ALGORITHMIC COLLUSION: REVIVING SECTION 5 OF THE FTC ACT

*Aneesa Mazumdar**

Although antitrust scrutiny of "big tech" companies has increased drastically over the past decade, much of the national debate has concerned issues of monopolization and the Sherman Act—the dominant federal antitrust statute. But with rapid developments in artificial intelligence and machine learning, algorithmic price fixing has become an increasingly pressing threat that the Sherman Act is ill-equipped to tackle. Under the current framework, the challenge of establishing the existence of an agreement between competitors in cases in which the algorithms have evolved beyond their programmers' intentions presents difficulties to regulators.

This Note underscores that section 5 of the Federal Trade Commission (FTC) Act offers a broader mandate to antitrust regulators and argues that it is the best vehicle for bringing price-fixing claims against companies that use algorithms to collude with one another. Unlike the Sherman Act, the FTC Act bans unilateral conduct and invitations to collude. It can reach collusive conduct without the showing of an agreement. While circuit courts have curbed the scope of the FTC Act by finding that tacit collusion is lawful, the FTC still retains the authority to bring standalone actions for section 5 violations. This Note presents a framework for regulators to consider when bringing a standalone section 5 action for algorithmic collusion. It argues that algorithms function as public announcements and should be scrutinized more carefully—first, for certain market characteristics indicating that collusion would benefit market players, and second, for the existence of plus factors that demonstrate the likelihood of actual collusion.

INTRODUCTION 450
I. THE FEDERAL PRICE-FIXING SCHEME 454
A. The Sherman Act 454
1. Contracts, Conspiracies, and Conscious Parallelism 455
2. Unreasonable Restraints and Standards of Review 458
B. The FTC Act 460
1. Legislative History and Enforcement 460
2. Incipiency and Invitations 465

* J.D. Candidate 2022, Columbia Law School. I'd like to thank Professor Lina Khan for her thoughtful guidance and comments, John Clayton for his careful reads and feedback, and the staff of the *Columbia Law Review* for their excellent editorial assistance. All views expressed and any errors are my own.

II. ALGORITHMS AND ENFORCEMENT 466
A. Types of Collusion 467
1. With Clear Evidence of an Agreement 468
a. Messenger 468
b. Hub and Spoke 468
2. Without Clear Evidence of an Agreement 470
a. Predictable Agent 470
b. Digital Eye 471
B. Enforcement 472
1. Sherman Act 472
2. FTC Act 473
III. ALGORITHMS AND ANNOUNCEMENTS UNDER THE FTC ACT 475
A. Treating Algorithms as Announcements 475
B. Examining the Evidence and the Market 479
1. Market Characteristics 479
2. Observable Plus Factors 481
C. Overview and Addressing Concerns 483
1. Summary of Framework 484
2. Counterarguments and Rebuttal 484
CONCLUSION 487

INTRODUCTION

It started with flies. At its peak, *The Making of a Fly*, a biology textbook for fly researchers, was priced at almost $24 million on Amazon.[1] The book, originally printed in 1992, was out of print by 2011, but Amazon had listed seventeen copies for sale.[2] While the fifteen used copies started at $35, the two new copies—sold by two different sellers—started at well over $1 million.[3] Every day, the prices of both copies increased by set multiples; the sellers had pegged their prices to each other's, causing a feedback loop, which only stopped once someone noticed the outlandish amount.[4]

---

1. Olivia Solon, How a Book About Flies Came to Be Priced $24 Million on Amazon, WIRED (Apr. 27, 2011), https://www.wired.com/2011/04/amazon-flies-24-million [https://perma.cc/BB5A-BSEW].

2. Id.

3. Michael Eisen, Amazon's $23,698,655.93 Book About Flies, It Is Not Junk: A Blog About Genomes, DNA, Evolution, Open Science, Baseball and Other Important Things (Apr. 22, 2011), http://www.michaeleisen.org/blog/?p=358 [https://perma.cc/UHL7-N3UA].

4. Id. ("Once a day profnath set their price to be 0.9983 times bordeebook's price. The prices would remain close for several hours, until bordeebook 'noticed' profnath's change and elevated their price to 1.270589 times profnath's higher price.").

Eventually, the price peaked at $23,698,655.93. The next day, the price dropped to $106.23.[5]

While this particular incident might be explained away by poor oversight on the part of the sellers, the use of algorithmic pricing on Amazon, as well as on other online platforms, has become increasingly common,[6] sometimes causing incredibly high—or low—prices.[7] In particular, the prevalence of algorithmic pricing has led to increased concerns about effective regulation of these algorithms to prevent price fixing between competitors, whether inadvertent or not.

Thus, this Note proposes a framework for the federal enforcement of antitrust prohibitions against price collusion between algorithms. As more companies adopt algorithms to determine prices, recent legal scholarship has noted that competitors may be able to collude with one another, resulting in price fixing, without triggering scrutiny under the federal antitrust statutes as they are currently being enforced.[8] And as these pricing algorithms often use fast-developing technologies like machine learning[9] or artificial intelligence,[10] companies may—even unwittingly—coordinate with other competitors to arrive at a supracompetitive price. Well-meaning

---

5. Id.

6. See Le Chen, Alan Mislove & Christo Wilson, An Empirical Analysis of Algorithmic Pricing on Amazon Marketplace, *in* Proceedings of the 25th International Conference on World Wide Web 1339, 1345 (Ass'n for Computing Mach. 2016) (estimating that more than a third of all Amazon sellers who changed prices frequently used algorithms). This fraction has likely increased since then. See, e.g., David Grossman, Left to Their Own Devices, Pricing Algorithms Resort to Collusion, Popular Mechanics (Feb. 12, 2019), https://www.popularmechanics.com/technology/robots/a26309827/left-to-their-own-devices-pricing-algorithms-resort-to-collusion [https://perma.cc/79V4-ZUJZ] ("A study from 2015 showed that a third of all items on Amazon had prices set by an algorithm, and chances are that percentage has only risen.").

7. See David Z. Morris, What Causes Crazy-High Prices on Wayfair and Amazon?, Fortune (July 14, 2020), https://fortune.com/2020/07/14/wayfair-cabinet-conspiracy-algorithm-amazon-pricing-ecommerce [https://perma.cc/4K4X-SWGD]; Rupert Neate, Amazon Sellers Hit by Nightmare Before Christmas as Glitch Cuts Prices to 1p, Guardian (Dec. 14, 2014), https://www.theguardian.com/money/2014/dec/14/amazon-glitch-prices-penny-repricerexpress [https://perma.cc/7VL2-WQF4].

8. See, e.g., Ariel Ezrachi & Maurice E. Stucke, Artificial Intelligence and Collusion: When Computers Inhibit Competition, 2017 U. Ill. L. Rev. 1775, 1794, 1796 [hereinafter Ezrachi & Stucke, When Computers Inhibit Competition] (describing the challenges of regulating certain types of algorithms); Ariel Ezrachi & Maurice E. Stucke, Sustainable and Unchallenged Algorithmic Tacit Collusion, 17 Nw. J. Tech. & Intell. Prop. 217, 255–58 (2020) [hereinafter Ezrachi & Stucke, Algorithmic Tacit Collusion] (noting the need to update "current antitrust policies" to resolve issues of algorithmic collusion).

9. See, e.g., How Do I Turn Smart Pricing On or Off?, Airbnb Help Ctr., https://www.airbnb.com/help/article/1168/how-do-i-turn-smart-pricing-on-or-off (on file with the *Columbia Law Review*) (last visited Jan. 12, 2021) (providing an opt-in algorithmic pricing feature for hosts).

10. See, e.g., Uber AI, Uber, https://www.uber.com/us/en/uberai/?_ga=2.145952564.1449153791.1600984909-1051261321.1600984909 [https://perma.cc/A7AY-PQG7] (last visited Jan. 12, 2021) (describing how artificial intelligence "powers many of the technologies and services underpinning Uber's platform").

companies may not intend to collude, but the "black box" nature of algorithms can often result in unintentional price coordination.[11]

Price collusion claims can be litigated under either section 1 of the Sherman Act or section 5 of the FTC Act.[12] But most price-fixing cases are brought under the Sherman Act, as for years the FTC expressed reluctance to challenge practices on a standalone section 5 basis when the Sherman Act could sufficiently address the uncompetitive practice.[13] But while price collusion can be per se illegal under section 1 of the Sherman Act, the statutory case law requires evidence, whether direct or circumstantial, of an agreement between competitors to fix prices to prove a statutory violation.[14] On the other hand, section 5 of the FTC Act does not require an explicit showing of an agreement for antitrust claims.[15] Section 5 is thus more expansive than the Sherman Act, as it also bars unilateral conduct such as invitations to collude.[16] Consequently, it is easier to file suit under the FTC Act against individuals or companies that rely on more complex algorithms to fix prices without directly communicating with one another. But after a series of "adverse appellate rulings in the 1980s involving Commission attempts to expand Section 5 beyond the Sherman Act," the

---

11. See infra section II.A.2.

12. See The Antitrust Laws, FTC: Protecting Am.'s Consumers, https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws/antitrust-laws [https://perma.cc/Q4QJ-RN7L] (last visited Jan. 12, 2021) (listing both the Sherman Act and FTC Act as mechanisms to enforce price-fixing prohibitions).

13. FTC, Statement of Enforcement Principles Regarding "Unfair Methods of Competition" Under Section 5 of the FTC Act (Aug. 13, 2015), https://www.ftc.gov/system/files/documents/public_statements/735201/150813section5enforcement.pdf [https://perma.cc/BFC7-K2N6] [hereinafter FTC, Statement of Enforcement Principles] ("[T]he Commission is less likely to challenge an act or practice as an unfair method of competition on a standalone basis if enforcement of the Sherman or Clayton Act is sufficient to address the competitive harm arising from the act or practice."). This policy statement was rescinded in 2021, but it has not yet been replaced with further guidance. FTC, Statement of the Commission: On the Withdrawal of the Statement of Enforcement Principles Regarding "Unfair Methods of Competition" Under Section 5 of the FTC Act (July 9, 2021), https://www.ftc.gov/system/files/documents/public_statements/1591706/p210100commnstmtwithdrawalsec5enforcement.pdf [https://perma.cc/KQX8-RGFP] [hereinafter FTC, Statement on Withdrawal].

14. See, e.g., Bell Atl. Corp. v. Twombly, 550 U.S. 544, 553 (2007) ("[T]he crucial question is whether the challenged anticompetitive conduct stem[s] from independent decision or from an agreement, tacit or express." (second alteration in original) (internal quotation marks omitted) (quoting Theatre Enters. v. Paramount Film Dist. Corp., 346 U.S. 537, 540 (1954))).

15. See, e.g., In re Musical Instruments & Equip. Antitrust Litig., 798 F.3d 1186, 1196 (9th Cir. 2015) ("[U]nlike § 1 of the Sherman Act, a violation of § 5 of the FTC Act does not require allegation and proof of a contract, combination, or conspiracy.").

16. Barbara Blank & Eric Sprague, A Compliance Check for Collaborators Who Also Compete, FTC: Protecting Am.'s Consumers (Aug. 16, 2016), https://www.ftc.gov/news-events/blogs/competition-matters/2016/08/compliance-check-collaborators-who-also-compete [https://perma.cc/RSU5-CW87] ("Invitations to collude, which are solicitations by one competitor to another to coordinate on price, output, or other important terms of competition, can cause competitive harm, and therefore violate Section 5 of the FTC Act.").

FTC generally abandoned bringing standalone section 5 price-fixing claims in court, a policy that was formalized in 2015.[17]

Several academics have noted the Sherman Act's deficiencies when it comes to vigorously enforcing against anticompetitive algorithmic conduct.[18] Others have pointed out that a potential solution for algorithmic collusion may lie in the FTC Act instead.[19] But no attempt has yet been made to map out an outline for bringing a standalone section 5 claim in algorithmic price-fixing cases. Thus, this Note aims to provide an overview of how section 5 can be used effectively to regulate different types of algorithmic collusion.

Specifically, this Note argues that the FTC Act, given its broader powers, remains the best enforcement mechanism to challenge algorithmic price fixing, and prior cases that limited the scope of section 5 should be revisited in light of rapid technological developments. Part I describes the current statutory regime of federal antitrust law with a focus on the Sherman and FTC Acts. While price fixing is a per se violation of the Sherman Act, a collusion claim requires evidence of an agreement. In contrast, the FTC Act contains a broader prohibition on all unfair methods of competition and does not require an agreement among competitors.

Part II describes four broad categories of pricing algorithms and the challenges they pose to enforcement. While some algorithms are built with a clear intention to collude, others are more opaque. A conventional application of the antitrust framework is sufficient to regulate the simpler algorithms. But with the advent of artificial intelligence and other technologies, the more sophisticated algorithms are capable of evolving beyond what their programmers had initially built them for.[20] It is these algorithms that will present major challenges to antitrust enforcers.

---

17. James C. Cooper, The Perils of Excessive Discretion: The Elusive Meaning of Unfairness in Section 5 of the FTC Act, 3 J. Antitrust Enf't 87, 88 (2015); see also FTC, Statement of Enforcement Principles, supra note 13.

18. See, e.g., Salil K. Mehra, Antitrust and the Robo-Seller: Competition in the Time of Algorithms, 100 Minn. L. Rev. 1323, 1328 (2016) ("The Sherman Act contains a gap in its coverage under which oligopolists that can achieve price coordination interdependently, without communication or facilitating practices generally escape antitrust enforcement, even when their actions yield supracompetitive pricing that harms consumers." (footnote omitted)).

19. See, e.g., Ezrachi & Stucke, Algorithmic Tacit Collusion, supra note 8, at 233 ("One way is for the US Federal Trade Commission to attack practices that facilitate tacit collusion under its broader powers under Section 5 of the FTC Act, which it hasn't actively pursued in the past few decades.").

20. See Joe Devanesan, Google Has Found a Way for Machine Learning Algorithms to Evolve Themselves, TechWire Asia (May 21, 2020), https://techwireasia.com/2020/05/google-has-found-a-way-for-machine-learning-algorithms-to-evolve-themselves [https://perma.cc/7QWD-DY8W] ("[A]lgorithms can be tested against standard AI problems for their ability to solve new ones. . . . And crucially, those machine learning applications will be free from human input.").

