

## THE ALGORITHMIC ANTITRUST PARADOX

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### *Abstract*

*When algorithms fix prices instead of CEOs, does antitrust law have an answer? Scholars have largely lamented the so-called liability gap, dismissing algorithmic tacit collusion as lacking an ‘agreement’ between competitors and thereby evading the watchful eye of the antitrust laws. This Article challenges that premise, developing a legal theory on which algorithmic tacit collusion falls within the reach of the antitrust laws.*

*The assumptions that justify permitting traditional tacit collusion—where companies coordinate prices without an express agreement, simply by watching and matching each other’s behavior—do not apply to collusion by algorithms. While tacit collusion is in principle characterized by the same incentives and anticompetitive outcomes as an express agreement, it is lawful because no conceivable antitrust rule can prohibit it without generating error costs—that is, without inadvertently deterring otherwise economically efficient behavior. First, the problem of proof: evidence of parallel conduct alone is ambiguous, supplying no clear evidence of restraint of trade—a shift from competitive to monopoly prices—rather than an independently rational response to changing market conditions. Second, the problem of remedy: the only conceivable remedies—judicial price regulation or limits on public price disclosure—are more costly than beneficial.*

*Pricing algorithms help courts circumvent both problems. Because algorithms follow predictable computational rules, the strategic logic underlying firm behavior is observable through technical or economic tests, solving the problem of proof. Moreover, courts can instruct firms to avoid anticompetitive pricing algorithms without imposing price controls, suppressing*

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*public price information, or chilling the use of procompetitive pricing algorithms, solving the problem of remedy. Algorithmic tacit collusion therefore falls within the doctrinal category of tacit agreement: coordination that falls short of an express agreement but is facilitated by some demonstrably inefficient and practicably remediable mechanism.*

*This Article further refutes the claim that an unlawful agreement requires some formal element—collective decision-making, nonpublic information, or shared intent—that various forms of algorithmic tacit collusion lack. None of these features are necessary or sufficient conditions of an unlawful agreement; treating them as such contradicts the welfare-oriented principles of the antitrust laws. This internal inconsistency between the economic rationale of the agreement doctrine and its formalistic application to algorithmic tacit collusion is termed here the algorithmic antitrust paradox.*

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## INTRODUCTION

For over a century, American law has viewed collusion—those clandestine agreements in smoke-filled back rooms to fix prices, rig bids, or carve up markets—as the “supreme evil” of antitrust.<sup>1</sup> Now, that evil is evolving in form.<sup>2</sup> A “new frontier”<sup>3</sup> of anticompetitive conduct—algorithmic collusion—is evidently ubiquitous across the economy, purportedly infiltrating sectors from housing,<sup>4</sup> hotels,<sup>5</sup> and health insurance<sup>6</sup> to potatoes,<sup>7</sup> pork, and poultry.<sup>8</sup> When asked about the role his company’s software played in Nashville’s 14.5% rent increase, one executive at RealPage, a company that provides algorithmic revenue management services for landlords across the country, answered: “I think it’s driving it, quite honestly.”<sup>9</sup> Amidst an affordability crisis,<sup>10</sup> the potential contributions of algorithmic pricing to

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<sup>1</sup> *Verizon Commc’ns Inc. v. L. Offs. of Curtis V. Trinko, LLP*, 540 U.S. 398, 408 (2004) (“[C]ollusion . . . [is] the supreme evil of antitrust.”).

<sup>2</sup> Terrell McSweeney, Comm’r, Fed. Trade Comm’n, *Algorithms and Coordinated Effects* (May 22, 2017), [https://www.ftc.gov/system/files/documents/public\\_statements/1220673/mcsweeney\\_-\\_oxford\\_cclp\\_remarks\\_-\\_algorithms\\_and\\_coordinated\\_effects\\_5-22-17.pdf](https://www.ftc.gov/system/files/documents/public_statements/1220673/mcsweeney_-_oxford_cclp_remarks_-_algorithms_and_coordinated_effects_5-22-17.pdf) [https://perma.cc/YR7E-RCVB].

<sup>3</sup> Statement of Interest of the United States at 2, *McKenna Duffy v. Yardi Sys., Inc.*, No. 2:23-cv-01391-RSL (W.D. Wash. May 22, 2024), (“Algorithms are the new frontier.”).

<sup>4</sup> *In re RealPage, Inc., Rental Software Antitrust Litig.* (No. II), No. 3:23-md-03071 (M.D. Tenn. Dec. 28, 2023).

<sup>5</sup> *Gibson v. Cendyn Grp., LLC*, No. 24-3576, slip op. (9th Cir. Aug. 15, 2025), *cert. denied*, 2026 WL 1052046 (2026).

<sup>6</sup> *In re MultiPlan Health Ins. Provider Litig.*, No. 24-cv-6795 (N.D. Ill. 2025).

<sup>7</sup> *Govea v. Nat’l Potato Promotion Bd.*, No. 1:24-cv-11816 (N.D. Ill. filed Nov. 17, 2024).

<sup>8</sup> Complaint, *United States v. Agri Stats, Inc.*, No. 0:23-cv-03009 (D. Minn. filed Sept. 28, 2023).

<sup>9</sup> Heather Vogell, *Rent Going Up? One Company’s Algorithm Could Be Why*, PROPUBLICA (Oct. 15, 2022), <https://www.propublica.org/article/yieldstar-rent-increase-realpage-rent> [https://perma.cc/PS8L-FMM6].

<sup>10</sup> Angela Hanks & Julie Margetta Morgan, *The Affordability Crisis Is Here, and It’s Hitting the Working Class the Hardest*, CENTURY FOUND. (Jan. 2026), <https://tcf.org/content/report/survey-the-affordability-crisis-is-here-and-its-hitting-the-working-class-the-hardest/> [https://perma.cc/NS36-LQW3] (“52 percent of people in

higher rents,<sup>11</sup> steeper grocery prices,<sup>12</sup> and growing medical bills<sup>13</sup> cannot be ignored.

Proving collusion under Section 1 of the Sherman Act<sup>14</sup> requires an “agreement,” described as “a meeting of the minds between rivals, a conscious commitment to a common scheme.”<sup>15</sup> But when algorithms—rather than CEOs—fix prices, is there an agreement? The Sherman Act has been interpreted not to reach *tacit collusion* (or, synonymously, *conscious parallelism*), where firms in oligopolistic markets watch each other hawkishly and raise prices in lockstep without negotiating an express agreement.<sup>16</sup> Algorithmic pricing systems can displace the need for any communication between rivals, giving rise to *algorithmic tacit collusion*: supracompetitive prices produced by interdependent algorithmic decision-making rather than explicit human agreements. As Senator Klobuchar summarized, “[m]ost courts require proof of an explicit agreement to fix prices before condemning the conduct, but that

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American families don’t have the resources to cover what it really costs to live securely.”).

<sup>11</sup> Vogell, *supra* note 9.

<sup>12</sup> Christopher Leonard, *Is the Chicken Industry Rigged?*, BLOOMBERG, (Feb. 15, 2017), <https://www.bloomberg.com/news/features/2017-02-15/is-the-chicken-industry-rigged>.

<sup>13</sup> Chris Hamby, *5 Takeaways From a Times Investigation Into Health Insurers and Medical Bills*, N.Y. TIMES (Apr. 7, 2024), <https://www.nytimes.com/2024/04/07/us/health-insurance-medical-bills-takeaways.html> [<https://perma.cc/5RAJ-NVFJ>].

<sup>14</sup> 15 U.S.C. § 1.

<sup>15</sup> *The New Invisible Hand? The Impact of Algorithms on Competition and Consumer Rights: Hearing Before the Subcomm. on Competition Pol’y, Antitrust, & Consumer Rts. of the S. Comm. on the Judiciary*, 118th Cong. 4 (2023) (statement of the Hon. Bill Baer, Visiting Fellow, Brookings Inst.).

<sup>16</sup> *Brooke Grp. Ltd. v. Brown & Williamson Tobacco Corp.*, 509 U.S. 209, 227 (1993) (“Conscious parallelism describes the process, not in itself unlawful, by which firms in a concentrated market might in effect share monopoly power, setting their prices at a profit-maximizing, supracompetitive level by recognizing their shared economic interests and their interdependence with respect to price and output decisions.”); *In re Text Messaging Antitrust Litig.*, 782 F.3d 867, 875 (7th Cir. 2015) (“Competitors in concentrated markets watch each other like hawks.”).

agreement may not exist when a computer is coordinating prices instead of humans.”<sup>17</sup>

There are three forms of algorithmic tacit collusion (“ATC”), as taxonomized by Professors Ariel Ezrachi and Maurice Stucke: *Predictable Agent*, *Digital Eye*, and *Hub-and-Spoke*.<sup>18</sup> In the *Predictable Agent* scenario, programmers instruct their own separate pricing algorithms to carry out collusive strategies using simple logical rules, relying solely on public price information. In the *Digital Eye* scenario, separate machine-learning algorithms independently learn that collusive strategies maximize profits, potentially without any intent by the firm’s human agents. In the *Hub-and-Spoke* scenario, each rival firm—without express coordination—delegates pricing to a common third-party algorithm, which sets or recommends prices above competitive levels across the market, drawing either on publicly available information or pooled nonpublic data supplied by the downstream firms themselves. These three ATC scenarios stand in contrast with the *Messenger* scenario of algorithmic collusion, where competitors negotiate an express agreement to use algorithms to fix prices.

