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Algorithms and Conscious Parallelism: Why Current Antitrust Doctrine is Prepared for the Twenty-First Century Challenges Posed by Dynamic Pricing

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I. INTRODUCTION

As technology has disrupted the traditional brick and mortar institutions of the nineteenth and twentieth centuries, calls for amending

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traditional antitrust doctrine has similarly grown.[1] In previous discussions, I have examined and concluded why shifts in American vertical merger integration law[2] and predatory price discrimination law[3] should not be altered because of the boom in internet commercial activity (e-commerce). In this piece, I do not analyze Brandeisian economists' calls seeking to revive antitrust doctrine long put to bed,[4] but instead I analyze hypothesized harms that Brandeisian academics predict will await us in the future.[5] Professors Ariel Ezrachi and Maurice Stucke contend in their book, *Virtual Competition: The Promise and Perils of the Algorithm Driven Economy*, coupled with their recent law review article, *Sustainable and Unchallenged Algorithmic Tacit Collusion*, that in the (near) future, algorithms will be able to collude with one another, and modern day antitrust doctrine is not suited to counteract this virulently offensive and illegal behavior.[6] Specifically, they contend that conscious parallelism poses a significant danger to competition policies, and new doctrine should be developed to counter it. This Article argues that the United

1. *See* Ariel Ezrachi & Maurice Stucke, *Sustainable and Unchallenged Algorithmic Tacit Collusion*, 17 NW. J. TECH. & INTELL. PROP. 217 (2020) [hereinafter *Algorithmic Tacit Collusion*]; Daniel A. Crane, *Antitrust's Unconventional Politics* 104 VA. L. REV. ONLINE 118 (2018); Ariel Ezrachi & Maurice Stucke, *The Rise, Fall, and Rebirth of the U.S. Antitrust Movement*, HARV. BUS. REV. (Dec. 15, 2017), http://hbr.org/2017/12/the-rise-fall-and-rebirth-of-the-u-s-antitrust-movement [hereinafter *Rebirth of the U.S. Antitrust Movement*]; *see also* ARIEL EZRACHI & MAURICE STUCKE, VIRTUAL COMPETITION: THE PROMISE AND PERILS OF THE ALGORITHM-DRIVEN ECONOMY (Harv. Univ. Press 2016) [hereinafter VIRTUAL COMPETITION]; Lisa M. Khan, *Amazon's Antitrust Paradox*, 126 YALE L.J. 710, 756-58 (2017).

2. *See* John A. Fortin, *Why Calls for Shifting to Brandeisian Economic Theory Are Flawed: An Evaluation of the United States' and European Union's Approach to Vertical Mergers*, 54 U. RICH. L. REV. ONLINE 1 (2021).

3. *See* John A. Fortin, Predatory Pricing and the Flaws in Brandeisian Economics Challenging Recoupment Theory (June 30, 2020) (unpublished manuscript) (on file with author).

4. *See id.* at 2 n.2 ("While I respect and admire the commentary by Professors Wright, Dorsey, Klick, and Rybnicek and why they chose to refer to this movement as "Hipster Antitrust;" I have instead chosen to refer to this movement after the late Justice Louis Brandeis' thoughts and ideas on antitrust (Brandeisian economics)); *see also* Joshua D. Wright et al., *Requiem for a Paradox: The Dubious Rise and Inevitable Fall of Hipster Antitrust*, 51 ARIZ. ST. L.J. 293, 295 (2018) [hereinafter *Requiem for a Paradox*]; Elyse Dorsey et al., *Consumer Welfare & the Rule of Law: The Case Against the New Populist Antitrust Movement* 47 PEPP. L. REV. 861 (2020). *Contra Rebirth of the U.S. Antitrust Movement*, *supra* note 1; Crane, *supra* note 1. My reasoning for referring to the movement as Brandeisian economics is simple. By forcing readers to remember the time period before and immediately following the *Standard Oil* case when antitrust theory was in its nascency and lacking in an economic foundation, the reader will remember how arbitrary liability could be. Regardless of the name we refer to a particular viewpoint, I intend to respect the seriousness of the ideas advocated by Brandeisian enthusiasts by articulating a thoughtful response. *See* Standard Oil Co. of N.J. v. United States, 221 U.S. 1 (1911).

5. *See Algorithmic Tacit Collusion*, *supra* note 1; VIRTUAL COMPETITION, *supra* note 1.

6. *See Algorithmic Tacit Collusion*, *supra* note 1; VIRTUAL COMPETITION, *supra* note 1.

States' conscious parallelism plus factors maintain their value to antitrust regulators and courts even in this highly technical, rapidly evolving environment facilitated by technology. Ezrachi & Stucke's arguments to the contrary are actually belied by the history of the doctrine, the technology itself, and in the end—their own arguments and descriptions of the technology. Finally, while some European empirical research sides with Ezrachi & Stucke, the competition authorities and other scholars sufficiently rebut these arguments by pointing out these experiments fail to reflect real world environments. All in all, we should approach this dynamic pricing cautiously and require oversight by corporations. However, antitrust authorities and courts should not create new laws to combat problem that have already been solved.

Despite the prospect of misbehavior by algorithms, the DOJ has already implemented reforms in its leniency program that should be expanded and further developed to counter these theorized threats. Furthermore, shifting away from per se to the rule of reason when analyzing potential price fixing, market allocation, and group boycotts conducted by algorithms will assist in countering any algorithm mischief. The thrust of antitrust review must consider the effect on consumer pricing and consumer welfare. The toolbox available to American regulators has all of the widgets necessary to punish anticompetitive conduct. We should not be developing new theories of harm that will likely not protect consumers and leave society worse off because of a hypothetical fear of what the future holds. We should embrace innovation, not chill its progress.

I begin by introducing Section 1 of the Sherman Antitrust Act, oligopoly, and the conscious parallelism theory of harm.[7] I continue by describing the technology Ezrachi & Stucke contend should force Congress and the courts into enacting new theories of harm for liability.[8] Next, I outline the future Ezrachi & Stucke posit awaits us.[9] Then, I shift to providing context to conscious parallelism by relaying the history, the modern day standard applied by courts, and the debate that rages to this day on what factors courts should consider in order to find liability.[10] Finally, I rebut Ezrachi & Stucke by largely relying on their description of technology to show that innovation will counter innovation and that

7. *See infra* Part II.
8. *See infra* Part III.
9. *See infra* Part IV.
10. *See infra* Part V.

stymieing progress and technology through arbitrary, unpredictable, and in the end, speculative antitrust regulation will lead to an increase in false positives.[11] Further, recent studies by competition authorities in Europe provide some support to Ezrachi & Stucke; however, these lab experiments likely are too simplistic compared to real world markets.[12]

II. DEFINING SHERMAN ACT SECTION 1 LIABILITY, OLIGOPOLY, AND CONSCIOUS PARALLELISM

In a general manner of speaking, the thrust of American antitrust doctrine is to ensure that in a free-market economy, laws protect competition between competitors and adequately punish anticompetitive activity. The Sherman Antitrust Act's Section 1 details that

> [e]very contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is declared to be illegal. Every person who shall make any contract or engage in any combination or conspiracy hereby declared to be illegal shall be deemed guilty of a felony, and, on conviction thereof, shall be punished by fine not exceeding $100,000,000 if a corporation, or, if any other person, $1,000,000, or by imprisonment not exceeding 10 years, or by both said punishments, in the discretion of the court.[13]

In *Board of Trade of Chicago v. United States*, the United States Supreme Court interpreted this broad language and outlined for future courts and regulators the rule of reason.[14] The Court explained that

> [e]very agreement concerning trade, every regulation of trade, restrains. To bind, to restrain, is of their very essence. The true test of legality is whether the restraint imposed is such as merely regulates, and perhaps thereby promotes competition, or whether it is such as may suppress or even destroy competition. To determine that question, the court must ordinarily consider the facts peculiar to the business to which the restraint is applied, its condition before and after the restraint was imposed, the nature of the

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11. *See infra* Part VI.

12. *Id.*

13. Antitrust Criminal Penalty Enhancement and Reform Act of 2004, Pub. L. No. 108-237, § 215(a), 118 Stat. 66 (codified as amended at 15 U.S.C. § 1). While there are additional antitrust laws and analysis of vertical arrangements, *see* U.S. DEP'T OF JUST., NON-HORIZONTAL MERGER GUIDELINES 1 (1997), http://www.justice.gov/atr/page/file/1175141/download; *see also* Press Release, U.S. Dep't of Just., DOJ and FTC Announce Draft Vertical Merger Guidelines for Public Comment, (Jan. 10, 2020), http://www.justice.gov/opa/pr/doj-and-ftc-announce-draft-vertical-merger-guidelines-public-comment, and inquiries into anticompetitive conduct of monopolists, 15 U.S.C. § 2, the focus of my analysis will be on competition between competitors under Section 1 of the Sherman Act.

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

> restraint, and its effect, actual or probable. The history of the restraint, the evil believed to exist, the reason for adopting the particular remedy, the purpose or end sought to be attained, are all relevant facts. This is not because a good intention will save an otherwise objectionable regulation, or the reverse, but because knowledge of intent may help the court to interpret facts and to predict consequences.[15]

Section 1 review deals only when restraints of trade occur with more than one firm.[16] When courts and regulators analyze restraints of trade, the Supreme Court has both narrowed and expanded the rule of reason as economic conditions have shifted over the last 100 years since *Board of Trade of Chicago*. First, per se violations—meaning no amount of procompetitive justifications can overcome antitrust liability—include price fixing, market allocation, and group boycotts.[17] If not caught in any of these categories, following an analysis of the alleged anticompetitive conduct, defendants must offer pro-competitive justifications for the restraints. The Supreme Court enunciated an abbreviated, or quick look analysis, for cases that are not quite per se, but that also do not quite require full rule of reason analysis.[18] Again, if beyond quick look review, after weighing the anticompetitive conduct alongside the proffered alleged benefits such as the innovation that the conduct provides, courts conduct a full rule of reason analysis,[19] and antitrust liability may or may not attach for anticompetitive conduct.[20]

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15. *Id.* at 238.

16. 15 U.S.C. § 1.