Consequently, Part III suggests that the best way to tackle these algorithms is under the FTC Act: by treating collusive algorithms as announcements and therefore as invitations to collude. Research has indicated that algorithms can evolve to "broadcast" their pricing intentions to other chosen algorithms while also masking these communications from third parties.[21] In doing so, they function as announcements. And when a market satisfies certain structural characteristics that can facilitate collusion, courts should more closely examine any evidence of specific plus factors[22] that might be more prominent in an algorithmic setting. If these structural market characteristics are accompanied by specific plus factors, this should weigh in favor of finding evidence of an invitation to collude.

I. THE FEDERAL PRICE-FIXING SCHEME

This Part provides background on the two primary federal antitrust statutes governing price collusion. Section I.A lays out the components of the Sherman Act and describes the challenges of regulating algorithmic price fixing under the Act. Section I.B traces the history of the FTC Act and outlines its advantages when charging anticompetitive behavior in an algorithmic context.

A. *The Sherman Act*

Price fixing, or an "agreement . . . among competitors that raises, lowers, or stabilizes prices or competitive terms,"[23] has long been deemed illegal.[24] Price collusion cases have traditionally been enforced under section 1 of the 1890 Sherman Act,[25] which prohibits any "contract,

21. See infra notes 189–192 and accompanying text.

22. Plus factors are "economic actions and outcomes, above and beyond parallel conduct by oligopolistic firms, that are largely inconsistent with unilateral conduct but largely consistent with explicitly coordinated action." William E. Kovacic, Robert C. Marshall, Leslie M. Marx & Halbert L. White, Plus Factors and Agreement in Antitrust Law, 110 Mich. L. Rev. 393, 393 (2011); see also infra notes 175–178 and accompanying text.

23. Price Fixing, FTC: Protecting Am.'s Consumers, https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws/dealings-competitors/price-fixing [https://perma.cc/FP29-QH92] (last visited Sept. 20, 2021).

24. See DOJ, Price Fixing, Bid Rigging, and Market Allocation Schemes: What They Are and What to Look For 1 (2021 rev.) (2005), https://www.justice.gov/atr/file/810261/download [https://perma.cc/A6YQ-GJ82] ("Price fixing, bid rigging, and other forms of collusion are illegal . . . .").

25. Sherman Act, Pub. L. No. 51-647, 26 Stat. 209 (1890) (codified at 15 U.S.C. § 1 et seq. (2018)). The Sherman Act emerged as a response to the increased dominance of large businesses and was viewed as necessary to restore a "competitive market" while also imposing both "civil and criminal sanctions for antitrust violations." William H. Page, The Ideological Origins and Evolution of U.S. Antitrust Law, *in* 1 Issues in Competition Law and Policy 1, 5 (2008).

combination . . . , or conspiracy[] in restraint of trade."[26] Section 1 price-collusion suits face two primary challenges: first, the need to prove the existence of a contract between competitors, and second, the lenience given under the rule of reason.

1. *Contracts, Conspiracies, and Conscious Parallelism.* — Section 1 of the Sherman Act "does not prohibit [all] unreasonable restraints of trade" but forbids only those that arise from a contract, combination, or conspiracy.[27] Thus, a successful prosecution or civil action under section 1 of the Sherman Act requires either direct evidence of price fixing or circumstantial evidence of a "meeting of minds in an unlawful arrangement."[28]

It is rare to find direct evidence of an agreement, especially if the combination involves more than two parties.[29] Examples of direct evidence include written contracts[30] or documents explicitly discussing conspirators meeting and deciding to boycott a competitor.[31] But in the absence of a similar smoking gun, the standard for establishing direct evidence is high. For example, courts have found that neither witness testimony describing price information exchanges[32] nor competitors telling one another they could succeed if they "played by the rules"[33] constitutes direct evidence of an agreement.

---

26. 15 U.S.C. § 1; see also United States v. Socony-Vacuum Oil Co., 310 U.S. 150, 221 (1940) ("Any combination which tampers with price structures is engaged in an unlawful activity.").

27. Copperweld Corp. v. Indep. Tube Corp., 467 U.S. 752, 775 (1984); *Socony*, 310 U.S. at 223 ("Under the Sherman Act a combination formed for the purpose and with the effect of raising, depressing, fixing, pegging, or stabilizing the price of a commodity in interstate or foreign commerce is illegal per se.").

28. Am. Tobacco Co. v. United States, 328 U.S. 781, 810 (1946); cf. Monsanto Co. v. Spray-Rite Serv. Corp., 465 U.S. 752, 764 (1984) (requiring evidence of a "conscious commitment to a common scheme designed to achieve an unlawful objective" (quoting Edward J. Sweeney & Sons, Inc. v. Texaco, Inc., 637 F.2d 105, 111 (3d Cir. 1980))).

29. Practical Law Antitrust, Establishing an Agreement Under Section 1 of the Sherman Act, Westlaw 7-565-5646 ("Concerted action is often more difficult to prove in per se cases involving alleged conspiracies or cartels where direct evidence of an agreement is rare.").

30. Geneva Pharms. Tech. Corp. v. Barr Lab'ys Inc., 386 F.3d 485, 508 (2d. Cir. 2004) (reversing a summary judgment order because the plaintiffs had sufficiently shown that a competing manufacturer and its supplier had conspired through a confidentiality agreement to restrain the trade of sodium).

31. Arnold Pontiac-GMC, Inc. v. Budd Baer, Inc., 826 F.2d 1335, 1338 (3d Cir. 1987) (finding that the plaintiffs' production of a memorandum describing the conspirators' meeting was sufficient to establish a genuine issue of material fact regarding concerted action).

32. In re Baby Food Antitrust Litig., 166 F.3d 112, 121 (3d Cir. 1999) (applying the rule of reason to direct evidence that "evinces only an exchange of information among the defendants").

33. InterVest, Inc. v. Bloomberg, L.P., 340 F.3d 144, 162 (3d Cir. 2003) (stating that there was no reason to believe that "the rules" were a reference to an illegal conspiracy).

Those plaintiffs who cannot meet the standard for direct evidence must prove the existence of an agreement through circumstantial evidence—and face a heavy burden to show an inference that the agreement existed.[34] The plaintiff must show circumstantial evidence that "tends to exclude the possibility of independent action" by the alleged conspirators.[35] But crucially, the Supreme Court has long held that "parallel business behavior" is not, in itself, a violation of the antitrust laws.[36] This tacit collusion, also known as conscious parallelism,[37] is defined as the "mere interdependence of basic price decisions."[38] It occurs through "the process by which companies use public announcements, investments, and algorithms to raise prices or depress wages without ever coming to an explicit agreement with one another."[39] This basic interdependence is not considered conspiracy because each firm ostensibly makes a decision to move to the set price unilaterally and without consulting any other firms.[40] Instead, even in an oligopolistic market, courts require more evidence than just conscious parallelism to prove the existence of an agreement.[41] Although tacit collusion can have harmful effects on consumers, the rule has been justified as administrable and difficult to change, as it acts as a shield to protect those who exhibit rational and competitive behavior.[42] Courts have been reluctant to order market participants to engage in conduct that would objectively go against their own self interests.[43]

---

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

35. Id.

36. Theatre Enters., Inc. v. Paramount Film Distrib. Corp., 346 U.S. 537, 541 (1954).

37. Brooke Grp. Ltd. v. Brown & Williamson Tobacco Corp., 509 U.S. 209, 227 (1993).

38. Donald F. Turner, The Definition of Agreement Under the Sherman Act: Conscious Parallelism and Refusals to Deal, 75 Harv. L. Rev. 655, 672 (1962).

39. Brendan Ballou, The "No Collusion" Rule, 32 Stan. L. & Pol'y Rev. 213, 213–14 (2021). As an example, typical large law—or "Big Law"—firms engage in tacit collusion when setting salary scales for their associates. See Sara Randazzo, Entry-Level Lawyers Are Now Making $200,000 a Year, Wall St. J. (June 12, 2021), https://www.wsj.com/articles/entry-level-lawyers-are-now-making-200-000-a-year-11623499201 (on file with the *Columbia Law Review*) ("Corporate law firms are unique among businesses in that they typically increase pay in tandem, with a few market leaders triggering moves throughout the industry.").

40. See Turner, supra note 38, at 673 ("Dominant sellers may make other consciously parallel decisions, interdependent in the sense that all must decide the same way, but free of agreement of the more obvious sorts.").

41. See Valspar Corp. v. E.I. Du Pont De Nemours & Co., 873 F.3d 185, 193 (3d Cir. 2017) ("[T]o prove an oligopolistic conspiracy with proof of parallel behavior, that evidence 'must go beyond mere interdependence' . . . ." (quoting In re Baby Food Antitrust Litig., 166 F.3d 112, 135 (3d Cir. 1999))).

42. See Clamp-All Corp. v. Cast Iron Soil Pipe Inst., 851 F.2d 478, 484 (1st Cir. 1988) (Breyer, J.) ("[Interdependent pricing is not prohibited] not because such pricing is desirable (it is not), but because it is close to impossible to devise a judicially enforceable remedy . . . . How does one order a firm to set its prices *without regard* to the likely reactions of its competitors?").

43. See id.

But in *Bell Atlantic Corp. v. Twombly*, the Supreme Court held that a sufficient complaint for section 1 Sherman Act violations must allege "an agreement, tacit or express."[44] Lower courts have distinguished tacit *agreements* from tacit *collusion* by stating that a tacit agreement must have "uniform behavior among competitors, preceded by . . . conduct that in context suggests that each competitor failed to make an independent decision."[45] As a result, the Sherman Act's requirement for an agreement, and thus dependent decisionmaking, removes liability for unilateral conduct.

In 1968, then-Professor Richard A. Posner proposed a solution to this problem, stating that "tacit collusion . . . is very like express collusion," as both require voluntary behavior and thus should be regulated in a similar manner.[46] He viewed tacit collusion as a form of conspiracy, even when firms act unilaterally, and enumerated several types of evidence—or plus factors—that, when present, should create an inference of noncompetitive pricing.[47] These indications of noncompetitive market pricing range from comparing competitors' changes in market prices to examining their history of having fixed shares of the market.[48] These plus factors, claimed Posner, are examples of "cartel-like conduct" and thus would fall within the scope of section 1.[49]

But decades later, Judge Posner, then on the Seventh Circuit, shifted his stance, holding that tacit collusion, or conscious parallelism, is not prohibited by section 1, even with strong evidence of various plus factors.[50] For example, in *In re Text Messaging Antitrust Litigation*, a class action lawsuit filed against the four largest wireless network providers (AT&T, Verizon, Sprint, and T-Mobile), the plaintiffs alleged that the defendants had conspired with each other to increase the prices for text messaging.[51] In an earlier interlocutory appeal, Posner noted that the plaintiffs alleged multiple facilitating practices, such as the defendants' reliance on shared information, and observed that marginal prices had increased even as marginal costs fell.[52] Despite this evidence, and although the market was effectively an oligopoly, Posner later held that the circumstantial evidence

---

44. 550 U.S. 544, 553 (2007).

45. White v. R.M. Packer Co., 635 F.3d 571, 576 (1st Cir. 2011) (internal quotation marks omitted) (quoting Brown v. Pro Football, Inc., 518 U.S. 231, 241 (1996)). Tacit agreement thus hinges on a lack of independent *decisionmaking*. Tacit collusion, in contrast, involves only the competitors' *recognition* of their shared economic interests and the necessarily resulting interdependence of their price and volume decisions. Id.

46. Richard A. Posner, Oligopoly and the Antitrust Laws: A Suggested Approach, 21 Stan. L. Rev. 1562, 1575 (1969).

47. See id. at 1578–88.

48. Id.

49. See id. at 1583.

50. See In re Text Messaging Antitrust Litig., 782 F.3d 867, 874 (7th Cir. 2015) (arguing that tacit collusion "probably shouldn't be" a violation of the Sherman Act).

51. Id. at 870.

52. In re Text Messaging Antitrust Litig., 630 F.3d 622, 628 (7th Cir. 2010).

to support those allegations could not survive a motion for summary judgment.[53]

In summary, Posner's original proposal that conscious parallelism can and should be regulated under section 1 has fallen by the wayside. It is well-settled law that unilateral parallel conduct—barring very strong circumstantial evidence of a tacit agreement—does not establish a section 1 violation.

2. *Unreasonable Restraints and Standards of Review.* — There are further challenges to regulating price fixing under the Sherman Act. Section 1 has been interpreted to prohibit only "unreasonable restraints" of trade, and courts will apply either the per se rule or the rule of reason in their analysis of section 1 claims.[54] Courts generally consider horizontal price fixing—those agreements between competitors who occupy the same level within an industry[55]—as per se illegal because of its presumptive unreasonableness and will not examine any procompetitive justifications for the restraint.[56] On the other hand, under the rule of reason, courts will determine whether the restraint "merely regulates and perhaps thereby promotes competition or whether it is such as may suppress or even destroy competition."[57] There are several categories of cases in which courts have used the rule of reason. For example, if the horizontal price-fixing agreement is considered ancillary to a lawful joint venture that creates a new product,[58] or is a novel arrangement,[59] courts will rely on this more lenient framework.

---

53. *Text Messaging*, 782 F.3d at 879. Posner relied on arguments similar to those of other proponents of the legality of tacit collusion, asking how sellers in an oligopolistic market were to "avoid getting into trouble" while still producing profits, if they could not base their pricing decisions on their competitors decisions. Id. at 874.

54. State Oil Co. v. Khan, 522 U.S. 3, 10 (1997).

55. Unlike horizontal price-fixing agreements, vertical agreements "take place between firms operating at different levels of production." Sandra Marco Colino, Cartels and Anti-Competitive Agreements, *in* 1 The Library of Essays on Antitrust and Competition Law 1, 1 (Jonathan Galloway, Rosa Greaves & Sandra Marco Colino eds., 2013).

