respond to any deviation from the common plan, the less likely the cartelist would try to cheat. The algorithms enable firms to respond to cheating effectively and efficiently.

220 *See* Ezrachi & Stucke, *supra* note 8, at 1806.

221 *Id*.

222 Ezrachi & Stucke, *supra* note 120, at 28.

223 *Id*.

224 *Id*.

from perfect because it is relatively static and will not reflect changes in market dynamics over time and alteration to algorithms through, for example, human intervention.[225] Nevertheless, according to Ezrachi and Stucke, such experimental research will help identify which algorithmic features raise red flags and warrant further investigation.[226] Such selective intervention, Ezrachi and Stucke argue, "may have more limited cost implications" than random screening and "may also limit the possible adverse effects on innovation and investment, as it is only after tacit collusion is detected that the market is subjected to a monitoring exercise."[227]

Professor Rosa M. Abrantes-Metz and Managing Director at Moody's Investor Services, Albert D. Metz, go a step further by proposing that the authorities use algorithms to screen for digital cartels and other collusive, anti-competitive practices.[228] Abrantes-Metz and Metz explain that the successful detection of digital collusion requires prediction or classification functions that algorithms perform seamlessly, and which are the very same functions that make algorithms so attractive to cartels in the first place.[229] The pair acknowledges that simply asking algorithms to identify illegal collusion would be hopeless because lawful tacit collusion can be virtually indistinguishable from unlawful explicit collusion.[230] Nevertheless, according to them, enforcers can train algorithms to identify prices that are either unresponsive to costs or tightly clustered across rival firms.[231] After such red flags are raised, economists and computational experts would further analyze the algorithms at issue and data used by them.[232] Abrantes-Metz and Metz emphasize the importance of economists in the process because "an empirical approach to cartel detection is not only a prediction or classification problem: there is usually a testing component."[233] The pair explains

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225 *Id*.

226 *Id*.

227 Ezrachi & Stucke, *supra* note 8, at 1806.

228 *See* Rosa M. Abrantes-Metz & Albert D. Metz, *Can Machine Learning Aid in Cartel Detection?*, CPI ANTITRUST CHRON., July 2018, at 1, 3.

229 *See id.* at 3.

230 *Id*.

231 *Id*.

232 *Id*.

233 *Id.* at 4.

that, for effective cartel detection, it is paramount to formulate a hypothesis to be tested: "how likely is it that the observed data were generated from a collusive rather than a competitive dynamic?"[234] As Abrantes-Metz and Metz note, economists have the necessary expertise to perform statistical testing and make the determination regarding the likelihood of one hypothesis over an alternate.[235]

To illustrate how economists can use algorithms to identify collusion, Abrantes-Metz and Metz provide an example of the work that they performed "almost two decades ago . . . with [a] compliance department of [one] company."[236] Their task was "to identify which managers [in the company] were colluding to boost [their] performance evaluations."[237] The suspicion was that conspiring managers had agreed to boost the scores they assigned among themselves while depressing the evaluations of others.[238] Having the anonymized evaluation scores and other relevant data, such as practice areas and locations, the economists used "a clustering algorithm to run over all possible combinations to find groups which minimized differences within and maximized differences without . . . ."[239] Ultimately, the economists "identified exactly the [] managers [that] were suspected of colluding and the year [they had] started" to do so.[240]

The possibility of using algorithms to screen for collusion is also addressed in the Organization for Economic Co-operation and Development's ("OECD") report.[241] According to the OECD, a number of competition agencies have already reported using algorithms to detect bid-rigging by screening for anomalies and suspicious bidding patterns.[242] For instance, algorithmic screening enabled the Korea Fair Trade Commission to detect several bid-rigging conspiracies.[243] These efforts and successes point to the

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234 *Id*.
235 *See id.*
236 *Id.* at 3.
237 *Id*.
238 *Id*.
239 *Id*.
240 *Id*.
241 *See* OECD, *supra* note 21, at 14.
242 *Id*.
243 *Id*.

promise of screening as a solution to enhancing the detection of algorithmic cartels.