17. *See, e.g.*, Catalano, Inc. v. Target Sales, Inc., 446 U.S. 643, 648 (1980) (per curiam) (determining that extending interest free credit for a time is equivalent to giving a discount equal to the value of the use of the purchase price for that period of time and "falls squarely within the traditional *per se* rule against price fixing."); Palmer v. BRG of Ga., Inc., 498 U.S. 46, 49-50 (1990) (per curiam) (determining that bar preparation services agreeing to not compete in certain territories is an impermissible market allocation and "[s]uch agreements are anticompetitive regardless of whether the parties split a market within which both do business or whether they merely reserve one market for one and another for the other."); Fed. Trade Comm'n v. Superior Ct. Trial Laws. Ass'n, 493 U.S. 411, 424 (1990) ("The social justifications proffered for respondents' restraint of trade [a collective boycott by trial lawyers over low fees paid to its lawyers] thus do[es] not make it any less unlawful.").

18. *See, e.g.*, Nat'l Collegiate Athletic Ass'n v. Bd. of Regents of the Univ. of Okla., 468 U.S. 85, 109 (1984) (holding that harm to competition can be so evident that a court will be justified in shifting the burden of production to the defendants to justify their conduct without undertaking any elaborate industry analysis).

19. For a thorough and complete analysis of the rule of reason, *see* Polygram Holding, Inc. v. Fed. Trade Comm'n, 416 F.3d 29 (D.C. Cir. 2005).

20. *See, e.g.*, Broad. Music, Inc. v. Columbia Broad. Sys., Inc., 441 U.S. 1 (1979) (holding that the creation of a music library in order to solve collective action problems between musicians

At the heart of Sherman Section 1 analysis are two things—an agreement between two or more individuals (or firms) and a restraint of trade. Relevant here is the extent and the necessity of an agreement. As the Supreme Court concluded

> [i]t is elementary that an unlawful conspiracy may be and often is formed without simultaneous action or agreement on the part of the conspirators. Acceptance by competitors, without previous agreement, of an invitation to participate in a plan, the necessary consequence of which, if carried out, is restraint of interstate commerce, is sufficient to establish an unlawful conspiracy under the Sherman Act.[21]

But analysis of the factors regarding an agreement should be carefully scrutinized. The then-law professor at Stanford and now former judge of the United States Court of Appeals for the Seventh Circuit, Judge Richard Posner, outlined how and why competitive behavior is distinct in markets with many sellers as opposed to markets with only a few.[22] He explained that markets with several sellers insulate an individual seller from issues related to pricing and output on the market price.[23] The individual seller "can sell all that he produces at the market price, and nothing above it. He can shade the price without fear of retaliation because the resulting

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and consumers is not a violation of the antitrust laws because it lowered costs and innovated industry). As mentioned throughout the academic citations in this paper, in addition to Section 1 liability, Section 5 of the Federal Trade Commission Act (FTC Act) permits review for unfair and deceptive trade practices. 15 U.S.C. § 45(n). Unfairness is met when "the act or practice causes or is likely to cause substantial injury to consumers which is not reasonably avoidable by consumers themselves and not outweighed by countervailing benefits to consumers or to competition. In determining whether an act or practice is unfair, the Commission may consider established public policies as evidence to be considered with all other evidence. Such public policy considerations may not serve as a primary basis for such determination." *Id.* In evaluating a facilitating practices claim, the United State Court of Appeals for the Second Circuit stated the Federal Trade Commission (FTC) must show either (1) evidence of tacit or express agreement to avoid competition or (2) oppressiveness, such as (a) evidence of defendants' anticompetitive intent or purpose or (b) the absence of an independent legitimate business reason for the conduct. E.I. du Pont de Nemours & Co. v. Fed. Trade Comm'n, 729 F.2d 128, 128-29 (1984). 15 U.S.C. § 45(n); *see also* Rudolph J.R. Peritz, *Toward a Dynamic Antitrust Analysis of Strategic Market Behavior*, 47 N.Y.L. SCH. L. REV. 101, 117 (2003); Spencer Weber Waller, *Prosecution by Regulation: The Changing Nature of Antitrust Enforcement*, 77 OR. L. REV. 1383, 1390 n.31 (1998) ("The high (or low) point of FTC enforcement of Section 5 of the FTC Act challenging tacit collusion and oligopoly came in the late 1970s and early 1980s in three unsuccessful cases against the oil, fuel additives, and cereal industries. The oil investigation was eventually dropped after years of investigation. The FTC lost the other two matters." *See E.I. du Pont de Nemours & Co.*, 729 F.2d at 128-29; *In re* Kellogg Co., 99 F.T.C. 8 (1982)). Thus, Section 5, while an option in the toolbox would require significant reworking that is outside the scope of this paper to include in my analysis.

21. Interstate Cir., Inc., v. United States, 306 U.S. 208, 227 (1939).

22. Richard Posner, *Oligopoly and the Antitrust Laws: A Suggested Approach*, 21 STAN. L. REV. 1562 (1968).

23. *Id.* at 1563.

expansion of his output at the expense of his rivals will divert an imperceptible amount of business from each."[24] In contrast, markets containing only a few firms lack this insulation.[25] Instead, "a price reduction that produces a substantial expansion in the output of one will result in so substantial a contraction in the output of the others that [competitors] will quickly respond to the reduction."[26] Posner further explained that "[o]ligopolists 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."[27] Agreements to conspire or collude are per se illegal. Thus, direct evidence of conspiracies will lead to significant criminal and civil penalties.[28] But more common—and more difficult to prove—are the tacit collusion (conscious parallelism) cases in which oligopolists—reacting to market conditions by rivals—appear to be fixing prices, but are in fact only acting as a rational market participant.[29]

Conscious parallelism occurs every day across the United States. For example, think of your drive to work as you pass by gas stations that are located in close proximity. These gas stations located across the street from one another "are likely to engage in parallel supracompetitive pricing behavior because each gas station understands that matching the highest price in the region encourages prices to stay uniformly high without hurting demand, and that all local competitors are likely to independently reach the same conclusion."[30] There is no doubt that conscious parallelism harms competition, which results in a decrease in consumer welfare, but this behavior—standing alone—is legal. As the Supreme Court detailed

> [t]acit collusion, sometimes called oligopolistic price coordination or conscious parallelism, describes the process, not in itself unlawful, by which firms in a concentrated market might in effect share monopoly power, setting

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24. *Id.*
25. *Id.* at 1563-64.
26. *Id.* at 1564.
27. *Id.*
28. 15 U.S.C. § 1.
29. ANDREW I. GAVIL ET AL., ANTITRUST LAW IN PERSPECTIVE: CASES, CONCEPTS AND PROBLEMS IN COMPETITION POLICY 300-06 (3d. ed. 2016) (outlining factors facilitating coordination through tacit collusion include: few firms, product homogeneity, simple products, public (open and transparent) transactions, excess capacity (multiple firms), predictable demand, small transaction, small buyers, inelastic market demand, low marginal costs relative to price, high customer switching costs, and prior express collusion).
30. *In re* Nexium (Esomeprazole) Antitrust Litig., 42 F. Supp. 3d 231, 250 (D. Mass. 2014).

> their prices at a profit-maximizing, supracompetitive level by recognizing their shared economic interests and their interdependence with respect to price and output decisions.[31]

For regulators and courts, this legal behavior is far more difficult to detect than a traditional conspiracy. Thus, "[t]acit coordination is feared by antitrust policy even more than express collusion, for tacit coordination, even when observed, cannot easily be controlled directly by the antitrust laws."[32] But challenging this behavior requires either an indirect attack[33] or an attack with additional factors.[34]

One of the common ways the DOJ prosecutes these agreements is through conspiracy law. Conspiracies can take the form of "hub and spoke." As the United States Court of Appeals for the First Circuit noted, these conspiracies occur when "a central mastermind, or 'hub,' controls numerous 'spokes' or secondary co-conspirators."[35] The spokes each "participate in independent transactions with the individual or group of individuals at the 'hub' that collectively further a single, illegal enterprise."[36] "A common example is where the mastermind recruits different coconspirators to carry out the illegal enterprise's various functions, such as procuring" illicit materials.[37] In order to show and prove a hub and spoke conspiracy, there must be a connection between the hub and the individual spokes (forming a wheel), in that "each defendant knew or had reason to know of the scope of the conspiracy and that each defendant had reason to believe that their own benefits were dependent upon the success of the entire venture."[38]

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31. Brooke Group Ltd. v. Brown & Williamson Tobacco Corp., 509 U.S. 209, 227 (1993) (citations omitted).

32. Fed. Trade Comm'n v. H.J. Heinz Co., 246 F.3d 708, 725 (D.C. Cir. 2001) (quoting 4 PHILLIP E. AREEDA ET AL., ANTITRUST LAW ¶ 901b2, at 9 (rev. ed. 1998)).

33. Max Huffman, *Marrying Neo-Chicago with Behavioral Antitrust*, 78 ANTITRUST L.J. 105, 134-35 (2012) ("Consciously parallel conduct does not provide a basis for Section 1 liability under the current state of the law, but the potential for conscious parallelism is relevant to merger review under Clayton Act Section 7, and there have been calls for the FTC Act Section 5 enforcement against conscious parallelism.")

34. *See, e.g.*, Am. Tobacco Co. v. United States, 328 U.S. 781 (1946).

35. United States v. Newton, 326 F.3d 253, 255 n.2 (1st Cir. 2003).

36. *Id.*

37. VIRTUAL COMPETITION, *supra* note 1, at 46.

38. United States v. Kostoff, 585 F.2d 378, 380 (9th Cir. 1978) (per curiam). For examples of hub and spoke conspiracies, *see* Interstate Cir., Inc., v. United States, 306 U.S. 208 (1939); United States v. Apple, Inc., 791 F.3d 290 (2d Cir. 2015).

III. ALGORITHMS, MACHINE (AND DEEP) LEARNING, AND DYNAMIC PRICING

Ezrachi & Stucke present an alarmist and a largely speculative piece theorizing on future problems related to competition law, behavioral economics, and privacy law.[39] In this piece, I am only concerned with the theory of harm related to conscious parallelism and the possibility of technology (not humans) colluding with one another. However, before diving into their arguments, a brief primer on technology is necessary.

