Loyola Consumer Law Review

Volume 32
Issue 2 *2020*

Article 5

2020

Algorithms Take Flight: Modern Pricing Algorithms' Effect On Antitrust Laws in the Aviation Industry

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ALGORITHMS TAKE FLIGHT: MODERN PRICING ALGORITHMS' EFFECT ON ANTITRUST LAWS IN THE AVIATION INDUSTRY

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ABSTRACT

What happens when an inevitable moving force collides with an immovable object? Either the force finds a way around the object or the object must adapt to contain the force. Over a century has passed since the federal government passed the Sherman Act, Clayton Act, and Federal Trade Commission Act. As times change, the three reigning laws have had very little reform. Federal antitrust laws remain immovable through the past century as civilization has made astounding advancements. The advancement of technology in business is inevitably becoming a large part of how corporations are securing advantages against their competition. Artificial intelligence and algorithms can make real-time business decisions while weighing thousands of factors. Self-learning artificial intelligence can make real-time decisions and learn from every mistake they have ever made. However, these "robo-sellers" call into question whether federal antitrust laws can properly regulate and punish a decision made by an inanimate object. Because artificial intelligence is so beneficial to businesses (and society), should antitrust laws worry about them?

Real-time pricing decisions have become especially important in the aviation industry. Airlines are dependent on pricing algorithms to remain profitable—perhaps even at the expense of consumers. The airline industry's oligopoly market increases the risk of consumer harm. Airlines have a long-standing history with federal antitrust laws and the addition of pricing algorithms in their businesses has not appeared to decrease the momentum of antitrust litigation.

In 2010, the financial market suffered the "Flash Crash." Algorithmic trade activity caused a chain reaction which led to the S&P 500, Nasdaq 100, and Dow Jones temporarily dropping. The financial industry panicked before prices eventually bounced back. A Flash Crash in the airline industry would be disastrous because of society's reliance on air transportation. Regulators need to learn from the financial market's Flash Crash mistake.

In this Article, I argue that the airline industry is in a position where it can leverage its oligopoly market and pricing-algorithm technology in a manner that is harmful to consumers. I argue that it would be in the best interest of both airlines and the government to develop a new method of regulating the pricing algorithms that are used in the airline industry.

I. INTRODUCTION

Imagine a world where artificial intelligence runs a large corporate department with minimal human interaction. Well, that world will be here sooner than you can imagine.[1] Algorithms "work with a huge amount of data, unimaginably fast, without interruptions, without emotions, and increasingly also without human involvement."[2] Companies that employ *robo-sellers* (pricing algorithms) are at a clear advantage over those companies that do not. Robo-sellers remove human error in pricing decisions, employment expenses, and other labor expenses. However, as this Article discusses, there are several issues that arise with the implementation of pricing algorithms—especially in the airline industry context.[3]

The airline industry is evolving quickly and does not seem to be slowing down.[4] Airlines use technology, such as artificial

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[1] *See* Charlie Osborne, *Future Enterprise Companies Will Be Run by Robots*, ZDNET (Nov. 9, 2016, 12:25 AM), https://www.zdnet.com/article/future-enterprise-companies-will-be-ran-by-robots/.

[2] Václav Šmejkal, *Cartels by Robots – Current Antitrust Law in Search of an Answer*, 4 J. INT'L & EUR. L., ECON. & MKT. INTEGRATIONS 1, 3 (2017).

[3] *See infra* Part V.

[4] *2036 Forecast Reveals Air Passengers Will Nearly Double to 7.8 Billion*, INT'L AIR TRANSP. ASS'N (Oct. 24, 2017),

intelligence, to keep their business profitable—especially pricing algorithms.[5] As this technology is new and airlines are at the forefront of their usage, the airline industry has become a "guinea pig" for antitrust regulators. For example, in *United States v. Airline Tariff Publishing Co.*,[6] the Department of Justice ("DOJ") investigated several major airlines and the Airline Tariff Publishing Company ("ATP") for price fixing.[7] The airlines were using hidden messages in ATP's database to communicate with each other to "increase [airfare], eliminate discounts, and set fare restrictions."[8] All parties eventually settled, but the DOJ made it clear that they will investigate intra-airline pricing discussions—even discussions made through technology, like pricing algorithms.

The government will undoubtedly face difficulties regulating pricing algorithms in the airline industry using current antitrust laws. First, the airline industry is an oligopoly.[9] Firms in an oligopoly market are at an advantage because of a "crack" in antitrust law.[10] It is difficult for antitrust regulators to prove that parallel pricing in an oligopoly is a manifestation of concerted, rather than unilateral, behavior.[11] If there are only three firms in a market and their objective is, presumably, to maximize profit, then it would benefit all three firms to coordinate and price their product or service higher than what is competitive—at a supracompetitive price.[12] If the firms regularly monitor each other's pricing, then

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https://www.iata.org/pressroom/pr/Pages/2017-10-24-01.aspx (discussing research on how the airline industry is growing internationally).

[5] *See* Tom Chitty, *This Is How Airlines Price Tickets*, CNBC (Aug. 3, 2018, 11:59 AM), https://www.cnbc.com/2018/08/03/how-do-airlines-price-seat-tickets.html.

[6] *See infra* Section V(a).

[7] Competitive Impact Statement at 1-2, United States v. Airline Tariff Publ'g Co., 836 F. Supp. 9 (D.C.C. 1993) (No. 92-2854).

[8] *Id.* at 10.

[9] Jonathan M. Bruneau, *Concentration Within the U.S. Airline Industry: A "Natural Phenomenon" or an "Ordinary" Monopoly/Oligopoly Resulting from the Behaviour of Competitors?*, 17 ANNALS AIR & SPACE L. 123, 123–24 (1992); for a discussion of oligopoly, *see* discussion *infra* Section V(b).

[10] *See* discussion *infra* Section IV(b).

[11] Alan Devlin, *A Proposed Solution to the Problem of Parallel Pricing in Oligopolistic Markets*, 59 STAN. L. REV. 1111, 1113 (2007).

[12] *Id.* at 1113–15.

they can fix their prices without concerted action.[13] Another problem, which logically flows from the first issue, is how pricing algorithms can help oligopoly firms hide traces of concerted action.[14] Both of these issues are pressing concerns that will surely shape competition regulations in the airline industry.

This Article evaluates the obstacles, issues, and possible solutions that the airline industry and its regulators face with the advent of pricing algorithms. Part II discusses how businesses and airlines use artificial intelligence and pricing algorithms. Part III discusses the pertinent federal antitrust laws—Sherman Act, Clayton Act, and Federal Trade Commission Act—with a focus on the Sherman Act. Part IV analyzes cases in which algorithms were the focal point of the litigation. Additionally, this part explores the challenges that algorithms provide for antitrust regulators. Part V provides examples of antitrust litigation involving airlines and discusses the potential harm that pricing algorithms in the airline industry can cause. Part VI provides a recommendation for government regulators and airlines moving forward. Technology is an inevitable force that will find its way around the immovable federal antitrust laws—that is, unless they adapt.

II. PRICING ALGORITHMS HASSLING WITH FEDERAL ANTITRUST LAWS

"We will not tolerate anticompetitive conduct, whether it occurs in a smoke-filled room or over the Internet using complex pricing algorithms."[15]

Algorithms,[16] along with their artificial intelligence capabilities, have become "so pervasive in modern society that they track,

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[13] *Id.*

[14] *See* discussion *infra* Section IV(b)(i).

[15] U.S. DEP'T JUST., *Former E-Commerce Executive Charged with Price Fixing in the Antitrust Division's First Online Marketplace Prosecution* (last updated Feb. 4, 2016), https://www.justice.gov/opa/pr/former-e-commerce-executive-charged-price-fixing-antitrust-divisions-first-online-marketplace.

[16] Artificial intelligence and machine learning are intensive topics mentioned throughout this Article. This background section is intended to provide you with the necessary knowledge and context to understand the discussion that

predict and influence how individuals behave in nearly all aspects of life."[17] "[A]n algorithm is a sequence of rules that should be performed in an exact order to carry out a certain task . . . 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."[18] Originally, long strings of code were required for algorithms to function. Today, algorithms are teaching themselves and creating their own code through machine learning—a subset of artificial intelligence.[19] It is unsurprising that businesses would take advantage of the efficiency and cost savings that accompany employing an algorithmic-machine over a human. This Part discusses how businesses and airlines use pricing algorithms.

A. Businesses' Utilization of Pricing Algorithms

Businesses are employing algorithms to gain a competitive edge over their rivals. This creates a domino effect of global digitalization, encouraging firms to develop and use algorithms so they can compete with their competition.[20] Businesses are employing algorithms for two broad functions: predictive analytics and optimizing business processes.[21] The first function, predictive analytics, allows businesses to "[e]stimate demand, forecast price changes, predict customer behavior and preferences, assess risks and forecast . . . the entry of new firms."[22] The second function, optimizing business processes, encompasses an algorithm's ability to "reduc[e] production and transaction costs, [segment] customers [and] . . . [set] optimal prices that effectively respond to market circumstances."[23] An algorithm's benefits arise from its ability to

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follows. For additional information on artificial intelligence, see Antonio A. Martino, *Artificial Intelligence and Law*, 2 INT'L J.L. & INFO. TECH. 154 (1994). For additional information on machine learning, see Harry Surden, *Machine Learning and Law*, 89 WASH. L. REV. 87 (2014).

[17] OECD, ALGORITHMS AND COLLUSION: COMPETITION POLICY IN THE DIGITAL AGE 7 (2017) [hereinafter ALGORITHMS AND COLLUSION].

[18] *Id.* at 8.

[19] *Id.* at 9.

[20] *Id.* at 11–12.

[21] *Id.* at 11.

[22] *Id.*

[23] *Id.*

analyze large sets of data and make quick, accurate, and efficient business decisions.[24] The 'optimizing business processes' function is particularly relevant because it includes an algorithm's pricing capabilities.