56. See, e.g., Standard Oil Co. of N.J. v. United States, 221 U.S. 1, 64–65 (1911) (claiming that in two cases involving horizontal combinations, application of the per se rule was appropriate and the restraints "could not be taken out of [the per se] category by indulging in general reasoning as to the expediency . . . of having made the contracts).

57. Bd. of Trade of Chi. v. United States, 246 U.S. 231, 238 (1918).

58. See, e.g., Texaco, Inc. v. Dagher, 547 U.S. 1, 6 (2006) (explaining that anticompetitive violations of joint ventures are judged under the rule of reason); Addamax Corp. v. Open Software Found., 152 F.3d 48, 52 (1st Cir. 1998) ("Where the venture is producing a new product . . . there is patently a potential for a productive contribution to the economy, and conduct that is strictly ancillary to this productive effort . . . is evaluated under the rule of reason.").

59. See, e.g., Broad. Music, Inc. v. Columbia Broad. Sys., Inc., 441 U.S. 1, 10 (1979) (noting that claims the Court has never seen before should not be per se outlawed). But see Arizona v. Maricopa Cnty. Med. Soc'y, 457 U.S. 332, 349 n.19, 350–51 (1982) (applying the per se rule despite having little experience in the relevant industry while maintaining that

The per se doctrine evolved out of the recognition that companies can engage in some practices that have such a negative impact on competition that they are deemed to be presumptively unreasonable, thereby obviating the need to show resulting market effects.[60] But the standard to apply this rule is high—only restraints that have "no purpose except stifling of competition" are considered per se violations of the Sherman Act.[61]

Additionally, it is "only after considerable experience with certain business relationships that courts classify them as per se violations."[62] For example, in 1979, the Court declined to apply the per se rule to the issuance of blanket licenses to musical compositions, stating that the rule of reason was more appropriate because of the arrangement's novelty and uniqueness.[63] Similarly, courts may also be unlikely to apply the per se rule to alleged algorithmic price fixing in cases where it is difficult to prove the intent to collude.[64] The relatively recent rise of algorithmic pricing that takes competitors' pricing into account in real time has created new markets and new business relationships.[65] To err on the side of caution, courts may be reluctant to apply a complete prohibition to all cases involving algorithmic price fixing, and will likely rely on the rule of reason instead.

In contrast to the per se rule's blanket prohibition on certain forms of contract, an application of the rule of reason involves a fact-specific inquiry, in which the "true test of legality is whether the restraint imposed . . . promotes competition or whether it . . . destroy[s] competi-

---

a "*new* per se rule is not justified until the judiciary obtains considerable rule-of-reason experience with the particular type of restraint challenged").

60. N. Pac. Ry. Co. v. United States, 356 U.S. 1, 5 (1958).

61. United States v. Topco Assocs., 405 U.S. 596, 607–08 (1972) (quoting White Motor Co. v. United States, 372 U.S. 253, 263 (1963)).

62. Id.

63. See *Broad. Music*, 441 U.S. at 10, 24–25.

64. See infra sections II.A.2, II.B.1.

65. Although dynamic pricing in its most basic sense has existed for millennia in the form of bargaining or haggling, in the United States, the concept of using fixed prices in retail developed only in the late 1800s and was pioneered by Quakers. See Stephen A. Kent, The Quaker Ethic and the Fixed Price Policy: Max Weber and Beyond, 53 Socio. Inquiry 16, 18–19 (1983); Bronson Arcuri & Benjamin Naddaff-Hafrey, The Price Tag Hasn't Always Existed, It Had to Be Invented, NPR (Feb. 28, 2018), https://www.npr.org/sections/money/2018/02/28/589278258/planet-money-shorts-the-invention-of-the-price-tag [https://perma.cc/A3HW-CKB6]; Daniel B. Schneider, F.Y.I., N.Y. Times (Apr. 13, 1997), https://www.nytimes.com/1997/04/13/nyregion/fyi-559601.html (on file with the *Columbia Law Review*). Fixed pricing then dominated until Congress granted airlines free reign to set prices under the Airline Deregulation Act of 1978. See R. Preston McAfee & Vera te Velde, Dynamic Pricing in the Airline Industry 1 (2007), https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.86.6594&rep=rep1&type=pdf [https://perma.cc/8PDH-8ZER]. This began a wave of changes and gave rise to the modern concept of dynamic pricing, which incorporates competitors' prices and consumers' willingness to pay in near real time, a trend that has only accelerated with the development of new technologies.

tion."[66] Courts will conduct an assessment of "'market power and market structure . . . to assess the [restraint]'s actual effect' on competition."[67]

Due to the rule of reason's flexibility, many scholars have advocated for its application instead of the per se rule in cases involving high technology, particularly given the rapid advancements in the industry and the need to "protect[] innovation."[68] On the other hand, this same flexibility has also led others to criticize the rule of reason as inaccurate, inconsistent, and subjective.[69] The vast majority of antitrust plaintiffs never reach trial, with their rule of reason claims dismissed on summary judgment for failing to make a prima facie showing of anticompetitive effect.[70] Consequently, the difficulty of proving the existence of an agreement, along with the ease of showing procompetitive effects, provides a large loophole for companies defending algorithmic price-fixing claims under the Sherman Act.

B. *The FTC Act*

The FTC Act was passed in 1914[71] as a response "necessitated by the Sherman Act's failure to halt the growth of business combinations."[72] Its comparatively broader congressional mandate and prohibition of incipient violations and invitations to collude make the FTC Act a more effective tool for regulating algorithmic price-fixing cases.

1. *Legislative History and Enforcement.* — Section 5 of the FTC Act prohibits "[u]nfair methods of competition . . . and unfair or deceptive acts or practices in or affecting commerce."[73] This ban encompasses not only conduct that would violate the Sherman Act but also conduct that "con-

66. Bd. of Trade of Chi. v. United States, 246 U.S. 231, 238 (1918).

67. Ohio v. Am. Express, 138 S. Ct. 2274, 2284 (2018) (alterations in original) (quoting Copperweld Corp. v. Indep. Tube Corp., 467 U.S. 752, 768 (1984)).

68. See, e.g., Thibault Schrepel, A New Structured Rule of Reason Approach for High-Tech Markets, 50 Suffolk U. L. Rev. 103, 104, 115 (2017) ("We should not deprive ourselves the chance to enhance these procompetitive effects by applying a per se legality rule that questions their market consequences.").

69. Maurice E. Stucke, Does the Rule of Reason Violate the Rule of Law?, 42 U.C. Davis L. Rev. 1375, 1421 (2009).

70. See Michael A. Carrier, The Real Rule of Reason: Bridging the Disconnect, 1999 BYU L. Rev. 1265, 1269 (noting that only 4% of rule of reason cases reach the balancing stage). The rate of dismissal of rule of reason cases has accelerated in recent years, with only 2% of cases reaching the balancing stage between 1999 and 2009. Michael A. Carrier, The Rule of Reason: An Empirical Update for the 21st Century, 16 Geo. Mason L. Rev. 827, 828 (2009).

71. Act of Sept. 26, 1914, Pub. L. No. 63-203, 38 Stat. 717 (codified at 15 U.S.C. § 41 et seq. (2018)).

72. James C. Lang, The Legislative History of the Federal Trade Commission Act, 13 Washburn L.J. 6, 6 (1974).

73. 15 U.S.C. § 45(a)(1).

travene[s] the spirit of the antitrust laws and those that, if allowed to mature or complete, could violate the Sherman . . . Act."[74] Unlike the Sherman Act or the Clayton Act,[75] Congress notably chose not to define the specific acts that would violate the FTC Act. Instead, as this statute reaches conduct not covered by the other federal antitrust laws, the Act has been acknowledged as a "broad and flexible statute."[76]

The far-reaching nature of the statute is borne out by its legislative history as well. The FTC Act was passed in the wake of the Supreme Court's 1911 decision, *Standard Oil Co. of New Jersey v. United States*, which introduced the rule of reason approach for Sherman Act violations.[77] The *Standard Oil* decision prompted an unusually quick response from Congress, with Senator Francis Newlands (later the FTC Act's principal sponsor) arguing, the day after the decision, for corrective legislation.[78] The resulting Act's ban on "unfair competition" was to be enforced by the FTC, with Congress believing that "it would be better to put in a general provision condemning unfair competition than to attempt to define the numerous unfair practices."[79]

The broader powers of the statute have also, in the past, enabled the FTC to "plug apparent statutory gaps in the antitrust framework."[80] Although the Supreme Court has held that any conduct in violation of the spirit of antitrust laws is a section 5 violation,[81] lower courts have sought to apply a more specific analysis when determining what constitutes an unfair practice.[82] While courts took a broader view of the powers granted under section 5 through the 1970s, they began to shift back in the 1980s with *E.I. Du Pont de Nemours & Co. v. Federal Trade Commission* (*Ethyl*)[83] and *Boise*

74. See FTC, Statement of Enforcement Principles, supra note 13.

75. 15 U.S.C. §§ 12–27. Like the FTC Act, the Clayton Act, also passed in 1914, was intended to strengthen the Sherman Act. It prohibits anticompetitive mergers and certain kinds of discriminatory pricing practices. Unlike the Sherman Act, it addresses incipient threats that may create a monopoly. See 15 U.S.C. § 18.

76. Neil W. Averitt, The Meaning of "Unfair Methods of Competition" in Section 5 of the Federal Trade Commission Act, 21 B.C. L. Rev. 227, 229 (1980).

77. See 221 U.S. 1, 61–62 (1911).

78. Averitt, supra note 76, at 231. Motivated at least in part by the rule of reason's ambiguity and the immense discretion it offered to courts, Congress engaged in a flurry of activity. Two bills were introduced in the months following *Standard Oil*, and after several more months of testimony and the issuance of multiple reports, Congress passed the FTC Act. Id. at 230–33.

79. S. Rep. No. 63-597, at 13 (1914).

80. William Holmes & Melissa Mangiaracina, Antitrust Law Handbook § 7:2, Westlaw (database updated Dec. 2021).

81. Fed. Trade Comm'n v. Sperry & Hutchinson Co., 405 U.S. 233, 239 (1972).

82. See generally E.I. Du Pont de Nemours & Co. v. Fed. Trade Comm'n (*Ethyl*), 729 F.2d 128 (2d Cir. 1984); Boise Cascade Corp. v. Fed. Trade Comm'n, 637 F.2d 573 (9th Cir. 1980).

83. 729 F.2d 128.

Cascade Corp. v. Federal Trade Commission,[84] expressing concern over the potentially unconstrained reach of section 5.

In *Boise Cascade*, for example, the Ninth Circuit held that, in the absence of an agreement to fix prices, the FTC must show an actual anticompetitive effect.[85] The FTC had found that the petitioners, plywood manufacturers, violated section 5 by "adopting and maintaining a system of delivered pricing which utilized the computation of rail freight charges . . . in determining the price of southern plywood." [86] The Commission held that, by relying on a heavily manufactured formula, the manufacturers had stabilized the price of plywood, thus violating the FTC Act.[87] Nevertheless, the Ninth Circuit found that to prove a section 5 violation in the absence of an actual effect on competition, the FTC needed to show evidence of an agreement.[88] Without such a showing of an agreement or sufficient evidence regarding any potential effect, there could be no finding of collusion.

Four years later, in *Ethyl*, the Second Circuit held that the petitioners, manufacturers of gasoline additives, had not violated section 5's prohibition of unfair methods of competition despite causing an alleged decrease in competition.[89] Acting in parallel but unilaterally, the firms had adopted certain practices, including (1) announcing price changes in advance of the period contractually required, (2) implementing delivered pricing, and (3) including most-favored-nation clauses in their sales contracts.[90] The FTC claimed that although the firms' adoption of these prices was not collusive, their actions substantially lessened competition and thus violated section 5.[91] The Second Circuit found, first, that there was no significant decrease in competition and, furthermore, that a "[l]essening of competition is not the substantial equivalent of 'unfair methods' of competition."[92] The court added that "[s]ection 5 is aimed at conduct, not at the result of such conduct, even though the latter is usually a relevant factor in determining whether the challenged conduct is 'unfair.'"[93]

In addition to these judicial curbs on the FTC's powers,[94] in 2015, the Commission issued its first policy statement outlining the limits of its

---

84. 637 F.2d 573.

85. Id. at 582.

86. Id. at 573.

87. Id. at 575.

88. Id. at 582.

89. *Ethyl*, 729 F.2d at 142.

90. Id. at 130.

91. Id.

92. Id. at 138.

93. Id.

94. There is no private right of action under section 5. See Moore v. N.Y. Cotton Exch., 270 U.S. 593, 602–03 (1926) ("[R]elief . . . must be afforded in the first instance by the commission"); Holloway v. Bristol-Myers Corp., 485 F.2d 986, 997 (D.C. Cir. 1973) (finding

authority to enforce section 5 on a standalone basis.[95] Despite the broad congressional mandate, the FTC tethered the section 5 analysis to the rule of reason, seemingly limiting the exercise of its enforcement powers.[96] It explained that incipient acts or practices that contravene the spirit of the antitrust laws will be policed and that any actions taken will be guided by "the promotion of consumer welfare" and evaluated under "a framework similar to the rule of reason."[97] While the 2015 guidelines were in force, only one case was brought under the FTC's standalone authority through section 5.[98]

But in 2017, then-Federal Trade Commissioner Terrell McSweeny acknowledged the growing danger of algorithms that can facilitate tacit collusion and the potential to prosecute these cases under section 5.[99] She specifically noted that while "the use of a pricing algorithm, by itself, does not raise antitrust concerns," the potential for tacit collusion increases, putting the algorithm beyond section 1's reach.[100] Thus, although courts have limited section 5's reach, developing technology not only implicates algorithmic price fixing but also provides a "strong argument for an enhanced focus on coordinated effects in merger analysis and for lower thresholds of concern related to coordinated effects." [101] McSweeny pointed out that, since the Sherman Act explicitly permits conscious parallelism, the FTC Act may be "the only current tool available to police individual instances of algorithmic collusion."[102]

---

that a private right of action cannot be impliedly found under the FTC Act and congressional intent dictated that the FTC enforce the statute).

