SLAYING THE PRICING HYDRA: HOW ANTITRUST ENFORCERS CAN TACKLE TACIT ALGORITHMIC COLLUSION

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ABSTRACT

New, cutting-edge problems require new, cutting-edge solutions. But do they? Since the passage of the Sherman Act, antitrust enforcers have continuously challenged novel price fixing practices—all for the benefit of the consumer and healthy competition. As Aritficial Intelligence develops, we may face a future where each firm has its own AI pricing agent that can react instantaneously to changes in the market. Can we hold firms accountable if those AIs collude on price, even without any human input?

This Note evaluates the power of algorithmic pricing in cartel formation and operation. These algorithms create market conditions that are a breeding ground for anticompetitive practices, and their utilization may make collusive pricing inevitable. Through an understanding of the current enforcement mechanisms of the Sherman and F.T.C. Acts, this Note analyzes the challenges that current enforcement practices have in confronting algorithmic pricing and theorizes how antitrust enforcers can combat the competitive harms of tacit algorithmic collusion moving forward within the framework of our current laws.

INTRODUCTION

From the enactment of the Sherman Act and the Federal Trade Commission (F.T.C.) Act until today, antitrust enforcers and courts have grappled with new technologies and how they might be used to harm competition. As we have moved into the internet age, a new frontier has developed: firms using algorithms which can react almost instantaneously

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to changing market conditions and set prices accordingly.[1] Of course, "these increasingly automated, digitalized transactions could create a more transparent marketplace in which resources are allocated more efficiently and where the best product or service, at the lowest price, triumphs."[2] However, they may also have serious anticompetitive effects. Authorities in the United States, United Kingdom, and European Union all acknowledge "the risk that algorithms can allow competitors to share competitively sensitive information, fix prices, or collude on other terms or business strategies."[3]

Part I of this Note will discuss the issues of cartel formation and tacit collusion. It will then demonstrate how algorithmic pricing can be used to solve the challenges usually faced by cartels and thus amplify the harmful effects of collusion, both active and tacit. Part II will then discuss how our antitrust laws have dealt with tacit collusion in the past, the challenges to enforcement algorithmic pricing poses, and how the Sherman and F.T.C. Acts might be used in the future to tackle the competitive harms of tacit algorithmic collusion.

I. INTERDEPENDENCE: THE OLIGOPOLY PROBLEM

A. Active Versus Tacit Collusion: Cartels & Oligopoly

Since the passage of the Sherman Act in 1890, which outlawed all "contract[s], combination[s] . . . or conspirac[ies], in restraint of trade or

1. *See* Ariel Ezrachi & Maurice E. Stucke, *Artificial Intelligence & Collusion: When Computers Inhibit Competition*, 2017 U. ILL. L. REV. 1775, 1782 (2017) ("[W]e are shifting from the world where executives expressly collude in smoke-filled rooms to a world where pricing algorithms continually monitor and adjust to each other's prices and market data."); Terrell McSweeney & Brian O'Dea, *The Implications of Algorithmic Pricing for Coordinated Effects Analysis and Price Discrimination Markets in Antitrust Enforcement*, 32 ANTITRUST 75, 75 (2017) ("We must understand the potential effects of intelligent, high-velocity pricing technologies on competition and adapt our enforcement approach to keep pace. For example, algorithmic pricing might contribute to overt collusion or facilitate tacit collusion."); ORG. FOR ECON. COOP. & DEV., ALGORITHMS AND COLLUSION: COMPETITION POLICY IN THE DIGITAL AGE 20 (June 2017), https://web-archive.oecd.org/2019-02-17/449397-Algorithms-and-colllusion-competition-policy-in-the-digital-age.pdf [https://perma.cc/DB4E-ZEJJ] ("Regardless of the means used by companies, there is a concern that algorithms make collusive outcomes easier to sustain and more likely to be observed in digital markets.").

2. Ezrachi & Stucke, *supra* note 1, at 1781.

3. MARGRETHE VESTAGER ET AL., JOINT STATEMENT ON COMPETITION IN GENERATIVE AI FOUNDATION MODELS AND AI PRODUCTS 3 (July 23, 2024), https://www.ftc.gov/system/files/ftc_gov/pdf/ai-joint-statement.pdf [https://perma.cc/9ZH6-UH5L].

commerce,"[4] agreements between firms to form a cartel and fix prices have been illegal. But the Sherman Act and related antitrust laws are not a mandate to compete.[5] If a firm sees its competitor raise its prices and chooses to raise its prices to match without an agreement to do so ahead of time, there is no Sherman Act violation since there has been no contract, combination, or conspiracy in restraint of trade or commerce. This parallel market conduct is known as "tacit collusion."

Tacit collusion is not an issue in markets where a large number of firms are competing, i.e. markets with low levels of concentration,[6] since the pricing decisions of any one firm will not have a large effect on the market share of any other firm and thus that firm will not be worried about retaliation from its competitors.[7] For example, imagine a market that is evenly divided between 100 firms. If one firm drops its price and sees a 20% increase in market share, each other firm will see its market share drop by slightly less that 0.2%—a negligible amount. However, should that market instead be divided between three firms, a 20% increase of any one firm's market share would entail a 10% decrease for the other two.[8]

Thus, the paucity of competing firms in a concentrated market, or oligopoly, means that the actions of any one firm have a significant effect on the market as a whole. If one firm cuts its prices in order to gain a competitive edge, the other firms will not just sit idly by and lose their market shares. They will instead match that price cut, meaning all firms lose revenue until prices are raised back to the original level. If, on the other hand, one firm raises its prices, it can simply wait and see if its few competitors will raise theirs to match. If they do, the oligopolists have now set a new price, and if they do not, the firm that stepped out of line simply returns its prices to the previous level in order not to lose its market share.

4. Sherman Antitrust Act, 15 U.S.C. § 1.

5. *See* In re Text Messaging Antitrust Litig., 782 F.3d 867, 873 (7th Cir. 2015) ("[T]he Sherman Act imposes no duty on firms to compete vigorously, or for that matter at all, in price.").

6. Market concentration is the measure of how many firms are competing in the market where a "concentrated" market is a market with only a few competing firms. The metric economists generally use in measuring a market's concentration is the Herfindahl–Hirschman index (HHI). *See generally* Michael Bromberg, *Herfindahl-Hirschman Index (HHI): Definition, Formula, and Example*, INVESTOPEDIA (June 10, 2025), https://www.investopedia.com/terms/h/hhi.asp [https://perma.cc/9XLY-V23Q].

7. *See* Richard A. Posner, *Oligopoly and the Antitrust Laws: A Suggested Approach*, 21 STAN. L. REV. 1562, 1563–64 (1969).

8. *Id.*

While no explicit agreement between the firms has been made, an individual firm's pricing decisions nevertheless depend on those of its competitors as a simple consequence of the market being so concentrated. Firms in an oligopoly are therefore "interdependent" in their pricing.[9]

Economists, antitrust enforcers, and policymakers are concerned about interdependent pricing because we have known for over a century that markets in highly developed and financialized economies (like ours) tend towards increased concentration. As Rudolf Hilferding wrote in 1910: "The most characteristic features of 'modern' capitalism are those processes of concentration which . . . 'eliminate free competition' through the formation of cartels and trusts."[10] The empirical evidence supports these theories and tells us that more and more sectors of the American economy are becoming increasingly concentrated.[11]

That said, there is good concentration and there is bad concentration. Good concentration results from factors such as technological innovation giving increased benefits to economies of scale.[12] We want good concentration, as it means that "more productive firms expand yet

9. *See* Posner, *supra* note 7, at 1564.

> Anticipating a prompt reaction by his rivals that will quickly nullify his gains, the seller in a concentrated market will be less likely to initiate a price reduction than his counterpart in the atomized market. Oligopolists are thus "interdependent" in their pricing. They base their pricing decisions in part on anticipated reactions to them. The result is a tendency to avoid vigorous price competition.

Id. See also WILLIAM FELLNER, COMPETITION AMONG THE FEW: OLIGOPOLY AND SIMILAR MARKET STRUCTURES 43 (1949) ("Spontaneous co-ordination will tend to develop if more than one firm is of appreciable size in relation to the market.").

10. RUDOLF HILFERDING, FINANCE CAPITAL: A STUDY OF THE LATEST PHASE OF CAPITALIST DEVELOPMENT 21 (Tom Bottomore ed., Morris Watnick & Sam Gordon trans., Routledge & Kegan Paul 1981). *See also* VLADIMIR LENIN, IMPERIALISM, THE HIGHEST STAGE OF CAPITALISM: A POPULAR OUTLINE 20 (International Publishers 1939) ("[T]he rise of monopolies, as the result of the concentration of production, is a general and fundamental law of the present stage of development of capitalism."); Michał Kalecki, *The Determinants of Distribution of the National Income*, 6 ECONOMETRICA 97, 109 (1938) ("The degree of monopoly has undoubtedly a tendency to increase in the long run because of the progress of concentration.").