Generally speaking, algorithms are sequences of information with instructions to follow in an orderly fashion.[40] "Thus, an algorithm is an instance of logic that generates an output from a given input, whether it is a method to solve a mathematical problem, a food recipe, or a music sheet."[41] Furthermore, "[a]lgorithms can be represented in multiple ways, such as plain language, diagrams, codes, or even [programs] that can be read and executed by a machine."[42] As technology has advanced, "[r]ecent developments in artificial intelligence and machine learning have brought algorithms to a new level, allowing computers to solve complex problems, make predictions, and make decisions more efficiently than humans, frequently achieving desirable policy goals for society."[43]

Beyond the surface of algorithms, artificial intelligence (AI) in its infancy involved "machines [that] were programmed with extensive lists of detailed rules in order to attempt to replicate human thoughts, which could easily become a burdensome process."[44] However, AI now entails machines adapting to their inputs through "the study of pattern recognition and learning theory."[45] Machine learning is a sub-category of AI that "gives 'computers the ability to learn without being explicitly programmed.' Machine learning algorithms can be classified into three broad categories, depending on their learning pattern."[46] In addition to

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39. *See* VIRTUAL COMPETITION, *supra* note 1.

40. ORG. FOR ECON. COOP. & DEV., ALGORITHMS AND COLLUSION: COMPETITION POLICY IN THE DIGITAL AGE 8 (2017), www.oecd.org/competition/algorithms-collusion-competition-policy-in-the-digital-age.htm [hereinafter OECD].

41. *Id.*

42. *Id.* at 9.

43. *Id.*

44. *Id.*

45. *Id.*

46. *Id.* (alteration in original) (quoting P. Anitha et al., *Machine Learning Techniques for Learning Features of Any Kind of Data: A Case Study*, 3 INT'L J. ADVANCED RSCH. COMPUT. ENG'G & TECH. 4324, 4325 (2014)). The three categories of machine learning include (1) "[s]upervised learning, where the algorithm uses a sample of [labeled] data to learn a general

machine learning's three categories, "[d]eep learning is a subfield of machine learning . . . that enables computer systems to learn using complex software that attempts to replicate the activity of human neurons by creating an artificial neural network."[47]

Relevant here is the technology known as dynamic pricing algorithms.[48] These algorithms allow buyers or sellers to see and act on rapid shifts in information.[49] "Pricing algorithms allow for constant adjustment and [optimization] of individual prices based on many factors, including available stock and anticipated demand."[50]

> Pricing algorithms are commonly understood as the computational codes run by sellers to automatically set prices to [maximize profits], being particularly common in the airline, hotel, booking, road transport, electricity, and retail industries. As compared to standard pricing strategies, pricing algorithms have the advantage of processing large amounts of data that are incorporated into the [optimization] process, allowing them to react fast to any change in market conditions. Given their automatic nature, pricing algorithms are particularly useful to implement continuous price changes over time—[hence] dynamic pricing.[51]

These algorithms increase market efficiency by allowing sellers to react immediately to supply chain inefficiencies while also permitting consumers to gain by capitalizing on reduced prices through drops in market demand.[52] In contrast to sellers' dynamic pricing, consumers rely on price comparison websites (PCWs) because it is "easier for consumers to compare the available offers and find the best alternative."[53] "By

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that maps inputs to outputs"; (2) "[u]nsupervised learning, where the algorithm attempts to identify hidden structures and patterns from [unlabeled] data"; and (3) "[r]einforcement learning, where the algorithm performs a task in a dynamic environment, such as driving a vehicle or playing a game . . . and learns through trial and error." *Id.* at 9.

47. *Id.* at 11 (citing IAN GOODFELLOW ET AL., DEEP LEARNING (MIT Press 2016)). Deep learning however has its limitations on teachable products for humans. For example, "[d]espite recent advances and the enormous potential of deep learning to solve the most complex problems, the lack of feature extraction implies that there is no way to know which features or information were used by the algorithm to convert inputs into outputs. In other words, regardless of the quality of the results produced, deep learning algorithms do not provide programmers with information about the decision-making process leading to such results." OECD, *supra* note 40, at 11. However, "[i]t is not unusual for companies to run simultaneously deep learning and traditional machine learning algorithms, so that they can identify the best course of actions and, simultaneously, to be aware of the features that were relevant for the final decision." *Id.* at n.4.

48. *See id.* at 16.

49. *Id.*

50. *Id.*

51. *Id.*

52. *Id.*

53. *Id.* at 18.

collecting and aggregating information on products and services, PCWs can reduce the asymmetry of information and improve information flows. This can make it harder for suppliers to take advantage of ill-informed customers. PCWs can also weaken the power of sellers to segment and price discriminate."[54] With this technological primer complete, I provide Ezrachi & Stucke's theories of the future.

IV. THE ALGORITHMS ARE COMING! THE ALGORITHMS ARE COMING! ARE THEY THOUGH?

As a threshold matter, it is important to set up what this debate is not. As Ezrachi & Stucke detail in their recent piece, "[t]his discussion does not concern 'the rise of the machines' nor the creation of 'evil' algorithms that seek to profit at the expense of consumers."[55] As much as I would enjoy debating whether Dolores could collude with Bernard or Maeve on the dynamic price of an overnight visit in the park that Delos built,[56] this debate instead revolves around "the possibility that human-designed algorithms might offer a superior instrument for the optimization of pricing decisions, in markets that may support conscious parallelism."[57] Ezrachi & Stucke offer several theories of future misconduct facilitated by technology.

First, Ezrachi & Stucke hypothesize a future with the "Algorithm-Fueled Hub and Spoke" conspiracy.[58] In this hypothetical, they imagine that every firm in the marketplace shifts its business model to dynamic pricing, but are essentially lazy and cheap.[59] Instead of hiring engineers to craft their own dynamic pricing algorithm and pay data brokers to obtain vast swaths of information to feed that algorithm, Ezrachi & Stucke theorize that every firm chooses to rely on an upstream supplier's algorithm.[60] Thus, the supplier acts as the hub while each of the retailers work as one of the spokes.[61] "Here we face an industry-wide use of a single algorithm, which competitors use to determine the market price or react to

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54. *Id.*
55. *Algorithmic Tacit Collusion*, *supra* note 1, at 241.
56. *See Westworld* (HBO television broadcast 2020). For the record, in the dystopian future of Westworld I concede that Dolores absolutely could collude in the way Ezrachi & Stucke posit in their piece. *See, e.g.*, *id.* Season Three.
57. *Algorithmic Tacit Collusion*, *supra* note 1, at 241.
58. *See* VIRTUAL COMPETITION, *supra* note 1, at 47.
59. *Id.* at 47-48
60. *Id.*
61. *Id.* at 48.

market changes. As a result, the market behavior of the competitors could be 'magically' aligned, when they all use a similar 'brain' to determine their price strategy."[62]

Second, Ezrachi & Stucke forecast the "Predictable Agent" scenario.[63] This involves each firm using an algorithm with instructions to maximize profits.[64] "The algorithm among other things, is programmed to monitor price changes and swiftly react to any competitor's price reduction. The algorithm is also programmed to follow price increases when sustainable, that is, when others follow in a timely manner so that no competitor benefits from keeping prices lower."[65] Ezrachi & Stucke claim that these algorithms will also rely on "'predictive analytics'—that is, the study of patterns in pricing and commercial decisions. Such an analysis will enable firms to combine 'real-time, historical and third-party data to build forecasts of what will happen in their business months, weeks, or even just hours in advance.'"[66] They claim that as each firm adopts predictive analytics algorithms, the supply of pricing data each firm is relying on will also increase and thereby increase price transparency across the market to a level far greater than the gas station oligopoly hypothetical posed in Part II.[67] One of the major concerns raised by Ezrachi & Stucke under this prediction is that with the "competitive pressure to quickly adjust prices, firms may have neither the time nor the incentive to manually check the algorithm's price . . . because it is ineffect[ient] for humans to independently analyze all the underlying market data to calculate prices (or discounts) on many products."[68]

The next futuristic competition problem Ezrachi & Stucke envision is termed "God View."[69] They opine that algorithms will have a panoramic view of the entire world.[70] "Firms can see on a giant screen for any city, their own driverless trucks, their rivals' driverless trucks, their customers' trucks, what the trucks are carrying, and where they are traveling. Each firm can track the movement of its own and its rivals products traveling

62. *Id.*
63. *Id.* at 61.
64. *Id.*
65. *Id.*
66. *Id.* (quoting Roland Moore-Colyer, *Predictive Analytics Are the Future of Big Data*, V3 (Oct. 9, 2015), http://www.v3.co.uk/v3-uk/analysis/2429494/predictive-analytics-are-the-future-of-big-data).
67. *Id.*
68. *Id.* at 61-62.
69. *Id.* at 72.
70. *Id.*

through the supply chain."[71] They further claim that "[i]n markets where customers can switch between suppliers, and where the goods are homogenous, computer algorithms can quickly detect price reductions by a rival and effectively deprive that rival of any significant increase in sales."[72] Thus, as price transparency increases, "the quicker the competitive response, the less likely the first mover will benefit, and the less likely any firm will discount."[73] It is at this point that their argument—in my view—ventures into the implausible. They contend that because every firm will possess God View, firms will be able to predict the first-mover through "[t]he real-time data from tracking the behavior of rivals, potential entrants, and customers—[that] will reveal when competitors are seeking to increase sales (including expanding into serving new territories or types of customers, such as institutional buyers)."[74] Ezrachi & Stucke contend that "[b]y responding quickly, the rivals deprive any would-be mavericks of the benefits of launching competitive initiatives, and thereby diminish the incentive to undertake these initiatives in the first place."[75] Thus, firms with God View would overtake all other firms not employing this technology and achieve either oligopoly status in the industry or monopoly status depending on what other rivals do.[76]

But, God View would only be the beginning; firms would eventually advance to a level Ezrachi & Stucke term the "Digital Eye."[77] They contend that engineers will provide algorithms with choices, where "the computer can be programmed to *choose* among different strategies each of which has a greater degree of tolerance . . . [and t]he self-learning