Many courts and scholars have thus far treated all three ATC scenarios as beyond the reach of the antitrust laws. In *Federal Trade Commission v. Amazon*, the Federal Trade Commission’s (“FTC”) claim against Amazon’s Project Nessie algorithm survived a motion to dismiss, but the court characterized it as a unilateral practice reachable only under the Federal Trade Commission Act (“FTC Act”) when paired with a showing of anticompetitive intent.<sup>19</sup> This categorically excludes enforcement of the *Predictable Agent* scenario under the Sherman Act and, absent evidence of anticompetitive intent, under the FTC Act as well. Scholars have largely presumed that

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<sup>17</sup> *The New Invisible Hand? The Impact of Algorithms on Competition and Consumer Rights: Hearing Before the Subcomm. on Competition Pol’y, Antitrust, & Consumer Rts. of the S. Comm. on the Judiciary*, 118th Cong. 4 (2023) (statement of Sen. Amy Klobuchar) (Dec. 13, 2023), <https://www.judiciary.senate.gov/committee-activity/hearings/the-new-invisible-hand-the-impact-of-algorithms-on-competition-and-consumer-rights> [<https://perma.cc/N7RD-CNEC>].

<sup>18</sup> Ariel Ezrachi & Maurice E. Stucke, *Sustainable and Unchallenged Algorithmic Tacit Collusion*, 17 NW. J. TECH. & INTELL. PROP. 217, 219–20 (2019).

<sup>19</sup> Sealed Order on Defendant’s Motion to Dismiss and Plaintiffs’ Motion to Bifurcate at 25–27, *FTC v. Amazon.com, Inc.*, No. 2:23-cv-01495-JHC (W.D. Wash. Sep. 30, 2024), ECF No. 289.

the *Digital Eye* scenario is entirely unactionable under the Sherman Act due to the lack of human involvement, but these are, thus far, only anticipatory arguments.<sup>20</sup> Finally, with respect to the *Hub-and-Spoke* scenario, the Ninth Circuit recently ruled in *Gibson v. Cendyn* that when many competitors all subscribe to the same price-recommendation service, they are engaged in nothing more than conscious parallelism, which does not establish the agreement required under the Sherman Act.<sup>21</sup> The Supreme Court declined to review that decision.<sup>22</sup> In general, the prevailing assumption seems to be that ATC fails to constitute an agreement.

This Article rejects that premise, proposing a legal theory on which all three forms of ATC necessarily fall within the Sherman Act's reach. The agreement doctrine rests on certain economic assumptions about what practices the law should deter or permit, and the justifications which exonerate traditional tacit collusion do not apply to ATC.

First, some definitions. *Parallel conduct*, or *parallelism*, refers to all instances in which firms appear to execute identical business strategies. Parallel conduct is not necessarily anticompetitive. For instance, firms' strategies may be identical, but nevertheless *independent*. Here, *independence* has a

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<sup>20</sup> See Baer, *supra* note 15, at 4; Ezrachi & Stucke, *supra* note 18, at 222; Maurice E. Stucke, *What Can Policymakers Do About Algorithmic Collusion and Discrimination?*, PROMARKET (June 27, 2023), <https://www.promarket.org/2023/06/27/what-can-policymakers-do-about-algorithmic-collusion-and-discrimination/> [https://perma.cc/A44X-VVVW]; Salil K. Mehra, *Antitrust and the Robo-Seller: Competition in the Time of Algorithms*, 100 MINN. L. REV. 1323, 1340 (2016) (describing the agreement requirement as a “[crack in the Sherman Act]”); Michal Gal, *Algorithms as Illegal Agreements*, 34 BERKELEY TECH. L.J. 67, 116 (2019) (“[T]he current interpretation of the term ‘agreement’ is likely to leave out many welfare-reducing instances.”); see also Michal Gal, *Can We Limit Algorithmic Coordination?*, PROMARKET (July 18, 2023), <https://www.promarket.org/2023/07/18/can-we-limit-algorithmic-coordination/> [https://perma.cc/EA93-33G2].

<sup>21</sup> *Gibson*, slip op. at 9. See *A New Culprit in the Housing Crisis: Rent-Setting Software Algorithms*, AM. ECON. LIBERTIES PROJECT & LOC. PROGRESS 4 (Mar. 2024), <https://www.economicliberties.us/wp-content/uploads/2024/03/Policy-Memo-Rent-Setting-Software-Algorithms.pdf> [https://perma.cc/XE5D-LX8P] (explaining that when coordination is “facilitated and enforced by a third party . . . an agreement among competitors can be challenging to prove”).

<sup>22</sup> *Gibson*, slip op.

particular economic meaning: a firm's behavior is independent when it is unrelated to the strategies of its rivals—the firm would have done the same no matter what.<sup>23</sup> Parallel conduct may also arise from some scheme of *anticompetitive coordination*, an explicit or implicit scheme where, rather than holding one's competitor's strategies constant, firms play reward-punishment strategies designed to incentivize supracompetitive results; put simply, firms reward high prices by their rivals with high prices of their own, and punish low prices by their competitors with low prices of their own. A scheme of anticompetitive coordination can occur because of an *express agreement*, where firms meet or talk to exchange mutual promises to hold to the agreement. Coordination can also occur as a result of *tacit collusion*, *conscious parallelism*, or *mere interdependence*, all of which are used synonymously to mean “follow-the-leader pricing.”<sup>24</sup> Any scheme of coordination requires a *mechanism of coordination*: the principal means through which it is facilitated (e.g., an exchange of mutual assurances in an express agreement versus public price signals in tacit collusion).

All economic coordination reduces competition, but some kinds of coordination are nonetheless *reasonable* when their anticompetitive effects are outweighed by countervailing gains in consumer welfare or economic efficiency. Explicit collusion—the “forbidden process”<sup>25</sup> of negotiating in smoke-filled backrooms—has no plausible efficiency justification and is therefore unlawful per se. Tacit collusion, on the other hand, arises through public price signals alone, which enhance efficiency because they convey information to consumers and other market actors. A rule prohibiting tacit collusion would therefore risk inadvertently deterring procompetitive behavior, including the observation of and rational response to common market signals.

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<sup>23</sup> William H. Page, *Tacit Agreement Under Section 1 of the Sherman Act*, 81 ANTITRUST L.J. 593, 601–02 (2017) (explaining that independent strategies are those where “rivals act in the same way regardless of one another’s actions”).

<sup>24</sup> *In re Text Messaging Antitrust Litig.*, 782 F.3d at 871 (“‘follow the leader’ pricing (‘conscious parallelism,’ as lawyers call it, ‘tacit collusion’ as economists prefer to call it) . . . means coordinating their pricing without an actual agreement to do so.”).

<sup>25</sup> Jonathan B. Baker, *Identifying Horizontal Price Fixing in the Electronic Marketplace*, 65 ANTITRUST L.J. 41, 43 (1996) (explaining that the “‘forbidden process’ of negotiation and exchange of assurances” constitutes an express agreement).



This Article shows that those justifications do not extend to ATC. Unlike public price signals, which are inseparable from the operation of competitive markets, collusive pricing algorithms are avoidable: their anticompetitive properties are distinct from, and unnecessary to, the legitimate efficiencies that pricing algorithms can provide. Pricing algorithms follow computational patterns that can be examined and tested, allowing courts to reliably distinguish between collusive and procompetitive algorithms (solving the problem of proof). Moreover, prohibiting the specific properties or design features that facilitate collusion does not chill the use of efficiency-enhancing pricing algorithms, nor does it require the imposition of price controls or the suppression of public price information (solving the problem of remedy). In other words, in each ATC scenario, the efficiencies of algorithmic pricing are achievable via practical and less restrictive alternatives. The design, deployment, or adoption of an anticompetitive pricing algorithm is the ‘extra something’ that separates lawful tacit collusion from unlawful agreement—a discrete and identifiably inefficient practice that courts can practicably instruct firms to avoid.

ATC is therefore best understood within the doctrinal category of *tacit agreement*: concerted practices that fall short of the classic ‘forbidden process,’ yet arise through inefficient, avoidable means and are susceptible to administrable judicial intervention. Unlike tacit collusion, targeting such practices generates no error costs, making their prohibition consistent with the underlying economic logic of Section 1’s agreement doctrine. The nomenclature is admittedly awkward—distinguishing *tacit collusion* and *tacit agreement*—but “it is the one the courts use.”<sup>26</sup>

Each ATC scenario admits a distinct test supporting the inference of such an agreement. In the *Predictable Agent* scenario, courts can invite technical experts to inspect the code’s logic for hard-coded interdependent pricing rules. In the *Digital Eye* scenario, courts can evaluate the algorithm in a controlled simulated environment to observe whether it systematically converges on a strategy of anticompetitive reward-and-punishment. In the *Hub-and-Spoke* scenario, courts can test whether the average price of the subscribing firms increases with the number of adopters.

Based on this economic account of the agreement doctrine, this Article critiques the prevailing approaches that effectively

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<sup>26</sup> Page, *supra* note 23, at 599.

exonerate various renditions of ATC through formalistic line drawing. This narrow approach to the agreement doctrine equates ‘agreement’ with ‘traditional conspiracy,’ demanding features like collective decision-making, nonpublic information, and subjective intent. This Article demonstrates that none of those elements are either necessary or sufficient conditions of Section 1 liability. This internal inconsistency between the economic rationale underlying the agreement doctrine and its deontological application to ATC constitutes what this Article terms the *algorithmic antitrust paradox*.

Some have argued that Section 5 of the FTC Act, with its prohibition on “unfair methods of competition,” can fill any perceived gaps left by the Sherman Act.<sup>27</sup> This Article contends that no such gap exists.<sup>28</sup> While the FTC Act may reach somewhat further than the Sherman Act in certain respects, it does not extend to mere parallel conduct.<sup>29</sup> Nevertheless, the same error-cost analysis that supports treating ATC as an unlawful tacit agreement under the Sherman Act applies with equal force to the FTC Act.