11. *See* Spencer Y. Kwon, Yueran Ma & Kaspar Zimmerman, *100 Years of Rising Corporate Concentration*, 114 AM. ECON. REV. 2111, 2112 (2024) ("Our findings reveal that increasing concentration of production activities has been a feature of the US economy for at least a century."); Gustavo Grullon, Yelena Larkin & Roni Michaely, *Are US Industries Becoming More Concentrated?*, 23 REV. FIN. 697, 698 (2019) ("We find that over the last two decades the Herfindahl–Hirschman index (HHI) has systematically increased in more than 75% of US industries, and the average increase in concentration levels has reached 90%.").

12. Matias Covarrubias, Germán Gutiérrez & Thomas Phillipon, *From Good to Bad Concentration? US Industries over the Past 30 Years*, 34 NBER MACROECON. ANN. 1, 1 (2020).

competition remains stable or increases."[13] Bad concentration, on the other hand, is the result of elevated barriers to competition and "increases economic rents and decreases innovation."[14] Unfortunately, the economic data suggests that the concentration seen in the American economy is the latter kind—it is correlated not with productivity gains but with a decrease in productivity growth, an increase in price growth, and a fixing of market shares.[15] Economies depend on competition to keep prices tied closely to costs, motivate innovation, and develop new techniques and technologies to enhance productivity. When competition is absent, these benefits cease to arise. But why are concentrated markets—also known as oligopolies—not competitive ones?

The answer is that in an oligopolistic market, the oligopolist is no longer seeking to maximize short-term profits, as traditional economics would insist should be its goal. Instead, they seek primarily to maintain their market share. Their focus is on security against potential competitors.[16] In the words of Richard Whish: "The main argument against oligopoly is that the structural conditions of the market in which oligopolists operate are such that they will not compete on price and will have little incentive to compete in other ways."[17] To put it more succinctly: "Oligopoly is grit thrown into the mechanism of competition."[18] This is why, while concentrated markets

13. *Id*.

14. *Id.* at 1–2.

15. *Id.* at 5. *See also* Grullon, Larkin & Michaely, *supra* note 11, at 699 ("[F]irms in concentrated industries are becoming more profitable predominantly through higher profit margins, rather than via greater efficiency.").

16. Kurt W. Rothschild said:

> For the absolute monopolist security against competitors is part of the definition; and for the small competitor, for whom the security question is a very urgent one, the market conditions are such an overwhelming force that he alone cannot do anything to safeguard his position. All he can do is to try to make full use of every opportunity as it comes up. Maximisation [sic] of (short-term) profits is, therefore, a legitimate generalisation [sic] for an explanation of price behaviour [sic] in the large number cases. But once we enter the field of duopoly and oligopoly this assumption is no longer sufficient. For here we find neither the safety of the single monopolist nor the impotence vis-i-vis [sic] his environment of the small competitor. Here is both the desire for achieving a secure position as well as the power to act on this desire.

Kurt W. Rothschild, *Price Theory and Oligopoly*, *in* READINGS IN PRICE THEORY 440, 451 (George J. Stigler & Kenneth E. Boulding eds., 1952).

17. RICHARD WHISH, COMPETITION LAW 468 (3d ed. 1993).

18. JOSEF STEINDL, MATURITY AND STAGNATION IN AMERICAN CAPITALISM 55 (1952).

tend to have higher prices than competitive markets, the price hikes one would generally associate with true monopolies are not generally present in oligopolies.[19] Indeed, "in practically all oligopolistic industries . . . price rigidity obtains."[20]

Price rigidity helps maintain the oligopolists' market share by maintaining barriers to entry in oligopolistic markets. If prices, and thus profits, are high, the market will be enticing to new competitors even if there are high fixed costs associated with entry. "The price in oligopolistic industries is therefore fixed on a level which just keeps potential competitors out."[21] Profits are sought only to the point which does not jeopardize a firm's market share. Thus, traditional neoclassical theories of economic behavior, i.e. price theory, are insufficient in describing the pricing behavior of oligopolies. We must instead look to theories of price interdependence.[22]

This price rigidity is the primary reason interdependence is considered harmful. When a firm's prices are dependent on those of other firms, they are no longer truly competing on price. Since "price is the 'central nervous system of the economy,'"[23] any restraint on pricing is *de facto* a restraint on competition. In this sense, the oligopoly essentially acts like a cartel.[24] Price rigidity is the result of maintaining that cartel: no individual firm wants to risk punishment for stepping out of line.[25]

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19. *See* Jonathan B. Baker & Joseph Farrell, *Oligopoly Coordination, Economic Analysis, and the Prophylactic Role of Horizontal Merger Enforcement*, 168 U. PA. L. REV. 1985, 1994 (2020) ("Coordination may not easily be recognized because coordinated outcomes in real-world markets, while harmful, do not necessarily approach the joint profit maximizing outcome that a monopolist would achieve.").

20. STEINDL, *supra* note 18, at 15. *See also* Kurt W. Rothschild, *supra* note 16, at 455 ("*Price rigidity is an essential aspect of 'normal' oligopolistic price strategy*." (emphasis in original)). *Cf.* Sharat Ganapati, *Growing Oligopolies, Prices, Output, and Productivity*, 13 AM. ECON. J.: MICROECON. 309, 317 (2021) ("[A] 10 percent increase in the market share of the largest 4 firms is linked to a 1 percent increase in . . . flat prices.").

21. STEINDL, *supra* note 18, at 17.

22. *See* Rothschild, *supra* note 16.

23. Nat'l Soc'y of Pro. Eng'rs v. U.S., 435 U.S. 679, 692 (1978) (quoting U.S. v. Socony-Vacuum Oil Co., 310 U.S. 150, 226 n. 59 (1940)).

24. S*ee* Posner, *supra* note 7, at 1575 ("There is . . . no vital difference between formal cartels and tacit collusive arrangements.").

25. *See Oligopoly and Inflation*, 3 ANTITRUST L. & ECON. REV. 27, 29 (1969) ("In . . . oligopolistic markets it is said that firms tend to recognize their mutual interdependence in pricing and that fear of retaliation causes the few firms in the market not to cut prices when industry demand falls or when costs decline.").

B. Algorithmic Pricing And Interdependence

Pricing algorithms are useful to would be price-fixers because they provide solutions to two of the main challenges facing cartels: "selecting and coordinating the behavior of all cartel participants on mutually consistent, collusive strategies" and "monitoring the behavior of cartel participants to detect and deter defections from these collusive strategies."[26] Pricing algorithms can be "set up to monitor the market and explore the likelihood of establishing interdependence of action . . . [and also] to punish deviations from a possible tacit agreement and to identify maverick firms which depart from the equilibrium."[27] The costs of developing collusive strategies and punishing cheaters are thus significantly reduced, as those behaviors are simply baked in to the algorithm to begin with.

Pricing algorithms can take several forms. Researchers Ariel Ezrachi and Maurice E. Stucke have identified two kinds of pricing algorithms which are both used to facilitate traditional cartels—what they call "Messenger" and "Hub and Spoke" algorithms.[28] Messenger algorithms work as their name would suggest: firms first agree to operate as a cartel, setting prices in coordination with each other, and then "use their computer to assist in implementing, monitoring, and policing the cartel."[29] A Hub and Spoke algorithm describes a scenario wherein "competitors use the same (or a single) algorithm to determine the market price or react to market changes. In this scenario, the common algorithm, which traders use as a vertical input, leads to horizontal alignment."[30] Hub and Spoke algorithms have been challenged in notable litigation against companies like Uber[31] and, more recently, RealPage.[32] Messenger algorithms are understood to be *per se* illegal under the Sherman Act, as they exist solely to facilitate price-

26. Margaret C. Levenstein & Valerie Y. Suslow, *What Determines Cartel Success?*, 44 J. ECON. LITERATURE 43, 44 (2006). *See also* Posner, *supra* note 7 at 1571 ("[T]he attractiveness and feasibility of a price-fixing scheme to the sellers in a market are limited by the costs of bargaining to agreement and of enforcing the agreement to prevent cheating.").

27. Ezrachi & Stucke, *supra* note 1 at 1791.

28. *Id.* at 1782.

29. *Id*.

30. *Id.* at 1787.