Can you imagine the inefficiencies a modern business would encounter if it still used human pricing? Not only would it cost the business valuable employee time because of the necessary diligence, but instances of calculation inaccuracies would be much more frequent. Pricing algorithms—through *dynamic pricing*—price products and services based on an enormous amount of data points. Pricing algorithms will look at factors such as market segments, date, time, available stock, and anticipated demand—the list of factors is endless.[25] Companies can even use computer 'cookies' to access the consumer's internet browsing history to customize their pricing.[26] Businesses in several industries—travel, retail, sports, and entertainment—use pricing algorithms.[27] Pricing algorithms use machine learning to become more sophisticated. Machine learning is the process by which algorithms "learn through trial and error and [find] patterns from a great volume and variety of data, leading to optimal pricing."[28] A benefit of using dynamic pricing is that over time, as the algorithm accumulates data and experiments with different pricing combinations, "pricing becomes more dynamic, differentiated and personalized" from machine learning.[29] For example, an airline's pricing algorithm will accumulate data over time and use this data to price airfare. If it prices airfare at an inefficient rate, then its artificial intelligence will adapt, using machine learning, and not make that mistake again. Over a significant period of time—with the accumulation of a significant amount of data—an airline's pricing algorithm will have years of pricing experience and will never forget a previous mistake. Less obviously, consumers also benefit from dynamic pricing in businesses. The consumer benefits from dynamic pricing's

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[24] *Id.*

[25] Ariel Ezrachi & Maurice E. Stucke, *Artificial Intelligence & Collusion: When Computers Inhibit Competition*, 2017 U. ILL. L. REV. 1775, 1780 (2017).

[26] Robert M. Weiss & Ajay K. Mehrotra, *Online Dynamic Pricing: Efficiency, Equity and the Future of E-Commerce*, 6 VA. J.L. & TECH. 11, ¶ 13 (2001).

[27] Ezrachi & Stucke, *supra* note 25, at 1780.

[28] ALGORITHMS AND COLLUSION, *supra* note 17, at 16.

[29] ALGORITHMS AND COLLUSION, *supra* note 17, at 16.

ability to keep the market in equilibrium—preventing unsatisfied demand which leads to higher prices.[30]

Dynamic pricing has garnered the name 'perfect price discrimination' because it is capable of considering data such as a consumer's location, browsing history, previous purchases, and other private information.[31] Companies and their pricing algorithms' access to this intimate data comes with both positive and negative results. One positive aspect is that companies can provide lower prices for consumers who have a low willingness to pay.[32] Because the technology takes into account everything it knows about a consumer, it can provide that individual consumer with a price that is mutually beneficial to the consumer and the company. On the other hand, computers could discriminate based on characteristics such as gender or race.[33] For the good and the bad, the business world greatly benefits from dynamic pricing to optimize and individualize its products and services for its customers. The airline industry is at the forefront of employing dynamic pricing.

B. Airlines' Utilization of Pricing Algorithms

Airlines use algorithms to price their airfare under the dynamic pricing economic theory.[34] Experts have trouble agreeing on a definition of dynamic pricing, sometimes referred to as yield management.[35] However, American Airlines once defined the objective of yield management as "maximiz[ing] passenger revenue by selling the *right* seats to the *right* customers at the *right* time."[36] The factors that airlines use to price airfare—through pricing

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[30] ALGORITHMS AND COLLUSION, *supra* note 17, at 16.

[31] ALGORITHMS AND COLLUSION, *supra* note 17, at 16.

[32] ALGORITHMS AND COLLUSION, *supra* note 17, at 16.

[33] ALGORITHMS AND COLLUSION, *supra* note 17, at 16.

[34] Lisa Magloff, *Dynamic Pricing Strategy*, CHRON, https://smallbusiness.chron.com/dynamic-pricing-strategy-5117.html (last visited Jan. 26, 2019); *see also* Jessica Stillman, *Learn How Airlines Set Their Prices (So You Can Get a Better Deal)*, INC. (Sept. 23, 2016), https://www.inc.com/jessica-stillman/learn-how-airlines-set-their-prices-so-you-can-get-a-better-deal.html.

[35] Lawrence R. Weatherford & Samuel E. Bodily, *A Taxonomy and Research Overview of Perishable-Asset Revenue Management: Yield Management, Overbooking, and Pricing*, 40 OPERATIONS RES. 831, 832 (1992).

[36] *Id.*

algorithms—are generally unknown,[37] especially for self-learning algorithms. A few factors are apparent. First, airlines segment their prices by charging passenger groups different prices, depending on their willingness to pay more or less.[38] For example, airlines will charge business people more because they often wait until the last minute to book their ticket.[39] Second, airlines will vary their airfare depending on the flight's time of day and week.[40] Lastly, airlines will vary their airfares depending on the particular route a passenger takes—whether it is a direct route, to or from a busy airport, etc.[41]

The airline industry is on the forefront of artificial intelligence, pricing algorithms, and dynamic pricing. Because it is an international industry, the pricing factors can change in a matter of seconds. Therefore, fast-paced robo-sellers in the airline industry have become the norm.[42] Pricing algorithms are instantaneous, with an ever-growing ability to process large amounts of data and quickly learn from their mistakes.[43] Airlines that implement dynamic pricing have seen $200 million to $500 million increases in revenue.[44] As you can see, airlines would be crazy not to use dynamic pricing and pricing algorithms. However, there are negative perceptions of dynamic pricing in the airline industry. Dynamic pricing allows airlines to charge higher prices to less price-sensitive, business individuals and lower prices to more 'price-sensitive

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[37] Sara Robinson, *Computer Scientists Find Unexpected Depths in Airfare Search Problem*, 35 SIAM NEWS, July–Aug. 2002, at 1, 1 (discussing artificial intelligence students at MIT who attempted to decode airline pricing algorithms in order to find the cheapest flights but called it "unsolvable."). For economic studies that attempt to decipher airline pricing, see Kevin R. Williams, *Dynamic Airline Pricing and Seat Availability*, COWLES FOUND. FOR RES. IN ECON., No. 2103U, Feb. 2018, at 1; *see also* Beat Burger & Matthias Fuchs, *Dynamics Pricing — a Future Airline Business Model*, 4 J. REVENUE & PRICING MGMT. 39 (2004).

[38] Magloff, *supra* note 34.

[39] Magloff, *supra* note 34.

[40] Magloff, *supra* note 34.

[41] Magloff, *supra* note 34.

[42] *See* Diego Escobari, *Dynamic Pricing, Advance Sales and Aggregate Demand Learning in Airlines*, 60 J. INDUS. ECONS. 697 (2012).

[43] *See* Ezrachi & Stucke, *supra* note 25; *see also* ALGORITHMS AND COLLUSION, *supra* note 17.

[44] Michael P. Schubmehl, Wesley M. Turner & Daniel M. Boylan, *Models for Evaluating Airline Overbooking*, 23 UMAP J. 301, 316 (2002).

individuals,' such as students or the elderly.[45] Airline passengers, however, often become irked when they realize they paid more for a ticket then someone they are sitting next to.[46] The same row, same airline, same bag of peanuts and drink, yet the airfare is different.[47] Regardless, airlines are utilizing this technology, and if a consumer is looking to travel by air, they have very few options.

III. THE LEGAL COMPOSITION

The Sherman Act, Clayton Act, and Federal Trade Commission ("FTC") Act are the 'core federal antitrust laws.'[48] These laws create the general framework for deterring anti-competitive business decisions.[49] The objective of antitrust laws has always been "to protect the process of competition for the benefit of consumers, making sure there are strong incentives for businesses to operate efficiently, keep prices down, and keep quality up."[50] This

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[45] *See* Kelly L. Haws & William O. Bearden, *Dynamic Pricing and Consumer Fairness Perceptions*, 33 J. CONSUMER RES. 304 (2006)

[46] Weiss & Mehrotra, *supra* note 26, ¶ 19; *see also* Haws & Bearden, *supra* note 45 (examining dynamic pricing and how consumers perceive the idea of price discrimination).

[47] One consumer paying a higher price than another consumer for an identical product would constitute price discrimination. Under the Robinson-Patman Act, 15 U.S.C. § 13 (2012), price discrimination is illegal in certain contexts. Airlines seem to be pricing discriminatorily, which would provide the government with an avenue to regulate airlines' pricing algorithms. However, the Robinson-Patman Act is confined to regulating commodities. Courts have construed that to exclude services, like airfare. Fleetway, Inc. v. Pub. Serv. Interstate Transp. Co., 72 F.2d 761 (3rd Cir. 1934) (deciding transportation by bus is not a "commodity" under the Robinson-Patman Act); Gen. Shale Products Corp. v. Struck Constr. Co., 132 F.2d 425 (6th Cir. 1942), *cert. denied*, 318 U.S. 780 (1943) (deciding a construction contract that included labor and work was not a "commodity" under the Robinson-Patman Act); Gaylord Shops, Inc. v. Pittsburgh Miracle Mile Town & Country Shopping Ctr., Inc., 219 F. Supp. 400, 403 (W.D. Pa. 1963) (defining the sale of a "commodity" as a transfer of chattel or personal property). Therefore, airlines are likely free from any Robinson-Patman violations.

[48] FED. TRADE COMM'N, *The Antitrust Laws* [hereinafter *Antitrust Laws*], https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws/antitrust-laws (last visited Oct. 12, 2018).

[49] *Id.*

[50] *Id.*

Part analyzes the Sherman Act in detail and briefly discusses the Clayton and FTC Acts.

A. The Sherman Act

In the business context, the words "monopoly" and "price-fixing" have negative connotations because of their implications for consumers.[51] Before 1890, businesses and individuals who possessed wealth were merging together in an attempt to gain monopolistic power.[52] The natural result of this business maneuver was to fix prices in order to maximize profits.[53] The federal government recognized this injustice and passed the Sherman Act in 1890 as a means to outlaw "every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States," and punish any person who "shall monopolize, or attempt to monopolize . . . any part of the trade or commerce among the several States."[54] By its own nature, a pricing algorithm could violate the Sherman Act by price fixing, colluding, and creating horizontal agreements.[55]

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[51] *See* Laurel A. Rigertas, *The Legal Profession's Monopoly: Failing to Protect Consumers*, 82 FORDHAM L. REV. 2683 (2014) (discussing a monopoly in the legal profession and how it harms consumers); *see also* Nicole Manuel, *How Does a Monopoly Affect Business and Consumers?*, CHRON (Jan. 25, 2019), https://smallbusiness.chron.com/monopoly-affect-business-consumers-70033.html.