The Article proceeds as follows. Part I details the mechanics of ATC in its relevant forms. Part II explains the economic rationale of the agreement doctrine to draw the boundary between *tacit collusion* and *tacit agreement*. Part III justifies the legal approach to algorithmic tacit agreement and outlines the appropriate tests and remedies that make it a workable antitrust

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<sup>27</sup> See OECD, ALGORITHMS AND COLLUSION: COMPETITION POLICY IN THE DIGITAL AGE 38 (2017), [https://www.oecd.org/content/dam/oecd/en/publications/reports/2017/05/algorithms-and-collusion-competition-policy-in-the-digital-age\\_02371a73/258dcb14-en.pdf](https://www.oecd.org/content/dam/oecd/en/publications/reports/2017/05/algorithms-and-collusion-competition-policy-in-the-digital-age_02371a73/258dcb14-en.pdf) [https://perma.cc/E75Z-RMSQ]; Aneesa Mazumdar, *Algorithmic Collusion: Reviving Section 5 of the FTC Act*, 120 COLUM. L. REV. 449, at 453 (2020); Stucke, *supra* note 20; Joseph E. Harrington Jr., *Developing Competition Law for Collusion by Autonomous Price-Setting Agents*, 14 J. COMPETITION L. & ECON. 331, 358-59 (2019).

<sup>28</sup> Relying solely on the FTC Act would not only foreclose the private right of action that has long been a pillar of American antitrust law—and generated the first algorithmic-collusion cases—but would also leave such enforcement in the hands of a single administrative agency. Most antitrust cases alleging algorithmic collusion were brought first by private plaintiffs. See *In re RealPage, Inc. (No. II)*, No. 3:23-md-03071; *Gibson*, slip op.; *In re MultiPlan Health Ins. Provider Litig.*, No. 24-cv-6795.

<sup>29</sup> *E.I. du Pont de Nemours & Co. v. FTC (“Ethyl”)*, 729 F.2d 128 (2d Cir. 1984).

rule. Finally, Part IV introduces the algorithmic antitrust paradox and refutes the formalistic account of the agreement doctrine, critiquing the predominant legal approaches to ATC.

## I. HOW ALGORITHMIC TACIT COLLUSION WORKS

An algorithm is simply a “procedure for solving a mathematical problem”<sup>30</sup>—in this case, a set of computational rules for setting prices. What makes pricing algorithms powerful, for better and worse, is information: the volume of data they can process, and the speed at which they process it. That informational advantage can either generate efficiencies by making prices more responsive to supply and demand,<sup>31</sup> or enable coordination more sustainably and precisely than humans can.<sup>32</sup>

Part I explains how. It begins with the economics of collusion and tacit collusion, then turns to what makes ATC different, before examining its three main forms.

### A. HOW COLLUSION WORKS

In perfectly competitive markets,<sup>33</sup> each firm sets price equal to the marginal cost of producing an additional unit—any higher and competitors or entrants will undercut to capture its market share.<sup>34</sup> Hence, firms in competitive markets are “price takers,” accepting the prevailing market-clearing price—at which supply meets demand—as given.<sup>35</sup> This is the competitive equilibrium:

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<sup>30</sup> *Algorithm*, MERRIAM-WEBSTER, <https://www.merriam-webster.com/dictionary/algorithm> [<https://perma.cc/EG4S-JJGG>].

<sup>31</sup> Sophie Calder-Wang & Gi Heung Kim, *Coordinated vs. Efficient Prices: The Impact of Algorithmic Pricing on Multifamily Rental Markets* 4, Cowles Found. Econ. Rsch., 2024, <https://cowles.yale.edu/sites/default/files/2024-05/Calder-Wang-main.pdf> [<https://perma.cc/9D5L-3R8A>] (“[A]lgorithm[s] help[] . . . set efficient prices . . . when prices are more responsive to demand changes, it produces efficiency gains.”).

<sup>32</sup> Ezrachi & Stucke, *supra* note 18, at 221.

<sup>33</sup> Perfect competition assumes identical products, numerous buyers and sellers, perfect information, and free entry and exit of firms in the market. See STEVEN A. GREENLAW & DAVID SHAPIRO, *PRINCIPLES OF ECONOMICS* 188 (2d ed. 2017).

<sup>34</sup> *Id.*

<sup>35</sup> *Id.*

no firm can unilaterally improve its position by switching strategies.<sup>36</sup>

However, in imperfectly competitive markets,<sup>37</sup> firms maximize their joint profits by coordinating to restrict quantity and raise prices.<sup>38</sup> Yet even colluding firms face a constant temptation to cheat, i.e., undercut their ostensible collaborators to capture additional market share.<sup>39</sup> Therefore, a successful scheme of coordination alters firms' expected payoffs over repeated interactions such that cooperation becomes the rational choice. In a precise sense, collusion is a "reward-punishment scheme which rewards a firm for abiding by the supracompetitive outcome and punishes it for departing from it."<sup>40</sup> For instance, firms could mutually promise to play a Grim Trigger strategy: if either party cheats in one period, the other retaliates by reverting to competitive pricing indefinitely, eliminating collusive profits in all future periods.<sup>41</sup> This changes the parties' payoffs to a supracompetitive equilibrium where neither has a unilateral incentive to deviate.

Reaching this equilibrium requires overcoming three challenges: (1) reaching consensus on terms of coordination; (2) deterring defection; and (3) preventing entry by non-colluding firms.<sup>42</sup> The archetypal example is the "hard-core cartel,"<sup>43</sup> where such terms are agreed upon through an express exchange

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<sup>36</sup> *Id.* at 189.

<sup>37</sup> Firms in imperfectly competitive markets are not price takers; they have market power over prices. *Id.* at 236. Anticompetitive coordination reduces "consumer surplus," which refers to the gains consumers enjoy from trade (the amount they are willing to pay less the amount actually paid). *Id.* at 71. Moreover, anticompetitive coordination results in an inefficient quantity, producing "deadweight loss" (lost gains from trade that would have occurred at the competitive price and quantity). *Id.* at 75.

<sup>38</sup> *Id.* at 244.

<sup>39</sup> *Id.* at 245.

<sup>40</sup> Harrington, *supra* note 27, at 336.

<sup>41</sup> See James W. Friedman, *A Non-cooperative Equilibrium for Supergames*, 38 REV. ECON. STUD. 1, 5 (1971).

<sup>42</sup> ANDREW I. GAVIL, WILLIAM E. KOVACIC, JONATHAN B. BAKER & JOSHUA D. WRIGHT, *ANTITRUST LAW IN PERSPECTIVE: CASES, CONCEPTS AND PROBLEMS IN COMPETITION POLICY* 306 (4th ed. 2022).

<sup>43</sup> See Eur. Comm'n, ICN Cartel Working Group, [https://competition-policy.ec.europa.eu/antitrust-and-cartels/icn-working-group\\_en](https://competition-policy.ec.europa.eu/antitrust-and-cartels/icn-working-group_en) [<https://perma.cc/X75T-M64Z>]; Maurice E. Stucke, *Morality and Antitrust*, 2006 COLUM. BUS. L. REV. 443, 450 (2006).

of mutual assurances—a negotiation in a smoke-filled back room or a back-and-forth over email.

The most clear-cut form of algorithmic collusion, the *Messenger* scenario, is algorithmic pricing in service of a hard-core cartel.<sup>44</sup> For example, in 2015, David Topkins pleaded guilty in the first-ever criminal prosecution for algorithmic price-fixing, after orchestrating a scheme among online poster sellers on Amazon Marketplace to collude using a pricing algorithm.<sup>45</sup> While the *Messenger* scenario presents its own enforcement challenges—evidence of express collusion is sparser than in a traditional cartel, since the agreement needs only one meeting to delegate its ongoing execution to an algorithm—it is in principle a legal “no-brainer.”<sup>46</sup> The subject of this Article is coordination facilitated by algorithms where no such express agreement ever exists.

### 1. *How Tacit Collusion Works*

Though direct agreements are most effective, firms can also communicate terms of coordination not through spoken language, but through the language of markets: prices, which “themselves communicate pertinent information.”<sup>47</sup>

Price is a mechanism for transmitting information about supply and demand—a signal wrapped in an incentive to efficiently allocate resources.<sup>48</sup> For instance, a natural disaster that increases the scarcity (and therefore cost) of a good translates to higher prices, directing the remaining goods to those who value them most, i.e., those willing to pay. However, the communicative power of price signals can serve a second purpose between rivals. A price increase untethered to any change in supply or demand can signal an invitation to

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<sup>44</sup> ARIEL EZRACHI & MAURICE E. STUCKE, VIRTUAL COMPETITION: THE PROMISE AND PERILS OF THE ALGORITHM-DRIVEN ECONOMY 39 (Harv. U. Press 2016), <https://doi.org/10.4159/9780674973336> (explaining that, in the *Messenger* scenario, “humans are the masters who agree to collude and map out the cartel”).

<sup>45</sup> Plea Agreement at 2–3, *United States v. Topkins*, No. CR 15-00201 WHO (N.D. Cal. Apr. 30, 2015).

<sup>46</sup> EZRACHI & STUCKE, *supra* note 44, at 39.

<sup>47</sup> Louis Kaplow, *On the Meaning of Horizontal Agreements in Competition Law*, 99 CAL. L. REV. 683, 687 (2011); F.A. Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519, 526 (1945) (“We must look at the price system as such a mechanism for communicating information . . .”).

<sup>48</sup> Greenlaw & Shapiro, *supra* note 33, at 98.

coordinate: one firm raises its price, a rival follows suit, and—each anticipating that defection would trigger a price war—both hold at the supracompetitive price and enjoy sustained profits. Here, rather than communicating changes in supply or demand, prices communicate terms of coordination.

This dynamic is self-reinforcing in oligopolistic markets, even absent an express agreement, because of *oligopolistic interdependence*. With few sellers, the collusive pie is divided among fewer firms, making coordination more profitable than in a market with numerous sellers.<sup>49</sup> At the same time, defection captures a disproportionately large share of business from one's rivals, inviting predictable retaliation.<sup>50</sup> Relative to competitive markets, oligopolists are presented with greater gains from coordination and greater losses from competition. Oligopolists therefore treat their strategies as interdependent, anticipating rivals' responses rather than taking market prices as given.