D. Solution #2: Antitrust Bounty Statute

Given that the Leniency Program is hardly effective at detecting conventional cartels, scholars and practitioners have been advocating for the passage of an antitrust whistleblower statute since long before algorithmic cartels have emerged on the scene.[244] Specifically, Robert Connolly and Kimberly Justice, former prosecutors at the DOJ's Antitrust Division, have argued that a statute that provides antitrust whistleblowers with financial rewards (bounty) will add an additional tool to help the Department detect cartels.[245]

Connolly and Justice explain that "the cartel whistleblower calculus currently is all trouble, no reward": whistleblowers receive neither bounty nor protection from employment retaliation.[246] Even if a potential whistleblower did not participate in a cartel, but learned about its existence by, for example, overhearing conversations of their coworkers, they may often decide to look the other way.[247] Otherwise, they may face the risk of losing their job, spending their savings on attorney fees, and being blacklisted from the industry.[248] If low-level employees—following their superior's orders—get involved in a cartel's activities, their decision to report the cartel would involve additional hurdles of applying for leniency and cooperating with the DOJ.[249] The fact that the Individual Leniency Policy is almost never used suggests that rational individuals are more likely to forgo reporting rather than exposing themselves to all of

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244 *See generally* William E. Kovacic, *Private Monitoring and Antitrust Enforcement: Paying Informants to Reveal Cartels*, 69 GEO. WASH. L. REV. 766, 768–69 (2001) (arguing for the extension of the corporate leniency program by giving rewards to individuals who provide information about cartels); *see also* Jonathan Wright, *Blow the Whistle: How Bringing Whistleblower Rewards to antitrust Would Help Cartel Enforcement*, 3 ADMIN. L. REV. 695 (2017); Robert Connolly & Kimberly Justice, *It's a Crime There Isn't an Antitrust Whistleblower Statute*, ANTITRUST L. DAILY 1 (Apr. 8, 2018), http://business.cch.com/ald/ALD_Criminal-Antitrust-Whistleblower-Statute_04-05-2018_final_locked.pdf [https://perma.cc/9NGC-W84C].

245 Connolly & Justice, *supra* note 244, at 3.

246 *Id.* at 2.

247 *Id*.

248 *See id*.

249 *Id*.

the aforementioned risks.[250] Therefore, providing whistleblowers with a bounty, according to Connolly and Justice, can mitigate the risks that whistleblowers face and, ultimately, incentivize them to come forward.[251] Moreover, Connolly notes that the bounty statute would not only improve the detection rate of cartels but would also destabilize them.[252] The mere possibility that a whistleblower is able to receive a reward for reporting a cartel might destabilize the cartel or prevent its formation in the first place.[253]

Proponents of an antitrust whistleblower statute point to the success of the nation's most renowned whistleblower system: the False Claims Act's ("FCA") whistleblower provision.[254] The FCA imposes civil liability for anyone who knowingly defrauds the government and permits the DOJ to recover treble damages.[255] The Act includes a *qui tam* provision that allows whistleblowers, who are not affiliated with the government, to file an action on behalf of the government.[256] The FCA provides standing for individuals who have direct and independent knowledge regarding fraudulent activities and have voluntarily shared the information with the government before filing an action.[257] If the DOJ decides to intervene, the whistleblowers receive between fifteen and twenty-five percent of the money the DOJ recovers.[258] If the DOJ does not join and bring the suit themselves, the whistleblowers are still free to proceed on their own and collect between twenty-five and thirty percent of the amount recovered.[259] Furthermore, under the FCA, whistleblowers enjoy protections against retaliation, including a private right of

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250 Connolly, *supra* note 217.
251 Connolly & Justice, *supra* note 244, at 2.
252 *Id*.
253 Connolly, *supra* note 217.
254 *See* Connolly & Justice, *supra* note 244.
255 *See* 31 U.S.C. §§ 3729–33 (2006).
256 *Id*.
257 *Id.* § 3730(e).
258 U.S. DEP'T OF JUST., *The False Claims Act: A Primer* (Apr. 22, 2011), https://www.justice.gov/sites/default/files/civil/legacy/2011/04/22/C-FRAUDS_FCA_Primer.pdf [https://perma.cc/WLJ7-VQ2S].
259 *Id*.

action.[260] Since the mid-1980s, the government has recovered $27.2 billion from claims brought by whistleblowers under the FCA.[261]

Advocates of an antitrust bounty statute use the success of the FCA *qui tam* provision as an exemplar that whistleblowing works.[262] However, there is a consensus that an antitrust whistleblower statute cannot be modeled after the FCA *qui tam* provision because the "DOJ has the sole authority to prosecute federal criminal cases, so a private right of action in the criminal context would conflict with this authority."[263] Because a private party cannot bring a criminal claim on behalf of a government, Connolly and Justice believe that an antitrust bounty statute should be similar to the one that the SEC currently has.[264]

The SEC whistleblower program emerged after Congress passed the Dodd–Frank Wall Street Reform and Consumer Protection Act ("the Dodd–Frank Act") in 2010.[265] The SEC whistleblower provision provides an informant with a reward for disclosing violations, such as insider trading and fraudulent reporting.[266] The SEC rewards program is triggered only in cases where the SEC's monetary sanctions exceed $1 million.[267] When this threshold is met, a whistleblower receives no less than ten percent and no more than thirty percent of a total recovery.[268] However, to be eligible for a bounty, a

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260 Memorandum from the U.S. Att'y Off. of the E.D. Pa. on False Claims Act Cases, U.S. Dep't of Just. (2011), https://www.justice.gov/sites/default/files/usao-edpa/legacy/2011/04/18/fcaprocess2_0.pdf [https://perma.cc/N2QZ-SUNW].