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

32. *See generally* In re RealPage, Inc., Rental Software Antitrust Litig. (No. II), 709 F. Supp. 3d 478 (M.D. Tenn. 2023).

fixing.[33] How the law will treat Hub and Spoke algorithms remains to be seen, and likely will be a fact-intensive inquiry as these types of pricing systems "pose difficult evidentiary challenges for (1) detecting anticompetitive misconduct and (2) linking the misconduct to a 'meeting of the minds' among accused conspirators or general anticompetitive intent of a single actor."[34] That said, as these algorithms have become wider spread and their use has come under increasing scrutiny, there has been good scholarship produced on how both the Sherman Act and the F.T.C. Act might be wielded to clamp down on their anticompetitive effects.[35]

Additionally, Ariel Ezrachi and Maurice E. Stucke identified a third category of pricing algorithms which would not necessarily implicate current antitrust law at all, despite having harmful anticompetitive effects. This is a scenario where each firm develops its own algorithm unilaterally and each independently gives its algorithm the goal of maximizing profits while protecting the firm's market share. This leads to possibility of there being no legally cognizable collusion, since each firm is acting independently, even if the algorithms utilize collusive pricing strategies resulting in supracompetitive prices. Ariel Ezrachi and Maurice E. Stucke call the programs which might facilitate such tacit algorithmic collusion "Predictable Agents," and it is these Predictable Agents the rest of this note will focus on.

Economists Zach Y. Brown and Alexander Mackay have shown that in a scenario where each firm in a market is running its own Predictable Agent, these algorithms tend to set supracompetitive prices.[36] This holds true even when restricting the algorithms' behavior to "eliminate collusive strategies."[37] Using Predictable Agents has transformed the markets' conditions by "extend[ing] and multipl[ying] the scenarios in which tacit collusion weakens the functioning of competition."[38] Whereas previously,

33. *See* Plea Agreement at 3, U.S. v. Topkins, No. CR 15-00201-WHO (N.D. Ca. Apr. 30, 2015) (ECF No. 7).

34. Noelle Choi, *Retooling Federal Antitrust Laws to Address Modern Pricing Solutions: Pricing Algorithms and Dynamic Pricing*, 7 J.L. & INNOVATION 160, 176 (2024).

35. *See generally id*.; Aneesa Mazundar, *Algorithmic Collusion: Reviving Section 5 of the F.T.C. Act*, 122 COLUM. L. REV. 449 (2022).

36. *See generally* Zach Y. Brown & Alexander MacKay, *Competition in Pricing Algorithms*, 15 AM. ECON. J.: MICROECON. 109 (2023).

37. *Id*. at 111.

38. Francisco Beneke & Mark-Oliver Mackenrodt, *Remedies for Algorithmic Tacit Collusion*, 9 J. ANTITRUST ENF'T 152, 165 (2021).

firms set their prices independently of one another, the Predictable Agent induces interdependent action, either by aggressively "detect[ing] and punish[ing] rivals' price cutting" or by learning to engage in "parallel accommodating conduct."[39] As such, "when firms compete via algorithms . . . collusion is not only possible but rather, it is *inevitable*."[40] No wonder, then, that the anticompetitive effects of these algorithms are amplified in an oligopoly, where market action is already interdependent, resulting in even higher prices relative to the competitive price.[41]

It may be useful to look at an example of how these technologies might be applied. Let us imagine a scenario involving grocery stores, as they are often local oligopolies or even monopolies.[42] In the past few years, a number of grocery chains have started implementing electronic shelf labels (ESLs).[43] These labels allow the store to update prices in near-real time.[44] While there are clear concerns that introducing real-time pricing to grocery stores will facilitate price gouging,[45] there are efficiency-increasing reasons for their introduction.[46] But we can imagine a scenario where all of the grocery stores in an area have implemented ESLs, and the prices these ESLs display are not based solely on inputs within the store, such as lowering a product's price as it reaches its sell-by date, but are conditioned on the prices

39. Ezrachi & Stucke, *supra* note 1, at 1789–90.

40. Bruno Salcedo, Pricing Algorithms and Tacit Collusion 3 (Nov. 1, 2015) (unpublished manuscript) (on file with the *Washington University Journal of Law & Policy*) (emphasis in original).

41. Brown & MacKay, *supra* note 36, at 144–48.

42. U.S. DEP'T OF AGRIC. ECON. RSCH. SERV., A DISAGGREGATED VIEW OF MARKET CONCENTRATION IN THE FOOD RETAIL INDUSTRY 6 (2023) (finding food retailers have an HHI of 3,737 at the county level in the United States, equivalent to only 2.7 equal-sized firms per county on average).

43. Catherine Douglas Moran & Sam Silverstein, *Why More Grocers are Putting Electronic Shelf Labels in Their Stores*, GROCERY DIVE (Feb. 8, 2023), https://www.grocerydive.com/news/why-more-grocers-are-putting-electronic-shelf-labels-in-their-stores/642002/[https://perma.cc/RB64-SX3B].

44. Lola Murti, *A Supermarket Trip May Soon Look Different, Thanks to Electronic Shelf Labels*, NPR (June 19, 2024), https://www.npr.org/2024/06/17/nx-s1-5009271/electronic-shelf-labels-prices-walmart-grocery-store [https://perma.cc/7PB9-K2C4].

45. *See* Congresswoman Rashida Tlaib (@RepRashida), X (Nov. 8, 2024, at 4:57 PM), https://x.com/RepRashida/status/1858645652521316385 [https://perma.cc/9QBY-8B2G]; Letter from Elizabeth Warren & Robert P. Casey, Jr. to Kroger regarding Electronic Shelving and Price Gouging (Aug. 5, 2024) (on file with the *Washington University Journal of Law & Policy*).

46. *See* Murti, *supra* note 44 ("The bottom line, at least when I talk to retailers, is the calculation of the amount of labor that they're going to save by incorporating this. And in that sense, I don't think that this is something that only large corporations like Walmart or Target can benefit from."); Moran & Silverstein, *supra* note 43 ("They tackle the big issue of changing prices and the loss that grocery retailers can experience when they don't have accurate pricing on shelf.").

for the same or similar products in the other grocery stores. Of course, this would depend on knowing the prices in other grocery stores, but we can further assume that each grocer is listing its prices on its website given that "retailers are likely drawn to electronic shelf tags to ensure consistency between online and in-store pricing."[47] In such a scenario, we would expect to see the supracompetitive pricing Zach Y. Brown and Alexander Mackay found in their simulation, meaning consumers in that area will be forced to pay more and more for their groceries.

Realizing the harmful effects these new technologies can have for consumers, especially in a concentrated market, we thus must determine how we might combat those effects using the antitrust laws.

II. ANTITRUST LAW, OLIGOPOLY, AND ALGORITHMS

Considering what we know about the harmful effects of interdependence, one would think that oligopolies should be squarely in the sights of antitrust regulators. Indeed, the Supreme Court has even recognized that "firms in a concentrated market might in effect share monopoly power, setting their prices at a profit-maximizing, supracompetitive level by recognizing their shared economic interests and their interdependence with respect to price and output decisions."[48] Even so, the Court held that in such a scenario, tacit collusion is still "not in itself unlawful," since it is merely the output of those oligopolistic firms acting in their economically rational self-interest.[49] Despite the economic theory detailed above, which acknowledges that the pricing decisions of oligopolistic firms are interdependent, the Supreme Court famously admonished that "'conscious parallelism' has not yet read conspiracy out of the Sherman Act entirely."[50]

How then might regulators seeking to curb the harmful impact of Predictable Agents, especially among oligopolies, utilize the antitrust laws?

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47. Murti, *supra* note 44.
48. Brooke Group Ltd. v. Brown & Williamson Tobacco Corp., 509 U.S. 209, 227 (1993).
49. *Id*.
50. Theatre Enters., Inc. v. Paramount Film Distrib. Corp., 346 U.S. 537, 541 (1954). *See also* E.I. du Pont de Nemours & Co. v. F.T.C., 729 F.2d 128, 139 (2d Cir. 1984) ("The mere existence of an oligopolistic market structure in which a small group of manufacturers engage in consciously parallel pricing of an identical product does not violate the antitrust laws." (citing *id*.)).

A. Section One Of The Sherman Act

Agreements among competitors not to compete (horizontal agreements) and instead collude to set prices are a *per se* violation of Section One of the Sherman Act (§ 1):

> Price fixing . . . [is] among the group of antitrust offenses that are considered 'per se' unreasonable restraints of trade. The courts have reasoned that these practices, which invariably have the effect of raising prices to consumers, have no legitimate justification and lack any redeeming competitive purpose and should, therefore, be considered unlawful without any further analysis of their reasonableness, economic justification, or other factors.[51]

Furthermore, price-fixing in the antitrust context does not solely refer to the "establishment of uniform prices," but instead can be any "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."[52]

While every contract is a restraint of trade in some way, only some of them, like agreements to fix price, lack any legitimate business justification and are thus considered *per se* violations of the Sherman Act. Other kinds of agreements, while admittedly restraining trade, can also have procompetitive benefits, leading courts to often choose not to apply the *per se* rule but instead use the Rule of Reason: "an inquiry into market power and market structure designed to assess the combination's actual effect" and determine whether the harms outweigh the benefits.[53] Rule of Reason analysis involves a three-step burden shifting test:

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51. ARCHIVES: U.S. DEP'T OF JUSTICE, ANTITRUST RESOURCE MANUAL: 1. ELEMENTS OF THE OFFENSE, https://www.justice.gov/archives/jm/antitrust-resource-manual-1-attorney-generals-policy-statement (last visited Feb. 19, 2025) [https://perma.cc/C7MH-XJEY].