95. See FTC, Statement of Enforcement Principles, supra note 13.

96. Id. ("[T]he [challenged] act or practice will be evaluated under a framework similar to the rule of reason . . . ."). The Commission explained that this shift was prompted "in response to concerns from Members of Congress and others that the FTC's standalone Section 5 authority was too undefined." FTC, Report on Standalone Section 5 to Address High Pharmaceutical Drug and Biologic Prices 3 (2019), https://www.ftc.gov/system/files/documents/reports/ftc-report-standalone-section-5-address-high-pharmaceutical-drug-biologic-prices/p180101_drug_prices_appropriations_report_6-27-19.pdf [https://perma.cc/U4TU-GT6D] [hereinafter FTC, Report on Standalone Section 5].

97. FTC, Statement of Enforcement Principles, supra note 13.

98. Fed. Trade Comm'n v. Qualcomm Inc., 411 F. Supp. 3d 658 (N.D. Cal. 2019); Majority Staff of Subcomm. on Antitrust, Com. & Admin. L. of the H. Comm. on the Judiciary, 116th Cong., Investigation of Competition in Digital Markets: Majority Staff Report and Recommendations 402 (2020), https://judiciary.house.gov/uploadedfiles/competition_in_digital_markets.pdf [https://perma.cc/G6XP-PAMJ].

99. Terrell McSweeny & Brian O'Dea, The Implications of Algorithmic Pricing for Coordinated Effects Analysis and Price Discrimination Markets in Antitrust Enforcement, 32 Antitrust 75, 76 (2017).

100. Id.

101. Id.

102. Id.

While the FTC has acknowledged the challenge of using its standalone authority to challenge predatory pricing schemes,[103] this problem arises predominantly when companies act unilaterally. The Commission specifically noted that courts would likely be hostile to any attempt to expand liability under theories "not tied to harm from collusive . . . conduct recognized under Section 1 . . . of the Sherman Act."[104] Thus, the FTC has viewed the unilateral attainment of a "monopoly position through legitimate means" as a natural and lawful consequence of a free-market system that provides incentives for companies to compete.[105]

But in an age where "information is an unqualified good" available almost instantaneously, companies can observe their competitors' prices with minimal cost and in near real time.[106] This is especially problematic in an oligopolistic market because companies can coordinate and reach a consensus price with even less effort. With the recognition of the deficiencies in its enforcement practices, and in the face of mounting congressional criticism of technology companies' anticompetitive practices,[107] the FTC withdrew its 2015 guidance in 2021.[108] While the Commission criticized the 2015 guidelines for being too closely tethered to the rule of reason and for unnecessarily limiting its standalone section 5 authority,[109] it did not replace that statement with any new guidance.[110] Thus, this policy update still leaves an open question as to what additional conduct the FTC will now consider unlawful under section 5.[111]

---

103. FTC, Report on Standalone Section 5, supra note 96, at 2–5 ("In the 1970s, the Commission attempted to expand the use of its standalone Section 5 authority and suffered a string of federal court losses.").

104. Id. at 5.

105. Id.

106. Jonathan B. Baker, Identifying Horizontal Price Fixing in the Electronic Marketplace, 65 Antitrust L.J. 41, 44 (1996) (explaining that although the speed of information exchanges in the electronic marketplace can benefit consumers, it may also facilitate collusion).

107. See, e.g., Cecilia Kang, Lawmakers, Taking Aim at Big Tech, Push Sweeping Overhaul of Antitrust, N.Y. Times (June 11, 2021), https://www.nytimes.com/2021/06/11/technology/big-tech-antitrust-bills.html (on file with the *Columbia Law Review*) (last updated June 29, 2021) ("[E]fforts to curb the dominance of the biggest tech companies have gained broad support in recent years.").

108. See FTC, Statement on Withdrawal, supra note 13, at 2 ("By tethering Section 5 to the Sherman and Clayton Acts, the 2015 Statement negates the Commission's core legislative mandate, as reflected in the statutory text, the structure of the law, and the legislative history, and undermines the Commission's institutional strengths.").

109. See id. at 5.

110. FTC Rescinds "Unfair Methods of Competition" Enforcement Guidance, Suggesting Broader Regulatory Reach, Paul, Weiss (July 1, 2021), https://www.paulweiss.com/practices/litigation/antitrust/publications/ftc-rescinds-unfair-methods-of-competition-enforcement-guidance-suggesting-broader-regulatory-reach?id=40486 [https://perma.cc/9S9A-98KP].

111. Id.

2. *Incipiency and Invitations*. — The FTC Act covers conduct that does not rise to the level of a Sherman Act violation. As the Supreme Court has noted, part of the purpose of the FTC Act was to regulate any practice that could lead to a restraint on competition if not "stopped in its incipient stages."[112] This obviates the need to show an agreement between two or more parties—one of the Sherman Act's primary barriers to effectively regulating algorithmic price fixing. Instead, even invitations to collude to fix prices are prohibited as the FTC considers them to be "inherently suspect."[113] Thus, the FTC has been able to prosecute unilateral conduct under its standalone section 5 authority by prohibiting invitations to collude. While invitations to collude may be explicit, this ban also covers implicit invitations and acceptances.[114]

But parallel pricing incidents cannot be readily regulated as section 5 violations by being simplistically categorized as offers and acceptances because companies cannot easily remedy seemingly rational and competitive conduct.[115] In the past, when the FTC attempted to bring standalone section 5 actions for unilateral price matching, circuit courts recognized the challenges of fashioning a remedy for parallel pricing and the difficulty of reaching the requisite burden of proof. In *Boise Cascade*, the Ninth Circuit held that "the independent decision of an individual seller . . . to match a distant competitor's price is legal under the antitrust laws."[116] While the court noted the difficulty of proving an actual anticompetitive effect in parallel pricing cases, the lack of a showing of an "effect on overall price levels" forestalled a finding of a section 5 violation.[117] Similarly, in *Ethyl*, the Second Circuit stated that when there is parallel conduct facilitating coordination but no agreement, there must be evidence of anticompetitive intent and a sufficient showing of a lessening of competition.[118]

But despite these judicial limitations, the FTC Act still provides a more compelling tool to enforce the prohibition against algorithmic price fixing than the Sherman Act. For instance, the *Ethyl* court held that "absent a tacit agreement, at least some indicia of oppressiveness must exist such as

---

112. Fed. Trade Comm'n v. Cement Inst., 333 U.S. 683, 693 (1948).

113. FTC, Analysis to Aid Public Comment: In the Matter of Fortiline, LLC, File No. 151-0000, at 3 (2016), https://www.ftc.gov/system/files/documents/cases/160809fortiline analysis.pdf [https://perma.cc/PC47-FH2Q].

114. See, e.g., FTC, Analysis of Proposed Consent Order to Aid Public Comment (1998), https://www.ftc.gov/sites/default/files/documents/cases/1998/02/9510006.ana_.htm [https://perma.cc/X4X7-FNX5].

115. Baker, supra note 106, at 47 ("[T]he first price increase is an offer; those that follow are acceptances; as each observes the other's actions, they reach a common understanding."). Without the presence of sufficient plus factors, this alone cannot be considered an agreement in violation of the antitrust laws, as this would punish companies for rational decisionmaking. Id. at 48.

116. Boise Cascade Corp. v. Fed. Trade Comm'n, 637 F.2d 573, 576 (9th Cir. 1980).

117. Id. at 581.

118. *Ethyl*, 729 F.2d 128, 137–39, 142 (2d Cir. 1984) (drawing a line "between conduct that is anticompetitive and legitimate conduct that has an impact on competition").

(1) evidence of anticompetitive intent or purpose on the part of the producer charged, or (2) the absence of an independent legitimate business reason for its conduct."[119] Thus, despite the restrictions that the Second Circuit placed on section 5, the court also left the door open for effective regulation of algorithmic collusion. Given that section 5 was meant to reach beyond conduct prohibited by the Sherman Act and that it bans incipient violations without a showing of an agreement, this statute remains the best vehicle for enforcement under the current federal scheme.[120]

II. ALGORITHMS AND ENFORCEMENT

Both the Sherman Act and FTC Act were passed at a time when the current rate of technological developments was impossible to foresee. Legislators were motivated by a desire to restrain the power of big business, and the statutes were initially used to regulate various sectors like the railroad,[121] sugar,[122] and oil industries.[123] But even as the world has become increasingly digital, courts continue to apply the case law formed from older judgments to companies in the modern economy, which operate in newly created industries. While regulators must still operate within those judicial limitations, the antitrust guidelines must change in recognition of these digital advancements, especially as companies increasingly turn to artificial intelligence and machine learning.

This Part discusses the rise in the use of pricing algorithms and difficulties in regulating them. Section II.A covers the various types of algorithms that may give rise to collusion. Section II.B lays out the difficulties in enforcing prohibitions on price fixing under the current framework.

---

119. Id. at 139.

120. In a break from the Sherman and FTC Acts, a bill currently before the New York state legislature revising the Donnelly Act (New York's antitrust law) aims to prohibit unilateral conduct in a price-fixing context. S. 933A, 2021 Leg., 2021–2022 Reg. Sess. (N.Y. 2021). While this bill targets companies specifically to prevent monopolization, it would prohibit anyone "with a dominant position in the . . . furnishing of any service . . . to abuse that dominant position." Id at 2. This bill marks a step toward more effective regulation of algorithmic price fixing, as it no longer requires the existence of a contract to find an antitrust violation. See id. at 1. It was specifically written to address new antitrust concerns that technological developments have raised, including the rise of anticompetitive unilateral conduct. See Michael Gianaris, City & State: Can New York Lead the Nation on Antitrust Enforcement?, N.Y. State Senate (Sept. 14, 2020), https://www.nysenate.gov/newsroom/in-the-news/michael-gianaris/city-state-can-new-york-lead-nation-antitrust-enforcement [https://perma.cc/45FL-9CAF] (citing examples of anticompetitive unilateral conduct that the bill seeks to combat). Given the deficiencies under the current federal scheme in regulating unilateral conduct for price fixing (beyond the FTC Act's prohibition on invitations to collude), this bill represents a promising start to more effective and vigorous antitrust enforcement that could be applied to algorithmic collusion.

121. See, e.g., United States v. Trans-Mo. Freight Ass'n, 166 U.S. 290, 307 (1897).

122. See, e.g., United States v. E.C. Knight Co., 156 U.S. 1, 9 (1895).

123. See, e.g., Standard Oil Co. of N.J. v. United States, 221 U.S. 1, 31 (1911).

A. *Types of Collusion*

Developments in artificial intelligence and its increasing use in pricing algorithms pose a greater threat to collusion enforcement because of artificial intelligence's "ability to overcome collective action or coordination problems."[124] The use of artificial intelligence, specifically machine learning, in algorithms presents an added challenge because of the algorithms' self-learning capabilities. These machine-learning algorithms can be engineered to set prices and make decisions based on predictions of how competitors would respond.[125]

Professors Ariel Ezrachi and Maurice Stucke have outlined four categories of algorithms that present price collusion concerns.[126] These algorithms differ in complexity, with the most advanced algorithms "independently determin[ing] the means to optimize profit."[127] As programmers continue to build increasingly complex algorithms, regulators' ability to find the requisite elements of an agreement under the Sherman Act becomes more difficult. Simultaneously, however, as these technologies continue to develop, the threat of tacit collusion becomes more pressing.

The intent requirement for a finding of price fixing presents further challenges because computers do not have consciousness and are incapable of forming intent.[128] Thus, in prosecuting algorithmic collusion, regulators must rely on the intent of the algorithm's programmer or user.[129] Two of Ezrachi and Stucke's categories describe algorithms that do not use artificial intelligence.[130] These algorithms instead rely directly on human intent and can be treated as traditional price-fixing cases. The latter two algorithms are capable of self-learning, and the current antitrust framework does not provide an easy or obvious path for regulation of these algorithms.[131]

---

124. Joshua P. Davis & Anupama K. Reddy, AI and Interdependent Pricing: Combination Without Conspiracy?, 30 J. Antitrust UCL & Priv. Section Cal. Laws. Ass'n 1, 4 (2020) (on file with the *Columbia Law Review*).

125. See id. at 4–6.

126. Ezrachi & Stucke, When Computers Inhibit Competition, supra note 8, at 1782–84.

127. Id. at 1783.

128. See Yavar Bathaee, The Artificial Intelligence Black Box and the Failure of Intent and Causation, 31 Harv. J.L. & Tech. 889, 906 (2018) ("Machines and computer programs have no intent. The most we can glean from how they work and how they are designed is what goals their users or creators sought to achieve and the means they permitted their machine or program to use to achieve them.").

129. Id. at 906–07 ("It therefore makes sense to speak about the intent of the designer or user.").

130. See Ezrachi & Stucke, When Computers Inhibit Competition, supra note 8, at 1782–83.

131. See id. at 1783–84.

1. *With Clear Evidence of an Agreement.* — Ezrachi and Stucke's first two categories of algorithms discuss situations where there is clear evidence of intent or an agreement between competitors.[132] In these scenarios, humans create either horizontal or vertical agreements to collude and facilitate that collusion through the use of algorithms.[133] Thus, in these situations, the algorithm functions as merely a tool to carry out the agreed-upon collusion and can be prohibited under the traditional framework for price fixing.

a. *Messenger.* — In Ezrachi and Stucke's first category, there is clear evidence that humans—those who built the algorithms—intended to collude.[134] The only difference between this scenario and a classic price-fixing scheme is that, in this case, programmers simply write the algorithm to achieve their desired outcome rather than setting a price manually. Since there is clear evidence of an agreement to collude between competitors, these algorithms will likely be deemed per se illegal under the Sherman Act.[135]

Antitrust regulators have been able to regulate these types of algorithms effectively. In 2015, the Department of Justice prosecuted its first e-commerce antitrust case in *United States v. Topkins*, in which the defendant, David Topkins, pleaded guilty to conspiracy for the price fixing of posters for sale on Amazon in violation of section 1 of the Sherman Act.[136] Topkins and his co-conspirators were accused of agreeing to "adopt specific pricing algorithms . . . with the goal of coordinating changes to their respective prices."[137] Prosecution under the Sherman Act was relatively easier here, as the DOJ had evidence that Topkins had discussed the desired prices with his co-conspirators before writing an algorithm that would then carry out any coordinating changes.[138]

b. *Hub and Spoke.* — Ezrachi and Stucke's second category of algorithms, called the Hub and Spoke model, focuses on competitors' use of a single platform to obtain shared data.[139] Here, multiple competitors rely on vertical agreements with a developer of a single algorithm.[140] This causes industry-wide collusion because one algorithm is being used to set

---

132. See id. at 1782–83.

133. See id. at 1782.

134. Id. at 1784.

135. Id. at 1784–85.

136. Judgment in a Criminal Case at 1, United States v. Topkins, No. 3:15-cr-00201-WHO (N.D. Cal. Mar. 22, 2017), ECF No. 29 (noting that the defendant entered a guilty plea); Defendant Information Relative to a Criminal Action—In U.S. District Court at 3–6, *Topkins*, No. 3:15-cr-00201-WHO, ECF No. 1 (N.D. Cal. Apr. 6, 2015) (providing the factual background of the case).