71. *Id.*
72. *Id.*
73. *Id.*
74. *Id.* at 72-73. This theory of the future reminded me of the Tom Cruise thriller, Minority Report, where the "Pre-Cogs" foreshadow future crimes and the "Precrime" police unit thwarts these crimes before they happen. *See* MINORITY REPORT (20th Century Fox 2002).
75. *Id.* at 73.
76. *Id.* Ezrachi & Stucke outline two pathways for achieving this end. First, is the "survival of the fittest" path which entails firms seeking out and achieving God View technology the quickest. *Id.* By being the first mover with this nascent technology, firms "can react swiftly to market changes, increase sales, and acquire more data (from their products' sensors). Rivals without God view technology and data stream lose sales until they exit the market. *Id.* The second theorized path is through a "sharing" path. *Id.* Under this path firms will not be incentivized "to improve products, lower prices, or enter new markets because others will immediately detect and punish this initiative. By enabling the firm's significant competitive initiatives to be promptly and confidently observed by others, God view reduces uncertainty." *Id.*
77. *Id.* at 75.

computers, not tethered to following tit-for-tat, can optimize profits using evolving competitive strategies."[78] In Digital Eye

> each firm, in continuously tracking its rivals' behavior, can find multiple points on which to coordinate. The algorithms, for example can stabilize the market through de facto customer allocation. The self-learning algorithms may identify key customers services by competitors and refrain from targeting them with promotions and discounts. Such a unilateral strategy—the self-restriction of competition—could be used to avert price wars among competitors.[79]

Finally, Ezrachi & Stucke recently advocated an additional theory, that algorithms will push conscious parallelism out of oligopolistic markets and into other markets that are on the fringe of oligopoly, further decreasing competition.[80] Specifically, they contend that

> [t]he nature of electronic markets, the availability of data, and the development of similar algorithms by key providers will likely push some markets that were just outside the realm of tacit collusion into interdependence. Furthermore, in such circumstances, tacit collusion is likelier to be sustained over time. The market stability needed for tacit collusion (that is, the absence of significant price deviations from the tacitly collusive price) is enhanced by the fact that computer algorithms are unlikely to exhibit human biases.[81]

To remedy these hypothesized problems, Ezrachi & Stucke claim that Section 1 of the Sherman Act likely can attack the Algorithm-Fueled Hub and Spoke arrangement.[82] The FTC and DOJ "may also stretch [this] statute[] to Predictable Agent by reframing it as a simple conspiracy. Unless they have another statute (like Section 5 of the FTC Act), their current tools do not reach the unilateral use of algorithms by nondominant companies."[83] They further argue that some agencies have nothing to combat God View or Digital Eye where "there is no evidence of anticompetitive intent (or an anticompetitive agreement)" between the humans controlling the firms.[84] They further point out alleged problems with current day antitrust doctrine because "the prices may increase gradually as market transparency and interdependence increase. There

78. *Id.* (emphasis added).
79. *Id.* at 76.
80. *Algorithmic Tacit Collusion*, *supra* note 1, at 229.
81. *Id.*
82. VIRTUAL COMPETITION, *supra* note 1, at 221
83. *Id.*
84. *Id.*

may not be a definitive meeting or occurrence to which one can point."[85] Ezrachi & Stucke also ask the prescient question, "If algorithms collude . . . are humans liable?"[86]

V. UNDERSTANDING WHY THE FUTURE IS SECURE REQUIRES AN UNDERSTANDING OF THE PAST

As Professor Wright and others point out, "What the modern debate between antitrust insiders and the revolutionaries at the gate often lacks is antitrust history: the modern consumer welfare standard was an endogenous and direct response to this earlier regime. It was adopted after significant analysis and debate by leading jurists, economists, enforcers, and practitioners."[87] Accordingly, in order to rebut Ezrachi's & Stucke's futuristic predictions and to provide a more well-rounded explanation of why antitrust regulatory and judicial review is prepared for the algorithms, I provide a historical review of conscious parallelism's beginning to the modern-day theory of harm. In particular, I detail the analysis of the economics in the caselaw that shows *why* a theory of harm relying on conscious parallelism standing alone will stifle innovation and will lead to a far greater number of false positives.[88] As the doctrine shows, conscious parallelism liability without the plus factors will, in the end, leave consumers worse off. With this historical background clarified, it should become clear why Ezrachi & Stucke's theories do not pose a significant threat to regulators or courts or leave consumers worse off if we continue applying current antitrust doctrine while acknowledging the DOJ's recent alterations to its corporate governance policies.

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85. *Id.* at 222.

86. *Id.*

87. *Requiem for a Paradox*, *supra* note 4, at 297.

88. To understand the harm of false positives and false positives in antitrust, *see* Joshua D. Wright, Comm'r of the Fed. Trade Comm'n, *The Economics of Resale Price Maintenance & Implications for Competition Law and Policy*, Remarks Before the British Institute of International and Comparative Law 5 n.8 (Apr. 9, 2014) ("In order to construct a rule that maximizes consumer welfare it is necessary to employ a framework that considers three key factors. First, the framework must consider the probability that the challenged business arrangement is anticompetitive. Second, the framework must evaluate the magnitude of the social cost created by any errors in assessing antitrust liability because any legal rule inevitably will lead to some errors. . . . Third, the framework must acknowledge the administrative costs of implementing alternative legal rules."); Frank Easterbrook, *The Limits of Antitrust*, 65 TEX. L. REV. 11 (1984) (detailing the error-cost approach of false positives and false negatives).

The historical review of conscious parallelism begins with *Interstate Circuit, Inc., v. United States*.[89] This case dealt with a number of firms in the motion picture industry and movie theaters in Texas in the 1930s.[90] The firms under review consisted of distributors of motion pictures and exhibitors of those motion pictures.[91] The distributor-defendant firms possessed significant market share (75%) of all "first-class feature films exhibited" across the country.[92] The exhibitor-defendants owned local theaters and could be classified as either first-run (a movie theater that showed a new release) or second-run (a movie theater that showed a film at a later period of time after the first-run theaters).[93] "Interstate operate[d] forty-three first-run and second-run theaters, located in six Texas cities. It ha[d] a complete monopoly of first-run theaters in these cities, except for one in Houston operated by one distributor's Texas agent."[94] Relevant here, first-run theaters typically charged an admission price for adults of at least forty cents, while second-run theaters usually charged fifteen cents.[95] Interstate competed with other second-run move theaters while Texas Consolidated faced no competing first-run theaters; however, neither Interstate nor Texas Consolidated competed directly with each other.[96] Both Interstate and Texas Consolidated were affiliated with Paramount, one of the distributor defendants, and both were run by the same senior personnel.[97]

In July 1934, leadership from Interstate and Texas Consolidated sent letters to each of the "eight branch managers of the distributors" and placed these letters on Interstate letterhead.[98] The letter consisted of two demands as a condition of Interstate's continued exhibition of the distributor's films in its first-run theaters at a night admission of forty cents or more.[99]

> One demand was that the distributors "agree that in selling their product to subsequent runs, that this 'A' product will never be exhibited at any time or in any theatre at a smaller admission price than 25 [cents] for adults in the evening." The other [demand] was that "on 'A' pictures which are exhibited

89. *See* Interstate Cir., Inc., v. United States, 306 U.S. 208 (1939).
90. *Id.* at 214.
91. *Id.*
92. *Id.*
93. *Id.* at 215.
94. *Id.*
95. *Id.*
96. *Id.*
97. *Id.*
98. *Id.* at 215-16.
99. *Id.* at 216.

> at a night admission of 40 [cents] or more—they shall never be exhibited in conjunction with another feature picture under the so-called policy of double features. . . . We must insist that all pictures exhibited [in Consolidated's area of business] in our 'A' theatres at a maximum night admission price of 35 [cents and restrict] subsequent runs in the Valley at 25 [cents].[100]

Eventually, the "distributor[s] agreed with Interstate for the 1934-35 season to impose both the demanded restrictions upon their subsequent-run licensees in the six Texas cities served by Interstate."[101] The Court further noted that no party disputed "that all [of the distributors] joined in the agreement" and these agreements were renewed for several years.[102] The theory of harm alleged by the government was that these facts—the exhibitor letter to all of the distributors and their compliance—established that *the distributors* agreed to set prices amongst themselves even without any direct evidence of communications between the distributors.[103]

The Supreme Court agreed with the district court's "rightly drawn" inference of an agreement between the distributors because of "the nature of the proposals made on behalf of Interstate and Consolidated; from the manner in which they were made; [and] from the substantial unanimity of action taken upon them by the distributors."[104] The Court explained that it was

> unable to find in the record any persuasive explanation, other than agreed concert of action, of the singular unanimity of action on the part of the distributors by which the proposals were carried into effect as written . . . . It taxes credulity to believe that the several distributors would, in the circumstances, have accepted and put into operation with substantial unanimity such far-reaching changes in their business methods without some understanding that all were to join, and we reject as beyond the range of probability that it was the result of mere chance.[105]

The Court concluded that the evidence supported a finding of conspiracy because "[i]t was enough that, knowing that concerted action was contemplated and invited, the distributors gave their adherence to the scheme and participated in it. Each distributor was advised that the others

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100. *Id.* at 217.
101. *Id.* at 218.
102. *Id.* at 218-19.
103. *Id.* at 219 (emphasis added). In other words, this is a hub and spoke conspiracy where Interstate served as the Hub while the distributors served as the spokes and the letter served as the wheel completing the conspiracy and communicating the conspiracy to all of the other spokes.
104. *Id.* at 219, 221.
105. *Id.* at 223.

were asked to participate; each knew that cooperation was essential to successful operation of the plan."[106] "Today, *Interstate Circuit* is commonly viewed as marking the outer limits of how far courts will go to infer an agreement from circumstantial evidence that includes parallel conduct."[107]

In *Theatre Enterprises, Inc. v. Paramount Film Distributing Corp.*,[108] the Supreme Court's decision was more reserved in the theory of liability. In a private action brought by Theatre Enterprises against Paramount, Theatre Enterprises alleged a conspiracy "to restrict 'first-run' pictures to downtown Baltimore theatres, thus confining its suburban theatre to subsequent runs and unreasonable 'clearances.'"[109] The jury cleared Paramount of any wrongdoing, which the United States Court of Appeals for the Fourth Circuit and the Supreme Court affirmed.[110]

Specifically, the evidence detailed that Theatre Enterprises requested, from each of the distributors,[111] "exclusive first-runs, later asking for first-runs on a 'day and date' basis. But [Paramount] uniformly rebuffed [Theatre Enterprises] efforts and adhered to an established policy of restricting first-runs in Baltimore to the eight downtown theatres."[112] The Court teed up the relevant inquiry as

> [w]hether [Paramount's] conduct toward [Theatre Enterprises] stemmed from independent decision or from an agreement, tacit or express. To be sure, business behavior is admissible circumstantial evidence from which the fact finder may infer agreement. But this court has never held that proof

106. *Id.* at 226.