Two additional conditions make tacit collusion likely: *price transparency* and *speed*.<sup>51</sup> The textbook example is adjacent gas stations.<sup>52</sup> In *White v. R.M. Packer Co.*, the First Circuit considered allegations that four of nine gas stations on Martha's Vineyard had conspired to fix prices averaging fifty-six cents more per gallon than on nearby Cape Cod.<sup>53</sup> Lacking evidence of an express agreement, the court explained that the relevant market conditions were conducive to tacit collusion.

First, price transparency helps firms reach consensus on supracompetitive prices without an express agreement. In *White*, the court attributed the parallelism to the fact that each station could “easily monitor and respond to the prices of the others.”<sup>54</sup> Stations prominently display prices on big signs to attract consumers, but this also enables rivals to observe and track each

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<sup>49</sup> Donald F. Turner, *The Definition of Agreement under the Sherman Act: Conscious Parallelism and Refusals to Deal*, 75 HARV. L. REV 655, 665 (1962).

<sup>50</sup> *Id.*

<sup>51</sup> EZRACHI & STUCKE, *supra* note 44, at 60–61.

<sup>52</sup> JOSEPH E. HARRINGTON, JR., A THEORY OF TACIT COLLUSION 2 (2011) (“A common example [of conscious parallelism] is two adjacent gasoline stations in which one station raises its price to a supracompetitive level and the other station matches the price hike.”); *see also* LOUIS KAPLOW, COMPETITION POLICY AND PRICE FIXING 23–24 (2013).

<sup>53</sup> *White v. R.M. Packer Co., Inc.*, 635 F.3d 571, 578 (1st Cir. 2011).

<sup>54</sup> *Id.* at 579.

other's price changes in real time. In such markets, a price leader may raise prices above competitive levels, effectively signaling others to follow.<sup>55</sup> Price visibility helps firms overcome the first challenge of collusion: reaching terms of coordination.

Second, the speed of retaliation disincentivizes any potential defections: "[t]he original 'cheater' benefits very little from undercutting . . . because . . . competitors can match the price before many customers respond."<sup>56</sup> Speed solves the second cartel challenge of deterring defection, undermining the temptation to cheat and making coordination the profitable strategy.

## B. ALGORITHMIC TACIT COLLUSION

Pricing algorithms are meant to optimize the informational function of prices by processing a constant flow of data on supply and demand to set efficient prices. The concept was pioneered by American Airlines, where dynamic pricing systems adjust fares in real time.<sup>57</sup> As firms across the economy automate price-setting,<sup>58</sup> the informational advantages that make pricing algorithms efficient also make them potent instruments of tacit collusion. Algorithms ease the challenges for successful collusion: they make consensus easier to reach through greater price transparency, defection easier to punish through rapid price adjustment, and genuine deviations easier to distinguish from noise through greater predictive accuracy.

First, price transparency. Pricing algorithms continuously pull publicly available market data, and in some versions of the *Hub-and-Spoke* scenario, competing firms may even pool nonpublic information into a common pricing algorithm's

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<sup>55</sup> *Id.* ("[A] station acting as a price 'leader' risks little by raising its price under such market conditions. Other stations are likely to follow, given the possibility of higher prices and profit margins for all.").

<sup>56</sup> *Id.*

<sup>57</sup> Barak Orbach, *Do Revenue Management Platforms Like RealPage Facilitate Illegal Algorithmic Collusion?*, PROMARKET (Apr. 18, 2024), <https://www.promarket.org/2024/04/18/do-revenue-management-platforms-like-realpage-facilitate-illegal-algorithmic-collusion/> [https://perma.cc/9TLQ-8FEN].

<sup>58</sup> See Zach Brown & Alexander MacKay, *Are Online Prices Higher Because of Pricing Algorithms?* BROOKINGS INST. (July 7, 2022), <https://www.brookings.edu/articles/are-online-prices-higher-because-of-pricing-algorithms/> [https://perma.cc/9PWN-LGVS].

dataset.<sup>59</sup> By making rivals' pricing strategies more visible than any human monitoring could achieve, algorithms can immediately detect price changes signaling invitations to coordinate or defect.

Second, speed. Algorithms can assess and adjust prices far faster than humans, anywhere from "within an hour"<sup>60</sup> to "within milliseconds."<sup>61</sup> If a firm defects, its rival can instantaneously retaliate, undermining the incentive to discount at all.<sup>62</sup>

Finally, pricing algorithms enhance predictive accuracy, sustaining coordination more reliably than humans. Imperfect "noisy price information" can cause cartels to collapse when members misinterpret innocent market fluctuations for defections and mistakenly retaliate.<sup>63</sup> Algorithms trained on large datasets cut through that noise, accurately identifying genuine deviations.<sup>64</sup> Human collusion also depends on intangibles like trust,<sup>65</sup> whereas machines replace the human irrationality that sometimes causes cartels to unravel.<sup>66</sup>

Put simply, tacit collusion is hard. The Supreme Court has likened it to a "minuet" that is "most difficult to compose and to perform, even for a disciplined oligopoly," because price signals are "subject to misinterpretation and are a blunt and imprecise

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<sup>59</sup> EZRACHI & STUCKE, *supra* note 44, at 61 (with respect to algorithmic pricing, "more market data will be digitalized and accessible, and market transparency will likely increase").

<sup>60</sup> Brown & MacKay, *supra* note 58, at 2.

<sup>61</sup> Ezrachi & Stucke, *supra* note 18, at 246 ("[P]ricing algorithms can achieve this same price monitoring mechanism within milliseconds").

<sup>62</sup> Ezrachi & Stucke, *supra* note 18, at 227 ("Unique to an algorithmic environment is the speed of retaliation. Computers can rapidly detect deviations, and calculate the profit implications of a myriad of moves and counter-moves to punish deviations. The speed of calculated responses effectively deprives discounting rivals of any significant sales.") (citations omitted).

<sup>63</sup> Edward J. Green & Robert H. Porter, *Noncooperative Collusion Under Imperfect Price Information*, 52 *ECONOMETRICA* 87 (1984).

<sup>64</sup> COMPETITION & MARKETS AUTHORITY, *PRICING ALGORITHMS: ECONOMIC WORKING PAPER ON THE USE OF ALGORITHMS TO FACILITATE COLLUSION AND PERSONALISED PRICING* 24 (2018).

<sup>65</sup> Christopher R. Leslie, *Probative Synergy of Plus Factors in Price-Fixing Litigation*, 115 *NW. U. L. REV.* 1581, 1590 (2021).

<sup>66</sup> Mehra, *supra* note 20, at 1350 ("[I]mplementation of algorithmic pricing and automated decision making will reduce the possibility that agency slack will lead to choices by employees that undercut a cartel.").



means of ensuring smooth cooperation.”<sup>67</sup> Pricing algorithms, though, are remarkably good interpreters of price signals—precisely what makes them valuable, yet precisely what makes the minuet of tacit collusion easier to perform.

ATC takes three forms: (1) rivals operating separate algorithms deliberately programmed to execute rules-based collusive strategies (*Predictable Agent*); (2) separate machine-learning algorithms that autonomously learn to collude (*Digital Eye*); and (3) rivals independently adopting price recommendations by a common third-party algorithm (*Hub-and-Spoke*).<sup>68</sup>

### 1. *Predictable Agent*

In the *Predictable Agent* scenario, separate pricing algorithms are explicitly programmed by separate firms to follow simple logical rules that carry out interdependent strategies.<sup>69</sup> In one far-fetched example, two rival biology textbook sellers on Amazon Marketplace priced the same book using algorithms.<sup>70</sup> Because it had better reviews, Seller A priced its textbook at 1.27059 times the price that Seller B had set the previous day.<sup>71</sup> Meanwhile, Seller B priced at 0.99830 of Seller A’s previous day’s price.<sup>72</sup> The result was an upward spiral that drove the textbook’s price to over \$23 million.<sup>73</sup>

Amusing as it is, the underlying mechanism is ubiquitous.<sup>74</sup> Many e-commerce platforms, including Amazon, Walmart, and eBay, offer to retailers simple algorithmic tools that set the retailer’s price as a linear function of a specific competitor, matching the competitor’s price precisely or within a specific

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<sup>67</sup> Brooke Grp., 509 U.S. at 227–28.

<sup>68</sup> See EZRACHI & STUCKE, *supra* note 44, at 35–36 (laying out the taxonomy this Article follows).

<sup>69</sup> Ezrachi & Stucke, *supra* note 18, at 242 (“Humans can program adaptive algorithms to reflect a pricing strategy that assumes interdependence on the market or is geared to push toward such interdependence.”).

<sup>70</sup> Michael Eisen, *Amazon’s \$23,698,655.93 Book About Flies, It Is NOT Junk* (Apr. 22, 2011), <https://www.michaelseisen.org/blog/?p=358>.

<sup>71</sup> *Id.*

<sup>72</sup> *Id.*

<sup>73</sup> *Id.*

<sup>74</sup> Qiaochu Wang, Yan Huang, Param Vir Singh & Kannan Srinivasan, *Algorithms, Artificial Intelligence and Simple Rule-Based Pricing 2* (Wharton Sch., Working Paper, 2023).

dollar or percentage amount of that price, with the option to set a price floor or ceiling.<sup>75</sup> Even this simple rule engineers the reward-punishment logic behind collusion. A price-matching algorithm follows a rival's price hike or price cut instantaneously, making it trivial to raise prices in concert while immediately undermining any defection. This stands in contrast to the competitive equilibrium, where firms are price takers and prices depend on supply and demand rather than on rivals' strategies.