[52] Standard Oil Co. of N.J. v. United States, 221 U.S. 1, 31 (1911).

[53] *Id.* at 33.

[54] 15 U.S.C. §§ 1–2 (2012).

[55] Pricing algorithms can be subject to several violations under the Sherman Act. However, those violations will not be addressed here. One violation is creating or maintaining a monopoly. *See* FED. TRADE COMM'N, *Monopolization Defined*, https://www.ftc.gov/tips-advice/competition-guidance/guide-antitrust-laws/single-firm-conduct/monopolization-defined (last visited Jan. 7, 2019); *see also* Eugene V. Rostow, *Monopoly Under the Sherman Act: Power or Purpose?*, 43 ILL. L. REV. 745 (1949). Another violation is price discriminating. *See* M. A. Adelman, *Price Discrimination as Treated in the Attorney General's Report*, 104 U. PA. L. REV. 222 (1955); *see also* Daniel J. Gifford & Robert T. Kudrle, *The Law and Economics of Price Discrimination in Modern Economics: Time for Reconciliation?*, 43 U.C. DAVIS L. REV. 1235 (2010). Another violation is restraining the market. *See* Robert H. Jerry, II & Donald E Knebel,

1. Price Fixing and Collusion

The Supreme Court has stated that price fixing not only includes "an agreement to pay or charge rigid, uniform prices," but also fixed pricing ranges, fixed pricing levels of ascending or descending scales, or prices that are fixed through a formula—"[t]hey are fixed because they are agreed upon."[56] Under Section One of the Sherman Act, horizontal agreements—agreements on price or other trade terms between competitors—are so harmful that they are *per se* unlawful.[57] Courts presume that a horizontal agreement, or agreement to fix prices, has a negative effect on competition, which relieves a potential antitrust plaintiff of its burden to show a negative impact.[58] As a result, the plaintiff needs to prove only the existence of an agreement.[59] The agreement can be explicit or implicit.[60] Because the agreement is the sole element in a *per se* horizontal-agreement claim, it is discussed in-depth in Section III(a)(ii).

Price fixing negatively affects the market, even if the prices are reasonable.[61] If parties set prices that are reasonable today, they will likely set prices that are unreasonable in the future due to lack of supervision.[62] This would leave the parties in a dominant market position where they could destroy the competitive system.[63] Even if 'reasonable price fixing' does not lead to a monopoly, it would "interfere with the free play of market forces."[64] As a result, reasonableness cannot negate liability for price fixing or any other

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Antitrust and Employer Restraints in Labor Markets, 6 INDUS. REL. L.J. 173 (1984).

[56] United States v. Socony-Vacuum Oil Co., 310 U.S. 150, 222 (1940).

[57] George A. Hay, *Horizontal Agreements: Concept and Proof*, 51 ANTITRUST BULL. 877, 879 n.5 (2006) (discussing that vertical agreements—agreements between manufacturers and their distributors—are prosecuted under section 1 of the Sherman Act, but are not always evaluated under the *per se* illegality standard); *see also* United States v. Container Corp. of Am., 393 U.S. 333, 337 (1969).

[58] Hay, *supra* note 57, at 877.

[59] *Id.*

[60] Am. Tobacco Co v. United States, 328 U.S. 781, 809–10 (1946); Hay, *supra* note 57, at 878.

[61] United States v. Socony-Vacuum Oil Co., 310 U.S. 150, 221 (1940).

[62] *Id.*

[63] *Id.*

[64] *Id.*

per se horizontal agreement under Section One of the Sherman Act if an agreement exists.[65]

2. Proving the Existence of a Horizontal Agreement

A horizonal agreement is an agreement between competing entities on price or other terms of trade.[66] If two competing entities (e.g., American Airlines and Delta Air Lines) come to an agreement to price their international flights at the same price, then they have formed a horizontal agreement. For example, in 2007, British Airways pled guilty to fixing prices for its international flights.[67] British Airways pled that its representatives met with representatives of a competing airline and agreed to fix the passenger fuel surcharge for international flights between the United States and United Kingdom.[68] That agreement is a horizonal agreement. As discussed earlier, in a *per se* horizontal agreement case, a plaintiff can prevail by showing the existence of an agreement between the allegedly liable parties.[69] There are two types of agreements: explicit and tacit.

B. Explicit Agreements

The easiest way to establish an agreement is through an explicit agreement. Explicit agreements are written letters, in-person agreements, or any other means of oral communication (e.g., telephone) where parties decide to incrementally raise prices together.[70] In all of these situations, courts condemn and find no legitimate reason for competitors to discuss pricing together.[71] Additionally, communication among parties can be through a third-party channel. An example of a third-party horizontal agreement is a "hub and spoke" agreement, where the third-party individually conveys the willingness of several competitors to

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[65] *Antitrust Laws*, *supra* note 48.

[66] Hay, *supra* note 57, at 877.

[67] *See* United States v. British Airways PLC, Criminal No. 07-183 JDB (D.C.C. 2007) (plea agreement), https://www.justice.gov/atr/case-document/plea-agreement-44.

[68] *Id.*

[69] Hay, *supra* note 57, at 877.

[70] *Id.* at 880.

[71] *Id.* at 881.

participate in anticompetitive conduct.[72] Plaintiffs have a choice of direct and circumstantial evidence to establish an explicit agreement.

1. Evidence

There are two types of evidence that parties could potentially use to prove, or disprove, an explicit agreement. First, direct evidence—written communications, emails, recorded phone calls, etc.—is the easier way to evidence an explicit agreement.[73] The second, and more controversial type of evidence is circumstantial evidence.[74] When no direct evidence exists, fact-finders may rely on circumstantial evidence.[75] Generally, parallel prices must accompany other 'plus factors' in order for a fact-finder to use circumstantial evidence to infer an explicit agreement.[76] Cases tend to be fact specific, but courts have identified the following non-exhaustive plus factors.

The first plus factor (and most used) is whether it would be *economically plausible* for the defendants to reach an agreement.[77] In *Matsushita Electric Industries Co. v. Zenith Radio Corp.*, Japanese manufacturers allegedly sold consumer electronic products ("CEP") at a below-market rate in the United States in order to obtain a monopoly and eventually raise prices above the market rate.[78] The plaintiff presented circumstantial evidence that pointed

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[72] *Id.* at 882; *see also* Interstate Circuit v. United States; 306 U.S. 208 (1939) (discussing an example of a "hub and spoke" case where a party who owned a chain of theaters sought to have the film suppliers impose harsh restrictions on smaller theater chains; however, the court established that the suppliers in question would not have imposed the restrictions unless they were assured that the other suppliers would also impose the restrictions; therefore, the owner of the chain of theaters took on the role of the "hub," or third-party intermediary, and the suppliers took on the role of the "spokes.").

[73] Hay, *supra* note 57, at 883.

[74] *Id.*

[75] *Id.*

[76] *Id.* at 883–84; *see also* Michael D. Blechman, *Conscious Parallelism, Signaling and Facilitating Devices: The Problem of Tacit Collusion Under the Antitrust Laws*, 24 N.Y.L. SCH. L. REV. 881 (1979).

[77] Dean Harvey, Anticompetitive Social Norms as Antitrust Violations, 94 CALIF. L. REV. 769, 775 (2006).

[78] Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 577–78 (1986).

to a reasonable inference that the defendant attempted to monopolize the United States CEP market in violation of the Sherman Act.[79] However, the Supreme Court found that the defendants' alleged predatory pricing scheme was economically implausible.[80] The Court reasoned that if the defendants were selling their products at below-cost in order to gain a monopoly, then they must reasonably believe that they can make up for their losses in the long-term.[81] However, once the defendants attained a monopoly and subsequently raised prices, other firms would enter the market, leaving the defendants with the losses they amounted through their attempted monopoly.[82]

The second plus factor is whether there were *opportunities for collusion*.[83] For example, if the alleged competing parties had frequent phone conversations with no plausible excuse, or if the parties attended the same convention.[84] There needs to be an opportunity for the collusion to take place. The third plus factor is the *coincidence* factor—if the nature of the market is such that an identical price would be unlikely without a previous agreement.[85] The last plus factor looks at the *behavior of the parties* and attempts to show that the alleged anticompetitive actions could not have arisen through independent decision-making.[86]

2. The Oligopoly Defense

A defendant can combat parallel pricing allegations by asserting the *oligopoly defense*,[87] which is particularly relevant to this Article because of the oligopoly nature of the airline industry. The

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[79] Id. at 580 (Court of Appeals for the Third Circuit found these inferences reasonable and overturned the district court's summary judgment ruling).

[80] Id. at 595.

[81] Id. at 589.

[82] Id. at 592.

[83] Einer Elhauge, Harvard, Not Chicago: Which Antitrust School Drives Recent Supreme Court Decisions?, 3 COMPETITION POL'Y INT'L, No. 2, 2007, at 1, 10.

[84] Hay, supra note 57, at 886.

[85] Id. at 886.

[86] Id. at 887.

[87] *Id.* at 888; *see also* Gregory J. Werden, *Economic Evidence on the Existence of Collusion: Reconciling Antitrust Law with Oligopoly Theory*, 71 ANTITRUST L.J. 719 (2004) (discussing the oligopoly market's heightened ability to collude).

oligopoly defense is best understood through an example.[88] There are two fruit stands in a town, stand A and B, each providing the same quality of fruit. The consumers have no brand loyalty. The competitive market price for an apple is one dollar, and if each stand charges that rate, each business will have equal apple revenue. Both stands will post their apple price outside of their stores for consumers. Therefore, the other stand will see the price. If stand A raises its rate to two dollars—well above the market rate—stand B has two options. First, stand B can leave its rate at one dollar and absorb the excess business that will flow over as a result of stand A's price increase. Second, stand B can raise its price, forcing consumers to purchase apples at the two-dollar rate. At first glance, this seems identical to the two stand owners meeting and decided to fix the rate at two dollars. However, the price increase stems from "[t]he very nature of their market: only a few firms exist, barriers to entry are high, prices are very visible, and there is no chance for one rival, by maintaining a low price, permanently to lock up any significant chunk of business."[89]

Does it not seem counter-intuitive to allow the two stands, through observing each other's prices, to set a price well above the market rate? Is the injury to the consumer, or the gain to the stands, any different than if the two stands signed an agreement that set the price above the competitive price?