107. GAVIL ET AL., *supra* note 29, at 320. This is not to say that *Interstate Circuit* will not be relied upon to find liability. *See, e.g.*, Toys "R" Us, Inc. v. Fed. Trade Comm'n, 221 F.3d 928, 935 (7th Cir. 2000) ("Th[is case] if anything presents a more compelling case for inferring horizontal agreement than did *Interstate Circuit*, because not only was the manufacturers' decision to stop dealing with the warehouse clubs an abrupt shift from the past, and not only is it suspicious for a manufacturer to deprive itself of a profitable sales outlet, but the record here included the direct evidence of communications that was missing in *Interstate Circuit*."); *see also* United States v. Apple, Inc., 791 F.3d 290 (2d Cir. 2015) (affirming the district court's finding that Apple conspired to fix prices above Amazon's Kindle book prices (and marginal cost) with the book publishers in connection with the launch of the iBookstore). See Fortin, *supra*, note 3 at 23-24, for commentary on this case; *see also* CHRIS SAGERS, UNITED STATES V. APPLE: COMPETITION IN AMERICA (2019); *cf.* Khan, *supra* note 1.

108. *See* Theatre Enters., Inc. v. Paramount Film Distrib. Corp., 346 U.S. 537 (1954).

109. *Id.* at 538.

110. *Id.* at 538-39, 544.

111. The respondent-distributors included "Paramount Film Distributing Corp., Loew's Inc., RKO Radio Pictures, Inc. Twentieth Century-Fox Film Corp., Universal Film Exchanges, Inc., United Artists Corp., Warner Bros. Pictures Distributing Corp., Warner Bros. Circuit Management Corp., Columbia Pictures Corp." *Id.* at 538 n.2.

112. *Id.* at 539.

> of parallel business behavior conclusively establishes agreement or, phrased differently, that such behavior itself constitutes a Sherman Act offense. Circumstantial evidence of consciously parallel behavior may have made beavy inroads into the traditional judicial attitude toward conspiracy; but 'conscious parallelism' has not yet read conspiracy out of the Sherman Act entirely.[113]

By declining to overturn the district court and Fourth Circuit's decision, "*Theatre Enterprises* signaled to the lower courts that they should be wary of deeming mere parallel conduct among oligopolists an 'agreement' for purposes of the Sherman Act."[114] However, the propriety of this decision (mainly because it deals with a per se violation of market allocation *and* occurred prior to *NCAA* and *Broadcast Music* decisions),[115] coupled with *Socony-Vacuum*'s[116] strict instructions to the lower court's interpretation

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113. *Id.* at 540-41 (footnote omitted) (citations omitted).

114. GAVIL ET AL., *supra* note 29, at 321.

115. *Id.*; *see also* Nat'l Collegiate Athletic Ass'n v. Bd. of Regents of the Univ. of Okla., 468 U.S. 85, 109 (1984) (holding that harm to competition can be so evident that a court will be justified in shifting the burden of production to the defendants to justify their conduct without undertaking any elaborate industry analysis); Broad. Music, Inc. v. Columbia Broad. Sys., Inc., 441 U.S. 1 (1979) (holding that the creation of a music library in order to solve collective action problems between musicians and consumers is not a violation of the antitrust laws because it lowered costs and innovated industry).

116. United States v. Socony-Vacuum Oil Co., 310 U.S. 150, 224 (1940) ("Monopoly power is not the only power which the Act strikes down, as we have said. Proof that a combination was formed for the purpose of fixing prices and that it caused them to be fixed or contributed to that result is proof of the completion of a price-fixing conspiracy under [Section] 1 of the Act.") (citations omitted); *see also id.* at n.59 ("But it is well established that a person may be guilty of conspiring, although incapable of committing the objective offense. And it is likewise well settled that conspiracies under the Sherman Act are not dependent on any overt act other than the act of conspiring. It is the contract, combination . . . or conspiracy, in restraint of trade or commerce which [Section] 1 of the Act strikes down, whether the concerted activity be wholly nascent or abortive on the one hand, or successful on the other. . . . In view of these considerations a conspiracy to fix prices violates [Section] 1 of the Act though no overt act is shown, though it is not established that the conspirators had the means available for accomplishment of their objective, and though the conspiracy embraced but a part of the interstate or foreign commerce in the commodity. . . . Price-fixing agreements may or may not be aimed at complete elimination of price competition. The group making those agreements may or may not have power to control the market. But the fact that the group cannot control the market prices does not necessarily meant that agreement as to prices has no utility to the members of the combination. The effectiveness of price-fixing agreements is dependent on many factors, such as competitive tactics, position in the industry, the formula underlying price policies. Whatever economic justification particular price-fixing agreements may be thought to have, *the law does not permit* an inquiry in their reasonableness. They are all banned because of their actual or potential threat to the central nervous system of the economy.") (second alteration in original) (emphasis added) (citations omitted) (internal quotation marks omitted).

of antitrust cases, instructed lower courts to interpret *Theatre Enterprises*' holding broadly.

The final case relevant for our history here is *American Tobacco Co. v. United States*.[117] Here, the oligopoly cigarette manufacturers stood accused of conspiring to monopolize.[118] The scheme involved the manufacturers listing their cigarette prices for a number of years in the 1920s and 30s, and as a competitor rose its price, each of the other firms would likewise follow suit, matching these prices and leading to exorbitant profits at great harm to the consumer.[119] In affirming the United States District Court for the Eastern District of Kentucky and the United States Court of Appeals for the Sixth Circuit's decision holding the manufacturers' liable, the Supreme Court concluded

> [i]t is not the form of the combination or the particular means used but the result to be achieved that the statute condemns. It is not of importance whether the means used to accomplish the unlawful objective are in themselves lawful or unlawful. Acts done to give effect to the conspiracy may be in themselves wholly innocent acts. Yet, if they are part of the sum of the acts which are relied upon to effectuate the conspiracy which the statute forbids, they come within its prohibition. No formal agreement is necessary to constitute an unlawful conspiracy. Often crimes are a matter of inference deduced from the acts of the person accused and done in pursuance of a criminal purpose. Where the conspiracy is proved, as here, from the evidence of the action taken in concert by the parties to it, it is all the more convincing proof of an intent to exercise the power of exclusion acquired through that conspiracy . . . . Where the circumstances are such as to warrant a jury in finding that the conspirators had a unity of purpose or a common design and understanding, or a meeting of minds in an unlawful arrangement, the conclusion that a conspiracy is established is justified. Neither proof of exertion of the power to exclude nor proof of actual exclusion of existing or potential competitors is essential to sustain a charge of monopolization under the Sherman Act.[120]

The Court looked at the justifications made by the cigarette executives at trial—the thrust of which was they sought to increase profit margins and

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117. Am. Tobacco Co. v. United States 328 U.S. 781 (1946).

118. *Id.* at 783-87. However, this monopoly is separate and apart from the cigarette trusts that were broken up previously. *See* United States v. Am. Tobacco Co., 221 U.S. 106 (1911).

119. *American Tobacco*, 328 U.S. at 805-06 ("[I]n 1932, in the midst of the national depression with the sales of the [the manufacturer]'s cigarettes falling off greatly in number, the [manufacturers] still were making tremendous profits as a result of the price increase. Their net profits in that year amounted to more than $100,000,000. This was one of the three biggest years in their history.")

120. *Id.* at 809-10 (citation omitted).

follow the previous competitors price increases without any competitive reasoning—and concluded their reasoning lacked merit.[121] The Court concluded that there was no competitive justification for the increases in price other than profit making and thus, the court concluded that the sum of these activities constituted conscious parallelism, plus anticompetitive conduct, justifying liability.[122]

Following these cases, a great debate began (and continues) over the scope of conscious parallelism and what is required to find liability. Former Assistant Attorney General for Antitrust and Harvard Law Professor, Donald Turner's arguments represent the majority view followed by courts today.[123] Turner argued that "conscious parallelism is never meaningful by itself, but always assumes it might have from additional facts. Thus, conscious parallelism is not even evidence of agreement unless there are some other facts indicating that the decisions of the alleged conspirators were *interdependent*."[124] Turner explained that "[e]ven the fact that competitors have knowingly charged identical prices is a neutral fact in the absence of evidence which would lead one to expect that the prices would have been different if truly independent decisions had been made. Identical prices may be consistent with independent competitive decisions."[125] As he analyzed *American Tobacco*, he reasoned that the economics require that producers or sellers have assurances from "his competitors [that they] will not cut price[s] in order for him [to] safely refrain from cutting his own price. In this situation with such a large number of producers, it is virtually inconceivable that the necessary assurance could be obtained without a prior actual agreement."[126] Turner, relying on *American Tobacco*'s facts, agreed with the Court's conclusion that this conduct was unlawful because "[t]he three companies substantially raised their prices in 1931, though their costs were declining and there was a general depression" raging.[127] Thus, "[a]ny economist worthy of the name would immediately brand this price behavior as

121. *See id.* at 804-07.

122. *See id.* Accordingly, conscious parallelism must be combined with anticompetitive conduct like pure profit motives in the absence of competitive policies equals antitrust liability.