According to the FTC's complaint, Amazon, which makes over 2.5 million price changes every day,<sup>76</sup> implemented a simple price-matching algorithm to execute an "anti-discounting strategy" for its first-party retail business.<sup>77</sup> As alleged, Amazon's algorithm was designed to prevent discounts by rival online stores, programmed explicitly to avoid "perfectly competitive" market outcomes by deploying what senior executives called a "game theory approach": never moving first, but instantaneously matching rivals' discounted prices, undermining their incentive to discount in the first instance.<sup>78</sup> For instance, when Walmart launched a pickup-discount program in 2017, Amazon's "anti-discounting algorithm" created what its own internal documents called a "financial disincentive" strong enough that Walmart rolled back discounts on hundreds of thousands of products.<sup>79</sup> The informational advantage is key: by continuously monitoring rivals' prices and retaliating

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<sup>75</sup> *Id.* ("Most major e-commerce marketplaces, such as Amazon, eBay, Shopify, Walmart, and Google Shopping, offer simple rule-based pricing algorithms as free pricing tools to 3rd-party sellers. Typically, these algorithms permit sellers to establish prices that are below, equal to, or above the lowest price in the pre-defined market, with a user-specified listing condition and fulfillment method."); *see, e.g.*, Repricer: Create a Strategy, WALMART MARKETPLACE LEARN, <https://marketplacelearn.walmart.com/guides/Catalog%20management/Price%20management/Repricer:-Create-a-strategy> [https://perma.cc/EHG8-BG73] (last updated May 26, 2026).

<sup>76</sup> Profitero Reveals that Amazon.com Makes More Than 2.5 Million Price Changes Every Day, PROFITERO (Dec. 10, 2013), [https://www.prweb.com/releases/profitero\\_reveals\\_that\\_amazon\\_com\\_makes\\_more\\_than\\_2\\_5\\_million\\_price\\_changes\\_every\\_day/prweb11398848.htm](https://www.prweb.com/releases/profitero_reveals_that_amazon_com_makes_more_than_2_5_million_price_changes_every_day/prweb11398848.htm).

<sup>77</sup> Amazon (eCommerce): Revised Redacted Complaint at 102, FTC v. Amazon.com, Inc., No. 2:23-cv-01495-JHC (W.D. Wash. Nov. 2, 2023).

<sup>78</sup> *Id.* at 10.

<sup>79</sup> *Id.* at 102.

instantaneously, even simple price-matching algorithms can use public prices to “tame price cutters into price followers.”<sup>80</sup>

Beyond price-matching alone, the *Predictable Agent* scenario can involve more sophisticated versions of explicitly programming an algorithm to execute interdependent strategies. In particular, the algorithm can make decisions based on predictions of the best responses to its rivals’ behavior.<sup>81</sup> The FTC alleges that Amazon did just that using an algorithm called Project Nessie, which went a step further than its anti-discounting algorithm to offensively initiate price coordination.<sup>82</sup> The Project Nessie algorithm “predicted the likelihood that the online store or stores offering the lowest price for a given product would follow an Amazon price increase.”<sup>83</sup> If the Project Nessie algorithm calculated that rival online retailers were likely to follow—based on patterns observed in their historical price data—Amazon would raise prices for its products; if competitors failed to match, the algorithm would automatically roll back the price increase. In other words, Nessie was engineered to implement a collusive reward-punishment logic, explicitly oriented towards inducing price increases across the board. According to the FTC, Amazon admittedly accepted reduced sales volume in exchange for higher margins, generating over \$1 billion in net profits from 2016 to 2018.<sup>84</sup> Notably, Amazon allegedly turned Nessie “on” and “off” at least eight times between 2015 and 2019, deactivating it during periods of heightened regulatory scrutiny.<sup>85</sup>

## 2. *Digital Eye*

The *Digital Eye* scenario involves sophisticated machine-learning (“ML”) algorithms that autonomously learn whichever strategies best achieve a designated objective, such as profit maximization.<sup>86</sup> Rather than following hard-coded rules, an ML

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<sup>80</sup> *Id.* at 84.

<sup>81</sup> Gal, *supra* note 20, at 105.

<sup>82</sup> Amazon (eCommerce): Revised Redacted Complaint at 131, FTC v. Amazon.com, Inc., No. 2:23-cv-01495-JHC (W.D. Wash. Nov. 2, 2023).

<sup>83</sup> *Id.* at 124.

<sup>84</sup> *Id.* at 125.

<sup>85</sup> *Id.* at 126.

<sup>86</sup> See EZRACHI & STUCKE, *supra* note 44, at 71 (“Our final collusion scenario—Digital Eye—represents the next frontier. Here we consider how two key technological advancements can amplify tacit

algorithm tries different rules and constantly re-adjusts based on feedback, a method known as reinforcement learning. The agent takes an action (setting a price), observes how that action affected its reward (its profit), and adjusts the pricing algorithm accordingly; repeated over many iterations, the actions that best maximize the reward function converge into a policy, a systematic strategy applicable to any situation, or state, in which the agent finds itself.<sup>87</sup> The worry is that a profit-maximizing agent “‘learns’ in nanoseconds that price competition does not get you there, stops discounting, and stabilizes prices.”<sup>88</sup>

A growing experimental literature confirms this concern. In a landmark study, Calvano et al. simulated a market resembling a basic Bertrand competition game, where two ML pricing agents repeatedly set prices for identical products with symmetric demand.<sup>89</sup> Over thousands of iterations, the algorithms converged to supracompetitive prices in nearly all simulations.<sup>90</sup> When the researchers expanded the model to include three or four firms, the agents still sustained substantial profits above the Bertrand-Nash equilibrium—though less durably, consistent with the principle that the temptation to “cheat” intensifies with the number of competitors.<sup>91</sup>

The researchers then confirmed that the agents’ convergence reflected a systematic policy of collusive reward and punishment, rather than a failure to optimize.<sup>92</sup> To test this, they

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collusion to a new level of stability and scope. The first advancement involves the computer’s ability to process high volumes of data in real time to achieve a God-like view of the marketplace. The second advancement concerns the increasing sophistication of algorithms as they engage in autonomous decision making and learning through experience—that is, the use of Artificial Intelligence (AI).”).

<sup>87</sup> Abid Ali Awan, *An Introduction to Q-Learning: A Tutorial for Beginners*, DATA CAMP (Oct. 27, 2022), <https://www.datacamp.com/tutorial/introduction-q-learning-beginner-tutorial>.

<sup>88</sup> Baer, *supra* note 15, at 5.

<sup>89</sup> Emilio Calvano, Giacomo Calzolari, Vincenzo Denicolò & Sergio Pastorello, *Artificial Intelligence, Algorithmic Pricing, and Collusion*, 110 AM. ECON. REV. 3267, 3268 (2020).

<sup>90</sup> *Id.* at 3276–69.

<sup>91</sup> *Id.* at 3288.

<sup>92</sup> *Id.* at 3279 (“A natural question that arises when prices exceed the Nash-Bertrand level is why firms do not cut their prices. Is it because they are missing an opportunity to increase their payoff? Or is it because they realize that cutting the price would not be profitable given the rivals’ response in subsequent periods?”).

forced one pricing agent to “cheat” by undercutting the collusive price.<sup>93</sup> The rival agent responded by entering a prolonged punishment phase of low prices—a calculated strategy to deter defection by making cheating unprofitable—before gradually returning to cooperative pricing.<sup>94</sup>

In a sense, the *Digital Eye* scenario presents an “alignment problem,” where the abstract goals assigned to an AI agent can become misaligned with the objective of competitive and efficient markets.<sup>95</sup>

### 3. *Hub-and-Spoke*

Hub-and-spoke conspiracies long predate pricing algorithms.<sup>96</sup> The phrase describes schemes in which a ‘hub’ (an upstream or downstream firm, such as a supplier or distributor) facilitates collusion among the ‘spokes’ (horizontal competitors in the same market).<sup>97</sup> Liability in hub-and-spoke conspiracies requires proof of a horizontal agreement between direct competitors, or the “rim” of the wheel.<sup>98</sup> The hub, or ‘cartel

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<sup>93</sup> Sergio Pastorello, Giacomo Calzolari, Vincenzo Denicolo & Emilio Calvano, *Artificial Intelligence, Algorithmic Pricing, and Collusion*, VOXEU (Feb. 3, 2019), <https://cepr.org/voxeu/columns/artificial-intelligence-algorithmic-pricing-and-collusion> (“[W]e override one algorithm’s choice . . . forcing it to deviate downward to the competitive or Nash price . . . for one period.”).

<sup>94</sup> *Id.* (“Clearly, the deviation is punished immediately . . . making the deviation unprofitable . . . afterwards, the algorithms gradually return to their pre-deviation prices.”).

<sup>95</sup> See generally BRIAN CHRISTIAN, *THE ALIGNMENT PROBLEM: MACHINE LEARNING AND HUMAN VALUES* (2020) (exploring how AI systems optimizing for specified objectives may unintentionally produce outcomes misaligned with human values).

<sup>96</sup> See *Interstate Circuit, Inc. v. United States*, 306 U.S. 208 (1939); *Toys “R” Us, Inc. v. FTC*, 221 F.3d 928, 934–36 (7th Cir. 2000) (“The agreements took the form of a network of vertical agreements between TRU and the individual manufacturers . . . on the condition that other manufacturers would do the same.”).

<sup>97</sup> Barak Orbach, *Hub-and-Spoke Conspiracies*, ANTITRUST SOURCE, Apr. 2016, at 1, [https://www.americanbar.org/content/dam/aba/publishing/antitrust-magazine-online/apr16\\_full\\_source.pdf](https://www.americanbar.org/content/dam/aba/publishing/antitrust-magazine-online/apr16_full_source.pdf).