52. U.S. v. Socony-Vacuum Oil Co., 310 U.S. 150, 222–23 (1940). It is worth noting that in this same decision, the Supreme Court made it clear that an anticompetitive outcome was unnecessary for there to be a violation of § 1 as the mere agreement is itself the violation. *Id*. at 224 n.59.

53. Copperweld Corp. v. Indep. Tube Corp., 467 U.S. 752, 768 (1984). *See also* Ohio v. Am. Express Co., 585 U.S. 529, 541 (2018) (The Rule of Reason is how courts "'distinguis[h] between restraints with anticompetitive effect that are harmful to the consumer and restraints stimulating competition that are in the consumer's best interest.'" (quoting Leegin Creative Leather Prods., Inc. v. PSKS, Inc., 551 U.S. 877, 886 (2007))).

> Under this framework, the plaintiff has the initial burden to prove that the challenged restraint has a substantial anticompetitive effect that harms consumers in the relevant market. If the plaintiff carries its burden, then the burden shifts to the defendant to show a procompetitive rationale for the restraint. If the defendant makes this showing, then the burden shifts back to the plaintiff to demonstrate that the procompetitive efficiencies could be reasonably achieved through less anticompetitive means.[54]

With this brief introduction to § 1 concluded, we turn to its treatment of oligopolies and interdependent behavior.

i. Turner vs. Posner

The subject of oligopoly and interdependence has long been a topic of debate among antitrust scholars, practitioners, and jurists defined by two opposing camps: adherents of Harvard professor Donald F. Turner clashing with those of University of Chicago professor, and later federal judge, Richard A. Posner.

Professor Turner argued that "interdependent consciously parallel decisions as to basic price, as found in an industry dominated by a few sellers, should not be held to constitute an 'agreement,' or, even though we call it an 'agreement,' should not be deemed unlawful."[55] He believed that "[t]he behavior of the rational oligopolist in setting his price is precisely the same as that of the rational seller in an industry consisting of a very large number of competitors. . . .The rational oligopolist simply takes one more factor into account—the reactions of his competitors."[56] As a result, the oligopolist's behavior was best described as individual behavior—a "rational individual decision in the light of relevant economic facts"[57]—and thus no agreement as required by our laws to constitute an antitrust violation had occurred.

Turner also argued that there is no effective remedy to oligopolistic

54. *Am. Express Co.*, 585 U.S. at 541–42 (citations omitted).

55. Donald F. Turner, *The Definition of Agreement under the Sherman Act: Conscious Parallelism and Refusals to Deal*, 75 HARV. L. REV. 655, 663 (1962).

56. *Id*. at 665.

57. *Id*. at 666.

interdependence under § 1, since enjoining a firm in an oligopoly from considering the reactions of its competitors when setting its prices would "demand such irrational behavior that full compliance would be virtually impossible."[58] The only kind of injunction which would make sense to Turner would be one that required firms to set their prices equal to the competitive price. Ensuring such an injunction's enforcement, however, would require judges to calculate competitive prices—a task they are ill-equipped to do—and even if they could it would be unreasonable to expect total compliance when costs (and thus competitive prices) can fluctuate rapidly.[59]

Judge Posner, on the other hand, was skeptical of the interdependence theory. Instead, he believed that "tacit collusion or noncompetitive pricing is not inherent in an oligopolistic market structure but, like conventional cartelizing, requires additional, voluntary behavior by the sellers."[60] Instead of interdependence, Judge Posner suggested that it was better to understand supracompetitive pricing in concentrated markets under the theory of cartels.[61]

Of course, Judge Posner does not suggest that supracompetitive pricing alone is evidence of illegal collusion. Bringing § 1 claims under his theory would require proof of "conduct from which an absence of effective competition can be inferred: cartel-like conduct."[62] Such evidence could take the form of showing price rigidity or excess capacity (i.e. producing less than a firm's capabilities regardless of demand), among other things.[63] If a plaintiff could produce such evidence, then a court could deduce the existence of an agreement underlying oligopolists' parallel market behavior.

As stated above, it was Turner's view which won and has since been endorsed by the Supreme Court.[64] Indeed, it seemingly became the view of Judge Posner himself.[65] The law now views the anticompetitive effects of

58. *Id*. at 669.
59. *Id*. at 670.
60. Posner, *supra* note 7, at 1578.
61. *Id*. at 1569.
62. *Id*. at 1583.
63. *Id*. at 1578–83.
64. S*ee, e.g.*, Brooke Grp. Ltd. v. Brown & Williamson Tobacco Corp., 509 U.S. 209 (1993); Bell Atl. Corp. v. Twombly, 550 U.S. 544 (2007).
65. Judge Posner wrote:

> [T]he Sherman Act imposes no duty on firms to compete vigorously, or for that matter at all, in price. This troubles some antitrust experts . . . [who argue] that

oligopoly as almost inevitable. Since these effects are the result of oligopolists acting in their rational, economic self-interest and there is nothing *per se* illegal about becoming an oligopolist, one would think we all just have to put up with it; and if Predictable Agents end up supercharging these harms, then so be it. However, I believe that our antitrust laws do present avenues for tackling Predictable Agents, both under the Sherman Act and the F.T.C. Act.

ii. Bring Back Cartel Theory?

The first avenue antitrust enforcers might take against firms that use Predictable Agents is to challenge their use as illegal price-fixing under § 1. In this case, the allegation would be that the firms in a market all agreed to implement Predictable Agents knowing that this would result in general price increases. Of course, to succeed in a price fixing claim, the plaintiff must prove the existence of a conspiracy, and the use of a Predictable Agent by a firm or even all the firms in a market is certainly not direct evidence of a conspiracy. But most antitrust enforcement actions do not rely on direct evidence. Since price-fixing is *per se* illegal and market actors generally know better than to write memos or sign contracts that explicitly state they are breaking law,[66] those bringing claims under § 1 tend to rely on indirect evidence.

Indirect evidence of an agreement is the existence of parallel conduct along with the existence of "plus factors."[67] The Supreme Court has never

> tacit collusion should be deemed a violation of the Sherman Act. That of course is not the law, and probably shouldn't be. A seller must decide on a price; and if tacit collusion is forbidden, how does a seller in a market in which conditions (such as few sellers, many buyers, and a homogeneous product, which may preclude nonprice competition) favor convergence by the sellers on a joint profit-maximizing price without their actually agreeing to charge that price, decide what price to charge? If the seller charges the profit-maximizing price (and its 'competitors' do so as well), and tacit collusion is illegal, it is in trouble. But how is it to avoid getting into trouble? Would it have to adopt cost-plus pricing and prove that its price just covered its costs (where cost includes a 'reasonable return' to invested capital)? Such a requirement would convert antitrust law into a scheme resembling public utility price regulation, now largely abolished.

In re Text Messaging Antitrust Litig., 782 F.3d 867, 873–74 (7th Cir. 2015) (Judge Posner for the majority).

66. *Cf.* THE WIRE: *Straight and True* (HBO, accessed Oct. 30, 2025) ("Is you taking notes on a criminal . . . conspiracy? [What] is you thinking, man?").

67. The Third Circuit said:

laid out an exhaustive list of plus factors that a court must consider when evaluating claims under § 1 attempting to establish a price-fixing agreement via indirect evidence, but courts generally fixate on three: "(1) evidence that the defendant had a motive to enter into a price fixing conspiracy; (2) evidence that the defendant acted contrary to its interests; and (3) evidence implying a traditional conspiracy."[68]

In a concentrated market, the first factor can be understood as a restatement of interdependence, since firms would be motivated to collude since the market structure makes collusion easier.[69] The second factor might be satisfied due to the necessity of price transparency to facilitate the Predictable Agent,[70] especially if there is evidence that the market is one such that posting prices has little effect on consumer search costs or producer selling costs, meaning that price transparency has little procompetitive benefit.[71] Of course, in certain markets, price transparency already prevails. The Zach Y. Brown and Alexander Mackay study

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> [W]e have required that plaintiffs basing a claim of collusion on inferences from consciously parallel behavior show that certain "plus factors" also exist. Existence of these plus factors tends to ensure that courts punish "concerted action"–an actual agreement–instead of the "unilateral, independent conduct of competitors." In other words, the factors serve as proxies for direct evidence of an agreement.

In re Flat Glass Antitrust Litig., 385 F.3d 350, 360 (3d Cir. 2004) (citations omitted).