123. *See* Donald F. Turner, *The Definition of Agreement Under the Sherman Act: Conscious Parallelism and Refusals to Deal*, 75 HARV. L. REV. 655 (1962); *see also* Bell Atl. Corp. v. Twombly, 550 U.S. 544, 553-54 (2007).

124. Turner, *supra* note 123, at 658.

125. *Id.* at 659

126. *Id.* at 660.

127. *Id.* at 661.

noncompetitive. One can hardly find clearer evidence of an absence of effective competition than an increase of prices in the face of declining costs and weakening demand."[128] But as Turner shifted to examining conscious parallelism, he concluded that in an oligopolist market,

> the 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. Both are pricing their product and determining their output so as to make the highest profit, or suffer the least loss, that can be obtained in the market conditions facing them.[129]

Turner, therefore, contended that "[i]f monopoly and monopoly pricing are not unlawful per se, neither should oligopoly and oligopoly pricing, absent agreement of the usual sort, be unlawful per se."[130] Turner further concluded that any remedy—even injunctive relief—would not be available because the injunction would be ordering a firm to act irrationally in order to avoid competitively pricing their goods.[131]

In contrast, Posner argued that there could be a theory of harm for oligopoly behavior because of the concerted action shown to competitors through either outputs or pricing schemes.[132] Posner maintained that since "tacit collusion or noncompetitive pricing is not inherent in an oligopolistic market structure but, like conventional cartelizing, requires additional, voluntary behavior by the sellers," a violation of Section 1 occurs.[133] Posner opined, "[N]o inference that the price rise was the result of an understanding to move from a competitive price to a monopolistic price by contracting output could be drawn."[134] Posner pointed out that the largest problem in these cases is proof.[135] Specifically, he claimed that "[i]f the Government can prove systematic price discrimination, an inference of noncompetitive pricing should be drawn."[136] But through this debate, the conscious parallelism plus factors remain the standard applied by American courts and, as I argue below, should continue to do so.[137]

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128. *Id.*
129. *Id.* at 665.
130. *Id.* at 667-68.
131. *See id.* at 669-71.
132. Posner, *supra* note 22, at 1564.
133. *Id.* at 1578.
134. *Id.*
135. *Id.* at 1578-60.
136. *Id.* at 1579.
137. *See* RICHARD A. POSNER, ANTITRUST LAW 55-60 (2d ed. 2001) (providing an updated critique by Posner of Turner's argument). Posner's view has prevailed in additional litigation since he has taken the bench. *See In re* High Fructose Corn Syrup Antitrust Litig., 295 F.3d 651 (7th Cir. 2002). Additionally, Posner has gained a disciple. *See* Louis Kaplow, *An Economic Approach to*

Scholars and courts understand that the plus factors are neither a checklist nor a "be all and end all" analysis that provides a clear answer; instead, this approach is flexible and requires close analysis of the facts, economics, and explanations provided by the firm.[138] The factors tending to distinguish agreement from conscious parallelism directly include communication or an opportunity to communicate, conduct too complicated to be explained by mere parallel behavior, and conduct lacking an evident efficiency explanation.[139] The factors suggesting the industry is conducive to coordination or cartelization include: few firms, homogenous products, difficult entry conditions, large numbers of purchasers, small and frequent transactions, transparent prices, coupled

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Price Fixing, 77 ANTITRUST L.J. 343 (2011); LOUIS KAPLOW, COMPETITION POLICY AND PRICE FIXING (2013). However, Posner's shift from the classroom to the bench may have softened his stance. *See* Richard A. Posner, *Review of Kaplow, Competition Policy and Price Fixing*, 79 ANTITRUST L.J. 761 (2014) (expressing "sympat[hy] with Kaplow's frustration at allowing tacit collusion to slip through the antitrust net," but "[no] confidence that punishing tacit colluders under antitrust law can produce net social benefits" because courts are ill-positioned to instruct firms on how to correct behavior when there has been no communication). Posner additionally expressed concerns that any alteration to the current framework would chill innovation. *See In re* Text Messaging Antitrust Litig., 782 F.3d 867, 874 (7th Cir. 2015) ("[S]uppose that the firms in an oligopolistic market don't try to sell each other's sleepers, 'sleepers' being a term for a seller's customers who out of indolence or ignorance don't shop but instead are loyal to whichever seller they've been accustomed to buy from. Each firm may be reluctant to 'awaken' any of the other firms' sleepers by offering them discounts, fearing retaliation. To avoid punishment under antitrust law for such forbearance (which would be a form of tacit collusion, aimed at keeping prices high), would firms be *required* to raid each other's sleepers? It is one thing to *prohibit* competitors from agreeing not to compete; it is another to *order* them to compete. How is a court to decide how vigorously they must compete in order to avoid being found to have tacitly colluded in violation of antitrust law? Such liability would, to repeat, give antitrust agencies a public-utility style regulatory role.") (second and third emphasis added).

138. GAVIL ET AL., *supra* note 29, at 366-72. "None of the plus factors, or types of plus factors . . . should be looked at in isolation when considering whether the facts of a parallel conduct case support the inference or conspiracy. Moreover, some factors listed in each group and type may be more compelling than others." *Id.* at 369. *See also In re* Chocolate Confectionary Antitrust Litig., 801 F.3d 383, 398 (3d Cir. 2015) ("[E]vidence of conscious parallelism cannot alone create a reasonable inference of a conspiracy," thus to "move the ball across the goal line, a plaintiff must also show that certain plus factors are present," since these "plus factors are 'proxies for direct evidence' because they 'tend to ensure that courts punish concerted action—an actual agreement—instead of the unilateral, independent conduct of competitors."). The United States Court of Appeals for the Third Circuit detailed that "traditional non-economic evidence of a conspiracy as the most important plus factor," that is "proof that the defendants got together and exchanged assurances of common action or otherwise adopted a common plan even though no meetings, conversations, or exchanged documents are shown." *Id.*

139. *Id.* at 370-71. The framework adopted here "aim[s] to discriminate directly between consciously parallel conduct and conduct that would be deemed an agreement under the antitrust laws . . . [and] implicitly adopts Turner's perspective." *Id.* at 367.

with past history of coordination, rational motive to behave collectively, sustained and substantial profitability, persistent supra-competitive pricing, pre-announcement of price increases, and actions contrary to self-interest unless pursued collectively.[140] With conscious parallelism and the plus factors laid out, this Article compares and contrasts Ezrachi & Stucke's hypothesized future to the practical realities of regulating the algorithms and firms that rely on them through modern day antitrust doctrine.

VI. MODERN DAY ANTITRUST STANDS READY TO COUNTER THE ALGORITHMIC MISCHIEF THEORIES POSITED BY EZRACHI & STUCKE

To begin this rebuttal, let's start with Ezrachi & Stucke's newest theory of harm raised that algorithms will push conscious parallelism out of oligopolistic markets and into other markets that are on the fringe of oligopoly.[141] The economics simply do not agree with this theory. The reason oligopoly behavior is permitted is because it is rational and absent plus factors because it is the only economically feasible way oligopoly markets and firms in those markets can exist profitably. As Posner explained, "a price reduction that produces a substantial expansion in the output of one will result in so substantial a contraction in the output of the others that [competitors] will quickly respond to the reduction."[142] However, markets not characterized by oligopoly, even ones on the margins of oligopoly, still require the other conditions to permit retaliation, including: (1) homogenous products, (2) difficult entry conditions, (3) large numbers of purchasers, and (4) small and frequent transactions.[143] Even if a market is almost oligopolistic, Ezrachi & Stucke have not outlined how this type of market, absent the additional factors outlined above, would be able retaliate against mavericks and first-

140. *Id.* at 371. "The plus factors [here] are related to the economic question of whether the firms can successfully reach a coordinated outcome by reaching consensus on the terms of coordination, deterring deviation (cheating) from those terms, and preventing new competition." *Id.* at 368.

141. *Algorithmic Tacit Collusion*, *supra* note 1, at 229.

142. Posner, *supra* note 22, at 1564. "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.*

143. *See* GAVIL ET AL., *supra* note 29, at 371. "The plus factors [here] are related to the economic question of whether the firms can successfully reach a coordinated outcome by reaching consensus on the terms of coordination, deterring deviation (cheating) from those terms, and preventing new competition." *Id.* at 368.

movers.[144] Thus, this theory that markets on the margins of oligopoly should force regulators and courts to alter conscious parallelism plus doctrine to some new theory of harm should be carefully considered and eventually discarded as a viable solution. Instead, we should monitor merger and acquisition in this area to protect markets from becoming oligopolies.[145]

Next, Ezrachi & Stucke's Algorithm-Fueled Hub and Spoke conspiracy could be countered, as they agree, through traditional methods.[146] While they did not make this explicit, the algorithm in this scenario—where retailers rely on a supplier's pricing algorithm—is the wheel that combines all of the spokes (the retailer firms) to the hub (the supplier). To prove this theory of liability, prosecutors or plaintiffs would

144. *See* Posner, *supra* note 22, at 1563 (explaining that the individual seller "can sell all that he can produce at the market price, and nothing above it. He can shade the price without fear of retaliation because the resulting expansion of his output at the expense of his rivals will divert an imperceptible amount of business from each.").