137. Defendant Information Relative to a Criminal Action, supra note 136, at 5.

138. See id.

139. Ezrachi & Stucke, When Computers Inhibit Competition, supra note 8, at 1787–89.

140. Id. at 1782.

prices for multiple competitors in the industry.[141] While there may be limited evidence of direct horizontal agreements between the competitors, the intent to rely on a vertical agreement can establish evidence of price fixing under the rule of reason.[142]

As an example, Ezrachi and Stucke use Uber to describe how this type of "algorithmic monopoly" can give rise to price collusion.[143] In a private action filed in 2015, a plaintiff alleged that Uber had violated the Sherman Act because every driver on the platform entered a vertical agreement with Uber to use the same algorithm as part of an illegal conspiracy to coordinate high surge-pricing fares.[144] While the parties eventually settled the case by arbitration, the district court denied Uber's motion to dismiss, finding that the complaint contained sufficient allegations of a conspiracy between Uber and the drivers to coordinate prices, regardless of the use of an algorithm.[145] The Hub and Spoke model displays the potential implications of tacit collusion as the competitors—in this case, the drivers—are not directly communicating with one another and there is limited evidence of any explicit horizontal agreements.

In 2016, the European Court of Justice considered whether various Lithuanian travel companies had participated in a Hub and Spoke conspiracy.[146] Eturas, an online travel booking company, had invited various travel agencies that used its system to vote on the amount of a discount rate, and then capped the discounts at three percent.[147] Even though there was no evidence that any of the agencies had ever responded to Eturas's invitation or agreed with one another on a discount rate, the Competition Council had found that Eturas had facilitated a concerted practice and that each of the travel agencies, through mere receipt of the messages, had participated in a conspiracy.[148] Although the European Court of Justice remanded the latter holding subject to further factfinding, [149] in a traditional Hub and Spoke conspiracy model, the centralized "hub"—in this case, Eturas—would contain all the data necessary to facilitate collusion. And while there was no evidence of an agreement among the various

141. Id. at 1787.

142. Id. at 1787–88.

143. Id. at 1788.

144. Complaint at 1–3, Meyer v. Kalanick, 174 F. Supp. 3d 817 (S.D.N.Y. 2016) (No. 1:15 Civ. 9796), 2015 WL 9166194.

145. 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/LJB7-C6FM].

146. Case C-74/14, Eturas UAB v. Lietuvos Respublikos Konkurencijos Taryba, ECLI:EU:C:2016:42 (2016); Artificial Intelligence and Algorithms in Cartel Cases: Risks in Potential Broad Theories of Harm, Shearman & Sterling (Apr. 16, 2018), https://www.shearman.com/perspectives/2018/04/2018-antitrust-report/artificial-intelligence-and-algorithms-in-cartel-cases [https://perma.cc/YY3V-N528].

147. *Eturas*, ¶¶ 9–10.

148. Id. ¶ 15.

149. Id. ¶ 22.

travel agencies, or between the agencies and Eturas, had this case occurred in the United States, Eturas's actions would likely have been viewed as a straightforward invitation to collude in violation of section 5.

Despite these data aggregation partnerships, the current federal antitrust scheme can likely be used to effectively regulate such arrangements. If regulators can show that the pricing algorithm was designed with the requisite intent to facilitate collusion among its users, a court would likely find such an algorithm per se unlawful.[150] Further, even in the absence of anticompetitive intent, the existence of an explicit vertical arrangement would likely be judged as unlawful under the rule of reason.[151]

2. *Without Clear Evidence of an Agreement.* — In contrast to the above two scenarios, Ezrachi and Stucke then describe two potential situations where there is no clear evidence of an agreement to collude. In these cases, firms design algorithms to achieve a particular goal, such as profit maximization, but they do not form any implicit or explicit agreements with their competitors. But with the use of artificial intelligence and machine learning, these algorithms can learn to collude with each other, even if the human programmer does not intend such a result.

a. *Predictable Agent.* — A third category that Ezrachi and Stucke outlined involves an "industry-wide use of algorithms" that would "effectively enable conscious parallelism."[152] In this scenario, companies would unilaterally design algorithms to provide predictable outcomes. While programmers would be aware that other competitors are likely adopting similar algorithms, they are not coming to an agreement nor are they expressly communicating with each other while writing the code. Nevertheless, this can result in tacit collusion in two ways.[153]

First, the algorithms may reach a similar understanding with one another and learn to punish any rivals who lower prices. This incentivizes algorithms to desist from lowering prices in order to avoid punishment.[154] Second, the algorithms may also engage in rational "parallel accommodating conduct,"[155] which is intended to maximize their own profits individually rather than being motivated by an agreed-upon market outcome. This

150. Ezrachi & Stucke, When Computers Inhibit Competition, supra note 8, at 1788.

151. See Leegin Creative Leather Prods., Inc. v. PSKS, Inc., 551 U.S. 877, 894–99 (2007) (finding that minimum vertical resale price restraints should be analyzed under the rule of reason). This case represented the culmination of a shift in judicial treatment of vertical restraints from per se analysis to rule of reason treatment. See David I. Gelfand & Linden Bernhardt, Cleary Gottlieb Steen & Hamilton LLP, Vertical Restraints: Evolution From *Per Se* to Rule of Reason Analysis 7 (2017), https://www.clearygottlieb.com/~/media/organize-archive/cgsh/files/2017/publications/aba-antitrust-section-fall-forum-vertical-restraints-evolution-from-per-se-to-rule-of-reason-analysis-11-16-17.pdf [https://perma.cc/5NG2-HVTG] (identifying *Leegin* as the point at which the Supreme Court, after years of litigation, adopted the rule of reason test for minimum resale price maintenance).

152. Ezrachi & Stucke, When Computers Inhibit Competition, supra note 8, at 1789.

153. Id.

154. Id.

155. Id. at 1790.

second method, however, can still decrease competition by reducing the incentive to lower prices.[156] Both options are predicated on the presumption that each programmer independently knows that a "dominant strategy may be to follow the price increase of others."[157] These programmers will then design algorithms that monitor their competitors to induce potential tacit collusion.[158]

But unlike the previous two categories, the competitors here have not entered into any agreements with each other. Consequently, this type of algorithm cannot be regulated under the Sherman Act, and given the Second and Ninth Circuits' agreement in *Ethyl* and *Boise Cascade*, any resulting collusion may not be considered an "unfair practice" in violation of the FTC Act. In the absence of any implicit or explicit agreement, the FTC would likely have to show evidence of an anticompetitive intent or some other indication of oppressiveness to successfully bring a section 5 action.[159] This is particularly problematic because companies will argue that they made a rational decision to write an algorithm that can best optimize profit maximization, and that any resulting algorithm will likely share common inputs.[160] Especially in a market with limited major players, the chances of all competitors verging on the use of similar algorithms increases, which in turn accelerates the "path toward conscious parallelism."[161]

b. *Digital Eye.* — In Ezrachi and Stucke's final category, companies unilaterally design "black box"[162] algorithms that, through machine learning or artificial intelligence, will independently evolve to determine the best way to maximize profit.[163] Similar to the "predictable agent" scenario, here there is no agreement—whether express or tacit—between competitors to collude. But as an added difficulty for regulators, the outcomes here are particularly unpredictable because the algorithms' designers do not

156. Id.; see also supra notes 40–43 and accompanying text.

157. Ezrachi & Stucke, When Computers Inhibit Competition, supra note 8, at 1790–91.

158. See id. at 1791 ("The computer is therefore set up to monitor the market and explore the likelihood of establishing interdependence of action, without venturing into illegal concerted practice or illicit agreement.").

159. See supra note 118 and accompanying text.

160. See Maurice E. Stucke & Ariel Ezrachi, How Pricing Bots Could Form Cartels and Make Things More Expensive, Harv. Bus. Rev. (Oct. 27, 2016), https://hbr.org/2016/10/how-pricing-bots-could-form-cartels-and-make-things-more-expensive [https://perma.cc/54R4-7BKQ] ("With each algorithm sharing a common interest (profits) and common inputs (similar data), the industry-wide use of algorithms may lead to durable tacit collusion among many competitors.").

161. Ezrachi & Stucke, When Computers Inhibit Competition, supra note 8, at 1794.

162. Cynthia Rudin & Joanna Radin, Why Are We Using Black Box Models in AI When We Don't Need To? A Lesson From an Explainable AI Competition, Harv. Data Sci. Rev., Fall 2019, at 1, 2 (defining "black box models" as "created directly from data by an algorithm, meaning that humans, even those who design them, cannot understand how variables are being combined to make predictions").

163. Ezrachi & Stucke, When Computers Inhibit Competition, supra note 8, at 1795.

intend to engage in even tacit collusion. This is especially troubling because the programmers often cannot predict how the algorithm will reach the optimized price—particularly when developing a black-box algorithm.[164] While programmers know what inputs they have used to write the computer code and are able to see the outputs of their efforts, the self-learning nature of these artificial intelligence algorithms does not provide clarity about *how* the algorithms arrive at their results.[165]

Similar concerns have also arisen about the use of black-box algorithms in other areas of law, such as in risk assessments for sentencing purposes.[166] Concerningly, research has indicated that, as complex algorithms improve in accuracy, they become less transparent and more difficult for their programmers to explain.[167] From an antitrust perspective, the difficulty in explaining how an algorithm arrives at a certain price creates more problems for regulators seeking to show that companies had an intent to collude.

B. *Enforcement*

Ezrachi and Stucke's first two categories of algorithms can be regulated as classic price-fixing scenarios. The latter two, however, present a more difficult problem because of the lack of an agreement. Since section 1 of the Sherman Act requires the existence of an agreement, it cannot be used to regulate algorithms in the Predictable Agent or Digital Eye scenarios. For those categories, the best option would be to regulate through the FTC Act instead, although courts will require evidence of sufficient plus factors in addition to a showing of parallel conduct.

1. *Sherman Act.* — Of the four types of algorithms described above, the current antitrust framework can likely only effectively regulate the first two: Messenger, and Hub and Spoke. The per se rule and the rule of

---

164. For example, in 2016, Microsoft launched a chatbot powered by artificial intelligence that could interact with public consumers on platforms such as Snapchat, Facebook, and Twitter. Sarah Perez, Microsoft Silences Its New A.I. Bot Tay, After Twitter Users Teach It Racism, TechCrunch (Mar. 24, 2016), https://techcrunch.com/2016/03/24/microsoft-silences-its-new-a-i-bot-tay-after-twitter-users-teach-it-racism/ [https://perma.cc/CWK8-LMUP]. The bot was discontinued after it began outputting racist tweets—behavior it had learned from other Twitter users who interacted with it. Id.

165. Ezrachi & Stucke, When Computers Inhibit Competition, supra note 8, at 1795 ("Smart machines may independently optimize profitability by reaching conscious parallelism—or they may not.").

166. See, e.g., State v. Loomis, 881 N.W.2d 749, 760 (Wis. 2016) (addressing whether a court's consideration of an algorithm-based risk assessment "violates a defendant's due process right to be sentenced based on accurate information"); Leah Wisser, Pandora's Algorithmic Black Box: The Challenges of Using Algorithmic Risk Assessments in Sentencing, 56 Am. Crim. L. Rev. 1811, 1812 (2019) (exploring "what happens when society allows . . . risk assessments to slip behind an algorithm's black curtain").

167. See Vanessa Buhrmester, David Münch & Michael Arens, Analysis of Explainers of Black Box Deep Neural Networks for Computer Vision: A Survey 1 (2019), https://arxiv.org/pdf/1911.12116.pdf [https://perma.cc/9VFC-BSWS].

reason used in section 1 of the Sherman Act are only helpful when there is a showing of intent or agreement between competitors. As *Topkins* indicated, the Sherman Act is well equipped to regulate these more conventional algorithms.[168] But without this showing, the Sherman Act's requirement for an agreement, whether implicit or explicit, makes the Act an ineffective tool when faced with companies that have not specifically coordinated with each other, as outlined in the Predictable Agent and Digital Eye scenarios.

2. *FTC Act.* — On the other hand, the broader powers granted in section 5 of the FTC Act likely provide a more viable method of preventing price fixing when there is no agreement between companies. Under section 5, circuit courts have found that an anticompetitive outcome is not enough for activity to be considered unlawful, even when there is parallel conduct.[169] Even in these cases, courts look for evidence of intent. As Ezrachi and Stucke have shown, when companies rely on algorithms that follow the Predictable Agent or Digital Eye models, the FTC would find it difficult to argue, under their existing enforcement principles, that such practices meet the requirements outlined by the Second and Ninth Circuits.