68. *Id.* (internal quotations and citations omitted).

69. *See id.*

> Evidence that the defendant had a motive to enter into a price fixing conspiracy means evidence that the industry is conducive to oligopolistic price fixing, either interdependently or through a more express form of collusion. In other words, it is "evidence that the structure of the market was such as to make secret price fixing feasible."

Id. (quoting In re High Fructose Corn Syrup Antitrust Litig., 295 F.3d 651, 655 (7th Cir. 2002)).

70. *See* Ezrachi & Stucke, *supra* note 1, at 1790 (describing how in a market with limited price transparency, "to shift pricing decisions from humans to computers, each firm must increase price transparency. Now both the firm's customers and rivals can promptly observe all the competitively significant terms.").

71. Joseph E. Harrington, Jr., *Posted Pricing as a Plus Factor*, 7 J. COMPETITION L. & ECON. 1, 21 (2011).

> When the adoption of posted pricing has little effect on consumers' search costs and firms' selling costs, it was shown that the industrywide adoption of setting a list price with no discounting is contrary to firms' interests when they compete. Therefore, the adoption of posted pricing is optimal for firms only if it results in coordinated pricing.

Id.

discussed in Part I.B is a simulation of the effect of pricing algorithms in online retail markets, where price is necessarily transparent. In such a market, the implementation of a Predictable Agent might not give rise to an inference of an explicit agreement.[72] But suppose that the market is not one that ordinarily has transparency over prices. In order to facilitate the Predictable Agent, then, a firm will have to make its pricing transparent, so that their interdependent competitors can more quickly react to their changes in price (and their Predictable Agent can then better react to their competitors' reaction). Suppose further that over a short period, all or most of the firms in this market announce that they are implementing Predictable Agent algorithms and making their prices transparent. Of course, these firms are aware that doing so ensures they will receive the benefits of supracompetitive pricing.

The final factor, evidence implying a conspiracy, is a catch-all category for evidence of collusive behavior short of direct evidence of a conspiracy. Courts view these factors as part of a totality of circumstances test to determine whether plaintiffs have raised a plausible inference of price fixing beyond mere tacit collusion. It is not difficult to see how the implementation of Predictable Agent algorithms might fall into this category of evidence. First and foremost, we must recognize that any firm implementing a Predictable Agent surely knows of the effect it will have on its pricing. It is not the case that technological development is "an autonomous process, having a life of its own which proceeds automatically, and almost naturally, along a singular path."[73] A company which implements a pricing algorithm does so with a singular purpose: to maximize its profits. That on its own is clearly not enough to say that using Predictable Agents is evidence of a conspiracy. What weighs far heavier is that, as noted in Part I.B., these algorithms solve many problems previously inherent to cartels.[74]

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72. Indeed, pricing algorithms are already widely prevalent in online retail markets. *See Pricing Algorithms*: *Economic Working Paper on the Use of Algorithms to Facilitate Collusion and Personalised Pricing* 19 (Competition & Mkts. Auth., Working Paper No. CMA94, 2018), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/746353/Algorithms_econ_report.pdf [https://perma.cc/G2XW-ZGDX].

73. DAVID F. NOBLE, FORCES OF PRODUCTION: A SOCIAL HISTORY OF INDUSTRIAL AUTOMATION xi (1984).

74. *See* Christophe S. Hutchinson, Gulnara F. Ruchkina & Sergei G. Pavlikov, *Tacit Collusion on Steroids: The Potential Risks for Competition Resulting from the Use of Algorithm Technology by Companies*, 13 SUSTAINABILITY (SPECIAL ISSUE) 2 (2021) ("[I]t is not excluded that in the years to come algorithms will be used to obtain the effects of a cartel without the need to enter into restrictive

Economists have noted that cheating is the "preeminent challenge that cartels face."[75] Successful cartels thus develop methods of monitoring cartel members in order to deter and detect any cheating.[76] Since the Predictable Agent can update prices in real time,[77] it "allow[s] for an immediate retaliation to deviations from collusion,"[78] and prevents any lag time between cheating and detection which might have incentivized cheating.[79] The lack of lag before implementation of retaliatory price cuts afforded by the Predictable Agent "effectively deprives discounting rivals of any significant sales."[80]

Considering all this, when we are faced with a market in which all or most of the firms are implementing Predictable Agents and increasing price transparency to facilitate their use, that behavior could reasonably give rise to an inference that these firms made the following agreement: to make their pricing transparent and implement Predictable Agents so as to effect a general raising or stabilization of prices. Such an agreement would be *per se* illegal.[81]

iii. Facilitating Practices

Use of the Predictable Agent might be enough to sustain a *per se* price fixing claim, as outlined above, but in recent years the Supreme Court has cautioned that "we take special care not to deploy [the *per se* rule] until we have amassed 'considerable experience with the type of restraint at issue' and 'can predict with confidence that it would be invalidated in all or almost all instances.'"[82] Considering how recently algorithmic pricing has

agreements between them or to engage in concerted practices.").

75. Levenstein & Suslow, *supra* note 26, at 44.

76. *Id*. at 47–48.

77. Organisation for Economic Co-operation and Development, *Algorithms and Collusion - Background Note by the Secretariat*, DAF/COMP(2017)4 (June 9, 2017), https://one.oecd.org/document/DAF/COMP(2017)4/en/pdf [https://perma.cc/5CBP-94WK].

78. *Id*. at 20. *See also* Maria Bigoni, Jan Potters & Giancarlo Spagnalo, *Frequency of Interaction, Communication, and Collusion: An Experiment*, 68 ECON. THEORY 827 (2019).

79. Posner, *supra* note 7, at 1567 ("[I]f a lag does occur, the price cut may pay even though it will eventually be matched.").

80. Ariel Ezrachi & Maurucie Stucke, *Sustainable and Unchallenged Algorithmic Tacit Collusion*, 17 NW. J. TECH. & INTELL. PROP. 217, 227 (2020).

81. *See* U.S. v. Socony-Vacuum Oil Co., 310 U.S. 150, 223 (1940) ("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.").

82. Nat'l Collegiate Athletic Ass'n v. Alston, 594 U.S. 69, 89 (2021) (quoting Leegin Creative

developed and the fact that "there has been comparatively little research" on the impacts of pricing algorithms on pricing behavior,[83] it seems likely that courts will hesitate to call them *per se* illegal, especially as a Predictable Agent is not easily analogous to other practices which have been established as *per se* illegal price fixing.[84]

Still, that does not mean there is no claim under § 1. Apart from price fixing, the behavior necessary to implement a Predictable Agent might be challenged as "a closely related but analytically distinct type of claim . . . where the violation lies in the information exchange itself."[85] The Supreme Court has already found that the exchange of price information in a market for a "fungible" product "dominated by relatively few sellers" is a violation of the Sherman Act, as "the exchange of price information has . . . an anticompetitive effect in the industry, chilling the vigor of price competition."[86] While the Supreme Court has clarified that "the dissemination of price information is not itself a *per se* violation of the Sherman Act,"[87] it has also noted that "[e]xchanges of current price information . . . have the greatest potential for generating anticompetitive effects and although not *per se* unlawful have consistently been held to violate the Sherman Act."[88] Following this line of cases, there is a good chance that should there be evidence of an agreement to implement Predictable Agents and increase price transparency to facilitate them, it would violate the Sherman Act.

Furthermore, using the Predictable Agent itself may be challenged as a facilitating practice, since the definition includes any "mechanisms that enhance rival firms' ability to police" a potential cartel.[89] As discussed above, the Predictable Agent does exactly that: eliminate any lag between

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Leather Prods., Inc. v. PSKS, Inc., 551 U.S. 877, 886–87 (2007)).

83. Renato Nazzini & James Henderson, *Overcoming the Current Knowledge Gap of Algorithmic "Collusion" and the Role of Computational Antitrust*, 4 STAN. COMPUTATIONAL ANTITRUST 1, 31 (2024).

84. *Cf.* In re RealPage, Inc., Rental Software Antitrust Litig. (No. II), 709 F. Supp. 3d 478, 521 (M.D. Tenn. 2023) (noting that "that courts are cautious in considering whether to apply *per se* treatment to new or novel ways of doing business" when refusing to apply *per se* analysis in an alleged case of Hub and Spoke algorithmic collusion).

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

86. U.S. v. Container Corp. of Am., 393 U.S. 333, 337 (1969).

87. U.S. v. Citizens & S. Nat'l Bank, 422 U.S. 86, 113 (1975) (citations omitted).

88. U.S. v. U.S. Gypsum Co., 438 U.S. 422, 441 n.16 (1978) (citations omitted).

89. William H. Page, *Facilitating Practices and Concerted Action under Section 1 of the Sherman Act*, *in* ENCYCLOPEDIA OF LAW AND ECONOMICS. 23 (Gerrit de Geest ed., 2d. ed. 2023).

conspirators to ensure they are moving in lock step and deters cheaters due to the speed with which it can retaliate to any decrease in price.