261 *Id*.

262 Connolly & Justice, *supra* note 244.

263 *See* U.S. GOV'T ACCOUNTABILITY OFF., CRIMINAL CARTEL ENFORCEMENT: STAKEHOLDER VIEWS ON IMPACT OF 2004 ANTITRUST REFORM ARE MIXED, BUT SUPPORT WHISTLEBLOWER PROTECTION 38 (2011), http://www.gao.gov/assets/330/321794.pdf [https://perma.cc/BXM7-7ARC] [hereinafter STAKEHOLDER VIEWS].

264 Connolly & Justice, *supra* note 244.

265 *See* Dodd–Frank Wall Street Reform and Consumer Protection Act, Pub. L. No. 111-203, 124 Stat. 1376 (2016); Samuel C. Leifer, Note, *Protecting Whistleblower Protections in the Dodd–Frank Act*, 113 MICH. L. REV. 121, 122–23 (2014).

266 *See* Ben Kerschberg, *The Dodd–Frank Act's Robust Whistleblowing Incentives*, FORBES (Apr. 14, 2011, 9:20 AM), http://www.forbes.com/sites/benkerschberg/2011/04/14/the-dodd-frank-acts-robustwhistleblowing-incentives/#596000991193 [https://perma.cc/2M3S-RPSQ].

267 *Id*.

268 15 U.S.C. § 78u–6 (2010).

whistleblower cannot be "convicted of a criminal violation related to the judicial or administrative action for which the whistleblower otherwise could receive an award."[269] When determining the amount of a bounty, the SEC considers the significance of the information shared, the degree of assistance provided by the informant, and the importance of deterring the specific violation at issue.[270] Besides a monetary award, the SEC whistleblower statute provides informants with anti-retaliation protections, including anonymity and a private right of action.[271] The SEC whistleblower program has been an undeniable success: from its inception to the end of Fiscal Year 2019, 67 whistleblowers received approximately $387 million for cooperating with the SEC.[272] On the whole, whistleblowers' tips have helped the SEC to recover more than $2 billion in financial remedies.[273]

In spite of the SEC whistleblower program's success, Congress has failed to provide antitrust whistleblowers even with minimal job retaliation protection.[274] In 2011, the Government Accountability Office issued a report ("the Report") on Criminal Cartel Enforcement recommending that Congress enact protections for whistleblowers who report criminal antitrust violations.[275] This Report emphasized the consensus among key stakeholders that whistleblowers should be protected from retaliation.[276] Although the Report noted that some stakeholders believed that a whistleblower reward would be an effective additional tool in detecting and destabilizing cartels, the Report found that there was no consensus on the issue and that

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269 *Id.* § 78u–6.

270 Kerschberg, *supra* note 266.

271 15 U.S.C. § 78u–6.

272 SEC. & EXCH. COMM'N, WHISTLEBLOWER PROGRAM 1 (Nov. 22, 2019), https://www.sec.gov/files/sec-2019-annual-report-whistleblower-program.pdf [https://perma.cc/9FVN-K4UC].

273 SEC. & EXCH. COMM'N, WHISTLEBLOWER AWARDS FOR TIPS RESULTING IN ENFORCEMENT ACTIONS (Aug. 23, 2019), https://www.sec.gov/page/whistleblower-100million [https://perma.cc/5VUS-JX7X].

274 Robert Connolly, *It Is Time for an Antitrust Whistleblower Statute—Part 2*, CARTEL CAPERS (Nov. 14, 2017), http://cartelcapers.com/blog/time-antitrust-whistleblower-statute-part-2 [https://perma.cc/3JHC-JYW2].

275 *See* STAKEHOLDER VIEWS, *supra* note 263, at 36–37.

276 *See id*.

the DOJ was opposed to the idea.[277] Relying on this Report, Senators Chuck Grassley (Republican) and Patrick Leahy (Democrat) introduced the Criminal Antitrust Anti-Retaliation Act ("the Act") in 2012, which would have provided whistleblowers with protection from workplace retaliation.[278] The Senate unanimously passed similar versions of this legislation in 2013,[279] 2015,[280] 2017,[281] and 2019.[282] However, on all four occasions, the House failed to take up the bill.[283] In light of the Senate's bipartisan support of the Act, observers patiently wait for the House to take up the bill.[284] Meanwhile, because the Report documented the lack of consensus among stakeholders—including the DOJ—regarding a whistleblower reward, this issue has never made it to the language of the Act.[285]

The DOJ's main concern with a whistleblower reward statute is that jurors will not perceive whistleblowers—who will be rewarded from the successful prosecution of those they implicate—as credible.[286] The DOJ points out that, although leniency applicants receive amnesty, their credibility is somewhat maintained because they have to admit their criminal wrongdoing.[287] The Antitrust Division notes that concerns regarding witness credibility are especially emphatic in the criminal context, where the government has to prove its case beyond a reasonable doubt.[288] According to the Department, although ninety percent of the cartel enforcement cases

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277 *See id*.