145. See John McGee, *Predatory Price Cutting: The Standard Oil (N.J.) Case*, 1 J.L. & ECON. 137 (1958) for a thoughtful critique of *Standard Oil* and its rise to market dominance through horizontal merger. ("Standard Oil did not use predatory price discrimination to drive out competing refiners, nor did its pricing practices have that effect . . . . I am convinced that Standard did not systematically, if ever, use local price cutting in retailing, or anywhere else, to reduce competition."); *see also* ROBERT BORK, THE ANTITRUST PARADOX 145 (1978) ("Standard attained its market share by merger."). However, as previously detailed, merger review robustly protects consumer welfare already. *See* Fortin, *supra* note 2, at 3-5; *see also* 15 U.S.C. § 18; Robert Robertson & Corey W. Roush, *Procedural and Substantive Differences in Merger Challenges by Different Authorities in the United States*, 58 ANTITRUST BULL. 201 (2013) (detailing that merger control provisions were enacted in 1914 and modified in 1950 by the Celler-Kefauver Act). State Attorneys General also have authority to enforce Section 7 and a review by the federal government does not preclude state involvement. William E. Kovacic et al., *Merger Control Procedures and Institutions: A Comparison of the EU and US Practice* 9 (Columbia L. Sch., Ctr. for L. & Econ. Stud., Working Paper No. 476, 2014). Even if the federal government clears a merger, State AG's may use Section 7 to block or seek additional relief. *Id.* at 9-10 (citing California v. Am. Stores Co., 495 U.S. 271 (1990)). Other regulatory agencies may review mergers, but they are typically reviewed concurrently with DOJ and the FTC. GAVIL ET AL., *supra* note 29, at 673 (providing examples such as "railroads (Surface Transportation Board), energy producers (Federal Energy Regulatory Commission), and Banking (Federal Reserve Board). Furthermore, "[m]ergers involving national security interests are subject to antitrust review and to an additional regulatory regime under the Exon-Florio Amendment to the Defense Production Act of 1950 ("Exon-Florio"), 50 U.S.C. App. § 2170." *Id.* Additionally, "[s]tate public utility commissions enjoy substantive authority similar to the FCC's competence for deals that affect commerce within their state borders. Many state public utility laws establish public interest mandates that enable the public utility commission (PUC) to review and oppose mergers on competition grounds." Kovacic et al., *supra*, at 10.

146. *See* VIRTUAL COMPETITION, *supra* note 1, at 47 (detailing the theory); *see id.* at 221 (detailing that traditional methods will counter Algorithm-Fueled Hub and Spoke).

need to explain the nature of algorithms and machine learning,[147] but a reasonable jury presented with these facts and the description of the technology would likely find a per se collusive price fixing or market allocation agreement similar to precedent.[148]

Additionally, Ezrachi & Stucke's Predictable Agent scenario, while facially problematic, has already been countered by recent DOJ policies.[149] The Assistant Attorney General for Antitrust, Makan Delrahim, outlined in 2019 that the DOJ's leniency program will shift from a first come, all or nothing scenario for the first whistleblower involved in cartelization to one that rewards robust corporate governance programs initiated by firms that responsibly attempt to counter cartelization behavior like price fixing, market allocation, and group boycotts.[150] While the current DOJ guidance document does not mention algorithms at all, the continued debate by scholars should ensure this document (and potentially another policy guidance created by the FTC) provides sufficient, ex ante measures to combat any potential algorithmic mischief before it gets to the fantastical level theorized by Ezrachi & Stucke. Therefore, I submit that their general concern is warranted and should be debated by regulators, but if this new policy is followed to its logical conclusion, their theory is unlikely to materialize.

However, Ezrachi & Stucke's specific policy can also be rebutted even without the DOJ's new policy. Under their first prong a Predictable

147. *See supra* Part III.

148. *See, e.g.*, Toys "R" Us, Inc. v. FTC, 221 F.3d 928, 935 (7th Cir. 2000); *see also* United States v. Apple, 791 F.3d 290 (2d Cir. 2015).

149. VIRTUAL COMPETITION, *supra* note 1, at 61.

150. *See* Makan Delrahim, Assistant Att'y Gen., Antitrust Divi. of U.S. Dep't of Just., *Wind of Change: A New Model for Incentivizing Antitrust Compliance Programs*, Remarks at the New York University School of Law Program on Corporate Compliance 3 (July 11, 2019), http://justice,gov.opa/speech/assistant-attorney-general-makan-delrahim-delivers-remarks-new-york-university-school-1-0 ("I believe the time has now come to improve the Antitrust Division's approach and recognize the efforts of companies that invest significantly in robust compliance programs. In the words of our former Deputy Attorney General Rod Rosenstein, '[t]he fact that some misconduct occurs shows that a program was not foolproof, but that does not necessarily mean it was worthless. We can make objective assessments about whether programs were implemented in good faith.'"). "Therefore, effective immediately, the Antitrust Division will: (1) change its approach to crediting compliance at the charging stage; (2) clarify its approach to evaluating the effectiveness of compliance programs at the sentencing stages; and (3) for the first time, make public a guidance document for the evaluation of compliance programs in criminal antitrust investigations." *Id. See, e.g.*, U.S. DEP'T OF JUST. ANTITRUST DIV., EVALUATION OF CORPORATE COMPLIANCE PROGRAMS IN CRIMINAL ANTITRUST INVESTIGATIONS (2019), http://www.justice.gov/atr/page/file/1182001/download.

Agent does not pose a problem.[151] Regulators, courts, and most of all consumers should want pricing algorithms to respond to reductions in prices favorably, with a firm following the first mover and engaging in a price war. It is the second prong of their hypothesis that regulators and courts should be especially weary of.[152] By programming this instruction into an algorithm, whether it be machine (or deep) learning, would invite anticompetitive conduct contrary to antitrust doctrine. While there should certainly be controls over potential mistakes,[153] regulators and firms should not permit algorithms to purposefully raise prices in order to negate a first mover's or maverick's intention of cutting into demand side profits.[154] After the first algorithm is prosecuted and other firms remove this prong in their code, Ezrachi & Stucke's claim that these algorithms relying on "predictive analytics"[155] to counter mavericks and first movers would be negated. Again, forcing market participants to engage with and counter first movers and mavericks will further serve greater value to consumers, in addition to the PCWs currently in effect driving innovation as well.[156]

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151. VIRTUAL COMPETITION, *supra* note 1, at 61 ("The algorithm among other things, is programmed to monitor price changes and swiftly react to any competitor's price reduction.").

152. *Id.* ("The algorithm is also programmed to follow price increases when sustainable, that is, when others follow in a timely manner so that no competitor benefits from keeping prices lower.").

153. *See id.* at 13 (detailing a particularly problematic pricing fiasco) ("Amazon's pricing algorithms made headlines when they led to an unintended escalation in price of Peter Lawrence's book *The Making of a Fly*. At its peak, Amazon priced the book at $23,698,655.93 (plus $3.99 in shipping)." (footnotes omitted)); *see also* Andrew Couts, *Why Did Amazon Charge $23, 698,655.93 for a Textbook?* DIGITAL TRENDS (Apr. 23, 2011), http://www.digitaltrends.com/computing/why-did-amazon-charge-23698655-93-for-a-textbook/. Clearly this is a scenario all firms engaged in dynamic pricing should avoid.

154. It's also not entirely clear how buyer side PCWs would not counteract any attempt by suppliers to actually implement this instruction.

155. *Id.* (quoting Roland Moore-Colyer, *Predictive Analytics Are the Future of Big Data*, V3 (Oct. 9, 2015), http://www.v3.co.uk/v3-uk/analysis/2429494/predictive-analytics-are-the-future-of-big-data.)

156. As detailed above, Ezrachi & Stucke claim that firms will not force humans to check the algorithms prices likely will not be borne out under the DOJ's new policy. VIRTUAL COMPETITION, *supra* note 1, at 61-62. At least one would hope that firms with valuable outside or general counsel would not permit engineers to frolic with pricing algorithms unencumbered and unchecked. This also will not create a burdensome restriction on innovation. *See* OECD, *supra* note 40, at n.4 ("It is not unusual for companies to run simultaneously deep learning and traditional machine learning algorithms, so that they can identify the best course of actions and, simultaneously, to be aware of the features that were relevant for the final decision."). Thus, while it may not be a human going through lines and lines of code—technology can be used to check technology and avoid mischief.

Furthermore, as detailed in Part IV, I am deeply skeptical of when and if God View[157] or Digital Eye[158] will materialize. Regardless of its probability, this theory requires only an answer to their remedy question, "If algorithms collude . . . are humans liable?"[159] Again, the DOJ's recent changes to the leniency program should provide guidance to this question, but even without a current position by the government, in my view, the answer is yes. The logic (both of the law and computer algorithms) requires human input for collusion to prevail through dynamic pricing in the way Ezrachi & Stucke theorize. If the DOJ is providing leniency for corporate governance programs that provide greater oversight and training for their employees related to antitrust liability—like per se collusion—then it would make sense that as a firm relies on an engineer to create an algorithm used in dynamic pricing, the firm must require and ensure that collusive tendencies be avoided.[160] Certainly, mistakes are bound to happen, but that is quite different from programming in collusion instructions to an algorithm. Thus, the question needs to be reframed by regulators and courts: If a human develops an algorithm (whether by inputting the ones and zeroes or by allowing machine or deep learning to take place), are humans and firms liable if the algorithm commits mischief and colludes with competition? The answer is yes.

Additionally, the reason for my skepticism towards the Digital Eye is that Ezrachi & Stucke posit a world in which autonomous technology takes over every facet of life. They opine that we will get to a point when the algorithms just *do everything*,[161] and there are only lawyers at the DOJ and FTC monitoring competition and these authorities just throw their hands in the air befuddled over what to do because Section 1 requires agreements between humans—not algorithms. First, the humans at the firm will have to program the algorithms, and as detailed above, that should create liability for anticompetitive conduct, especially when

157. VIRTUAL COMPETITION, *supra* note 1, at 72.

158. *Id.* at 75.

159. *Id.* at 222.

160. *See* Our Curious Amalgam, *Can Robots Collude? Understanding the Competition Implications of AI*, AM. BAR ASS., ANTITRUST L. SECTION (May 18, 2020), http://podcast.ourcuriousamalgam.com/episode/50-can-robots-collude-competition-implications-ai/) (discussing the role lawyers must play in the rise of start-ups and developing and relying on AI); *see also* Karen Silverman et al., *Antitrust Intelligence: Six Tips for Talking to Developers about Antitrust*, 5 COMPETITION L. & POL'Y DEBATE, Oct. 2019, at 35; *see also supra* note 155 and accompanying text.

161. As I read VIRTUAL COMPETITION, I could not help but keep thinking back to WALL E and Disney's dystopian future of machines controlling human behavior. *See WALL E* (Disney Pixar, Inc. 2000).

adequate corporate governance is not installed.[162] But it is difficult for me to believe that corporations (and the board of directors) will simply cease to examine profit motives—even with the extremely detailed, extremely accurate, and extremely quick response time of dynamic pricing. While Ezrachi & Stucke are correct that there may be a rise in prices initially (which would likely be attributed to the sunk cost of investment in this advanced technology), I simply cannot envision corporations and their boards nor consumers wholesale would *abandon basic competition principles* in this new environment.[163] Regardless of what an algorithm posits as an efficient allocative resource, buyers and sellers will resort to these principles on their own if the data misleads them—I am still confident of humanity's free-choice principles.