That all said, whether the facilitating practice is the Predictable Agents themselves or the information transparency necessary to facilitate them, § 1 requires an agreement. Despite both Professor Turner and Judge Posner agreeing that independent adoption of a facilitating practice among oligopolists should be illegal,[90] that is not the position of the courts.[91]

iv. Proving Collusion

The main challenge in bringing claims under § 1 is the requirement that there be a "contract, combination . . . or conspiracy."[92] Thus, it will be insufficient to point to a group of firms, even in a concentrated market, implementing Predictable Agents and making their prices transparent when alleging collusion. The standard for indirect evidence is high for claims under § 1. It is not enough to merely demonstrate that collusion *might* have occurred. Instead, "a plaintiff seeking damages for a violation of § 1 must present evidence 'that tends to exclude the possibility' that the alleged conspirators acted independently."[93] Remember: *tacit collusion is not illegal*. In fact, an allegation of mere tacit collusion dies at the motion to dismiss stage.[94] Plaintiffs bringing a price-fixing claim must demonstrate

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90. *See* Turner, *supra* note 55, at 674–76 ("What if oligopolists, without overt, explicit agreement, simply drift into an identical pattern of, say, rigid zone pricing, in the conscious awareness of the mutual benefits to be gained from their doing so? Should this be held an unlawful conspiracy? I believe the answer should be 'yes.'"); RICHARD A. POSNER, ANTITRUST LAW: AN ECONOMIC PERSPECTIVE, 70–71 (1976).

> The purpose of basing-point pricing is to facilitate collusion by simplifying the pricing of the colluding firms. It is plainly inconsistent with competition. . . .With one exception, in all of the cases in which basing-point systems have been challenged as a violation of the Sherman Act, there has been evidence that the sellers had agreed to set up a basing-point system. It should be clear by now that I regard such evidence as unnecessary to establish a violation of the Sherman Act.

Id.

91. *See* George A. Hay, *Horizontal Agreements: Concept and Proof*, 51 ANTITRUST BULL. 877, 912 (2006) ("Whatever the underlying economic theory, a plaintiff seeking to succeed under section 1 of the Sherman Act must still allege an unlawful agreement.").

92. Sherman Antitrust Act, 15 U.S.C. § 1.

93. Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 588 (1986) (citing Monsanto Co. v. Spray-Rite Serv. Corp., 465 U.S. 762, 764 (1984)).

94. Bell Atlantic Co. v. Twombly, 550 U.S. 544, 556 (2007).

parallel conduct,[95] but to state a violation of § 1 there needs to be something more. This may include demonstrating that prices are unrelated to costs,[96] previous government investigations into defendant(s)' for price-fixing,[97] or opportunities to conspire such as common membership in trade organizations.[98] While none of these factors on their own are determinative of a conspiracy, their presence in addition to the parallel conduct supports the inference of collusion.

That said, the mere act of implementing a Predictable Agent along with increasing price transparency does not on its own exclude the possibility that the firms which did so acted independently, and so cannot by itself sustain a claim under § 1, either for *per se* price-fixing or as a facilitating practice, even though those acts likely raise the inference of an agreement.[99] This is because antitrust law has a very limited definition of agreement: only "an express, manifested agreement, and thus an agreement involving actual, verbalized communication" is sufficient to sustain claims under § 1.[100] Thus, "[i]n the search for evidence that tends to exclude independent action, courts have focused primarily on evidence tending to suggest [oral or written]

95. *See, e.g.*, Park Irmat Drug Corp v. Express Scripts Holding Co., 911 F.3d 505, 517 (8th Cir. 2018) ("Because Irmat fails to plausibly plead parallel conduct . . . [t]he district court correctly dismissed Irmat's Section 1 claim.").

96. *See* In re High Fructose Corn Syrup Antitrust Litig., 295 F.3d 651, 658 (7th Cir. 2002).

> If sellers are competing in the sale of an identical product which costs each of them $1 to produce . . . so that the competitive price . . . is $1, no one of them can sell his product to some of his customers for $2, for they can buy from his competitors for $1 - unless the sellers collude, and agree not to cut price to the disfavored buyers.

Id.

97. *See* Hinds County, Miss. v. Wachovia Bank N.A., 790 F. Supp. 2d 106, 115 (S.D.N.Y. 2011) ("[G]overnment investigations may be used to bolster the plausibility of § 1 claims.").

98. *See* In re Flash Memory Antitrust Litig., 643 F. Supp. 2d 1133, 1148 (N.D. Cal. 2009) ("[C]ourts have recognized that trade association affiliations and attendance at industry events may be alleged to show that putative conspirators had the opportunity and means to develop and/or further their alleged collusive scheme."); *Cf.* ADAM SMITH, THE WEALTH OF NATIONS 177 (Edwin Cannan ed., Bantam Classic 2003) ("People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices.").

99. Organisation for Economic Co-operation and Development, *Algorithms and Collusion - Note by the United States*, DAF/COMP/WD(2017)41 (May 26, 2017), https://one.oecd.org/document/DAF/COMP/WD(2017)41/En/pdf [https://perma.cc/G2QU-K6GL] ("Absent concerted action, independent adoption of the same or similar pricing algorithms is unlikely to lead to antitrust liability even if it makes interdependent pricing more likely.").

100. In re High Fructose Corn Syrup Antitrust Litig., 295 F.3d 651, 654 (7th Cir. 2002).

communication has occurred."[101]

Under these constraints, firms cannot be liable under § 1 for unilaterally implementing Predictable Agents even if those algorithms utilize collusive strategies to set supracompetitive prices. But why should that be the case? As discussed in Part II.A.ii, the two reasons Turner gave for not outlawing tacit collusion were that it was not cognizable as an agreement and that it would be too hard to craft a suitable injunctive remedy. The first reason can be discounted. Implied agreements are an acknowledged part of contract[102] and criminal[103] law. There is no reason why they cannot be a part of antitrust law as well. Even the conduct of the Predictable Agents, which act without human input, can be considered collusive in that their behavior "communicate[s] a conscious commitment to a common theme."[104] Thus, we need only deal with Professor Turner's second argument. In the case of tacit collusion generally, I agree with him. It makes no sense to order a firm not to look at other firms' pricing activity when setting its own prices, nor is it feasible to ask a judge to set a "competitive price" that a firm must stick to.[105]

Yet courts need not jump to these irrational injunctions in a case where tacit collusion has been facilitated by Predictable Agents, as it is not necessarily the case that no effective remedy exists to prevent *algorithmic* tacit collusion since an injunction might require a Predictable Agent to be programmed to compete and not cooperate. Collusive strategies could be disincentivized or rendered ineffective by prohibiting the Predictable Agent

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101. William H. Page, *Communication and Concerted Action*, 38 LOY. U. CHI. L.J. 405, 447 (2007).

102. *See*, *e.g.*, Bailey v. West, 249 A.2d 414, 416 (R.I. 1969) ("A 'contract implied in fact,' or an implied contract in the proper sense, arises where the intention of the parties is not expressed, but an agreement in fact, creating an obligation, is implied or presumed from their acts." (citation omitted) (citations cleaned up)).

103. *See*, *e.g.*, Livingston v. State, 524 S.E.2d 222, 228 (Ga. 1999) ("Conduct which discloses a common design, even without proof of an express agreement between the parties, may establish a conspiracy.").

104. Michal S. Gal, *Algorithms as Illegal Agreements*, 34 BERKELEY TECH L.J. 67, 109 (2019).

105. *See* Beneke & Mackenrodt, *supra* note 38, at 159.

> In short, even if one were to admit that the harm from mere interdependence is not distinguishable from that caused by hard-core cartels, the inherent difficulties of administering a broad prohibition should lead to the conclusion that competition law should only outlaw instances in which something more than price signalling has occurred.

Id.

from using other firms' prices as an input when setting prices, limiting "the scraping of rival firms' prices," or "restricting the storage of recent prices by other firms."[106] Alternatively, similar effects might be achieved if the prohibition was instead on high-frequency price updates.[107] As stated above, the main reason algorithmic pricing can have anticompetitive effects is due to the speed at which the algorithm can update prices, and so slowing the Predictable Agent down could tamper these effects.[108] Should a ban on certain conduct not be preferable, the injunction could instead "require sellers or third-party providers to test and train algorithms in a sandbox to ensure, as much as practically possible, that they are not prone to collusive outcomes."[109] Compliance with the injunction could then be determined not by a judge acting as a price-setter, but instead by testing the Predictable Agent in a simulation of the market.[110] These remedies maintain the efficiencies offered by algorithmic pricing, such as allowing firms to more rapidly respond to changing market conditions, while preventing the harms to consumers posed by algorithmic tacit collusion. Finally, if the Sherman Act is wielded against Predictable Agents, the prospect of criminal fines or the triple damages incurred due to a § 1 violation can be used to weight the Predictable Agents behavior away from collusive strategies and the setting of supracompetitive prices.[111]

The Supreme Court has always maintained that the Sherman Act is a flexible statute, one that can adapt with changing business practices and technologies in order to protect consumers and competition.[112] With the rise of algorithmic pricing and Predictable Agents, the Court ought to adapt its jurisprudence around the Sherman Act once again. Since there exist reasonable methods to prevent the harms caused by Predictable Agents and algorithmic tacit collusion, it should fall within the ambit of § 1.