Ethyl and *Boise Cascade* present troubling precedents for antitrust regulators faced with algorithmic collusion. But the situations in those cases are far removed from what takes place online today. For example, in *Boise Cascade*, the Ninth Circuit relied considerably on the FTC's earlier stance that conscious parallel action is not an unfair practice.[170] In doing so, the court found that, in the absence of an explicit agreement between competitors, there must be an actual showing of "fixing or stabilizing prices."[171] Similarly, the Second Circuit in *Ethyl* found that, notwithstanding the large weight given to the FTC's interpretation of section 5,[172] this section of the statute "is aimed at conduct, not at the result of such conduct" when determining whether a particular business practice is unfair.[173] Thus, courts

168. See supra notes 136–138 and accompanying text.

169. See supra notes 119–120 and accompanying text.

170. See Boise Cascade Corp. v. Fed. Trade Comm'n, 637 F.2d 573, 576 (9th Cir. 1980) ("It is important to stress that the weight of the case law and the Commission's own policy statement make it clear that we are looking for at least tacit agreement to use a formula which has the effect of fixing prices."). The FTC had earlier taken the position that conscious parallelism was unlawful, and it brought standalone section 5 charges under this theory against several steel manufacturers in 1948. Triangle Conduit & Cable Co. v. Fed. Trade Comm'n, 168 F.2d 175, 176 (7th Cir. 1948). After the Seventh Circuit upheld the FTC's cease-and-desist order, the Commission faced congressional and industrial backlash, and quickly shifted its position. *Boise Cascade*, 637 F.2d at 576–77. After its success in *Triangle Conduit*, the FTC did not bring any further standalone section 5 actions based on conscious parallelism until its attempts in the 1980s.

171. *Boise Cascade*, 637 F.2d at 577.

172. *Ethyl*, 729 F.2d 128, 136 (2d Cir. 1984) (citing Fed. Trade Comm'n v. Texaco, Inc., 393 U.S. 223, 226 (1968)).

173. Id. at 138.

only look to the effects of conduct—that is, whether there are stable or fixed prices—when there is no evidence of an agreement between competitors. But in an online retail context, prices can fluctuate constantly.[174]

When there is no explicit agreement and only evidence of parallel conduct, courts have required a showing of plus factors to prove collusion.[175] There is no standard definition of plus factors, but the Ninth Circuit has defined them as "economic actions and outcomes that are largely inconsistent with unilateral conduct but largely consistent with explicitly coordinated action."[176] The most important plus factors in an algorithmic context are (1) the motive and opportunity to conspire, (2) invitations to collude, and (3) the exchange of price information.[177] Since prices that are available online can be seen almost instantaneously by both competitors and consumers, there is ample opportunity to conspire and freely engage in the exchange of price information. Nevertheless, some courts have concluded that further direct evidence is required to prove collusion even in this online context, although this negates the purpose of using plus factors in the first instance.[178] Consequently, regulators face a massive evidentiary burden when attempting to show collusion under the current interpretation of section 5.

Judge Joseph Edward Lumbard, in his partial dissent in *Ethyl*, noted the "deliberate vagueness of the statutory language" of section 5 and that the FTC Act was meant to cover conduct contrary to the spirit of the Sherman Act.[179] As scholars such as Richard A. Posner and Donald Turner have claimed, the uniform legality of conscious parallelism arguably

---

174. See Neel Mehta, Parth Detroja & Aditya Agashe, Amazon Changes Prices on Its Products About Every 10 Minutes—Here's How and Why They Do It, Bus. Insider (Aug. 10, 2018), https://www.businessinsider.com/amazon-price-changes-2018-8 [https://perma.cc/2N65-BAVC] (noting that Amazon changes prices 2.5 million times a day, and the average product changes prices every ten minutes).

175. See Christopher R. Leslie, The Decline and Fall of Circumstantial Evidence in Antitrust Law, 69 Am. U. L. Rev. 1713, 1718 (2020).

176. See In re Musical Instruments & Equip. Antitrust Litig., 798 F.3d 1186, 1194 (9th Cir. 2015) (citing Bell Atl. Corp. v. Twombly, 550 U.S. 544, 556 n.4 (2007)).

177. See Leslie, supra note 175, at 1718–19 (listing the types of plus factors judges tend to disregard without direct evidence).

178. See In re Delta/AirTran Baggage Fee Antitrust Litig., 245 F. Supp. 3d 1343, 1371–81 (N.D. Ga. 2017) (holding that, despite allegations of six separate plus factors, including the motive to conspire, invitations to collude, and the exchanges of information, the record "'could not lead a rational trier of fact to find' that Defendants engaged in a conspiracy to fix prices" (quoting Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 587 (1986))). Here, various airlines had made public statements regarding their intention to introduce and raise baggage fees. Id. at 1349–50. While the court found evidence of parallel conduct in the simultaneous imposition of baggage fees, the defendants were granted summary judgment. Id. at 1370, 1381.

179. *Ethyl*, 729 F.2d 128, 142 (2d Cir. 1984) (Lumbard, J., concurring in part and dissenting in part).

violates the spirit of the Sherman Act.[180] While the Sherman Act requires the existence of an agreement, companies may make seemingly independent pricing decisions that are nonetheless collusive in that they depend on the certainty that other competitors will price their products in a particular manner.[181] Although this conduct is likely not unlawful under the letter of the Sherman Act, it may still be classified as an incipient practice that, fully fledged, could rise to the level of a Sherman Act violation and thus would be contrary to the spirit of the statute. Consequently, the greater flexibility afforded by section 5's language provides a better avenue through which conscious parallelism can be more effectively regulated.

III. ALGORITHMS AND ANNOUNCEMENTS UNDER THE FTC ACT

As Part I explained, the FTC Act has the broadest mandate among the federal antitrust statutes, as it was intended to reach conduct not covered by the Sherman Act and does not require the existence of an agreement. As Part II showed, the breadth of the FTC Act's mandate is critical because competitor companies that use algorithms that rely on artificial intelligence or machine learning may engage in collusion without creating an agreement. Thus, the FTC Act provides the best avenue to regulating algorithmic collusion when there is no evidence of an agreement.

This Part sets out a method for more effective federal regulation of algorithmic collusion under the FTC Act. Section III.A advocates for treating algorithms as announcements, which have been considered invitations to collude when they call for anticompetitive conduct. Section III.B discusses a framework combining the market's potential for collusion, along with particular plus factors that, when present, should lead to a conclusion that the algorithm is an invitation to collude. Section III.C presents potential issues with this framework and offers suggestions for how they can be addressed.

A. *Treating Algorithms as Announcements*

This section argues that algorithms can still be regulated under section 5's prohibition against invitations to collude if they are treated as public announcements. The FTC has successfully brought several enforcement actions through consent orders against companies that extend

180. See Posner, supra note 46, at 1575 ("There is . . . no vital difference between formal cartels and tacit collusive arrangements; the latter are simply easier to conceal."); Turner, supra note 38, at 658 (arguing that, when alleged co-conspirators make decisions in the same way that are consistent with their individual self-interests, conscious parallelism indicates evidence of agreement).

181. See Carl Kaysen, Collusion Under the Sherman Act, 65 Q.J. Econ. 263, 268 (1951) (stating that, in oligopolistic markets, sellers may receive more benefit by sacrificing their independent judgments in exchange for a greater level of certainty about competitors' pricing).

invitations to collude to competitors during earnings and investor calls.[182] These earnings calls are a type of public announcement, which is traditionally defined as a "conveyance of information by a firm or one of its employees using a medium that is widely accessible to individuals outside of the firm."[183] While of course not all public announcements are anticompetitive, there is a risk of collusion if the announcement references a competitor's conduct.[184] Specifically, when a company announces how its pricing strategy will be impacted by competitors' future conduct, collusion concerns arise because of the risk that competitors will view the announcements as demonstrative of the company's intent and will thus adjust their own pricing scheme in response.[185] Even if these competitors do not accept the company's offer and do not adjust their pricing accordingly, these announcements are viewed as invitations to collude by the issuing company[186] and thus are still prohibited under section 5.

When the market fulfills certain conditions, this framework can likely be applied to pricing algorithms because of their transparent nature. First, like public announcements, the *results* of pricing algorithms are also public; any consumer or competitor can easily and almost instantaneously view prices of other companies when in a transparent market. Second, Professor Bruno Salcedo has indicated that, when given the choice between masking algorithms or keeping them decodable, in an equilibrium, companies will always choose to keep their algorithms transparent to their competitors.[187] Likely, this is because this transparency "helps firms to coordinate on collusive outcomes" and maximize short-run profits as well as dominance in the long run.[188]

---

182. See, e.g., U-Haul Int'l, Inc., 150 F.T.C. 1, 7, 40–42 (2010) (decision & order) (entering consent order after a company president announced on an earnings call that "[t]he company has recently raised its rates, and competitors should do the same" while knowing that competitors were dialed in); Valassis Commc'ns, Inc., 141 F.T.C. 247, 251, 272 (2006) (decision & order) (finding that Valassis had invited its competitor, News America, to engage in price fixing and market allocation during an earnings call in which the president stated "Valassis will seek . . . not to encroach upon News America's position" and "will monitor News America's response to this overture").

183. Joseph E. Harrington, Jr., Collusion in Plain Sight: Firms' Use of Public Announcements to Restrain Competition 4 (May 25, 2021), https://joeharrington5201922.github.io/pdf/Public%20Announcements_21.05.25.pdf [https://perma.cc/KNP2-8V5L] (unpublished manuscript).

184. Id. at 5–6.

185. Id. at 19.

186. *Valassis*, 141 F.T.C. at 252 (complaint) (referencing "Valassis' invitation to collude, *if* accepted," which in itself leaves open the possibility that the offer may not have actually been accepted (emphasis added)).

187. See Bruno Salcedo, Pricing Algorithms and Tacit Collusion 18 (Nov. 1, 2015), http://brunosalcedo.com/docs/collusion.pdf [https://perma.cc/PQ3A-WXC7] (unpublished manuscript) ("For every equilibrium of the dynamic game, there is an equilibrium of the alternative game which yield the same path of play and in which firms always choose to make their algorithms transparent." (italics removed)).

188. Id. at 4, 19–20.

As another example, in a recent experiment, two researchers from the Google Brain project have shown that certain types of algorithms can learn to decrypt each other's messages while simultaneously encrypting those messages from third parties through the use of neural networks.[189] Through this decryption process, algorithms can evolve to understand their competitors' pricing strategies,[190] even if those strategies may not be visible to the general public without the resources to decode the algorithm.[191] Consequently, these "signalling algorithm[s]" can "establish and negotiate the terms of collusion before actually engaging in price coordination."[192]

For example, if Competitor A's algorithm is able to decode the patterns within Competitor B's algorithm, it can predict what the next pricing move is likely to be and then may choose to adjust accordingly to achieve an optimal price. In this context, if B's algorithm is programmed to make pricing changes based at least in part on what A is charging,[193] B's algorithm functions essentially as a public announcement. While this type of

---

189. See Martín Abadi & David G. Andersen, Google Brain, Learning to Protect Communications With Adversarial Neural Cryptography 3, 9–10 (2016), https://arxiv.org/pdf/1610.06918.pdf [https://perma.cc/6M48-JLS5]; Ulrich Schwalbe, Algorithms, Machine Learning, and Collusion, 14 J. Competition L. & Econ. 568, 595–96 (2019). In this experiment, Google researchers had set a training objective for the neural networks to be able to communicate with each other while masking those communications from others. Abadi & Andersen, supra, at 3. Neural networks are "computer programs that attempt to mimic the function of the human brain by learning from experience and understanding the world in terms of a hierarchy of concepts, in which each concept is defined in terms of its relationship to more basic concepts." Schwalbe, supra, at 579.

190. See Salcedo, supra note 187, at 2.

191. In addition to announcements given to the public, the FTC has also issued consent orders prohibiting invitations to collude when they are made in a private context. See, e.g., Stone Container Corp., 125 F.T.C. 853, 854, 856 (1998) (decision & order) (issuing a consent order after Stone Container executives made private communications to competitors regarding future pricing strategy); Precision Moulding Co., 122 F.T.C. 104, 105, 107–08 (1996) (decision & order) (issuing a consent order after the defendant met with a competitor and complained about the competitor's low pricing). Therefore, any added difficulty a company faces when decoding a competitor's algorithms compared to the relative ease of reading earnings call transcripts should not be a reason to abandon the analogy as long as the competitor is able to decode the algorithm.

192. Org. for Econ. Coop. & Dev. [OECD], Algorithms and Collusion: Competition Policy in the Digital Age 30–31 (June 2017), https://www.oecd.org/daf/competition/Algorithms-and-colllusion-competition-policy-in-the-digital-age.pdf [https://perma.cc/P53J-CGL6] [hereinafter OECD, Algorithms and Collusion].

193. It is perfectly rational for a company to internalize pricing changes made by its competitors and adjust accordingly, for example, as shown through a classic Stackelberg model. See Heinrich von Stackelberg, Market Structure and Equilibrium 15–22 (Damien Bazin, Lynn Urch & Rowland Hill trans., Springer-Verlag Wien New York 2d ed. 2011) (1934) (describing how, in a supply duopoly, one company will be viewed as "independent" and the other company will orient its behavior around that expectation in response). But the Stackelberg leader-follower model has been subject to criticism, namely due to its assumption of perfect information. See, e.g., William Fellner, Competition Among the Few:

public announcement in isolation may be perfectly legitimate as a sign of rational and competitive pricing,[194] there are circumstances in which this functions as increased evidence of collusion.[195] If B's algorithm is fully transparent, as Salcedo suggests it rationally should be,[196] it will signal to A's algorithm what its pricing strategy is. This will certainly facilitate tacit collusion at the very least, but if A can decode how B's algorithm is programmed to react to A's prices, then A will at least have the chance to adjust its own price accordingly. While A might find it suboptimal to actually accept B's offer and could in fact reject it (perhaps if acceptance would require an expensive change in technology[197]), B's initial offer can be viewed as an invitation to collude because it broadcasts this offer to A.