C. Tacit (Implicit) Agreements

"It is not a novel conspiracy doctrine to say that [an] agreement can be signified by actions as well as words . . . if there is agreement in the legal sense, the agreement seems inescapably an unlawful conspiracy in restraint of trade."[90] However, an oligopoly firm, like the apple-stand example,[91] is using its competitors' pricing as another factor to establish its profit-maximizing rate—something competitors in a large market regularly do.[92] In the hypothetical apple-stand market, if stand A lowers its apple price in half,

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[88] This example of an oligopoly defense is an adapted version of an example provided by Professor George Hay. Hay, *supra* note 57, at 888–90.

[89] *Id.* at 890.

[90] Donald F. Turner, The Definition of Agreement Under the Sherman Act: Conscious Parallelism and Refusals to Deal, 75 HARV. L. REV. 655, 665 (1962).

[91] See supra Section III(A)(2)(a)(ii).

[92] Turner, supra note 90, at 665.

and stand B does not factor that price-cut into its pricing decision, then stand B would lose half of its apple sales.[93] On the other hand, a seller in a highly populated market is not as likely to react to a price cut because if one seller lowers its price, the market evenly distributes the loss of sales over all sellers.[94] This theory is known as oligopolistic interdependence—American law does not draw a distinction between this and tacit collusion.[95] However, there is still ambiguity around what a tacit agreement is, and if it can be evidence of an agreement under Section One of the Sherman Act.

In *Bell Atlantic Corp. v. Twombly*, the Supreme Court said that "'[t]he crucial question' is whether the challenged anticompetitive conduct 'stem[s] from independent decision or from an agreement, *tacit or express*.'"[96] A plain-language reading of this statement indicates that a party could establish a Sherman Act (Section One) agreement through a tacit agreement. Many, however, disagree with this reading of *Twombly*.[97] The result of *Twombly* was that a tacit agreement could be found where "coordination [was] something more than mere interdependence" but did not indicate what *more* was needed.[98] But the Court did say that parallel conduct would be insufficient without circumstances that demonstrate a meeting of the minds.[99] Post-*Twombly* courts vary on defining a tacit agreement.[100] "A tacit agreement is better understood as one in which rivals communicate their intentions in language without

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[93] *Id.*

[94] *Id.*

[95] William H. Page, Tacit Agreement Under Section 1 of the Sherman Act, 81 ANTITRUST L.J. 593, 595 n.12 (2017).

[96] Bell Atl. Corp. v. Twombly, 550 U.S. 544, 553 (2007) (emphasis added) (quoting Theatre Enters., Inc. v. Paramount Film Distrib. Corp., 346 U.S. 537, 540 (1954)).

[97] Page, supra note 95, at 596–98, 604 (discussing that Judge Cecilia Altonaga in the Southern District of Florida believes the Supreme Court mistakenly put 'tacit' there; Judge J. Lumbard on the Second Circuit Court of Appeals despises the use of 'tacit agreement'; Judge Posner on the Seventh Circuit Court of Appeals claims that 'tacit agreements' do not violate antitrust laws; and several other scholarly writers have the same negative opinion of tacit agreements).

[98] *Id.* at 602.

[99] *Twombly*, 550 U.S. at 557.

[100] Page, *supra* note 95, at 605–06 (explaining the 11th Circuit Court of Appeal would rule without defining the difference between express and tacit; 8th Circuit Court of Appeals differentiates express and tacit by saying the former is oral or written and the latter is nonverbal agreements (i.e., gestures)).

forming a complete agreement, but then indicate their assent to the suggested course of action by subsequent interdependent pricing or other competitive actions."[101] This definition of a tacit agreement is ambiguous but, for the purposes of this Article, it will suffice.[102]

D. The Clayton Act and Federal Trade Commission Act

In 1914, Congress passed the Clayton and FTC Acts.[103] The Clayton and FTC Act are the two remaining laws that make up the "core federal antitrust laws."[104] The discussion of these laws will touch only on their relevant areas, as the Sherman Act is the most prevalent law in the scope of this Article.

The Clayton Act "[w]as intended for the protection of the public against the evils which were supposed to flow from the undue lessening of competition."[105] Congress enacted the Clayton Act to "[r]each specific conduct which had been held by the courts to be outside the ambit of the Sherman Act and which Congress felt must be proscribed in order to promote competition."[106] Congress amended the Clayton Act to include additional, anti-competitive actions which Congress deemed dangerous to consumers.[107] Additionally, the Clayton Act enables private parties to sue for treble damages—triple damages—for violations under the Clayton Act and the Sherman Act.[108] Treble damage eligibility hinges on whether the injured party alleges and proves "(1) [v]iolation by

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[101] *Id.* at 607.

[102] For additional materials that discuss tacit agreements, see William E. Kovacic, Robert C. Marshall, Leslie M. Marx & Halbert L. White, *Plus Factors and Agreement in Antitrust Law*, 110 MICH. L. REV. 393 (2011); *see also* Michael K. Vaska, *Conscious Parallelism and Price Fixing: Defining the Boundary*, 52 U. CHI. L. REV. 508 (1985); *see also* Louis Kaplow, *On the Meaning of Horizontal Agreements in Competition Law*, 99 CALIF. L. REV. 683 (2011).

[103] *Antitrust Laws*, *supra* note 48.

[104] *Id.*

[105] Int'l Shoe Co. v. Fed. Trade Comm'n, 280 U.S. 291, 297–98 (1930).

[106] McElhenney Co. v. W. Auto Supply Co., 269 F.2d 332, 337 (4th Cir. 1959); *see also Antitrust Laws*, *supra* note 45 (providing examples of what the Clayton Act regulates—anti-competitive mergers and acquisitions and interlocking directorates).

[107] *Antitrust Laws*, *supra* note 48 (amended by the Robinson-Patman Act in 1936 and the Hart-Scott-Rodino Antitrust Improvements Act in 1976).

[108] *Id. See also* 15 U.S.C. § 15 (2012).

defendant of an antitrust law, (2) an ascertainable injury to plaintiff's business or property which is reducible to money damages, and (3) a causal connection between the violation and the injury."[109]

The FTC Act created a commission that can investigate and bring claims under the Act.[110] All violations of the Sherman Act also violate the FTC Act.[111] Additionally, the FTC Act includes claims for some activities outside of the Sherman Act's scope.[112] This Article provides two methods in which the FTC could potentially regulate the airline industry's use of pricing algorithms.[113] These recommendations make a few characteristics of the FTC Act particularly relevant. First, Section Five of the FTC Act gives the commission jurisdiction, among other things, over "unfair . . . acts or practices in or affecting commerce."[114] The Supreme Court has identified three factors for analyzing alleged *unfair acts* under the FTC Act: whether the act (1) causes substantial injury to consumers; (2) is immoral, unethical, oppressive, or unscrupulous; and (3) offends public policy.[115] Second, the FTC has vocalized its opinion on how big-data companies need to be regulated.[116] This is relevant because pricing algorithms need large amounts of data to operate.

IV. THE AIRLINE INDUSTRY'S HISTORY OF ANTITRUST DISPUTES

Have you ever wondered how the price of an airline ticket can change in a matter of a days, hours, minutes, or even seconds? American Airlines, one of the largest airlines in the world, changes

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[109] James H. Watz, *Section 7 of the Clayton Act: The Private Plaintiff's Remedies*, 7 B.C. INDUS. & COM. L. REV. 333, 338 (1966).

[110] *Antitrust Laws*, *supra* note 48.

[111] *Id.*

[112] *Id.*

[113] *See infra* Section IV(b)(ii).

[114] 15 U.S.C. § 45(a)(1) (2012) ("Unfair methods of competition in or affecting commerce, and unfair or deceptive acts or practices in or affecting commerce, are hereby declared unlawful.").

[115] *Fed. Trade Comm'n v. Sperry & Hutchinson Co.*, 405 U.S. 233, 244 n.5 (1972).

[116] *See* EDITH RAMIREZ, JULIE BRILL, MAUREEN K. OHLHAUSEN & TERRELL MCSWEENY, FED. TRADE COMM'N, BIG DATA: A TOOL FOR INCLUSION OR EXCLUSION? (2016).

500,000 prices per day.[117] They, and most other airlines, do so through dynamic pricing—or yield management.[118] Occasionally, airlines lose control of their dynamic pricing system to their own detriment. In 2013, for example, the United Airlines booking system malfunctioned and priced tickets at ultra-low prices—including a $5 round-trip ticket from New York to Houston and a $2.50 one-way ticket from Washington, D.C. to Austin, Texas.[119] The negative results of losing control of a pricing algorithm's dynamic pricing system can be exacerbated in an oligopoly market.[120] Before examining the airline industry's pricing techniques and market structure, I will discuss some history of antitrust litigation involving airlines.

A. Airlines' Bad History with Sherman (the Act)

The airline industry has not always been a 'free' market. The Civil Aeronautics Act of 1938 gave the airline regulation reigns to the Civil Authority Board—later reorganized as the Civil Aeronautics Board ("CAB").[121] The CAB regulated the passenger-airlines industry for a significant portion of history; controlling things like which airlines could operate in a market, the routes that

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[117] R. Preston McAfee & Vera te Velde, *Dynamic Pricing in the Airline Industry*, CAL. INST. TECH., *https://mcafee.cc/Papers/PDF/DynamicPriceDiscrimination.pdf.*

[118] For additional resources on dynamic pricing, see Ahmad Faruqui, Ryan Hledik & John Tsoukalis, *The Power of Dynamic Pricing*, 22 ELECTRICITY J. 42 (2009) (discussing dynamic pricing in the electricity industry); *see also* Indre Deksnyte & Zigmas Lydeka, *Dynamic Pricing and Its Forming Factors*, 3 INT'L J. BUS. & SOC. SCI. 213 (2012) (discussing dynamic pricing and factors that are commonly used); Rainer Schmidt, Michael Möhring & Barbara Keller, *Design of Dynamic Pricing Systems for Online-Retailer's-Core Functionalities and Qualitative Insight*, MEDITERRANEAN CONF. ON INFO. SYSS., Sept. 2016, at 1 (examining how dynamic pricing functions in the online retail industry).