106. Brown & MacKay, *supra* note 36, at 149.

107. *Id*. at 149 n.46.

108. *Cf.* Maike Becker, Gregor Pfeifer & Karsten Schweikert, *Price Effects of the Austrian Fuel Price Fixing Act: A Synthetic Control Study* 4 (CESifo, Working Paper No. 8819, 2021) (finding that gasoline prices in Austria decreased 23.4% in the short-term and 7.5% in the long-term after the Austrian government passed a law permitting gasoline retailers to increase price only once a day).

109. Nazzini & Henderson, *supra* note 83, at 29.

110. *Id.* at 29.

111. Beneke & Mackenrodt, *supra* note 38, at 166.

112. *See* Appalachian Coals v. U.S., 288 U.S. 344, 359–60 (1933) ("As a charter of freedom, the [Sherman Act] has a generality and adaptability comparable to that found to be desirable in constitutional provisions. It does not go into detailed definitions which might either work injury to legitimate enterprise or through particularization defeat its purposes by providing loopholes for escape.").

B. The F.T.C. Act

i. Section Five Of The F.T.C. Act

Unlike claims under § 1, claims under Section 5 of the F.T.C. Act (§ 5) do not require proof of an agreement.[113] This is because "[t]he 'Unfair methods of competition', which are condemned by [sic] s 5(a) of the Act, are not confined to those that were illegal at common law or that were condemned by the Sherman Act."[114] Instead, "the Federal Trade Commission Act was designed to supplement and bolster the Sherman Act and the Clayton Act . . . [and] to stop in their incipiency acts and practices which, when full blown, would violate those Acts."[115] Thus, even unilateral conduct might be prohibited as an unfair method of competition.[116] In fact, the Supreme Court has gone so far to state that § 5 empowers the F.T.C "to define and proscribe an unfair competitive practice, *even though the practice does not infringe either the letter or the spirit of the antitrust laws*."[117] Given this broad grant of power to the F.T.C., scholars have suggested that the F.T.C. Act might be a better vehicle with which to mitigate the competitive harms of algorithmic pricing.[118]

It is easy to see why a Predictable Agent could be an unfair method of competition. It is a known fact that perfect competition is not the most profitable business strategy.[119] Suppose, then, that every firm in a market

113. In re Musical Instruments & Equip. Antitrust Litig., 798 F.3d 1186, 1196 (9th Cir. 2015).

114. F.T.C. v. Motion Picture Advert. Serv. Co., 344 U.S. 392, 394 (1953).

115. *Id*. at 394–95.

116. *See, e.g.,* Quality Trailer Prods. Corp., 115 F.T.C. 944, 945 (1992) (holding that an invitation to collude without acceptance "constitute[d] unfair methods of competition in or affecting commerce in violation of Section 5 of the Federal Trade Commission Act."). *Cf.* U.S. F.T.C., COMM'N FILE NO. P221202, POLICY STATEMENT REGARDING THE SCOPE OF UNFAIR METHODS OF COMPETITION UNDER SECTION 5 OF THE FEDERAL TRADE COMMISSION ACT 5 (Nov. 10, 2022), https://www.ftc.gov/system/files/ftc_gov/pdf/P221202Section5PolicyStatement.pdf [https://perma.cc/4V5C-5X5Q] (stating that the F.T.C. Act "allow[s] the Commission to proceed against a broader range of anticompetitive conduct than can be reached under the Clayton and Sherman Acts.").

117. F.T.C. v. Sperry & Hutchinson Co., 405 U.S. 233, 239 (1972) (emphasis added).

118. *See* Mazundar, *supra* note 35. *Cf.* William E. Kovacic, *Antitrust Policy and Horizontal Collusion in the 21st Century*, 9 LOY. CONSUMER L. REV. 97, 107 (1997) ("[T]he FTC remains perhaps the best vehicle for articulating standards designed to discourage anticompetitive coordination among competitors.").

119. Peter Thiel, *Competition is for Losers*, WALL ST. J. (Sep. 12, 2014) ("Under perfect competition, in the long run no company makes an economic profit."), https://www.wsj.com/articles/peter-thiel-competition-is-for-losers-1410535536 [https://perma.cc/G8FW-Y7CC].

has a Predictable Agent and they all give it the same, singular goal: maximize our profits. The Predictable Agent, in pursuit of this goal, may well utilize a pricing strategy that depends on collusion. That is, the Predictable Agent sets its price at a level that would not be as profitable if other firms do not raise their prices to match but maximizes profit should other firms do so. Since the other Predictable Agents are all focused on maximizing their profits too, they happily follow along. In fact, economist Bruno Salcedo found that this strategy is so dominant in the context of pricing algorithms as to make collusive pricing "inevitable."[120]

The F.T.C. should therefore have the authority to define the use of Predictable Agents as an unfair method of competition and proscribe it. However, the F.T.C.'s authority under § 5 has been limited by two important cases. While both come from United States Courts of Appeals, not the Supreme Court, they have generally defined § 5 jurisprudence in courts throughout the country. In the first, *Boise Cascade Corp. v. F.T.C.* (*Boise Cascade*),[121] the Ninth Circuit held that "in the absence of evidence of overt agreement to utilize a pricing system to avoid price competition, the Commission must demonstrate that the challenged pricing system has actually had the effect of fixing or stabilizing prices."[122] Given this holding, the F.T.C. would be unable to go after the mere implementation of a Predictable Agent, and would instead have to wait for the Predictable Agent to raise prices to supracompetitive levels. This would seem to contradict the F.T.C.'s mandate to "prevent . . . unfair methods of competition,"[123] as "prevention" generally means to stop something before it occurs,[124] and unreasonably limit the reach of the F.T.C. Act.[125] Nevertheless, in the case of Predictable Agents this restriction will likely only delay enforcement, not prevent it, since the economic evidence suggests they do fix prices in the

120. Salcedo, *supra* note 40, at 3.

121. Boise Cascade Corp. v. F.T.C., 637 F.2d 573 (9th Cir. 1980).

122. *Id*. at 577.

123. 15 U.S.C § 45 (2018).

124. *See Prevent*, MERRIAM-WEBSTER, https://www.merriam-webster.com/dictionary/prevent [https://perma.cc/3GHB-HU35] (defining "prevent" as "to keep from happening or existing.").

125. The F.T.C. Act is meant to cover a broader range of behaviors than the Sherman Act, see F.T.C. v. Motion Picture Advert. Serv. Co., 344 U.S. 392, 394 (1953), and actually evincing anticompetitive effects is not even a requirement for a violation of the latter. *See*, *e.g.*, In re High Fructose Corn Syrup Antitrust Litig., 295 F.3d 651, 655 (7th Cir. 2002) ("[P]rice-fixing agreements are illegal [under § 1] even if the parties were completely unrealistic in supposing they could influence the market price.").

antitrust sense. The other case, *E.I. du Pont de Nemours & Co. v. F.T.C.*,[126] arose in the Second Circuit, and held that:

> [B]efore business conduct in an oligopolistic industry may be labelled "unfair" within the meaning of § 5 a minimum standard demands that, absent a tacit agreement, at least some indicia of oppressiveness must exist such as (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.[127]

While this is a more significant hurdle than the one erected in *Boise Cascade*, it is not an insurmountable one for the F.T.C. to overcome in the context of Predictable Agents. First, it applies only in the context of oligopolies, leaving the F.T.C. free to challenge algorithm-induced interdependence in less concentrated markets. Secondly, the Second Circuit stated in that same opinion that "[i]f, for instance, a seller's conduct, even absent identical behavior on the part of its competitors, is contrary to its independent self-interest, that circumstance would indicate that the business practice is 'unfair' within the meaning of § 5."[128] Showing that a Predictable Agent's pricing and the price transparency associated with implementing the algorithm are contrary to a firm's self-interest might be done in one of two ways. The first, as stated in Part II.A.iii, would be to present evidence that the market is one such that posting prices has little effect on consumer search costs or producer selling costs, meaning that price transparency has no procompetitive benefit.[129] The second would be to demonstrate that the prices the Predictable Agents set are rational if and only if other firms set similar prices. This would indicate a collusive pricing strategy, which would not be in a firm's independent self-interest. Should these hurdles be cleared,

126. 729 F.2d 128 (2d Cir. 1984).
127. *Id.* at 139–40.
128. *Id.*
129. Harrington, *supra* note 71, at 21.