278 Mark L. Krotoski & Bernard W. Archbold, *US Senate Passed Criminal Antitrust Anti-Retaliation Act*, MORGAN LEWIS (Oct. 22, 2019), https://www.morganlewis.com/pubs/us-senate-passes-criminal-antitrust-anti-retaliation-act [https://perma.cc/U923-PNZB].

279 S. 42, 113th Cong. (2013).

280 S. 1599, 114th Cong. (2015).

281 S. 807, 115th Cong. (2017).

282 S. 2258, 116th Cong. (2019).

283 Connolly, *supra* note 274; *see All Information (Except Text) for S.2258—Criminal Antitrust Anti-Retaliation Act of 2019*, CONGRESS.GOV, https://www.congress.gov/bill/116th-congress/senate-bill/2258/all-info [https://perma.cc/RR7L-8GCA].

284 *See* Krotoski & Archbold, *supra* note 278. Notably, it is the House that usually passes bills that die in the Senate. *See e.g.*, Juliegrace Brufke, *569 House-Passed Bills Await Action in the Senate*, HILL (July 11, 2018), https://thehill.com/homenews/house/396401-569-house-passed-bills-await-action-in-the-senate [https://perma.cc/WYD3-2N2W].

285 Connolly, *supra* note 274.

286 *See* STAKEHOLDER VIEWS, *supra* note 263, at 39.

287 *See id.* at 40.

288 *See id.* at 39.

are settled by plea agreements, in the ten percent of the cases that go to trial, the Department virtually always utilizes the leniency applicants' testimony.[289] Also, the DOJ is concerned with the possibility that a whistleblower reward can undermine companies' internal compliance programs.[290]

Connolly and Justice argue that all of the aforementioned arguments "are really quite weak."[291] The pair points out that "it is not logical to worry about the credibility of witnesses you would otherwise not even know about absent a whistleblower statute."[292] Further, Connolly explains that an antitrust crime typically involves many culpable actors and a whistleblower would generally "get the ball rolling" and provide evidence that will turn other witnesses and allow the Department to obtain subpoenas and search warrants.[293] As to those rare cases that do go to trial, a whistleblower who stands to receive a financial reward does not seem that much less credible than a leniency applicant who testifies against other cartel members to gain amnesty.[294] Arguably, the fear of one's loss of liberty via incarceration is a stronger motivator than pecuniary gain; therefore, there is an argument that bounty recipients might be even more credible than leniency applicants in this context.

Also, while the concern that a whistleblower reward could undermine companies' internal compliance program "seems more legitimate," it can hardly be dispositive.[295] Connolly and Justice explain that the Division would still be able to approach a company with a credible compliance program and seek to negotiate a leniency application, i.e., so-called affirmative leniency.[296] Alternatively, a truly comprehensive compliance program can be taken into consideration by the DOJ at the charging and sentencing stage.[297] Furthermore, Connolly and Justice argue that if cartels are getting

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289 *See id.* at 40.
290 *Id.* at 42.
291 Connolly & Justice, *supra* note 244, at 2.
292 Connolly, *supra* note 274.
293 Connolly & Justice, *supra* note 244, at 2.
294 Connolly, *supra* note 274.
295 *Id*.
296 *Id*.
297 *Id*.

exposed by employees who decide to knock on the door of a prosecutor rather than a compliance officer, the balance of equities favors detecting cartels and stopping damaging price-fixing schemes from harming consumers.[298]

Other advocates for an antitrust bounty statute note that the statute can have a similar provision to the one contained in the Dodd–Frank Act, which requires whistleblowers from public companies with robust compliance programs to also report illegal conduct internally without stripping the whistleblowers of their reward.[299] In fact, a key goal of the Dodd–Frank Act—which has largely been achieved—was to use the SEC whistleblower system itself to incentivize the widespread adoption of robust compliance programs by public corporations.[300] This suggests that a strong internal compliance system will not be affected by a whistleblower bounty statute, as the two aspects of the enforcement scheme work well together, rather than being mutually exclusive.