<sup>98</sup> *In re Musical Instruments & Equip. Antitrust Litig.*, 798 F.3d 1186, 1192 n.3 (9th Cir. 2015) (“[A] rimless hub-and-spoke conspiracy is not a hub-and-spoke conspiracy at all (for what is a wheel without a rim?).”).

ringmaster,’ helps rivals overcome their cartel challenges—reaching terms of coordination, deterring defections, and preventing entry or expansion—by acting as messenger and monitor. In exchange for helping the spokes collude, the cartel ringmaster typically either collects some of the collusive profits or limits competition in its own upstream or downstream market by raising rivals’ costs.<sup>99</sup>

The seminal case is *Interstate Circuit v. United States*.<sup>100</sup> There, the Supreme Court found that Interstate Circuit, a monopolist on first-run theatres in several Texas cities, violated the Sherman Act by sending letters to film distributors demanding as a condition of business that they raise admission prices at second-run theatres.<sup>101</sup> Interstate Circuit functioned as the hub, inviting upstream distributors to collude with each other so as to raise its own rivals’ costs. No distributor had an independent incentive to comply, but each stood to profit if all did. Crucially, each knew the proposal was before its competitors—the letter listed all recipients on the same letterhead—and each accepted with the expectation that the others would too.<sup>102</sup>

Algorithmic hub-and-spoke collusion operates similarly: “a common intermediary facilitates price fixing among competitors who use the intermediary’s services.”<sup>103</sup> Typically, the intermediary is a revenue management service that uses its third-party pricing algorithm (“TPPA”) to recommend or otherwise manage pricing strategies for multiple horizontal competitors.

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<sup>99</sup> Orbach, *supra* note 97, at 2 (“For its services, the hub collects some of the collusive profits and may also strategically use the cartel to raise rivals’ costs.”); *see also* Thomas G. Krattenmaker & Steven C. Salop, *Anticompetitive Exclusion: Raising Rivals’ Costs to Achieve Power over Price*, 96 YALE L.J. 209, 238 (1986).

<sup>100</sup> *Interstate Circuit*, 306 U.S. at 216–17.

<sup>101</sup> *Id.* at 216–17 (“Acceptance by competitors, knowing that concerted action is contemplated, 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.”).

<sup>102</sup> *Id.* at 226 (“It was enough that, knowing that concerted action was contemplated and invited, the distributors gave their adherence to the scheme and participated in it.”).

<sup>103</sup> Ezrachi & Stucke, *supra* note 18, at 219.

Illustrative exemplars include RealPage in rental housing,<sup>104</sup> Cendyn in hotels,<sup>105</sup> and MultiPlan in health insurance.<sup>106</sup>

There are efficiency rationales for a firm to turn to a third party rather than develop a pricing algorithm in-house: the third party might have more technical expertise or better data, using its vantage point to develop a sophisticated understanding of market dynamics. In principle, the TPPA could efficiently tailor independent price recommendations to each client, helping individual firms compete more effectively; call this the *procompetitive scenario*. However, because the TPPA recommends prices to a set of firms that compete in the same downstream market, it must, in this scenario, “compete against itself.”<sup>107</sup> If the TPPA’s recommendations spark aggressive price competition between two rival subscribers, both come away with lower profits and a correspondingly weak incentive to keep paying for the TPPA’s services.

The TPPA is therefore incentivized to shape its subscribers’ pricing strategies to maximize their collective rather than individual profits by recommending supracompetitive, joint-profit-maximizing prices rather than competitive ones. Doing so increases its clients’ collective profits and, in turn, increases demand for the TPPA’s own services.<sup>108</sup> That the TPPA is positioned to dictate the strategies of rival firms is, in simple terms, a conflict of interest. It also creates a self-reinforcing feedback loop: as more firms adopt strategies recommended by the same “brain,” their collective pricing power increases, nudging joint-profit-maximizing price recommendations closer to monopoly levels, and thereby incentivizing further adoption.<sup>109</sup> Call this the *anticompetitive scenario*.

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<sup>104</sup> *In re RealPage, Inc. (No. II)*, No. 3:23-md-03071.

<sup>105</sup> *Gibson*, slip op.

<sup>106</sup> *In re MultiPlan Health Ins. Provider Litig.*, No. 24-cv-6795.

<sup>107</sup> Joseph E. Harrington, Jr., *The Effect of Outsourcing Pricing Algorithms on Market Competition*, 68 MGMT. SCI. 6355, 6360 (2022), <https://doi.org/10.1287/mnsc.2021.4241>.

<sup>108</sup> Matthias Hunold & Tobias Werner, *Algorithmic Price Recommendations and Collusion: Experimental Evidence*, 28 EXPERIMENTAL ECON. 298, 299 (2025), <https://doi.org/10.1017/eec.2025.9> (“[TPPAs] have an incentive to make the recommendations from the algorithm less competitive as it increases the profits of the supplied firms and thereby increases the demand for the algorithm itself”).

<sup>109</sup> Amended Complaint, *United States v. RealPage, Inc.*, No. 1:24-cv-00710-LCB-JLW (M.D.N.C. Jan. 7, 2025), at 49, 62 (alleging that RealPage seeks to enroll more landlords so they can “move in unison

Successfully carrying out the *anticompetitive scenario* requires three steps. (1) the hub, or ‘cartel manager,’ recommends a collusive price; (2) the subscribing firms, or ‘spokes,’ adopt it; (3) the spokes do not defect.

Step 1: the TPPA recommends supracompetitive prices to its subscribers. For example, MultiPlan’s Data iSight algorithm recommends reimbursement rates to the majority of U.S. health insurers, including the fifteen largest.<sup>110</sup> MultiPlan takes a direct cut of the ‘savings’ on each claim,<sup>111</sup> incentivizing it to recommend artificially low reimbursement rates estimated at 61% to 81% below competitive levels, amounting to an estimated \$22.9 billion in suppressed reimbursements.<sup>112</sup> Similarly, RealPage’s self-appointed mission of helping its landlords “driv[e] every possible opportunity to increase price” is best achieved by recommending joint-profit-maximizing rents; and, as one executive noted, as more landlords enroll, the easier it is for them to “move in unison versus against each other.”<sup>113</sup> The dissemination by a central authority of joint-profit-maximizing price strategies easily overcomes the first challenge of cartel formation: reaching terms of collusive coordination. However, the spokes must ‘accept’ the invitation to collude.

Step 2: the spokes adopt the TPPA’s supracompetitive price recommendations. In *Interstate Circuit*, each spoke raised the

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versus against each other” and that its “core value proposition creates a self-reinforcing feedback loop”); EZRACHI & STUCKE, *supra* note 44, at 42 (“[T]he market behavior of the competitors could be ‘magically’ aligned, when they all use a similar ‘brain’ to determine their price strategy.”).

<sup>110</sup> Rebecca Pifer Parduhn, *AMA Sues MultiPlan, Insurers, Alleging ‘Cartel’ to Fix Physician Prices*, HEALTHCARE DIVE (Oct. 25, 2024), <https://www.healthcaredive.com/news/american-medical-association-multiplan-lawsuit-price-fixing/730963/> [https://perma.cc/24QG-VYSL].

<sup>111</sup> Chris Hamby, *Insurers Reap Hidden Fees by Slashing Payments. You May Get the Bill.*, N.Y. TIMES (Apr. 7, 2024), <https://www.nytimes.com/2024/04/07/us/health-insurance-medical-bills.html> [https://perma.cc/SUQ5-YRGG].

<sup>112</sup> Dave Muoio, *MultiPlan, Major Payers Again Accused of Conspiring to Limit Provider Reimbursement*, FIERCE HEALTHCARE (Apr. 29, 2024), <https://www.fiercehealthcare.com/payers/multiplan-major-payers-again-accused-colluding-new-provider-class-action> [https://perma.cc/6UKN-NMAN].

<sup>113</sup> Amended Complaint, *United States v. RealPage, Inc.*, *supra* note 109, at 1 (RealPage describing its goal as “everybody succeeding versus essentially trying to compete against one another”).



price knowing its rivals received the same invitation.<sup>114</sup> The same logic applies here: for a subscriber to accept a TPPA's supracompetitive recommendation, it must know that its rivals are following the same instructions—assurance the TPPA has every incentive to convey.<sup>115</sup> Just as Interstate Circuit listed the competing film distributors on the same letterhead, RealPage allegedly provides each client with a “peer list” of rivals whose data informs its rent recommendations, which clients can review and supplement.<sup>116</sup> Cendyn made similar efforts to publicize its adopters to participating and prospective hotels.<sup>117</sup>

Finally, Step 3: the spokes must “resist the temptation” to undercut and capture short-term profits.<sup>118</sup> Therefore, the TPPA must facilitate a reward-punishment strategy. From the vantage point of cartel manager, a TPPA leveraging price transparency, continuous market data, and real-time pricing recommendations is particularly poised to detect defections and orchestrate retaliation.<sup>119</sup> If subscriber A undercuts, the TPPA can immediately direct rivals B and C to respond, making deviation irrational before it occurs. TPPAs also deploy more visible enforcement mechanisms: the Department of Justice (“DOJ”)

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<sup>114</sup> *Interstate Circuit*, 306 U.S. at 226.

<sup>115</sup> U.K. COMPETITION & MKTS. AUTH., PRICING ALGORITHMS: ECONOMIC WORKING PAPER ON THE USE OF ALGORITHMS TO FACILITATE COLLUSION AND PERSONALIZED PRICING 26 (2018),

[https://assets.publishing.service.gov.uk/media/5bbb2384ed915d238f9cc2e7/Algorithms\\_econ\\_report.pdf](https://assets.publishing.service.gov.uk/media/5bbb2384ed915d238f9cc2e7/Algorithms_econ_report.pdf) [<https://perma.cc/NQX4-53FJ>].

<sup>116</sup> *In re RealPage, Inc., Rental Software Antitrust Litig. (No. II)*, No. 3:23-MD-03071, slip op. at 7 (M.D. Tenn. Dec. 28, 2023), [https://www.govinfo.gov/content/pkg/USCOURTS-tnmd-3\\_23-cv-00979/pdf/USCOURTS-tnmd-3\\_23-cv-00979-1.pdf](https://www.govinfo.gov/content/pkg/USCOURTS-tnmd-3_23-cv-00979/pdf/USCOURTS-tnmd-3_23-cv-00979-1.pdf) [<https://perma.cc/H7A5-GV6A>].