[119] Hugo Martin, *Glitch Causes United to Sell Tickets for as Little as $2.50*, L.A. TIMES (Sept. 12, 2013), http://articles.latimes.com/2013/sep/12/business/la-fi-mo-glitch-causes-united-to-sells-tickets-for-as-little-as-250-20130912; *see also* Alex Hern, *United Airlines Cancels Thousands of Bargain Tickets Sold in Pricing Glitch*, GUARDIAN (Feb. 12, 2015, 5:02 PM), https://www.theguardian.com/technology/2015/feb/12/united-airlines-cancels-bargain-tickets-pricing-glitch.

[120] *See supra* Section IV(B)(1).

[121] Gerald N. Cook, *A Review of History, Structure, and Competition in the U.S. Airline Industry*, 7 J. AVIATION/AEROSPACE EDUC. & RES. 33, 33 (1996).

each airline had control of, ticket rates, and maximum airplane capacities.[122] These regulations hindered competition in the industry, which in turn hurt consumers. As a result, President Carter signed the Airline Deregulation Act of 1978.[123] Proponents of deregulation argued that a competitive market would not be prone to monopoly (or oligopoly) dangers because large airlines would have to price competitively or be subject to other airlines entering the market with lower prices.[124] Deregulation, however, had the opposite effect. Large airlines controlled a majority of the incoming and outgoing flights from 'hub' airports,[125] giving the resemblance of a monopoly (or oligopoly).[126] All of a sudden, the airline industry was in the purview of federal antitrust laws.

Without regulations, airlines now have much more freedom to operate as they wish. This backfired in the early twenty-first century. A group of plaintiffs, freight and passenger consumers, brought a class action lawsuit against Lufthansa Airlines, Air Canada, Air France, and many other airlines for inflating prices.[127] The airlines, "through regular and intricate coordination . . . jointly raised and maintained prices, eliminated discounting, allocated markets (of customers, routes and territories), restricted supply, and levied new, artificially inflated surcharges, particularly fuel surcharges."[128] The settlement agreement was $278 million in

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[122] *Id.* at 34.

[123] David G. Monk, *The Lessons of Airline Regulation and Deregulation: Will We Make the Same Mistakes in Space?*, 57 J. AIR L. & COM. 715, 721 (1992).

[124] Paul Stephen Dempsey, *Airline Deregulation and Laissez-Faire Mythology: Economic Theory in Turbulence*, 56 J. AIR L. & COM. 305, 314–17 (1990).

[125] 'Hub' airports are large airports, located in large cities, where a large volume of flights go in and out. For example, Dallas-Fort Worth Airport, Chicago O'Hare, Los Angeles International Airport, and Denver International Airport. John Elledge, *What is a Hub Airport and Why Should You Want One?*, CITYMETRIC (Sept. 2, 2014), https://www.citymetric.com/what-hub-airport-and-why-should-you-want-one-100.

[126] Dempsey, *supra* note 184, at 333–34.

[127] In re Air Cargo Shipping Servs. Antitrust Litig., No. 06-MD-1775, 2015 U.S. Dist. LEXIS 138479 (E.D.N.Y. Oct. 9, 2015); *see also* JOSHUA P. DAVIS & ROBERT H. LANDE, SUMMARIES OF TWENTY CASES OF SUCCESSFUL PRIVATE ANTITRUST ENFORCEMENT, U. S.F. SCH. L., NO. 2013-01, § 2.

[128] DAVIS & LANDE, *supra* note 187, § 2(A).

damages.[129] This case is a small sample of the times the government and private parties have pursued airlines for antitrust violations.[130]

In another example, the DOJ pursued the major U.S. airlines[131] and the Airline Tariff Publishing Company ("ATPCO").[132] The ATPCO case is particularly relevant to this Article because the case raised antitrust issues relating to price announcements in technology.[133] ATPCO was the central clearinghouse for airline pricing.[134] Airlines sent ATPCO their new fares to be added, old fares to be removed, and changes to existing fares.[135] ATPCO then compiled all of the information and sent it back to the major airlines and to the computer reservation systems ("CRS") in the United States—Sabre, Worldspan, System One, and Apollo.[136] The CRSs then made the information available to consumers, travel agents, and other airlines.[137] One characteristic of the fare that

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[129] *Id.* § 2.

[130] There is a pending lawsuit in the Unites States District Court for the District of Columbia against four major U.S. airlines (United Airlines, American Airlines, Southwest Airlines, and Delta Air Lines) for conspiring to limit the number of new seats available on flights in order to raise airfare. Hugo Martin, *Antitrust Suit Against Airlines Can Move Ahead, Judge Says*, L.A. TIMES (Nov. 5, 2016, 6:00 AM), https://www.latimes.com/business/la-fi-travel-briefcase-antitrust-20161105-story.html. Southwest Airlines settled and agreed to cooperate for $15 million. Jonathan Stempel, *Southwest Airlines to Pay $15 Million to Settle Price Collusion Lawsuit*, REUTERS (Jan. 4, 2018, 6:40 PM), https://www.reuters.com/article/us-southwest-settlement/southwest-airlines-to-pay-15-million-to-settle-price-collusion-lawsuit-idUSKBN1EU02F. Later, American Airlines settled and agreed to cooperate (even though American still denies any illegal acts) for $45 million. *American Airlines to Pay $45 Million to End Consumer Antitrust Lawsuit*, FORTUNE (June 16, 2018), http://fortune.com/2018/06/16/american-airlines-lawsuit/.

[131] The eight airlines were Alaska Airlines, American Airlines, Continental Airlines, Delta Air Lines, Northwest Airlines, Trans World Airlines, United Airlines, and US Airways. Severin Borenstein, *Rapid Price Communication and Coordination: The Airline Tariff Publishing Case*, ANTITRUST REVOLUTION 310, 314 n.2 (John E. Kwoka & Lawrence J. White eds., 3rd ed., Oxford Univ. Press 1999).

[132] *See* United States v. Airline Tariff Publ'g Co., 836 F. Supp. 9 (D.C.C. 1993).

[133] Borenstein, *supra* note 191, at 310.

[134] *Id.* at 310–11.

[135] *Id.* at 312.

[136] *Id.*

[137] *Id.*

airlines sent to ATPCO is the *first and last ticket dates*—the timeframe of when the airline would offer a particular fare.[138] The DOJ investigation revealed that airlines were setting *first and last ticket dates* weeks in advance and competing airlines would price their airfare identically for the respective timeframes.[139]

The DOJ alleged that the airlines used fare basis codes and footnote designators[140] to negotiate fares for certain routes.[141] All of the parties settled with the DOJ and agreed to: (1) only use fare basis codes and footnote designators for basic information, (2) not link fares with certain codes, and (3) not pre-announce price increases, with the exception of widely publicized sales.[142] The alleged agreement—or *meeting of the minds*—was an express agreement, hidden within technology. The facts of the ATPCO case provide a framework for analyzing situations where an airline's pricing algorithm could potentially be subject to antitrust violations.

B. Should We Worry About an Oligopoly Airline Industry?

Proponents of the Deregulation Act of 1978 argued that it would turn the airline industry "hotly competitive."[143] In the short-run, the market acted as proponents expected—more than one hundred and twenty new airlines opened.[144] Today, however, four airlines—United Airlines, American Airlines, Delta Air Lines, and Southwest Airlines—control 80% to 84% of America's consumer air travel.[145] This is largely the result of airlines merging together

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[138] *Id.* at 313.

[139] Algorithms and Collusion, *supra* note 17, at 30.

[140] The fare basis codes and footnote designators are information that was included in the fare information that airlines would send to ATPCO, who would then forward it to the CRS, who would then publish the information. Borenstein, *supra* note 191, at 313.

[141] *Id.* at 316 (providing an example of how the DOJ described the negotiations).

[142] *Id.* at 325.

[143] Dempsey, *supra* note 184, at 323.

[144] *Id.*

[145] Leanna Garfield, *The United Airlines Boycott Is Not Backing down — Here's How It Could Affect Sales*, Bus. Insider (Apr. 18, 2017, 11:55 AM), https://www.businessinsider.com/united-airlines-scandal-boycott-sales-2017-4; *see also* Christopher Drew, *Airlines Under Justice Dept. Investigation over*

in order to obtain a larger market share.[146] An oligopoly market consists of "a small number of organizations or companies [that have] control of an area of business."[147] Four companies controlling an upward of 84% of a market seems to fit that definition, right? The airline industry is arguably (or maybe clearly) an oligopoly.[148] The industry has maintained an oligopoly because of barriers to entry. First, there are few available slots at the major airports for a new airline to operate.[149] Second, United Airlines and American Airlines own the two largest CRSs; therefore, new airlines end up affiliating with the larger airlines to gain access to their CRS.[150]

Possible Collusion, N.Y. Times (July 1, 2015), https://www.nytimes.com/2015/07/02/business/airlines-under-justice-dept-investigation-over-possible-collusion.html?_r=0.

[146] In 2005, US Airways merged with American West Airlines; in 2008, Delta Air Lines merged with Northwest Airlines; in 2010, United Airlines merged with Continental Airlines; in 2011, Southwest Airlines merged with AirTran Airways; and in 2013, American Airlines merged with US Airways. *How M&A Has Driven the Consolidation of the US Airline Industry over the Last Decade?*, Forbes (May 4, 2016, 8:34 AM), https://www.forbes.com/sites/greatspeculations/2016/05/04/how-ma-has-driven-the-consolidation-of-the-us-airline-industry-over-the-last-decade/#6e32a6e92bba. In 1990, 2000, 2010, and 2015, the market share of the four largest airlines have gradually changed from 68%, to 61%, to 65%, to 84%, respectively. *Id.*

[147] *Oligopoly*, CAMBRIDGE DICTIONARY, https://dictionary.cambridge.org/dictionary/english/oligopoly (last visited Feb. 2, 2019).

[148] *See* Xander Prijs, *Oligopoly in the Sky*, RISK MAG. (May 9, 2017), https://riskmagazine.nl/article/2017-02-09-oligopoly-in-the-sky (arguing that airlines treat their customers badly because of the oligopoly market structure); *see also A Lack of Competition Explains the Flaws in American Aviation*, ECONOMIST (Apr. 22, 2017), https://www.economist.com/leaders/2017/04/22/a-lack-of-competition-explains-the-flaws-in-american-aviation (explaining that Warren Buffet believes the airline industry is an oligopoly).