Connolly and Justice also argue that a widespread concern that a bounty statute will enable a mastermind cartel to receive a financial reward is detached from reality.[301] They explain that an antitrust bounty statute would include the provision, similar to the one the SEC has, that denies a bounty for those who have been convicted of a criminal violation that they themselves reported.[302] Accordingly, to receive a bounty, every potential whistleblower with some criminal exposure would first have to obtain immunity under the Leniency Program.[303] During the leniency negotiations, the DOJ would decide whether an informant is eligible only for

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298 *See* Connolly & Justice, *supra* note 244.

299 STAKEHOLDER VIEWS, *supra* note 263, at 43.

300 *See* SEC. & EXCH. COMM'N, 2018 ANNUAL REPORT TO CONGRESS: WHISTLEBLOWER PROGRAM 17 (2018), https://www.sec.gov/sec-2018-annual-report-whistleblower-program.pdf [https://perma.cc/QS4N-6DCQ] ("Of the award recipients who were current or former employees of a subject entity, approximately eighty-three [percent] raised their concerns internally to their supervisors, compliance personnel, or through internal reporting mechanisms, or understood that their supervisor or relevant compliance personnel knew of the violations, before reporting their information of wrongdoing to the Commission.").

301 Connolly, *supra* note 274.

302 *Id*.

303 *Id*.

leniency, a whistleblower bounty, or for both.[304] The necessity of first seeking immunity would ensure that the Antitrust Division retains significant control over the decision whether a whistleblower is eligible for a reward.[305] Moreover, according to Connolly and Justice, a whistleblower bounty would be an amount to be determined.[306] Hence, the DOJ would be able to reduce a bounty based on a whistleblower's involvement in the cartel.[307]

Connolly and Justice argue that rewarding low-level employees—given the risks and expenses they face providing valuable information—is a reasonable exchange.[308] Under conspiracy law, low-level employees are liable for the actions of a cartel if they take a single act in furtherance of the illegal scheme while aware of its existence.[309] Thus, salespeople who know that their company is involved in a price-fixing scheme are liable as conspirators if they prepare a single bid that is a part of the scheme.[310] In fact, low-level employees are usually the ones who communicate with competitors, attend meetings, and oversee the implementation of the cartel.[311] An employee with such first-hand knowledge of the cartel's inner workings can be an effective whistleblower, and the DOJ—according to Connolly and Justice—would still have plenty of cartel members to prosecute.[312]

III. ASSESSING PROPOSED SOLUTIONS: THE BEST SOLUTION IS TO IMPLEMENT THE WHISTLEBLOWER BOUNTY PROGRAM BEFORE CARTEL SCREENING

These solutions—cartel screening and the whistleblower bounty program—are not mutually exclusive. Their implementation can enable the DOJ to target algorithmic cartels both proactively (with cartel screening) and reactively (with the whistleblower bounty

304 *Id*.
305 *Id*.
306 *Id*.
307 *Id*.
308 *Id*.
309 *Id*.
310 *Id*.
311 *Id*.
312 Connolly & Justice, *supra* note 244.

program). Furthermore, both solutions can complement each other and work in unison with the existing Leniency Program. After red flags are raised by cartel screening, the DOJ's investigation into a particular firm may trigger either the firm's leniency application or a whistleblower coming forward with information necessary for conviction. The Department would retain significant discretion in deciding which of the two options are more appropriate, depending on the culpability of actors involved, the timing of the disclosure, and the likelihood of a successful conviction without cooperation from leniency applicants or whistleblowers. Implementing both solutions, the antitrust authorities would be able to address the challenging task of detecting algorithmic and regular cartels. Although the optimal solution is to implement cartel screening and the whistleblower bounty program together, it would be more effective and efficient to implement the latter before the former.

Such an order of implementation would be cost-effective because it can eliminate the need for Ezrachi and Stucke's proposed research program. This research—aimed at determining algorithmic features and the digital markets environment that raise red flags—would be necessary[313] because traditional structural and behavioral approaches to screening are inadequate for the effective detection of algorithmic cartels.[314] However, the whistleblower bounty program can alleviate the need for this research because whistleblowers such as algorithms' developers, programmers, and computer technicians—who monitor algorithms on a daily basis—would be able to provide the authorities with valuable insight into algorithmic features that lead to collusion. Over time, by investigating cases of algorithmic cartels uncovered by whistleblowers, governmental agencies will acquire the necessary expertise on the issue. Because such expertise would be gained in practice—accounting for the real-time market conditions—it will ensure more accuracy in these agencies' decisions to bring a legal challenge and therefore would eliminate the risk of targeting benign algorithmic practices, depressing innovation, and wasting resources.

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313 Ezrachi & Stucke, *supra* note 120, at 28.

314 *See* OECD, *supra* note 21, at 24; *see also* DIRECTORATE, *supra* note 162, at 3.