<sup>117</sup> *Not Using Rainmaker?* (video), Rainmaker (archived Sept. 19, 2019), <https://web.archive.org/web/20190919213721/https://blog.letitrain.com/resources/video-not-using-rainmaker>.

<sup>118</sup> U.K. COMPETITION & MKTS. AUTH., *supra* note 115, at 26; *In re RealPage, Inc. (No. II)*, No. 3:23-md-03071 at 7 (“After all, if RealPage recommends increased rents to ten clients in a particular market and nine of those clients adopt the increases but one chooses to undercut the others, the one client with lower rent prices may attract more renters while the others suffer from increased vacancies.”).

<sup>119</sup> Joseph E. Harrington, Jr., *The Challenges of Third-Party Pricing Algorithms for Competition Law*, 26 THEORETICAL INQUIRIES L. 123, 131 (2025) (“[A] third party is in a good position to threaten and impose punishment.”).

alleged that RealPage pushes a feature whereby its price ‘recommendations’ are auto-accepted within certain parameters unless a property manager actively overrides them,<sup>120</sup> while any override requires “specific business commentary” reviewed by a personalized “pricing advisor.”<sup>121</sup> These pricing advisors have “accountability conversation[s]” to refresh client landlords on their “long-term goals,” and may even escalate non-cooperation to regional management.<sup>122</sup>

Hence, TPPAs help not only to solve cartel problem one, but also cartel problem two of deterring defection, thereby engineering disciplined and durable coordination. Cendyn has touted that its hotel clients accept GuestRev’s recommendations 90% of the time.<sup>123</sup> The DOJ alleged that RealPage’s landlord clients accept its recommendations within 5% of its rent recommendations over 85% of the time.<sup>124</sup> Few traditional cartels boast such compliance.<sup>125</sup>

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<sup>120</sup> Amended Complaint, *United States v. RealPage, Inc.*, *supra* note 109, at 24; COUNCIL ECON. ADVISERS, THE COST OF ANTICOMPETITIVE PRICING ALGORITHMS IN RENTAL HOUSING (2024), <https://bidenwhitehouse.archives.gov/cea/written-materials/2024/12/17/the-cost-of-anticompetitive-pricing-algorithms-in-rental-housing/> (noting that RealPage “pushes its software users to turn on the auto-accept setting so that price recommendations are automatically accepted”).

<sup>121</sup> Amended Complaint, *United States v. RealPage, Inc.*, *supra* note 109, at 25; COUNCIL ECON. ADVISERS, *supra* note 120 (explaining that “the process of rejecting a price recommendation [by RealPage] can be onerous . . . in order to reject a recommendation from AIRM software, users must provide a ‘business’ reason for doing so, and they must do so separately for each floorplan in the building”).

<sup>122</sup> Amended Complaint, *United States v. RealPage, Inc.*, *supra* note 109, at 26; *In re RealPage, Inc. (No. II)*, No. 3:23-md-03071 at 8 (“To ensure clients remain[] in the 80 to 85% acceptance rate target that RealPage s[ees] . . . Pricing Advisors often spen[d] considerable time . . . educat[ing] clients on the pricing methodology and associated benefits of accepting all, or almost all RealPage pricing recommendations, despite increasing vacancy rates.”).

<sup>123</sup> *Gibson*, slip op. at 9.

<sup>124</sup> Amended Complaint, *United States v. RealPage, Inc.*, *supra* note 109, at 29.

<sup>125</sup> Herbert Hovenkamp & Thibault Schrepel, *Cartel Management Services* (2026) (working paper, The Wharton School Research Paper), <http://dx.doi.org/10.2139/ssrn.6318841>.

## II. WHAT IS AGREEMENT?

Having discussed the economics of collusion in Part I, this Article turns next to the legal standards governing it—in particular, the doctrine of agreement.

Horizontal coordination is only unlawful in the presence of an ‘agreement,’ the “essence” of a Section 1 claim,<sup>126</sup> while unilateral action is lawful. However, courts have long struggled to define this line. An express exchange of mutual assurances is a per se unlawful agreement,<sup>127</sup> while tacit collusion—mere follow-the-leader pricing—is presumptively lawful.<sup>128</sup> But tacit collusion requires firms to communicate their mutual intentions to follow a cooperative reward-punishment scheme (just as in express collusion) only using price signals, the language of markets, instead of spoken language.<sup>129</sup> Courts have acknowledged that a “wink and a nod can mean more than words,”<sup>130</sup> and have accordingly insisted that unlawful agreements may be either “*tacit* or *express*” (emphasis added).<sup>131</sup> This yields a tension: “how is including *tacit agreement* consistent with excluding *tacit collusion*?”<sup>132</sup>

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<sup>126</sup> *Alvord-Polk, Inc. v. F. Schumacher & Co.*, 37 F.3d 996, 999 (3d Cir. 1994); *In re Baby Food Antitrust Litig.*, 166 F.3d 112, 117 (3d Cir. 1999) (“[A]n agreement is the hallmark of a Section 1 claim”).

<sup>127</sup> *United States v. Socony-Vacuum Oil Co.*, 310 U.S. 150, 224 n. 59 (1940).

<sup>128</sup> *Theatre Enters., Inc. v. Paramount Film Distrib. Corp.*, 346 U.S. 537, 540–41 (1954) (“[T]his Court has never held that proof of parallel business behavior conclusively establishes agreement.”); *Williamson Oil Co. v. Philip Morris USA*, 346 F.3d 1287, 1291 (11th Cir. 2003) (“[Tacit collusion is] a perfectly legal phenomenon commonly associated with oligopolistic industries”); *Todorov v. DCH Healthcare Auth.*, 921 F.2d 1438, 1438 n.30 (11th Cir. 1991) (“[E]vidence of conscious parallelism does not permit an inference of conspiracy”).

<sup>129</sup> Some have argued, therefore, that “explicit communication” between rivals should be the standard for establishing an agreement, as “any more inclusive definition could easily be interpreted to condemn conscious parallelism.” See William H. Page, *Communication and Concerted Action*, 38 LOY. U. CHI. L.J. 405, 434–35 (2007).

<sup>130</sup> *Esco Corp. v. United States*, 340 F.2d 1000, 1007 (9th Cir. 1965).

<sup>131</sup> *Bell Atl. Corp. v. Twombly*, 550 U.S. 544, 553 (2007) (quoting *Theatre Enters., Inc. v. Paramount Film Distrib. Corp.*, 346 U.S. 537, 540 (1954)); Page, *supra* note 23, at 596 (noting that the lower courts have quoted the phrase “dozens of times” since the *Twombly* decision).

<sup>132</sup> Page, *supra* note 23, at 466; George A. Hay, *Oligopoly, Shared Monopoly, and Antitrust Law*, 67 CORN. L. REV. 439, 466 (1982) (“[I]f

Part II explains that this tension can be most coherently resolved by drawing the line marking agreement not with respect to formal qualities—whether parties met or exchanged verbal promises—but with respect to economic effects. An unlawful agreement is best understood as “a form of coordination brought about by means that have no significant efficiency justification . . . and that courts can practically regulate.”<sup>133</sup> In other words, “[e]stablishing an agreement is not so much whether a ‘meeting of the minds’ in the common law contract sense existed as whether these are types of behavior that the law should suppress.”<sup>134</sup>

Any Section 1 violation must be (1) concerted action, and (2) an unreasonable restraint of trade.<sup>135</sup> Tacit collusion is concerted and undoubtedly restrains trade—it is an implicit scheme to cease competing on price and output—but it is not unreasonable, because the costs of enjoining it exceed the costs of tolerating it. First, consider the problem of remedy: courts cannot prohibit basic communication through prices without undermining the very mechanism through which markets allocate resources; prohibiting public price announcements altogether or imposing judicial price controls are both cures worse than the disease. Second, consider the problem of proof: parallel conduct alone is consistent with either lawful independent behavior or unlawful

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the concept of tacit agreement does not extend to this kind of oligopolistic coordination, what, if anything, does it include?”); William E. Kovacic, Robert C. Marshall, Leslie M. Marx & Halbert L. White, *Plus Factors and Agreement in Antitrust Law*, 110 MICH. L. REV. 393, 405 (2011) (“The line that distinguishes tacit agreements (which are subject to section 1 scrutiny) from mere tacit coordination stemming from oligopolistic inter dependence (which eludes section 1’s reach) is indistinct.”).

<sup>133</sup> Page, *supra* note 23, at 609.

<sup>134</sup> Herbert Hovenkamp, *The Pleading Problem in Antitrust Cases and Beyond*, 95 IOWA L. REV. BULL. 55, 62 (2010).

<sup>135</sup> 15 U.S.C. § 1 (prohibiting “[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”); NCAA v. Bd. of Regents of Univ. of Okla., 468 U.S. 85, 98 (1984) (“[T]he Sherman Act was intended to prohibit only unreasonable restraints of trade.”); *see also* Alvord-Polk, Inc. v. F. Schumacher & Co., 37 F.3d 996, 999, 999 n.1 (3d Cir. 1994) (“[S]ection 1 liability is predicated upon some form of concerted action . . . . The term ‘concerted action’ is often used as shorthand for any form of activity meeting the section 1 ‘contract, combination or conspiracy’ requirement.”).

conspiracy, making it an unreliable basis for inferring agreement without risking overdeterrence of lawful conduct.

The doctrine of tacit agreement, by contrast, covers forms of anticompetitive coordination that involve an intentional and avoidable step beyond mere interdependence, even if they fall short of an express agreement. Unlike communication through basic public price signals, such practices are not ancillary to productive trade, as their efficiencies can be achieved through less anticompetitive means. The justificatory problems of remedy and proof that exonerate tacit collusion do not apply: courts can isolate and prohibit the anticompetitive mechanism without also condemning conduct that benefits consumers. Hence, the costs of tolerating such practices exceed the costs of prohibiting them, making them unreasonable restraints of trade. Examples include private price announcements, information exchanges, and—as Part III shows—pricing algorithms.