[149] Amy Hunt, *Assault on the Airline Industry: Private Litigation and the Problem of Settlement*, 59 J. AIR L. & COM. 983, 992 (1994). 68% of United States airports have no gates to lease to new airlines. PAUL STEPHEN DEMPSEY, FLYING BLIND: THE FAILURE OF DEREGULATION 21 (Econ. Policy Inst. 1990) [hereinafter PAUL STEPHEN DEMPSEY]. When large airlines lease airport gates to new airlines, they can charge them absurd amounts.—Northwest Airlines charged Southwest Airlines eighteen times what they paid to lease a gate at the Detroit Airport. *Id.*

[150] PAUL STEPHEN DEMPSEY, *supra* note 209, at 22 (examples include United Express, American Eagle, and Continental Express); *but see* Andrew N.

Third, consumers build brand loyalty through airlines' frequent flyer programs and often stick with that airline to maximize their rewards.[151] These impediments to enter the airline market have led to the oligopolistic look the airline industry now maintains.

When companies operate in a monopoly or oligopoly market, they can offer a subpar good or service and the lack of competition (or other purchasing options) forces consumers to return to the subpar good or service. A pertinent example of this is United Airlines. United Airlines overbooked a flight leaving Chicago O'Hare Airport and forcibly removed a man from the plane.[152] Because United Airlines is one of the four major airlines that are responsible for the majority of flights in the United States, travelers are forced to fly with them at whatever price they demand (or take the inconvenient route and drive).[153] This 'damned if I do, damned if I do not' decision leaves consumers with a feeling of being wronged by the airline industry. The transportation industry is essential to the economic and social structure of any community.[154] For example, if a community does not have convenient access to airline services, they are unlikely to retain and attract new businesses. Therefore, the airline industry is in a position of power over communities that are seeking to improve the lives of their citizens.

Kleit, *Computer Reservation Systems: Competition Misunderstood*, 37 ANTITRUST BULL. 833 (1992).

[151] PAUL STEPHEN DEMPSEY, *supra* note 209, at 22.

[152] Avi Selk, *A Man Wouldn't Leave an Overbooked United Flight. So He Was Dragged off, Battered and Limp*, WASH. POST (Apr. 10, 2017), https://www.washingtonpost.com/news/dr-gridlock/wp/2017/04/10/a-man-wouldnt-leave-an-overbooked-united-flight-so-he-was-dragged-off-battered-and-limp/?utm_term=.878826f56231.

[153] *See* Alex Pareene, *Airlines Can Treat You Like Garbage Because They are an Oligopoly*, SPLINTER (Apr. 11, 2017, 9:33 AM), https://splinternews.com/airlines-can-treat-you-like-garbage-because-they-are-an-1794192270; *see also* James Downie, *Beyond United: How Oligopolies Hurt Americans' Pocketbooks*, WASH. POST (Apr. 12, 2017), https://www.washingtonpost.com/blogs/post-partisan/wp/2017/04/12/beyond-united-how-oligopolies-hurt-americans-pocketbooks/?utm_term=.ca5610c2fbe7; Mark Orton, *United Airlines, Monopoly/Oligopoly, the Natural Laws of Capitalism*, MEDIUM (Apr. 17, 2017), https://medium.com/@markorton93/united-airlines-monopoly-oligopoly-the-natural-laws-of-capitalism-c0d928641b94.

[154] *See* NAT'L BUS. COALITION FOR RAPID TRANSIT, THE ECONOMIC IMPORTANCE OF PUBLIC TRANSIT (2003); *see also* Thomas J. Goldsby et al., *The Critical Role of Transportation in Business and the Economy*, INFORMIT (Feb. 7, 2014), http://www.informit.com/articles/article.aspx?p=2171313.

The issue is magnified because the airline industry is an oligopoly.[155] "Unregulated monopolies or oligopolies in the transportation industry can reduce quality and service while holding up prices or pricing discriminately because of limited access through hubs."[156] Whether the airline oligopoly is truly bad for consumers or not, pricing algorithms will only intensify the issue. Both the airline industry and government regulators need to be aware of what is coming.

V. PRICING ALGORITHMS FACE-OFF WITH ANTITRUST LAWS

Algorithms allow businesses to remove human decision-making from their daily operations. It follows then that this increase in machine decision-making should also remove the human temptation to collude in order to gain a competitive advantage, right? Not necessarily. This Part will discuss litigation—past and future—involving pricing algorithms and how pricing algorithms affect an oligopoly market.

A. Pricing Algorithms in Court

Regulating algorithms to ensure compliance with competition laws extends beyond the borders of the United States. The United Kingdom's Competition and Markets Authority coordinated with the United States in the *Topkins* investigation.[157] In response to Lufthansa Airline's spike in pricing on domestic flights shortly after Air Berlin went bankrupt, president of Germany's Federal Cartel Office, Andreas Mundt, stated that "companies [cannot] hide behind pricing algorithms" and "algorithms [are not]

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[155] Monk, *supra* note 183, at 725; *see also* Melvin Brenner, *Airline Deregulation—a Case Study in Public Policy Failure*, 16 TRANSP. L.J. 179, 189 (1988) (discussing the potential impact of a concentration of service providers in the airline industry).

[156] Monk, *supra* note 183, at 731.

[157] Michelle A. Mantine & Karl Herrmann, *Agreements and Algorithms Can Add up to Antitrust Liability*, REEDSMITH (Oct. 18, 2018), https://www.globalregulatoryenforcementlawblog.com/2018/10/articles/antitrust-competition/agreements-and-algorithms-can-add-up-to-antitrust-liability/?utm_source=Mondaq&utm_medium=syndication&utm_campaign=View-Original.

written by dear God in heaven".[158] The European Commissioner for Competition, Margrethe Vestger, stated that even though automated dynamic pricing programs cannot come to a "meeting of the minds," that does not mean the software cannot make agreements on behalf of humans.[159] Vestger proposed that businesses incorporate ethical guidelines into the pricing algorithms' code and take responsibility for the technology they opt to use.[160] Pricing algorithms provide clear benefits to businesses everywhere in the world, but the benefits come with the responsibility of ensuring the pricing program is abiding by antitrust laws.

The DOJ has made it apparent that it is committed to a free and fair marketplace, even on the internet.[161] In 2015, the DOJ identified, investigated, and charged its first pricing-algorithm culprit with anticompetitive acts.[162] David Topkins plead guilty to fixing prices in violation of federal antitrust laws.[163] Topkins and his co-conspirators agreed to fix, increase, and maintain the prices of their posters sold on Amazon.[164] The competitors agreed to adopt a pricing algorithm—which Topkins manufactured—with the goal of coordinating their price changes.[165] In furtherance of the agreement, Topkins and his co-conspirators exchanged information to ensure the parties were adhering to the agreement.[166] An identical set of facts—defendants fixing poster prices online via a pricing algorithm—arose in the same year and led to a similar plea

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[158] *German competition watchdog slams Lufthansa over 'algorithm' price hikes on flights*, STRAIGHT TIMES (Dec. 28, 2017, 6:37 PM), https://www.straitstimes.com/world/europe/german-competition-watchdog-slams-lufthansa-over-algorithm-price-hikes-on-flights.

[159] Margrethe Vestager, Algorithms and Competition, Address at the Bundeskartellamt 18th Conference on Competition (Mar. 16, 2017).

[160] *Id.*

[161] Press Release, Dep't of Justice, *Former E-Commerce Executive Charged with Price Fixing in the Antitrust Division's First Online Marketplace Prosecution* (April 6, 2015)(on file with the author), https://www.justice.gov/opa/pr/former-e-commerce-executive-charged-price-fixing-antitrust-divisions-first-online-marketplace.

[162] *See* Plea Agreement at 1, United States v. Topkins, No. CR 15-00201 WHO (N.D. Cal. April 30, 2015), https://www.justice.gov/atr/case-document/plea-agreement-462.

[163] *Id.*

[164] *Id.* at 3.

[165] *Id.* at 4.

[166] *Id.*

agreement.[167] These two cases clearly show that when two parties agree to abide by a pricing algorithm, they are in violation of federal antitrust laws.[168] However, as algorithms advance, cases will not be as clear-cut.

B. Potential Challenges in the Future Between Antitrust Laws and Algorithms

So far, there have been no cases under federal antitrust laws where two competing companies' algorithms align and price their products identically without a human 'meeting of the minds.' This 'algorithm agreement' would be a tacit agreement, which is already more difficult to identify than an express agreement. A pricing algorithm can hide collusive behavior more effectively than humans, making it more difficult to expose a tacit agreement. This is an area of antitrust law that has become a concern for those tasked with regulating anti-competitive actions.[169] One argument is if "firms compete via algorithms that are fixed in the short run but can [adapt] over time, collusion is not only possible but rather, it is *inevitable*."[170] This antitrust issue becomes more tangled with the increase in oligopoly markets in the United States—including, arguably, the airline industry.[171] These two developments—the rise of pricing algorithms and the oligopoly airline industry—set the stage for how antitrust regulators should approach the airline industry.

1. Are Algorithms Perfecting the Art of Pricing or Collusion?

An issue at the core of algorithm decision-making is that the algorithm may not make an altruistic decision when it focuses on

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[167] *See* Plea Agreement, United States v. Trod Ltd., No. CR 15-0419 WHO (N.D. Cal. August 11, 2016).

[168] *See generally* Jonathan Stempel, *Uber Wins U.S. Court Appeal to Push Price-Fixing Case to Arbitration*, REUTERS (Aug. 17, 2017, 7:36 PM), https://www.reuters.com/article/us-uber-decision/uber-wins-u-s-court-appeal-to-push-price-fixing-case-to-arbitration-idUSKCN1AX1MU.

[169] *See* Michal S. Gal, *Illegal Pricing Algorithms*, 62 COMM. ACM 18 (2019) (discussing the issues pricing algorithms cause for antitrust laws).

[170] Bruno Salcedo, *Pricing Algorithms and Tacit Collusion*, PA. ST. U., Nov. 2015, at 1, 3.