Because antitrust whistleblowers' eligibility for a reward will be conditioned on a successful conviction, there is a guarantee that the costs of providing the reward will be offset by the criminal fines.[315] Also, the whistleblower bounty program—which would generally require the DOJ to sit back and wait for "smoking gun" evidence to knock on the door—would not require extensive expenditure for its implementation. Conversely, the launch of cartel screening would entail substantial investment in Ezrachi and Stucke's proposed research program. For the program to be effective, computer scientists, economists, and antitrust experts must work together, shadow the industry's algorithms, and run different variations of algorithms in various simulated market conditions.[316] All of this would be much more costly than simply paying those with existing knowledge to share it.

Furthermore, the screening itself can impose considerable costs even if agencies use algorithms to screen for cartels. At the stage of initial screening, after agencies' algorithms identify industries' algorithms that raise red flags, the authorities would be able to get only the black box access to suspect algorithms (unless firms' algorithmic codes are publicly accessible); therefore, the authorities would only have access to the algorithms' output and, if lucky, the dataset used to generate it.[317] To verify whether a specific outcome was caused by suspect algorithms, the authorities would have to invest in empirical scientists and economists to perform repeatability analyses.[318] After repeatability analyses, the antitrust enforcers would still have to investigate whether algorithmic decision-making is indicative of cartel existence. If an algorithmic decision tree is not readily available, the agencies would need to use publicly available algorithms to recreate the outcomes yielded by the algorithm at issue to discover the features it used.[319] To do so, the agencies need to have familiarity with state-of-the-art algorithms that can help them

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315 *See* 15 U.S.C. § 78u–6 (2004); *see also* Connolly, *supra* note 274.

316 *See* Ezrachi & Stucke, *supra* note 120, at 28; *see also* Abrantes-Metz & Metz, *supra* note 228, at 3–4.

317 *See* Gal, *supra* note 178, at 5–6; *see also* Deven R. Desai & Joshua A. Kroll, *Trust but Verify: A Guide to Algorithms and the Law*, 31 HARV. J.L. & TECH. 1, 55 (2017).

318 Gal, *supra* note 178, at 5–6.

319 *See* Gal, *supra* note 10, at 115; *see also* Gal, *supra* note 178, at 5–6.

understand whether the algorithm's decision-making took into account features that suggest the existence of a cartel.[320] Yet, such know-how and technologies are not currently accessible to the DOJ or the FTC because the antitrust community is largely playing catch-up on the technical aspects of algorithms.[321] As described by the former FTC Commissioner Ohlhausen, "[t]he innerworkings of these tools are poorly understood by virtually everyone outside the narrow circle of technical experts that directly work in the field."[322]

Perhaps the biggest downside of implementing screening before the whistleblower bounty program is the risk that the authorities would be stuck wasting their time and resources on investigating benign cases of parallel pricing while letting disruptive algorithmic cartels slip through the cracks. Meanwhile, whistleblowers, assumed to be reasonable people, would neither waste the DOJ's time nor risk perjuring themselves and facing criminal charges by bringing frivolous claims unless they are confident in the merits of their claims and the prospects of financial reward.

Another reason why the implementation of the whistleblower bounty program is more urgent than cartel screening is the former's ability to serve as an effective counterforce against cartels' use of pricing algorithms to stabilize their operations. As Connolly notes, a mere possibility that a single member of a cartel can provide actionable information and receive a reward would significantly destabilize the cartel.[323] To the contrary, screening does not seem to provide the effect of destabilization that strikes at the heart of the cartel's existence, i.e., the trust that it will not be exposed by its fellow cartelists or employees.[324] The statement of fraud convict Sam E. Antar, former Crazy Eddie CFO, is illustrative: "In the two decades I was deeply involved in the Crazy Eddie fraud, the only threat [that] made us lose sleep at night was the possibility of a

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320 *See* Gal, *supra* note 178, at 6.

321 Ai Deng, *An Antitrust Lawyer's Guide to Machine Learning*, CARTEL CAPERS (Dec. 6, 2017), http://cartelcapers.com/blog/antitrust-lawyers-guide-machine-learning-guest-post-ai-deng-phd [https://perma.cc/QS8Q-VGZL].