But the bulk of actions against these unilateral disclosures of information via announcements have been through the FTC's or Department of Justice's administrative processes,[198] with only one exception.[199] The

---

Oligopoly and Similar Market Structures 117–18 (1949) ("[T]hese 'equilibria' rest on arbitrary and incorrect notions regarding rival behavior. . . . Each firm assumes that the other firm will select a point along a reaction function which in reality plays no part whatsoever in shaping the policies of the other firm."). Nevertheless, given the easy availability of information today, "a key feature of pricing algorithms is the ability to condition on the prices of rivals." Zach Y. Brown & Alexander MacKay, Competition in Pricing Algorithms 5 (Nat'l Bureau of Econ. Rsch., Working Paper No. 28860, 2021), https://www.nber.org/system/files/working_papers/w28860/w28860.pdf [https://perma.cc/YJ38-PDQZ]. This rational behavior, however, becomes collusive when there is some form of communication between competitors—whether unilateral or bilateral—to agree on prices.

194. For example, Amazon uses an algorithm that "works to match or beat prices from other websites and stores." Jason Del Rey, Amazon and Walmart Are in an All-Out Price War That Is Terrifying America's Biggest Brands, Vox (Mar. 30, 2017), https://www.vox.com/2017/3/30/14831602/amazon-walmart-cpg-grocery-price-war [https://perma.cc/MS9B-G3Y6].

195. See infra section III.B.

196. See Salcedo, supra note 187, at 4.

197. See Brown & MacKay, supra note 193, at 10 (noting that changes to an algorithm can create technological or operational costs).

198. The FTC can choose to enforce section 5 through an internal adjudicative proceeding before an administrative law judge to obtain a cease-and-desist order. The respondent may then appeal to a circuit court with jurisdiction. But to obtain civil penalties or injunctive relief for a violation of a cease-and-desist order, the FTC must seek judicial enforcement by a district court. See FTC, A Brief Overview of the Federal Trade Commission's Investigative, Law Enforcement, and Rulemaking Authority, https://www.ftc.gov/about-ftc/what-we-do/enforcement-authority [https://perma.cc/S4T6-C6SG] (last updated May 2021). Under section 13(b) of the FTC Act, the Commission is also authorized to seek a preliminary injunction from a district court while the administrative proceedings are pending. See 15 U.S.C. § 53(b) (2018).

199. The exception was United States v. American Airlines, 743 F.2d 1114 (5th Cir. 1984). See Org. for Econ. Coop. & Dev. [OECD], Unilateral Disclosure of Information With Anticompetitive Effects (e.g. Through Press Announcements), at 4 (2012), https://www.justice.gov/sites/default/files/atr/legacy/2012/08/24/286288.pdf [https://perma.cc/6S6U-P6BB]. In that case, after the Fifth Circuit found that the elements of an attempted monopolization charge had been met, American Airlines entered into a consent decree with the Department of Justice. Id. at 6.

standards given in *Ethyl* and *Boise Cascade*[200] will present further difficulties for regulators seeking to have these actions litigated in court. To mitigate these challenges, this Note suggests considering certain observable effects, or plus factors, in the market that, when present, can suggest an algorithm is signaling an invitation to collude.

B. *Examining the Evidence and the Market*

Given that algorithms can be thus analogized to announcements, which have been regulated by the FTC, this section proposes two additional steps to guide whether this announcement is collusive in situations where there is no agreement between competitors. First, for a finding of price fixing in this context, the market in which the algorithm operates must be primed for collusion. Second, if a market analysis indicates a sufficiently high possibility of collusion, enforcers or courts may look to observable plus factors that suggest whether an actual lessening of competition has arisen.

1. *Market Characteristics.* — When outputs of multiple algorithms show these observable plus factors, courts should weigh this along with structural characteristics of the relevant market. In particular, if the market (1) is dominated by relatively few players, (2) has high barriers to entry, (3) is highly transparent, and (4) has a high frequency of interaction, this, along with evidence of the plus factors stated in section III.B.2 merit consideration as an invitation to collude in violation of the FTC Act.

First, an oligopolistic market is a "necessary condition . . . of successful price-fixing."[201] When only a few players dominate the market for a particular good, the costs associated with setting and adhering to a particular price is decreased. Algorithms that have to monitor relatively few competitors' prices are thus more easily able to collude. In the context of an invitation to collude, when an algorithm is sending out signals to indicate future pricing strategies, the chance of collusion is far higher when there are relatively fewer competitor algorithms that would be able to decode the invitation. In contrast, when there are many competitors in a market, coordination becomes more difficult to facilitate.

The oligopoly must also be sustainable through effective barriers to entry, which are enhanced by the presence of network effects.[202] Network effects along with other high startup costs make it more difficult for new competitors to gain a foothold in the industry.[203] For example, search

---

200. See supra notes 169–173 and accompanying text.

201. Posner, supra note 46, at 1571.

202. Inge Graef, Market Definition and Market Power in Data: The Case of Online Platforms, 38 World Competition 473, 484 (2015) ("Network effects are present when the utility that a consumer derives from consumption of a good increases with the number of others purchasing the good.").

203. Network effects are the resulting phenomena when the utility that a user derives from a product increases with the number of other agents using that product. These play

engines that rely on user searches will provide better results as more people use the tool.[204] Consequently, consumers are disincentivized from using other companies that they know will return less accurate searches, and this in turn creates a higher barrier.[205] With the threat of new entrants diminished, the existing players in the market will have less incentive to price competitively. This preserves the oligopoly over longer periods of time and makes it easier for companies to continue colluding with their existing competitors.

Additionally, there must be high market transparency. While market transparency is traditionally an indicator of a competitive market, it can also enable collusion in the case of algorithmic price fixing. Collusion has become easier to facilitate but also more difficult to regulate, in large part because of the information age, due to the sheer amount of data that is publicly available. There is no longer a need for companies to directly communicate with one another to collude because their prices are visible to the public on the internet. When these "information disclosures allow competitors to figure out what their rivals are charging," the likelihood of coordination rises.[206] Transparency also allows companies to coordinate much faster than before, as price changes are available online in near real time and algorithms can adjust quickly. In particular, this transparency and the continuous monitoring of competitor algorithms enable companies to "retaliate fast and punish aggressively any deviators."[207]

Finally, a market primed for collusion will have a high frequency of interaction.[208] The more that these algorithms can "perfectly observe each

---

an outsized role in the digital economy as many of the relevant markets are multisided platforms, such as Amazon Marketplace or Google Search. See John M. Yun, Overview of Network Effects & Platforms in Digital Markets, *in* The Global Antitrust Institute Report on the Digital Economy 2, 3 (2020). Many online platforms are particularly advantaged by indirect network effects, in which one type of group benefits as more members of other groups participate. In the case of Amazon Marketplace, for example, third-party sellers derive increased benefits as the number of purchasers increase and vice versa. See id. at 4, 10–14. The multitude of network effects that these online platforms enjoy increases the burden on new entrants in the market. Id. at 4–5.

204. Graef, supra note 202, at 487 ("If the intent of users making search queries changes due to a recent event, it is vital for a search engine to learn quickly and adapt to the new demands as soon as possible.").

205. Even large companies may not be able to create a sufficiently sized market to rely on network effects. In August of 2021, Google was used for approximately 92% of searches worldwide, while Microsoft's Bing had around 2.5% of market share over the same time period. See Search Engine Market Share Worldwide, Statcounter GlobalStats, https://gs.statcounter.com/search-engine-market-share/ [https://perma.cc/SRN3-XXMT] (last visited Oct. 7, 2021).

206. Tara Isa Koslov & Elizabeth Jex, Price Transparency or TMI?, FTC (July 2, 2015), https://www.ftc.gov/news-events/blogs/competition-matters/2015/07/price-transparency-or-tmi/ [https://perma.cc/T422-WQFG].

207. Org. for Econ. Coop. & Dev. [OECD], Algorithms and Collusion—Background Note by the Secretariat 19 (2017), https://one.oecd.org/document/DAF/COMP(2017)4/en/pdf [https://perma.cc/6TXG-KUWA].

208. See OECD, Algorithms and Collusion, supra note 192, at 21–22.

other's actions," the faster they can respond to any changes in price.[209] If algorithms only monitor or interact with competitors' algorithms relatively infrequently, they will treat any imperfect information that comes through as more significant than it should be—thus reducing the chance of learning to collude. On the other hand, as the frequency with which algorithms monitor their competition rises, they can learn to read the data coming from their competitors more efficiently, thus facilitating further collusion.[210]

2. *Observable Plus Factors.* — Given the opacity of complex black-box algorithms, programmers and prosecutors alike are only able to view the inputs into an algorithm and the resulting outputs. In a transparent market, many of the inputs are often the same across competitors.[211] For example, inputs that multiple companies in a transparent market would have access to include: competing firms' prices, past prices and the history of changes, and market information such as competitors' stock and inventory levels.[212] When this information is easily and readily available, the use of these factors in programming algorithms alone is not enough to infer the requisite intent to collude in Ezrachi and Stucke's Predictable Agent or Digital Eye scenarios.[213]

But there are still plus factors that can, when observed, be evidence of an invitation to collude. In particular, this Note proposes that an invitation to collude for a particular product can be inferred when (1) a company's algorithm determines a price that is optimal for the company only if other "firms will subsequently coordinate their pricing"[214] to match that price, or (2) if the company is cutting prices and expanding output in a set pattern in response to perceived "cheating."[215] Although the presence of these plus factors may not be completely indicative of the necessary intent required by *Ethyl*,[216] they do establish a greater likelihood at least of anticompetitive effects.

---

209. Maria Bigoni, Jan Potters & Giancarlo Spagnolo, Frequency of Interaction, Communication and Collusion: An Experiment, 68 Econ. Theory 827, 828 (2018).

210. See Martin Heller, What Is Machine Learning? Intelligence Derived From Data, InfoWorld (May 15, 2019), https://www.infoworld.com/article/3214424/what-is-machine-learning-intelligence-derived-from-data.html [https://perma.cc/E7HH-RN6S] (describing how various types of machine learning algorithms improve accuracy as they read more data).

211. See Competition & Mkts. Auth., Pricing Algorithms: Economic Working Paper on the Use of Algorithms to Facilitate Collusion and Personalised Pricing 15 (Oct. 8, 2018), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/746353/Algorithms_econ_report.pdf [https://perma.cc/7YWE-YCML] (listing common potential inputs for pricing algorithms).

212. Id.

213. See supra section II.A.2.

214. Joseph E. Harrington, Jr., Posted Pricing as a Plus Factor, 7 J. Competition L. & Econ. 1, 20 (2011) [hereinafter Harrington, Posted Pricing].

215. See Michael G. Vita, Fifteen Years After *Ethyl*: The Past and Future of Facilitating Practices, 68 Antitrust L.J. 991, 1004 (2001).

216. See supra note 118 and accompanying text.

For the first plus factor, when a company sets a price that would not be optimal unless its competitors cooperate, there is arguably an "absence of an independent legitimate business reason for its conduct," meeting the *Ethyl* standard of unfair business conduct.[217] This plus factor is likely to be more significant when algorithms do not adjust their prices frequently.[218] In particular, research has indicated that when products in a market are homogeneous, companies will always be more profitable when they set a price specific to each transaction made by a consumer at a particular point in time (complete dynamic pricing), rather than fixing prices for a set duration of time for all transactions and all consumers (through, for example, an announcement).[219] Although this type of posted pricing may be less optimal in terms of profits, it has dominated the retail industry for over a century.[220] This plus factor can thus be particularly helpful in a market where at least some companies' algorithms do not adjust prices on a near-constant basis.[221]

If an algorithm, for example, cuts prices unilaterally, with no indication that either demand has dropped or supply has increased, this could be viewed as a rational attempt to gain market share. But the potential for collusion arises if market share does not increase in the wake of the price reduction—perhaps because of customer loyalty to the competitor[222]—but the algorithm continues to maintain the lower price, thus reducing total profits. This could indicate that the company is waiting for its competitors to also drop their prices. Given that price changes by high-frequency retailers are more likely to occur after a price change by a low-frequency retailer[223] and that high-frequency companies generally have "lower prices than their competitors,"[224] it is possible that the algorithms are cooperating to expand market demand by attracting new customers who would otherwise not purchase the given product when both companies have higher

217. *Ethyl*, 729 F.2d 128, 139 (2d Cir. 1984).

218. See Harrington, Posted Pricing, supra note 214, at 10.

219. See id. at 12 (comparing profits when firms choose quoted prices over posted prices).

220. See supra note 65.

221. Studies have shown that the frequency of algorithmic pricing changes has increased over the last several years. See Alberto Cavallo, More Amazon Effects: Online Competition and Pricing Behaviors 3 (Nat'l Bureau of Econ. Rsch., Working Paper No. 25138, 2018), https://ssrn.com/abstract=3262401 [https://perma.cc/Y6LA-2KNY] (finding multichannel retailers changed prices every 3.65 months in 2014–2017, down from 6.7 months in 2008–2010). Nevertheless, firms may consciously choose to lower this frequency, as doing so can maximize their profits. See Brown & MacKay, supra note 193, at 2 ("[W]hen firms can choose their pricing frequency, each firm has a unilateral profit incentive to choose more frequent or less frequent pricing than their rivals.").

222. See, e.g., Jagmohan S. Raju, V. Srinivasan & Rajiv Lal, The Effects of Brand Loyalty on Competitive Price Promotional Strategies, 36 Mgmt. Sci. 276, 283 (1990) (finding that companies more likely to reduce prices through temporary promotions and sales are also less likely to have strong brand loyalty among their customer bases).

223. See Brown & MacKay, supra note 193, at 12–14.

224. Id. at 1.

prices. If the competitor does not follow in lowering prices, the first mover's price cut was suboptimal, as its gross profits have now dropped below the preprice cut level. This price cut is therefore optimal only if other competitors also lower their prices—although price uniformity is not required. If the competitor does follow suit, then an intent to collude to expand market size may be inferred to satisfy the requirement set in *Ethyl*. Although, in this case, consumers have benefitted from lower prices by both companies in the market, this can still be anticompetitive.[225]

The second plus factor examines evidence of a classic "cooperate-or-punish" scheme.[226] Here, algorithms will "typically coordinate on prices that are somewhat below the monopoly level but substantially above the . . . equilibrium."[227] If an algorithm chooses to deviate from this collusive optimal price, then it is punished by the other competitors who will cut their own prices or expand their output. Thus, the "cheater" learns to return to the prior price levels. These punishments are not permanent; instead, the cooperators who have punished the cheater will gradually return to the predeviation price levels.[228] Unlike the first plus factor, here the invitation to collude comes in the second move—with the punishment. While the cheater is attempting to act competitively by changing the price, the punisher invites collusion through a coercive move to force the cheater's price back to predeviation levels. Algorithms that frequently interact with their competitors' algorithms (not to be confused with frequency of price changes) are more easily able to detect when a competitor has deviated from the agreed-upon price in a transparent market.[229] Thus, this plus factor is likely to be more significant as the frequency of interaction increases.