[171] Tim Wu, *The Oligopoly Problem*, NEW YORKER (Apr. 15, 2013), https://www.newyorker.com/tech/annals-of-technology/the-oligopoly-problem.

achieving a particular goal. What happens when an algorithm must decide between something that is individually rational, and its primary objective, but is socially inferior to something else? For example, driverless cars use artificial intelligence and algorithms in order to maneuver public streets.[172] If the individual goal of the autonomous vehicle's algorithm is to safely transport the rider from one point to another, should it sacrifice the lives of five others to accomplish its goal?[173] The data can become even more complex—consider if the five lives being sacrificed are all criminals. Applying these questions in the context of this Article raises the following question: What happens when a pricing algorithm must decide between optimizing firm profits and protecting consumer welfare? Competing airlines' pricing algorithms can raise airfare to a rate that is highly profitable to the airlines, but harmful to consumers. This causes a predicament for the airline industry, who almost entirely leaves pricing decisions to pricing algorithms.[174]

To demonstrate how competing algorithms can lead to collusion, I will discuss two examples.[175] The first example comes from two pricing algorithms on Amazon. Two sellers of a biology book (*The Making of a Fly* by Peter Lawrence) allowed their prices of this book to climb to over $23 million.[176] Seller one's pricing algorithm was set to price at 1.270589 times the price of seller two.[177]

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[172] Loz Blain, *AI Algorithm Teaches a Car to Drive from Scratch in 20 Minutes*, NEW ATLAS (July 5, 2018), https://newatlas.com/wayve-autonomous-car-machine-learning-learn-drive/55340/ (discussing that algorithms are the key to autonomous driving vehicles).

[173] Catie Keck, *Self-Driving Cars Can't Choose Who to Kill yet, but People Already Have Lots of Opinions*, GIZMODO (Oct. 24, 2018, 11:00 PM), https://gizmodo.com/self-driving-cars-cant-choose-who-to-kill-yet-but-peop-1829984331 (discussing a test administered by the Massachusetts Institute of Technology to determine how society would want an autonomous vehicle to respond in a life-and-death situation).

[174] *See supra* Section II(b).

[175] For an additional example that is discussed in the Abstract, see generally Thomas Heath, *The Warning from JPMorgan About Flash Crashes Ahead*, WASH. POST (Sept. 5, 2018), https://www.washingtonpost.com/business/economy/the-warning-from-jpmorgan-about-flash-crashes-ahead/2018/09/05/25b1f90a-b148-11e8-a20b-5f4f84429666_story.html?utm_term=.268f92924644 (discussing the "Flash Crash" in the financial market).

[176] Michael Eisen, *Amazon's $23,698,655.93 Book About Flies*, IT IS NOT JUNK (April 22, 2011), http://www.michaeleisen.org/blog/?p=358.

[177] *Id.*

Seller two's pricing algorithm was set to change its price once a day to 0.9983 times seller one's book price.[178] This example illustrates how two unsupervised algorithms can lead to an absurd result and possibly even collusion. The second example is a hypothetical scenario. There are two firms in a market that are pricing their product competitively using pricing algorithms.[179] Firm One sets its algorithm to match any price increase that Firm Two makes to its product, which may be viewed as a proposal to collude. Once Firm Two decodes Firm One's pricing algorithm through trial and error or another method, Firm Two can price its product at higher rates knowing that firm one is going to match it. A human could potentially decode firm one's algorithm, but not as efficient as an algorithm.[180] After the price raises, consumers are subjected to a higher price without an express agreement between Firm One and Two.[181] Both of these examples illustrate how pricing algorithms can, and surely will, be used to maintain a harmful, but legal, pricing scheme. If the firms employing these pricing algorithms have the oligopoly defense at their disposal, it makes collusion much harder to regulate.

An increase in oligopolies[182] in the United States poses extensive risks, one of which is the difficulty of regulating anticompetitive behavior. This is increasingly relevant in the airline industry following the 2013 merger agreement between American Airlines and U.S. Airways, as a result of which four airlines control 69% of domestic air travel.[183] As discussed, oligopolies possess a

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[178] *Id.*

[179] For the example, see Salcedo, *supra* note 130, at 3.

[180] Jennifer M. Logg, Julia A. Minson & Don A. Moore, *Algorithm Appreciation: People Prefer Algorithm to Human Judgment* 3–4 (Harv. Bus. Sch., Working Paper No. 17-086, 2018).

[181] Salcedo, *supra* note 130, at 3.

[182] Oligopolies are "situation[s] in which a small number of organizations or companies [have] control of an area of business, so that others have no share." *Oligopoly*, CAMBRIDGE DICTIONARY, https://dictionary.cambridge.org/dictionary/english/oligopoly (last visited Feb. 2, 2019). In oligopoly markets, "profit maximi[z]ing competitors set their strategies by paying close attention to how their rivals are likely to react." *Oligopoly*, ORGANISATION FOR ECON. CO-OPERATION & DEV. (1999).

[183] Jordan Weissmann, *The Return of the Monopoly: An Infographic*, ATLANTIC (Apr. 2013), https://www.theatlantic.com/magazine/archive/2013/04/the-chartist/309271/ (last visited Jan. 10, 2019); *see also U.S.*

defense to parallel pricing, which some consider to be a "crack in the Sherman Act."[184] Legal scholars have made arguments for both sides of whether the Sherman Act can, and should, regulate oligopoly parallel pricing. Antitrust expert and Harvard Law School professor, Donald Turner, argues that when an oligopoly firm matches a competitor's price change, it is merely responding to market changes and optimizing its ability to be competitive in the market.[185] Turner further argues that it would be counterintuitive to punish firms for being competitive in the market.[186] "[G]enerally, interdependent parallel conduct, without more, has not been held to satisfy [Sherman Act] Section 1's 'agreement' language."[187] However, other scholars, such as Richard Posner,[188] argue that "[i]f seller *A* restricts his output in the expectation that *B* will do likewise, and *B* restricts his output in a like expectation, there is quite literally a meeting of the minds or mutual understanding even if there is no overt communication."[189] Consequently, the Supreme Court has stated that Section One of the Sherman Act does not require proof of express collusion.[190] Regardless, there is concern that oligopoly firms can price their services or products at a supracompetitive level, thus harming consumers.

When an oligopoly firm uses a pricing algorithm, the interdependent pricing issue increases. For example, a method that antitrust officials use to regulate cartels is a reliance on the cartels'

Airline Mergers and Acquisitions, AIRLINES FOR AM., http://airlines.org/dataset/u-s-airline-mergers-and-acquisitions/ (last visited Jan. 10, 2019).

[184] Salil K. Mehra, *Antitrust and the Robo-Seller: Competition in the Time of Algorithms*, 100 MINN. L. REV. 1323, 1340 (2016); *see supra* Section III(a)(2)(a)(ii).

[185] Turner, *supra* note 90, at 665–67.

[186] *Id.*

[187] *Id.*

[188] Richard Posner was a Circuit Judge on the 7th Circuit Court of Appeals of the United States from 1981 to 2017 (and Chief Judge from 1993 to 2000) and currently is a professor at The University of Chicago Law School. *Richard A. Posner*, U. CHI. L. SCH., https://www.law.uchicago.edu/faculty/posner-r (last visited Jan. 10, 2019).

[189] Richard A. Posner, *Oligopoly and the Antitrust Laws: A Suggested Approach*, 21 STAN. L. REV. 1562, 1576 (1969).

[190] *See, e.g.*, United States v. Paramount Pictures, Inc., 334 U.S. 131, 142 (1948); *see also* United States v. Masonite Corp., 316 U.S. 265, 275–76 (1942); E. States Retail Lumber Dealers' Ass'n v. United States, 234 U.S. 600, 612 (1914); Interstate Circuit, Inc. v. United States, 306 U.S. 208, 226–27 (1939).

disloyalty to one another,[191] whether it be violating their price fixing agreement or defecting and cooperating with officials in order to obtain a lessened punishment.[192] Because of the immense size of data that algorithms analyze, when one firm adjusts its rate, other firms will quickly identify and match it, thereby lessening the effects of disloyalty.[193] Additionally, where a human might make a decision that negatively effects an oligopoly's long-term, supracompetitive level, pricing plan, algorithms are immortal and not prone to make a short-term decision that would compromise its long-term focus.[194] A key component of antitrust law is fear of a large punishment, which does not work on algorithms or machines in the same manner as it does on humans.[195] Lastly, courts have evaluated the "agreement" language in Section One of the Sherman Act under contract standards—offer and acceptance or a *meeting of the minds*.[196] Claimants can point to *plus factors*, which make parallel behavior more suspicious.[197] Again, however, robo-sellers will not need to communicate with other algorithms to crunch data and come to identical prices.[198] Federal antitrust regulators will have a hard time charging an algorithm with a Sherman Act (Section One) price-fixing violation using the *meeting of the minds* and *plus factors* standards.[199]

In effect, the challenges that an oligopoly firm would traditionally face can be easily maneuvered with the help of pricing

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[191] Christopher R. Leslie, Trust, Distrust, and Antitrust, 82 Tex. L. Rev. 515, 518–19 (2004).

[192] *Id.*

[193] Mehra, *supra* note 144, at 1348–49.

[194] *Id.* at 1349–51.

[195] *Id.*

[196] *Id.* at 1359 (citing Interstate Circuit, Inc. v. United States, 306 U.S. 208, 227 (1939) (holding that "[a]cceptance by competitors . . . of an invitation to participate in a plan, the necessary consequence of which, if carried out, is restraint of inter- state commerce, is sufficient to establish an unlawful conspiracy under the Sherman Act"); Toys "R" Us, Inc. v. Fed. Trade Comm'n, 221 F.3d 928, 936 (7th Cir. 2000) (stating that "[Toy] manufacturers were in effect being asked by [Toys "R" Us] to reduce their output . . . [and] [i]t accomplished this goal by inducing [them] to collude, rather than compete."); *see also* Bell Atl. Corp. v. Twombly, 550 U.S. 544, 556 (2007) (dismissing for failure to state a claim with "enough factual matter (taken as true) to suggest that an agreement was made")).

[197] Mehra, *supra* note 144, at 1360.

[198] *Id.*

[199] *Id.*

algorithms. The airline industry is at the center of this issue that antitrust regulators and scholars are struggling with because it is viewed as an oligopoly that is at the cutting edge of pricing-algorithm use. The airline industry may deserve a customized approach to antitrust regulation.