> When the adoption of posted pricing has little effect on consumers' search costs and firms' selling costs, it was shown that the industrywide adoption of setting a list price with no discounting is contrary to firms' interests when they compete. Therefore, the adoption of posted pricing is optimal for firms only if it results in coordinated pricing.

Id.

the injunctive remedies described at the end of the previous section could then be used to allay the competitive harms of the Predictable Agents.

ii. Section Six Of The F.T.C. Act

Apart from individualized enforcement actions under the Sherman or F.T.C. acts, there is the possibility of enacting new laws which limit the use of Predictable Agents, making any possible injunction mentioned above required of all Predictable Agents *post hoc*.

Such regulations could, of course, be enacted by Congress. However, Section Six of the F.T.C. Act (§ 6) states that the F.T.C. has the authority "to make rules and regulations for the purpose of carrying out the provisions of [the F.T.C. Act]."[130] Since the F.T.C. Act's enactment in 1914 to the enactment of the Magnuson-Moss Warranty Act and its amendments to the F.T.C.s rulemaking powers in 1975,[131] the F.T.C. utilized its authority under § 6 on twenty-six occasions to conduct rulemaking regarding § 5 violations, including unfair methods of competition.[132] During that time, the only court to rule on whether the F.T.C. had the authority to issue substantive rules, the D.C. Circuit, expressly held that it did have that power in *National Petroleum Refiners Association v. F.T.C* (*National Petroleum*).[133]

Later, the Magnuson-Morrison Warranty Act codified the F.T.C.'s authority to issue substantive rules regarding unfair methods of competition. This is because those amendments conditioned the F.T.C.'s § 6 rulemaking by stating that such authority is "except as provided in section 57a(a)(2) of this title."[134] However, when we look at section 57a(a)(2), we see that it "shall not affect any authority of the Commission to prescribe rules . . . with respect to unfair methods of competition in or affecting commerce."[135] Heeding the Supreme Court's admonition that the "classic judicial task of reconciling many laws enacted over time, and getting them to 'make sense' in combination, necessarily assumes that the implications of a statute may be altered by the implications of a later statute,"[136] the implication of the

130. 15 U.S.C. § 46(g).
131. Magnuson-Moss Act, Public L. No. 93-637, 88 Stat. 2183 (1975).
132. Non-Compete Clause Rule, 89 Fed. Reg. 38349-50 (F.T.C. May 7, 2024).
133. 482 F.2d 672, 698 (D.C. Cir. 1973), *cert. denied*, 415 U.S. 951 (1974).
134. 15 U.S.C. § 46(g).
135. 15 U.S.C. § 57a(a)(2).
136. U.S. v. Fausto, 484 U.S. 439, 676–77 (1988).

1975 amendments is that the D.C. Circuit's interpretation of § 6 as it applied to unfair methods of competition is correct and untouched by Magnuson-Morrison Warranty Act.

Indeed the next court to take up the issue of the F.T.C.s rulemaking authority, the Seventh Circuit, "agree[d] with the conclusion reached by" the D.C. Circuit and found that the legislative history of the Magnuson-Moss Warranty Act meant that "Congress also considered the controversy surrounding the Commission's substantive rulemaking power under section 6(g) to have been settled by [*National Petroleum*]."[137] The Court thus held that the 1975 amendments were "intended to preserve the Commission's existing substantive rulemaking authority."[138] Despite contemporary division in the lower courts due to challenges to the F.T.C.'s latest substantive rule[139] and the recent shift at the F.T.C. which sees it now disavowing substantive rulemaking authority over unfair methods of competition,[140] it is difficult to argue with the Seventh Circuit that the decision in *National Petroleum* is "the D.C. Circuit at its most

137. U.S. v. JS & A Grp., Inc., 716 F.2d 451, 454 (7th Cir. 1983) (citations omitted).

138. *Id*.

139. *Compare* Ryan, LLC v. F.T.C., 746 F. Supp 3d 369, 387 (N.D. Tex. 2024) ("[T]he Court concludes the text and the structure of the F.T.C. Act reveal the F.T.C. lacks substantive rulemaking authority with respect to unfair methods of competition."), *with* ATS Tree Services, LLC. v. F.T.C., No. 24-1743, 2024 WL 3511630, at *13 (E.D. Pa. July 23, 2024) (denying motion for preliminary injunction due in part to lack of probability of success on the merits) ("[T]he Court finds it clear that the F.T.C. is empowered to make both procedural and substantive rules as is necessary to prevent unfair methods of competition."). ATS Tree Services, LLC voluntarily dismissed its suit later. Nalee Xiong & Brian D. Pedrow, *ATS Withdraws Challenges to the FTC's Final Non-Compete Rule After the Eastern District of Pennsylvania Denies its Motion to Stay Proceedings*, BALLARD SPAHR LLP (Oct. 8, 2024), https://www.hrlawwatch.com/2024/10/08/ats-withdraws-challenges-to-the-ftcs-final-non-compete-rule-after-the-eastern-district-of-pennsylvania-denies-its-motion-to-stay-proceedings/ [https://perma.cc/5BT9-XN9C]. The reconstituted F.T.C. under President Trump has since acceded to the Texas court's vacatur of the Non-Compete Clause Rule and filed to voluntarily dismiss its appeal of *Ryan*. U.S. F.T.C., FEDERAL TRADE COMMISSION FILES TO ACCEDE TO VACATUR OF NON-COMPETE CLAUSE RULE (Sep. 5, 2025), https://www.ftc.gov/news-events/news/press-releases/2025/09/federal-trade-commission-files-accede-vacatur-non-compete-clause-rule [https://perma.cc/J7WD-QY9V].

140. *See* U.S. F.T.C., *supra* note 139; U.S. F.T.C., STATEMENT OF CHAIRMAN ANDREW N. FERGUSON JOINED BY COMMISSIONER MELISSA HOLYOAK REGARDING RYAN, LLC V. FTC (Sep. 5, 2025), https://www.ftc.gov/legal-library/browse/cases-proceedings/public-statements/statement-chairman-andrew-n-ferguson-joined-commissioner-melissa-holyoak-regarding-ryan-llc-v-ftc [https://perma.cc/T5ZU-49QB]; U.S. F.T.C., STATEMENT OF COMMISSIONER MARK R. MEADOR IN THE MATTER OF NON-COMPETE CLAUSES (Sep. 5, 2025), https://www.ftc.gov/legal-library/browse/cases-proceedings/public-statements/statement-commissioner-mark-r-meador-matter-non-compete-clauses [https://perma.cc/9DFZ-YRMP].

persuasive"[141] and that Congress understood it to be the definitive interpretation of the F.T.C.'s rulemaking authority when they passed the Magnuson-Moss Warranty Act.[142] Thus, the law supports the F.T.C. possessing the authority to issue substantive rules prohibiting unfair methods of competition. It is this avenue that might prove to be most effective in combatting the harmful effects of Predictable Agents and other pricing algorithms. As the old saying goes, an ounce of prevention is worth a pound of cure.

CONCLUSION

Algorithmic pricing is not going away. In fact, given the rapid advancement of artificial intelligence[143] and a business community which is becoming more openly dismissive of the benefits of competition,[144] one imagines that we are only scratching the surface of what these technologies are capable of. But new technologies do not necessarily require new solutions. Our antitrust laws are flexible, powerful tools to restrain challenges to competition, and so as we progress to an age of fully automated pricing, we must be vigorous and adaptable in their enforcement so as to prevent the harms to consumer welfare and competitive market structures these new technologies seem posed to induce.

141. *JS & A Grp.*, 716 F.2d at 454.

142. *See, e.g.*, S. REP. NO 93-1408, at § 202 (1974) (Conf. Rep.), *as reprinted in* 1974 U.S.C.C.A.N. 7755, 7763 (stating that the final text of the Magnuson-Moss Warranty Act "does not affect any authority of the FTC under existing law to prescribe rules with respect to unfair methods of competition in or affecting commerce.").

143. *See generally* Xuli Tang et al., *The Pace of Artificial Intelligence Innovations: Speed, Talent, and Trial-and-Error*, 14 J. INFORMETRICS 4 (2020).

144. *See* Thiel, *supra* note 119; Complaint at 12 ¶ 32, U.S. v. RealPage, Inc., No. 1:24-cv-00710, 2024 WL 5690370 (M.D.N.C. Aug. 23, 2024) (Quoting a RealPage revenue management vice president as stating that "there is greater good in everybody succeeding versus essentially trying to compete against one another in a way that actually keeps the industry down.").