322 Deng, *supra* note 23, at 82.

323 Connolly, *supra* note 217.

324 *See* Deng, *supra* note 141; *see also supra* note 143 and accompanying text.

whistleblower blowing the lid on our crimes."[325] Although screening efforts would certainly place algorithmic cartels on guard, it is unlikely that screening would either destabilize algorithmic cartels or make companies forgo engaging in price-fixing schemes altogether. Rather, in light of the inherent obscurity of algorithms and the complexities of analyzing them, companies would still use algorithms to fix prices: the firms would hope that they would not be detected or that they would still be able to prevail in courts (since the DOJ would only be able to present jurors with "plus factors" from which a conspiracy can be inferred).[326]

While the use of algorithms to screen for cartels has already proven fruitful,[327] the success of the SEC whistleblower program also suggests that a similar antitrust program would be effective in cartel detection.[328] A high probability of success of the antitrust bounty statute is also supported by the recent work of the Antitrust Division with a *qui tam* whistleblower program.[329] In November 2018, the DOJ settled criminal ($82 million) and civil ($154 million) antitrust and *qui tam* claims against SK Energy Co. Ltd., GS Caltex Corporation, and Hanjin Transportation Co. Ltd.[330] The *qui tam* whistleblower uncovered the bid-rigging scheme that the defendants orchestrated to secure military fuel-supply contracts from the government.[331] The DOJ recovered both under the FCA for defrauding

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325 Robert Connolly, *Whistleblowing and Criminal Antitrust Cartels: A Primer and Call for Reform*, Cartel Capers (Dec. 12, 2019), http://cartelcapers.com/blog/whistleblowing-and-criminal-antitrust-cartels-a-primer-and-call-for-reform [https://perma.cc/JZ8X-MX28]; *see also* Henry Cutter, *SEC Seeks Right to Cut Whistleblower Bounties*, WALL ST. J. (June 29, 2018, 9:00 AM), https://www.wsj.com/articles/sec-proposes-whistleblower-awards-for-smaller-cases-1530212390 [https://perma.cc/KA8V-JUWF].

326 *See supra* Part I.E; Part II.A.

327 *See* Abrantes-Metz & Metz, *supra* note 228, at 3–4; OECD, *supra* note 21, at 14; *see also supra* Part II.C.

328 *See supra* Part II.D; *see also* Connolly, *supra* note 274.

329 *See* United States v. GS Caltex Corp., No. 18-1456, 2019 US Dist. LEXIS 125998, at *2 (S.D. Ohio Mar. 14, 2019).

330 Ross Brooks, *Recent DOJ Settlement of Qui Tam and Antitrust Claims in Bid-Rigging Case Shows That an Additional Remedy Does Not Have to Be an Alternate Remedy*, CASE TEXT (Jan. 9, 2019), https://casetext.com/analysis/recent-doj-settlement-of-qui-tam-and-antitrust-claims-in-bid-rigging-case-shows-that-an-additional-remedy-does-not-have-to-be-an-alternate-remedy [https://perma.cc/JK5P-ZFWK].

331 *Id.*

the government and under Section 4(A) of the Clayton Act,[332] which amended the Sherman Act to provide injured parties the right to collect their economic losses caused by the "anti-competitive effect" of the defendants' actions.[333] The fact that it was the *qui tam* whistleblower who uncovered the scheme that would have otherwise gone undetected illustrates the necessity of the antitrust bounty program. The antitrust whistleblower statute is needed precisely because the FCA's *qui tam* action is unavailable in price-fixing schemes where the private sector and consumers, rather than the government, are damaged.[334]

Another example that illustrates the effectiveness of rewarding whistleblowers for reporting violations of competition law is a cartel whistleblower program in South Korea. South Korea introduced its cartel whistleblower policy in 2002.[335] The program has already led to convictions that would not have otherwise occurred[336]; and in early 2019, the program awarded the highest whistleblower reward to date (690 million Won, which is approximately $587,000) to an informant in a price-fixing case.[337] Notably, the implementation of the whistleblower program coincided with the trend towards improving South Korean companies' internal compliance programs: an increasing number of companies are now offering anonymous whistleblower hotlines.[338] This trend suggests that whistleblowing

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332 15 U.S.C. § 15(a) (2004).

333 *See* United States v. Beatrice Foods, 330 F. Supp. 577, 580 (D. Utah 1971) (noting that "[h]ad Congress in passing Section 4A [of the Clayton Act] intended to preclude application of the [FCA] to conduct also constituting an antitrust violation, it would not have been difficult, and it would be expected for it, to so indicate . . . .").

334 *See* Connolly, *supra* note 274.

335 *See* Andreas Stephan*, Is the Korean Innovation of Individual Informant Rewards a Viable Cartel Detection Tool?* 1, 5 (ESRC Ctr. for Competition Pol'y, Working Paper No. 14–3, 2014), http://competitionpolicy.ac.uk/documents/8158338/8199490/CCP+Working+Paper+14-3.pdf/7a9c1d06-d790-4e83-86bf-d43c68c83d0d [https://perma.cc/F8DG-KGGD].

336 *See id*.

337 Hee Won (Marina) Moon et al., *Recent Developments in Anti-Corruption Enforcement in South Korea*, WWL (Sept. 3, 2019), https://whoswholegal.com/features/recent-developments-in-anti-corruption-enforcement-in-south-korea [https://perma.cc/YK2U-KARE].