C. *Overview and Addressing Concerns*

This section justifies and reviews the framework presented above, examines its problems, and provides counterarguments to those issues. Section III.C.1 explains that by treating algorithms like potential invitations to collude, the FTC can then engage in a two-step process to determine whether those algorithms are unlawful: first, by looking to the structure of the market as a whole, and second, by determining the existence of certain plus factors. Section III.C.2 acknowledges that this approach bucks the FTC's traditionally hands-off approach to exerting its standalone section 5 authority, but reiterates that the threat these pricing algorithms pose to competition cannot be ignored.

---

225. See infra note 237 and accompanying text.

226. Brown & MacKay, supra note 193, at 2.

227. Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolo & Sergio Pastorello, Artificial Intelligence, Algorithmic Pricing, and Collusion, 110 Am. Econ. Rev. 3267, 3268 (2020).

228. Id.

229. OECD, Algorithms and Collusion, supra note 192, at 22.

1. *Summary of Framework.* — In light of *Ethyl* and *Boise Cascade*, courts should recognize that computers have developed far beyond what was envisioned at the time of those decisions. While the legal personhood status of computers is still up for debate,[230] when computers can make decisions independent of their programmers, and are purposely making pricing decisions in anticipation of their competitors also making certain pricing changes, this should qualify as an intent to collude in violation of section 5. In particular, when a market is structured to easily facilitate collusion, evidence of certain plus factors takes on greater significance. *Ethyl* and *Boise Cascade* did not contemplate the pace of technological developments and consequently they should be revisited in light of the increased ease of tacit collusion.

As a result, the FTC should first examine the structure of the relevant market to see the likelihood of collusion successfully developing.[231] If the market has characteristics that facilitate collusion, courts should next look for evidence of plus factors that would suggest that the algorithms are not merely interdependent but are engaging in collusion.[232] And if the market contains the requisite characteristics to suggest it is primed for collusion and the relevant plus factors are also present, this serves as evidence that the algorithms in question function essentially as unlawful invitations to collude in the FTC's adjudication process.[233] This process would provide a systematic framework for dealing with problems of algorithmic collusion. In particular, the plus factors described above avoid the traditional intent requirements in favor instead of showing anticompetitive effect, as the *Ethyl* and *Boise Cascade* courts had required.[234]

2. *Counterarguments and Rebuttal.* — A more aggressive and systematic approach to policing potential algorithmic price fixing may have some drawbacks. Some may argue that companies act rationally when relying on algorithms to maximize profits and that they should not be punished for

---

230. See, e.g., Shawn Bayern, The Implications of Modern Business-Entity Law for the Regulation of Autonomous Systems, 19 Stan. Tech. L. Rev. 93, 95 (2015) ("[A] computer program cannot presently serve as a legal agent simply because it formally lacks legal personhood, even if it would be commercially, politically, or socially useful for the computer program to have that capability." (footnote omitted)); Lynn M. LoPucki, Algorithmic Entities, 95 Wash. U. L. Rev. 887, 898 (2018) (pointing out that Bayern has argued that "by giving an algorithm control of a legal entity, an initiator can confer on the algorithm the ability to exercise the entity's rights . . . [and] such a link confers 'personhood' on the algorithm").

231. See supra section III.B.2.

232. See supra section III.B.1.

233. See supra section III.A.

234. *Ethyl*, 729 F.2d 128, 139 (2d Cir. 1984) (requiring "some indicia of oppressiveness . . . [like] the absence of an independent legitimate business reason for its conduct"); Boise Cascade Corp. v. Fed. Trade Comm'n, 637 F.2d 573, 582 (9th Cir. 1980) (requiring proof of actual or incipient anticompetitive effect when there is no evidence of per se illegal price fixing).

doing so.[235] They may argue that technology firms in particular have had positive effects on consumer welfare because the entry of these firms into various markets can lower prices.[236] But there is a need to make a normative judgment about what antitrust considerations a legal framework should prioritize. The ease of collusion will only continue to increase with technology developments, and even if prices are lowered through algorithmic collusion, there can still be anticompetitive effects. As current FTC Chair Lina M. Khan has noted in a monopoly context, a focus on prices alone does not sufficiently assess a company's anticompetitive behavior.[237]

Similarly, algorithms that collude with one another may effect lower prices for consumers but may simultaneously promote anticompetitive behavior. For example, Amazon often lowers prices on popular goods to increase the volume of consumers who use the website for all their shopping needs.[238] But to compensate, the margin on less popular goods is increased.[239] This locks in consumers who then assume that Amazon's prices on *all* goods are lower than other competitors—even to their detriment.[240]

---

235. See supra note 42–43 and accompanying text.

236. See, e.g., Alec Stapp, Opinion, Congress Made a Lousy Case for Breaking Up Big Tech, MIT Tech. Rev. (Oct. 9, 2020), https://www.technologyreview.com/2020/10/09/1009999/congress-antitrust-report-big-tech-policy-opinion [https://perma.cc/VZ6T-QC9J] (pointing out that book prices have fallen by over 40% since Amazon's IPO).

237. See Lina M. Khan, Note, Amazon's Antitrust Paradox, 126 Yale L.J. 710, 716–17 (2017) ("[A]ssess[ing] competition primarily through price and output . . . blinds us to the potential hazards."). This note argues that anticompetitive behavior should be determined by examining the underlying structure of a market or company instead of by looking at prices alone. This marked a shift in focus away from the prevailing attitude put forth in Judge Robert Bork's *The Antitrust Paradox*, which argued that the only focus of antitrust law should be to maximize consumer welfare, which is best done by lowering prices. See generally Robert H. Bork, The Antitrust Paradox: A Policy at War With Itself 104–05, 405 (1978) (explaining that "[t]he only goal that should guide interpretation of the antitrust laws is the welfare of consumers" as defined by productive efficiency, which is "any activity by a business firm that creates wealth . . . [and] consists in offering anything . . . that consumers are willing to pay for"); Khan, supra, at 720 (describing Bork's view that "promoting economic efficiency" is the best way to maximize consumer welfare).

238. Mehta et al., supra note 174.

239. Id.

240. Rana Foroohar, Don't Be Evil: How Big Tech Betrayed Its Founding Principles—and All of Us 178–80 (2019) (describing Amazon's practice of sharply discounting the price of e-books but recouping those losses by increasing prices in other sectors in which it dominated market share). Foroohar points out that Amazon sold its Kindle reading device below cost, which allowed it to dominate the e-book market—selling ninety percent of all e-books. In response, five of the six largest traditional publishers attempted to move the e-book business to Apple, which had agreed to allow the publishers to set the price of e-books. Id. at 179. But after Amazon accused the publishers of exerting monopoly power, the DOJ decided to bring an antitrust suit *against* Apple and the publishers. Id.; see also United States v. Apple Inc., 952 F. Supp. 2d 638, 645 (S.D.N.Y. 2013) (alleging that Apple and "five book publishing companies conspired to raise, fix, and stabilize the retail price for newly released and best-selling trade e-books in violation of Section 1 of the Sherman Antitrust Act . . . and various state laws"). The district court held for the government, a finding upheld by the Second Circuit on the grounds that this constituted a per se violation of the Sherman Act. United

Thus, even in a framework focused on consumer welfare, algorithmic price fixing can have harmful effects.

In regulating companies that did not agree or intend to collude via their algorithms,[241] critics may question how firms can avoid potential liability. They may argue that companies should not be held responsible for the anticompetitive effects of their algorithms if they did not intend to create those anticompetitive effects, as they would be unfairly punished. First, as a partial remedy, once companies become aware that their algorithms are colluding with one another, they should be obligated to change them to prevent further collusion, although high switching costs may prevent a complete abandonment of the algorithm altogether.[242] An application of the willful blindness doctrine may also be appropriate to prevent companies from escaping liability by purposely ignoring any evidence of collusion. Second, as Professor Salcedo has mentioned, algorithms that are given the option to make themselves transparent to competitors will always choose to do so, since this enables collusion and can maximize profits.[243] Therefore, if possible, companies should aim to mask their algorithms to lower the risk that competitors will be able to decrypt them.

Others may push back on the treatment of algorithms as announcements and question whether these algorithms are truly extending an invitation to collude. In particular, they may argue that, given the encryption capabilities of neural networks,[244] it will be difficult for enforcers to easily ascertain when a particular algorithm is, in fact, "announcing" its pricing intentions to other competitors. Perhaps this can be remedied through a requirement that online platforms—or any companies that heavily rely on pricing algorithms—conduct a regular due diligence review of their algorithms. If programmers find that their algorithm is indeed broadcasting their pricing strategy to competitors, the company has the opportunity to disclose that information to regulators and modify the algorithm to avoid collusion concerns. This would also lessen the chance of surprise liability.

Other scholars have pointed out that no cases have been brought claiming that pricing algorithms have learned to collude with each other,

---

States v. Apple, Inc., 791 F.3d 290, 339 (2d Cir. 2015) (holding that Apple had organized a horizontal conspiracy among the publishers to raise e-book prices). The irony that the defendants had been sued for antitrust violations for trying to break up Amazon's monopoly and despite controlling less than ten percent of the market was not lost on observers and critics. See Joe Nocera, Opinion, Amazon's 'Bullying' Tactics, N.Y. Times (May 30, 2014), https://www.nytimes.com/2014/05/31/opinion/nocera-amazons-bullying-tactics.html (on file with the *Columbia Law Review*).

241. See supra section II.A.2.

242. Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolò & Sergio Pastorello, Algorithmic Pricing: What Implications for Competition Policy?, 55 Rev. Indus. Org. 155, 168 (2018) ("[T]here is a wide consensus that algorithms may deliver big efficiency gains by allowing more efficient pricing.").

243. See supra notes 187–190 and accompanying text.

244. See supra note 189 and accompanying text.

independent of the programmers' intentions regarding collusion.[245] Nevertheless, research has suggested that autonomous agents are theoretically capable of doing so.[246] Given the rapid pace of artificial intelligence research,[247] it may only be a matter of time before companies begin to incorporate this technology into their pricing programs. Consequently, modern antitrust enforcement policy must be reexamined to mitigate the dangers of potential collusion in the future.

CONCLUSION

The rise in use of pricing algorithms that are opaque in nature will significantly harm consumer welfare if left unchecked. Although the Sherman Act has been the primary vehicle to prosecute price-fixing schemes, the difficulty in proving the existence of an agreement or conspiracy among algorithms leaves the Act inadequate. On the other hand, the broader powers of the FTC Act and the statute's lack of an agreement requirement can enable the FTC to create a check on the deployment of these algorithms. Notably, the FTC Act prohibits invitations to collude and other practices that may rise to the level of incipient violations of the antitrust laws. Algorithms bear many similarities to public announcements, which have been treated as invitations to collude in the past. Consequently, this offers some precedent for considering algorithms as invitations to collude as well. Given the black-box nature of many algorithms, the FTC should look for evidence of plus factors that indicate anticompetitive effects resulting from the use of these algorithms. If these plus factors are present and the relevant market is set up to easily facilitate collusion, this may show a section 5 violation.

Although some may argue that increasing oversight and regulation of these algorithms will harm companies and reduce their desire to innovate, anticompetitive pricing algorithms also harm innovation—to the public's detriment. Even if these algorithms are able to lower prices for consumers,

---

245. Schwalbe, supra note 189, at 596 ("[T]here has been no case, legal or otherwise, in which autonomous algorithms have learned to coordinate their price-setting behavior to maximize joint profits and thereby collude tacitly.").

246. See, e.g., Samuel Barrett, Avi Rosenfeld, Sarit Kraus & Peter Stone, Making Friends on the Fly: Cooperating With New Teammates, 242 Artificial Intelligence 132, 133–34 (2016) (describing how robots who have interacted with other robots in the past can learn how to cooperate with new agents to accomplish a shared goal). This experiment took place in a fully cooperative environment—that is, all agents had an explicitly defined common goal. Id. at 133. This differs from an oligopolistic setting where, although all firms may want to maximize profits, there remains still a tension between competitors and is thus not fully cooperative.

247. The innovation speed of artificial intelligence has dramatically increased. See Xuli Tang, Xin Li, Ying Ding, Min Song & Yi Bu, The Pace of Artificial Intelligence Innovations: Speed, Talent, and Trial-and-Error, J. Informetrics, Sept. 21, 2020, at 1, 2 (noting that the number of artificial intelligence papers submitted and new researchers who have entered the field have risen rapidly since the mid-1990s).

these reduced prices cannot be considered beneficial for consumer welfare when they come at the expense of a competitive market.[248] As companies continue to invest in artificial intelligence and machine learning, the risks of collusion will only continue to increase. The many recent advancements that have been made in these fields would have been unthinkable even fifteen years ago.[249] While this research provides innumerable benefits, it also must be viewed with caution in an antitrust setting.

The current antitrust framework is ill-equipped to deal with these new technologies. The *Ethyl* and *Boise Cascade* courts did not envisage the challenges that could be presented by self-learning and autonomous agents. These judicial limitations on what can be considered collusion, coupled with the potential harms that algorithmic pricing presents, should place enforcers on high alert. A framework that takes into account an algorithm's communicative capabilities, the observable plus factors as evidence of anticompetitive effect, and the market's structural characteristics would likely meet the standards presented in *Ethyl* and *Boise Cascade* for determining a section 5 violation and also provide regulators with a systematic approach.

248. Furthermore, legislative history reveals that consumer welfare was not Congress's focus when passing the antitrust statutes. These laws were passed to ensure "a host of political economic ends—including our interests as workers, producers, entrepreneurs, and citizens." Khan, supra note 237, at 737.

249. See supra note 247.