2. Should the Immovable Force (Antitrust Laws) Adapt?

In recent years, technology has evolved beyond what anyone ever thought it would. NASA manufactured and programmed Voyager 1 in the 1970s without the use of computers.[200] Voyager 1 went on to travel 11.6 billion miles and reach interstellar space even though it contained less memory than an iPhone 5.[201] For better or worse, technology has evolved, and maybe antitrust laws should as well. Antitrust laws have regulated businesses for over a century with very little change—surviving the advent of cell phones and the internet. However, oligopoly markets and pricing algorithms provide a unique issue that might require adaptation. The benefits that businesses gain from employing pricing algorithms are extraordinary, so banning them would be inappropriate.[202] If an adjustment to antitrust laws or governmental investigation methods allows for pricing algorithms to coexist with competition laws, then change may be necessary. This section explores various options to properly regulate oligopolies that use pricing algorithms.

The first option is to use the 'rule of reason.' Justice White introduced the rule of reason in his dissenting opinion in *United States v. Trans-Missouri Freight Ass'n*—it was initially rejected.[203] Once Justice White became Chief Justice White, the Supreme Court established that not all restraints on trade are illegal, only those that are unreasonable.[204] The test involves identifying and

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[200] Amanda Wills, *Voyager 1 Got to Deep Space on Less Memory than Your iPhone 5*, MASHABLE (Sep. 12, 2013), https://mashable.com/2013/09/12/voyager-1-iphone-5/#cMQ1UNfVDOqW.

[201] *Id.*

[202] *See* OXERA, WHEN ALGORITHMS SET PRICES: WINNERS AND LOSERS 9–14 (2017).

[203] United States v. Trans-Missouri Freight Ass'n, 166 U.S. 290, 356–57 (1897) (White, J., dissenting).

[204] Maurice E. Stucke, Does the Rule of Reason Violate the Rule of Law?, 42 U.C. Davis L. Rev. 1375, 1392 (2009); see Standard Oil Co. v. United States, 221 U.S. 1 (1911).

weighing the procompetitive and anticompetitive effects on the market to determine which predominates.[205] This obviously would depart from the current *per se* rule that governs price fixing violations. The rule of reason analysis may appear to be a sufficient analysis for the robo-seller but, in most cases, the benefits that pricing algorithms provide to businesses—labor cost-savings and competitive analysis—will outweigh the potential harm to competition.[206]

A second option is to treat a robo-seller as an agent of the human that deploys it. Under current law, computer programs are viewed as "instrumentalities of the persons who use them," and the legal consequences of a technology malfunction fall back on the human designer or user.[207] Accordingly, humans would be held liable for a robo-seller's anticompetitive pricing decisions. However, antitrust laws look toward the intent of anticompetitive acts for determining liability.[208] If pricing algorithms use artificial intelligence to make independent pricing decisions, it might be difficult to find that the human user manifested the requisite anticompetitive intent when they were not active in the algorithm's decision making.[209] Therefore, treating the robo-seller as an agent may not be the best method to regulate pricing algorithms in oligopolies.

The third option is to use current antitrust laws to regulate the robo-seller. Specifically, the FTC could regulate the 'crack.' As discussed earlier, the anticompetitive crack in antitrust laws is going to get worse with pricing algorithms.[210] The crack is not illegal but does factor in when regulators are attempting to block potential mergers.[211]

There are two methods I propose the FTC could utilize in regulating pricing algorithms in an oligopoly market. First, the FTC could use its *unfair practices* jurisdiction.[212] The most

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[205] Daniel C. Fundakowski, *The Rule of Reason: From Balancing to Burden Shifting*, 1 A.B.A. ANTITRUST L. 1, 1–2 (2013) (citing Standard Oil Co. v. United States, 221 U.S. 1 (1911); Bd. of Trade v. United States, 246 U.S. 231, (1918)).

[206] *Id.* at 1–3.

[207] Restatement (Third) of Agency: Terminology § 1.04 cmt. e (Am. Law Inst. 2006).

[208] Mehra, *supra* note 144, at 1367.

[209] *Id.*

[210] *Id.* at 1369; *see supra* Section IV(B)(1).

[211] Mehra, *supra* note 144, at 1369.

[212] The Supreme Court has identified three factors to consider: whether the act (1) causes substantial injury to consumers; (2) is immoral, unethical,

important factor in evaluating unfair practices is whether there has been consumer harm.[213] An example of sufficient consumer harm would be a seller leaving buyers with insufficient information to make informed price comparisons.[214] I argue that the oligopoly crack creates a similar injury—both lead to the consumer purchasing something at an uncompetitive rate. The second method for the FTC to regulate pricing algorithms is through its developing *big-data* regulation practice. The FTC recently made it apparent that there needs to be an increase in efforts to regulate big-data agencies that sell consumer data.[215] Algorithms may not sell consumer data, but they need a large amount of data to operate effectively.[216] Therefore, the FTC is in an optimal position to monitor data used by both big-data agencies and pricing algorithms.

The oligopoly crack in antitrust laws mirror what looks like anticompetitive behavior. The crack will increase substantially with the addition of pricing algorithms. Markets that already use pricing algorithms, like the airline industry, are at the forefront of this issue. Whether or not the oligopoly crack is worth regulators' concerns and, possibly, legislative concerns is unfolding before our eyes as technology like artificial intelligence advances far beyond most imagined.

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oppressive, or unscrupulous; and (3) offends public policy. Fed. Trade Comm'n v. Sperry & Hutchinson Co., 405 U.S. 233, 244 n.5 (1972).

[213] Michael Pertschuk, Paul Rand Dixon, David A. Clanton, Robert Pitofsky & Patricia P. Bailey, *FTC Policy Statement on Unfairness*, FED. TRADE COMM'N (Dec. 17, 1980), https://www.ftc.gov/public-statements/1980/12/ftc-policy-statement-unfairness (discussing a significant finding of consumer harm can, alone, exemplify an unfair practice under the FTC Act).

[214] *See, e.g.*, Va. State Bd. of Pharmacy v. Va. Citizens Consumer Council, 425 U.S. 748 (1976) (discussing that consumers have a First Amendment interest in the free flow of economic information in order to make informed purchase decisions).

[215] *See* Edith Ramirez, Julie Bell, Maureen K. Ohlhausen, Joshua D. Wright & Terrell McSweeny, *Data Brokers: A Call for Transparency and Accountability*, FED. TRADE COMM'N (May 2014), https://www.ftc.gov/reports/data-brokers-call-transparency-accountability-report-federal-trade-commission-may-2014.

[216] Algorithms need a significant amount of data to operate efficiently. Don Fluckinger, *How Enterprises Use Dynamic Pricing Algorithms with AI, CRM*, TECHTARGET (Oct. 24, 2018), https://searchcrm.techtarget.com/podcast/How-enterprises-use-dynamic-pricing-algorithms-with-AI-CRM.

VI. CONCLUSION: THE FUTURE OF AIRLINE PRICING

The airline industry is in a unique position. It is on the cusp of new pricing technology that antitrust regulators are seeking ways to regulate in a market defined as an oligopoly. It is clear that under current federal antitrust laws, if airlines use pricing algorithms to fix prices pursuant to an explicit agreement, the government (and private parties) could seek legal recourse and would most likely be successful in doing so.[217] A more difficult question is whether current antitrust laws could properly regulate a tacit agreement between two airlines' pricing algorithms. The Supreme Court in *Twombly* indicated that a tacit agreement is subject to antitrust regulations.[218] But how can someone or something regulate a tacit agreement between two pricing algorithms in an oligopoly industry that can lean on the oligopoly defense to explain any anticompetitive behavior? What about when artificial intelligence utilizes self-learning to master the art of price fixing without being detected? Airline consumers are already frustrated with the service and pricing of modern airfare. Pricing algorithms in that market will only make things worse.

When an inevitable moving force (technology) finds its way around an immovable object (federal antitrust laws), the object needs to adapt, not change. Most options to regulate the airlines' oligopoly 'crack' are unhelpful. However, using current antitrust laws—specifically the FTC—to promote transparency in the airlines' pricing algorithms would benefit consumers.[219] If airlines provided the information their algorithms use to the FTC, they could prevent anticompetitive behavior. This will also benefit airlines. Pricing algorithms are a necessity in the aviation industry. By making their pricing algorithm's information available to the FTC, airlines are able to continue using the technology. Additionally, being transparent with the FTC will prevent future lawsuits

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[217] *See* United States v. Topkins, No. CR 15-00201 WHO (N.D. Cal. 2015) (plea agreement), https://www.justice.gov/atr/case-document/plea-agreement-462; *see also* United States v. Trod Ltd., No. CR 15-0419 WHO (N.D. Cal. 2015) (plea agreement), https://www.justice.gov/atr/case/us-v-daniel-william-aston-and-trod-limited; United States v. Airline Tariff Publ'g Co., 836 F. Supp. 9 (D.C.C. 1993).

[218] Bell Atl. Corp. v. Twombly, 550 U.S. 544, 553 (2007).

[219] *See* Ezrachi & Stucke, *supra* note 25, at 1799.

that lead to costly discovery while investigators determine whether pricing algorithms were colluding.

I recommend the FTC regulate airlines' pricing algorithms because the FTC has previously recognized a need to regulate *big-data*[220] and it has jurisdiction over *unfair practices*.[221] An algorithm is useless without large amounts of data. Data is how it learns and improves.[222] Pricing algorithms in the aviation industry could lead to unfair-pricing.[223] With the FTC regulating *big-data* and *unfair practices*, regulating the data that airlines' pricing algorithms use is a logical extension. The FTC may not be able to catch everything, but someday they may employ an algorithm that can.

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[220] *See* Edith Ramirez, Julie Bell, Maureen K. Ohlhausen, Joshua D. Wright & Terrell McSweeny, *Data Brokers: A Call for Transparency and Accountability*, FED. TRADE COMM'N (May 2014), https://www.ftc.gov/reports/data-brokers-call-transparency-accountability-report-federal-trade-commission-may-2014; *see also* Weiss & Mehrotra, *supra* note 26, ¶ 34.

[221] 15 U.S.C. § 45(a)(1) (2012).

[222] *See supra* Section II(A).

[223] *See supra* Section IV(B).