338 *Id*.

improves the private sector's internal compliance initiatives rather than undermines them.

Finally, it should be noted that, while the DOJ seems to be opposed to the whistleblower bounty statute, the rationale for such opposition is so "weak" that it might be a pretext, hinting at the DOJ's caution in introducing any new tools to its Leniency Program that, while not perfect, still works.[339] If that is the case, the Department probably would also be opposed to the screening program if it is formally proposed and considered. However, this aversion to change is detached from reality because the whistleblower statute would not even change the Leniency Program, but rather would simply supply an additional tool to assist the DOJ in cartel detection and prosecution.

CONCLUSION

Considering the low detection rate of cartels in general and the inherent obscurity of algorithmic cartels in particular, it is not surprising that *Topkins* has been the only case involving algorithmic price-fixing prosecuted to date in the United States.[340] The increased difficulty of detecting algorithmic cartels, as documented in this Note, can be effectively addressed by adopting the whistleblower and cartel screening programs. They can complement each other and work in unison with the DOJ's existing Leniency Program, thereby increasing the detection rate of algorithmic cartels.

However, after analyzing the proposed solutions, it becomes clear that governmental authorities should implement the whistleblower statute before they launch cartel screening. The value of this order of implementation lies in whistleblowers' ability to "educate" the authorities about complex algorithmic features, which must be understood to perform cartel screening.[341] Because whistleblowers

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339 *See* Connolly & Justice, *supra* note 244, at 2; *see also* Connolly, *supra* note 274.

340 *See* Plea Agreement at 3–4, United States v. Topkins, No. 15-00201 (N.D. Cal. Apr. 30, 2015).

341 Ezrachi and Stucke propose to screen the digital markets for collusion. To better understand what factors are indicative of algorithmic collusion and, therefore, worth exploring further, Ezrachi and Stucke encourage enforcers to begin commissioning or

such as algorithms' developers, programmers, and computer technicians monitor algorithms on a daily basis, they are well-equipped to provide the authorities with valuable information about algorithmic features that lead to collusion. Whistleblowers, presumptively reasonable people, would come forward only if they are confident that their information would lead to a cartel detection and, therefore, a financial reward. Accordingly, by investigating cases of algorithmic cartels based on whistleblowers' inside information, the authorities would gain the expertise necessary to perform cartel screening accurately. Given the advantages that pricing algorithms have generated for businesses and consumers, it is essential to avoid the risk of targeting benign algorithmic practices, which would undermine technological development and the associated benefits that come with it.[342] The whistleblower bounty program can achieve this delicate task of enforcing antitrust laws without inhibiting innovation.

Moreover, the program is an effective and efficient way to begin the "hunt" for algorithmic cartels. If properly advertised, the program can start yielding results immediately after its introduction by incentivizing whistleblowers, who already are in possession of actionable information, to come forward. The program would not require extensive expenditures for its implementation; and, because a bounty will be contingent on a successful conviction, there is a guarantee that the costs of providing a whistleblower reward will be offset by criminal fines. Furthermore, having an informant with knowledge about the cartel would substantially eliminate the possibility that the authorities would be wasting their time and resources investigating benign cases of parallel pricing. Finally, incentivizing cartels' insiders to blow the whistle will serve as an effective counterforce to cartels' use of algorithms to stabilize their operations.

Given that cartels remain "the supreme evil of antitrust"[343] and algorithms are clearly going to be a large part of the world's economy moving forward, it is imperative to come up with adequate tools for detecting algorithmic cartels, which have unprecedented

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internally conducting experimental research of pricing algorithms. *See* Ezrachi & Stucke, *supra* note 8, at 1806.

342 *See supra* Part I.A.

343 Verizon Commc'ns Inc. v. Law Offices of Curtis V. Trinko, LLP, 540 U.S. 398, 408 (2004).

potential to harm consumers. Arguably, tacit algorithmic collusion—reached by deep-learning algorithms—can present an even greater threat to consumers. Because the firms that employ these deep-learning algorithms can collude without even knowing it, authorities face a challenging question of whether they can impose any liability on such firms. While it is unclear whether agencies should regulate such deep-learning algorithms, the government should certainly continue to enforce the existing antitrust laws. Whereas cartel screening is a desirable but out-of-reach regulatory tool, the whistleblower bounty program can be implemented immediately. Because the whistleblower statute would enable the DOJ to increase its detection rate of not only regular, but also algorithmic cartels, the passage of such a statute—followed by the launch of cartel screening—is more urgent than ever for eliminating price-fixing cartels. As price-fixing cartels employ new means such as advanced algorithms to carry out their conspiracies, Congress's and the DOJ's unwillingness to adopt new tools to fight such cartels is no longer acceptable.