The most concerning aspect of Ezrachi & Stucke's claim that antitrust needs a reboot is the problem of false positives. As they detail, "[t]he greater concern around governmental intervention lies with the risk of false positives, which can chill procompetitive market behavior and which market forces cannot readily redress."[164] The procompetitive behavior that would be chilled by intervention is outlined thoroughly by Ezrachi & Stucke, but is worth repeating here. First, they point to

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162. In the securities context, the SEC has already shown this conduct is unlawful. *See* Athena Cap. Rsch., LLC, Exchange Act Release No. 73369, Investment Advisers Act Release No. 3950, 2014 WL 5282074 (Oct. 16, 2014); Press Release, U.S. SEC. & EXCH. COMM'N, *SEC Charges New York-Based High Frequency Trading Firm with Fraudulent Trading to Manipulate Closing Prices* (Oct. 16, 2014), http://www.sec.gov/news/press-release/2014-229 (sanctioning high frequency traders for the use of a sophisticated algorithm which used a practice known as "marking the close" where stocks were bought or sold at a high frequency just before the closing bell). "The massive volumes of Athena's last-second trades allowed Athena to overwhelm the market's available liquidity and artificially push the market price—and therefore the closing price—in Athena's favor. *Id.* The firm's employees were "acutely aware of the price impact of its algorithmic trading, calling it 'owning the game' in internal emails." *Id.*

163. *See* United States v. Syufy Enters., 903 F.2d 659, 662-63 ("Competition is the driving force behind our free enterprise system. Unlike centrally planned economies, where decisions about production and allocation are made by government bureaucrats who ostensibly see the big picture and know to do the right thing, capitalism relies on decentralized planning—millions of producers and consumers making hundreds of millions of individual decisions each year—to determine what and how much will be produced. Competition plays the key role in this process: It imposes an essential discipline on producers and sellers of goods to provide the consumer with a better product at a lower cost; it drives out inefficient and marginal producers, releasing resources to higher-valued uses; it promotes diversity, giving consumers choices to fit a wide array of personal preferences; it avoids permanent concentrations of economic power, as even the largest firm can lose market share to a feistier and hungrier rival. If, as the metaphor goes, a market economy is governed by an invisible hand, competition is surely the brass knuckles by which it enforces its decisions.").

164. VIRTUAL COMPETITION, *supra* note 1, at 24.

Walmart's declining market share as compared to Amazon's.[165] My response to this problem is, Shouldn't we as a society want lower prices, more responsive sellers, and goods arriving at our doors faster? Second, they describe how, "as any retailer's product assortment grows, so too does the impracticability of manually adjusting pricing. Humans would have to process vast reams of data to decide the price."[166] Again, firms have solved this problem with technology and can use technology to provide adequate oversight. Third, they posit that this technological pressure will further increase the technological pressures on brick and mortar stores (like Walmart) to shift to dynamic pricing.[167] Again, shouldn't we as a society want better pricing data? Further, "algorithms will increasingly be pitted against other algorithms (rather than humans) for pricing decisions."[168] Not to be the squeaky wheel here—but isn't this what we want?

Finally, while some empirical work supports Ezrachi & Stucke's arguments,[169] there are severe criticisms and counterpoints undermining the real-world aspects of these trials.[170] First the research that supports Ezrachi & Stucke, Calvano et al., evaluates machine learning in a market with only two firms (clearly an oligopoly) and what occurs with the demand for a good while relying on dynamic pricing. Further, they evaluate what occurs with the entry of a third firm during the experiment and how that affects pricing.[171] Their results conclude that increasing complexity in the marketplace reduces the level of supra-competitive profits while also increasing the length of time it takes for collusion between the firms to occur.[172] This research is supported by Klein's work, which conveys that the time it takes for algorithms to collude decreases as the number of dynamic pricing algorithms used increases.[173] As Moore et

165. *Id.* at 11-12. ([Walmart's] customers increasingly are using computers, tablets, and smart phones to shop online with [Walmart] and with their competitors and to do comparison shopping.").

166. *Id.* at 13.

167. *Id.*

168. *Id.* at 14.

169. Emilio Calvano et al., *Artificial Intelligence, Algorithmic Pricing and Collusion*, 10 AM. ECON. REV. 3267 (2020); Timo Klein, *Autonomous Algorithmic Collusion: Q-Learning Under Sequential Pricing* (Amsterdam Ctr. for L. & Econ., Working Paper No. 2018-15, 2020), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=3195812.

170. Ulrich Schwalbe, *Algorithms, Machine Learning, and Collusion*, 14 J. COMPETITION L. & ECON. 568 (2019). The French and German competition authorities have also released a comprehensive study evaluating the likelihood of algorithmic collusion. *See* AUTORITE DE LA CONCURRENCE & BUNDESKARTELLAMT, ALGORITHMS AND COMPETITION 12-14 (2019).

171. Calvano et al., *supra* note 169.

172. *Id.*

173. Klein, *supra* note 169.

al. opined when evaluating these studies, "it may be inferred from these various experiments that factors such as [homogeneity] between firms, market stability, simple decision rules, and market transparency, while not an absolute prerequisite to algorithmic collusion . . . may facilitate its attainment or the level of profits (and hence the consumer loss) it generates."[174]

In contrast, Schwalbe, along with German and French competition authorities, lays out several criticisms of this research. For starters, Schwalbe claims that even if these trials removed the algorithms, the same competitive problems would occur because humans would set prices at supra competitive levels, because this is how oligopolistic markets work.[175] Further, he argues that the number of repetitions of the experiments precludes including humans in these trials to assess the variance of the pricing schemes to see whether the algorithms or humans would set prices higher.[176] Additionally, Schwalbe reiterates the problems I raised above—it is doubtful that firms would rely on black box dynamic pricing rather than descriptive algorithms[177] Schwalbe further contends that the use of discriminatory pricing[178] and tacit collusion together are highly unlikely to occur because—just as under twentieth century market conditions—without explicit communication between the algorithms coupled with markets defined with differentiated products, the use of personalized (or discriminatory) prices is far more difficult to use to reach a collusive effect for coordination.[179] Additionally, the experiments run by Calvano and Hansen rely on unrealistic economic environments of only two firms relying on the same algorithm to sell the same product with high barriers to entry and uniform prices.[180] But as the German and French

174. John Moore et al., *Some Reflections on Algorithms, Tacit Collusion, and the Regulatory Framework*, COMPETITION POL'Y INT'L: ANTITRUST CHRONICLE, July 2020, at 15, 16.

175. Schwalbe, *supra* note 170.

176. *Id.*

177. *Id.*; *See* AUTORITE DE LA CONCURRENCE & BUNDESKARTELLAMT, *supra* note 170 (describing the differences between black box algorithms versus comparative algorithms).

178. While my description above moved past this theory of harm because my focus is on tacit collusion, Ezrachi & Stucke argued this in addition to the tacit collusion. *See* VIRTUAL COMPETITION, *supra* note 1, at 85-89. Specifically, this theory of harm relies on the idea that certain consumers will be treated differently than others based on a variety of factors. *Id.* There is certainly a cause for concern with regarding this theory of harm especially as it relates to racial, gender, religious, and socio-economic background and the rise in consumer prices due to this discrimination. However, this theory of harm is outside the scope of this Article.

179. Schwalbe, *supra* note 170.

180. Calvano et al., *supra* note 169; Klein, *supra* note 169.

authorities detail, "a real-life market environment is likely to encompass several sources of complexity simultaneously. Their joint effect on the likelihood of collusion remains an open question for future economic research."[181]

Ezrachi & Stucke do put forth valuable reforms. First, they suggest relying on the per se rule of reason when courts evaluate algorithmic collusion may harm consumers as "[a] competition authority may find it cumbersome, and at times impossible to delve into the heart of an algorithm to establish whether it is designed in a way that would lead to, or may lead to, exploitation."[182] Thus, "[t]he algorithm used last year may not resemble the one used today. Unless the competition agencies discovered evidence of a clear anticompetitive design, their analysis [sh]ould shift from a 'per se illegal' to standard rule of reason.'"[183] I concur with this reform and believe other scholars would likewise agree that a movement from per se to rule of reason, and likewise from criminal sanctions to civil sanctions under rule of reason when related to this dynamic technological environment, would be beneficial for increasing innovation while continuing to protect consumers.[184]

VII. CONCLUSION

Technology has disrupted so much of our traditional economy over the first two decades of the twenty-first century. What is clear from a review of the economic formulation of conscious parallelism plus what is required to prove anticompetitive conduct, current doctrine does not need to be reworked for Ezrachi & Stucke's hypothesized future. At most, expansion of current policies recently enacted by the DOJ regarding corporate governance programs needs to be adopted to account for technological innovation. Ezrachi & Stucke provide any rebuttal I would offer quite cogently, as they claim:

> every risk we identify could be associated with a more competitive environment: the increase in market transparency can lower consumers' search costs. The velocity of price changes means that prices can come down faster (and go up quicker in periods of scarcity, which promotes allocative efficiency). The computers' ability to calculate the likely profits from different moves and countermoves may mean procompetitive responses that

181. AUTORITE DE LA CONCURRENCE & BUNDESKARTELLAMT, *supra* note 170, at 49.

182. *Id.* at 54.

183. *Id.*

184. *See* Douglas H. Ginsburg & Joshua D. Wright, *Antitrust Sanctions*, 6 COMPETITION POL'Y INT'L J. 3 (2010).

> humans may not have foreseen. Greater profits could be gained by developing computers that, through self-learning or programming, opt for the profit-maximizing strategy, whereby everyone else charges the high price while the company defects (and sells more items and earns greater profits).[185]

As we continue in the twenty-first century reaping the rewards of the technological advances, we should remain vigilant in our competition policies while maintaining course with consumer welfare.

185. VIRTUAL COMPETITION, *supra* note 1, at 80.