For clarity, it is helpful to think of parallel conduct as falling into one of four categories: (1) Pure independence (not concerted, not unreasonable); (2) Tacit collusion (concerted, but not unreasonable); (3) Tacit agreement (concerted and unreasonable); (4) Express agreement (concerted and unreasonable).<sup>136</sup>

Part II draws out the critical distinction between (2) lawful tacit collusion and (3) unlawful tacit agreement. First, Section A explains tacit collusion and its efficiency justifications, rooted in the error-cost problems of remedy and proof. Then, Section B explains the doctrine of tacit agreement, which covers non-express forms of coordination that lack such efficiency rationales.

#### A. TACIT COLLUSION

Tacit collusion is unactionable under the Sherman Act, meaning one of the following must be true: (1) it is not concerted;<sup>137</sup> (2) it is not unreasonable; or (3) it is neither concerted nor unreasonable.<sup>138</sup> This Section defends the second: tacit collusion is concerted, but not unreasonable.

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<sup>136</sup> See Page, *supra* note 23, at 601–02.

<sup>137</sup> Richard A. Posner, *Oligopoly and the Antitrust Laws: A Suggested Approach*, 21 STAN. L. REV. 1562, 1576 (1969) (“Since section 1 reaches only concerted activity . . . we must decide whether noncompetitive pricing by oligopolists can fairly be so classified.”).

<sup>138</sup> *In re Ins. Brokerage Antitrust Litig.*, 618 F.3d 300, 339 n.19 (3d Cir. 2010) (“[Conscious parallelism] is not, without more, sufficient

First, tacit collusion is concerted. Courts have defined an unlawful agreement as “consciousness of commitment to a common scheme,” a “unity of purpose,” or a “meeting of minds.”<sup>139</sup> Yet these formulations apply just as easily to lawful tacit collusion.<sup>140</sup> Tacit collusion is “quite literally a meeting of the minds or mutual understanding even if there is no overt communication.”<sup>141</sup> In the canonical debate between Judge Richard Posner and Professor Donald Turner over the proper treatment of tacit collusion, both nonetheless agreed that it amounts to concerted activity.<sup>142</sup> Judge Posner analogized tacit

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evidence of a § 1 violation, both because it is not an agreement within the meaning of the Sherman Act, and because it is resistant to judicial remedies.”); *see also In re Flat Glass Antitrust Litig.*, 385 F.3d 350, 359–60 (3d Cir. 2004) (“There are two primary bases for this approach [to conscious parallelism] . . . . First, there exists the notion that interdependent behavior is not an ‘agreement’ within the term’s meaning under the Sherman Act . . . . Second . . . judicial remedies are incapable of addressing the anticompetitive effects of consciously parallel pricing.”).

<sup>139</sup> *United States v. Standard Oil Co.*, 316 F.2d 884, 890 (7th Cir. 1963); *Am. Tobacco Co. v. United States*, 328 U.S. 781, 810 (1946); *see also Edward J. Sweeney & Sons, Inc. v. Texaco, Inc.*, 637 F.2d 105, 111 (3d Cir. 1980).

<sup>140</sup> Gavil et al., *supra* note 42, at 318 (“It is tempting but ultimately unpersuasive to identify an agreement under the antitrust laws from circumstantial evidence in parallel pricing cases by applying common judicial definitions that sound in contract, like a ‘meeting of the minds’ or ‘conscious commitment to a common scheme,’ which were used in some of the earlier Supreme Court cases. The reason: a court conscientiously applying these definitions would be led mistakenly to infer an agreement merely from the consciously parallel interaction among oligopolists. When one firm in an oligopoly raises its price, and each of the others follows that lead, the definitions are arguably satisfied: the first price increase is an offer; those that follow are acceptances; as each observes the other’s actions, they reach a common understanding.”); Hay, *supra* note 132, at 466 (“If ‘meeting of the minds’ is synonymous with ‘agreement,’ then every noncompetitive outcome involves agreement, and antitrust liability could follow from every finding of a noncompetitive outcome.”).

<sup>141</sup> Posner, *supra* note 137, at 1576.

<sup>142</sup> *Id.* (“There is no distortion of accepted meanings, however, in viewing what I have termed tacit collusion as a form of concerted rather than unilateral activity.”); Turner, *supra* note 49, at 665 (“[E]xplicit communication seems hardly a logically necessary ingredient of the kind of agreement that is an element in the legal concept of conspiracy . . . [c]onsidered purely as a problem in linguistic definition, there is no reason to exclude oligopolistic behavior from the scope of the term

collusion to a unilateral contract: one firm publicizes an offer by raising price or restricting output, and its rival accepts by following suit.<sup>143</sup> Professor Turner similarly emphasized that “agreement can be signified by action as well as by words.”<sup>144</sup> The substance of their debate turned not on whether tacit collusion is concerted, but on the economic consequences of prohibiting it.

Turn to Section 1’s second prong: unreasonableness. Section 1 requires courts to weigh a restraint’s competitive effects against its efficiency justifications to determine whether it *unreasonably* restrains trade.<sup>145</sup> Although the statute’s text instructs courts to prohibit “every” restraint of trade,<sup>146</sup> the Supreme Court has since abandoned its initial plain-text

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agreement simply because the circumstances make it possible to communicate without speech.”).

<sup>143</sup> Posner, *supra* note 137, at 1576 (“[Tacit colluders] are much like the parties to a ‘unilateral contract,’ which is treated by the law as a contract rather than as individual behavior. If someone advertises in a newspaper that he will pay \$10 to the person who finds and returns his dog, anyone who meets the condition has an enforceable claim against him for the promised reward . . . . A seller communicates his ‘offer’ by restricting output, and the offer is ‘accepted’ by the actions of his rivals in restricting their outputs as well.”). This dynamic of offer, contemplation, and acceptance is exactly the logic the Supreme Court relied on in *Interstate Circuit*. The Court’s reasoning in *Interstate Circuit* did not hinge on the communication in the letter. See Posner, *supra* note 137, at 1577 (“[With respect to *Interstate Circuit*] the Court’s formulation of the elements of a section 1 conspiracy is easily broad enough to encompass oligopolists who are able without any overt communication to raise price and restrict output in anticipation that each will perceive the advantage of that course of action and adhere to it.”).

<sup>144</sup> Turner, *supra* note 49, at 665.

<sup>145</sup> *NCAA v. Bd. of Regents of Univ. of Okla.*, 468 U.S. 85, 97–98 (1984) (any “anticompetitive limitation on price and output” must be “offset by any procompetitive justification”); *Continental T.V., Inc. v. GTE Sylvania Inc.*, 433 U.S. 36, 36 n.16 (1977) (“The probability that anticompetitive consequences will result from a practice and the severity of those consequences must be balanced against its procompetitive consequences.”); *Jefferson Par. Hosp. Dist. No. 2 v. Hyde*, 466 U.S. 2, 29 (1984) (requiring showing of “actual adverse effect on competition”); *United States v. Microsoft Corp.*, 253 F.3d 34, 59 (D.C. Cir. 2001) (“[A defense includes] a nonpretextual claim that its conduct is indeed a form of competition on the merits because it involves, for example, greater efficiency.”).

<sup>146</sup> 15 U.S.C. § 1.

reading.<sup>147</sup> In *Addyston Pipe & Steel Co. v. United States*, then-Judge (later President, later Chief Justice) Taft interpreted the Sherman Act to codify the English common-law doctrine of restraint of trade,<sup>148</sup> distinguishing unlawful ‘naked restraints,’ which have no purpose but to eliminate competition, from lawful ‘ancillary restraints,’ which may be reasonably necessary to effectuate a productive transaction.<sup>149</sup> As Justice Brandeis observed, writing for the Supreme Court in *Chicago Board of Trade v. United States*, “[e]very agreement concerning trade, every regulation of trade, restrains.”<sup>150</sup> Therefore, following the common-law doctrine and attentive chiefly to the economic evils of monopoly against which the antitrust laws were meant to fortify the republic, the governing standard—called the *rule of reason*—assesses whether a restraint promotes or suppresses competitive trade in the aggregate.<sup>151</sup> To “perfect the operation

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<sup>147</sup> *United States v. Trans-Missouri Freight Ass’n*, 166 U.S. 290, 328 (1897) (“[T]he plain and ordinary meaning of such language is not limited to that kind of contract alone which is in unreasonable restraint of trade, but all contracts are included in such language, and no exception or limitation can be added without placing in the act that which has been omitted by Congress.”); Gavil et al., *supra* note 42, at 116 (the railroads “urged the Court to qualify ‘every’ with a reasonableness standard, [but] the Court rejected their argument,” and the decision “had the ‘virtue of simplicity, but it also had the vice of over inclusiveness”).

<sup>148</sup> See, e.g., *Mitchel v. Reynolds* (1711) 24 Eng. Rep. 347 (QB) (holding that a baker’s covenant not to compete within a parish, given upon assignment of his bakeshop lease, was a reasonable restraint of trade because it was ancillary and necessary to the underlying transaction).

<sup>149</sup> *United States v. Addyston Pipe & Steel Co.*, 85 F. 271, 280 (6th Cir. 1898) (“Restrictions in the articles of partnership upon the business activity of the members, with a view of securing their entire effort in the common enterprise, were, of course, only ancillary to the main end of the union, and were to be encouraged. Again, when one in business sold property with which the buyer might set up a rival business, it was certainly reasonable that the seller should be able to restrain the buyer from doing him an injury which, but for the sale, the buyer would be unable to inflict.”).

<sup>150</sup> *Chi. Bd. of Trade v. United States*, 246 U.S. 231, 239 (1918) (applying the rule of reason test to horizontal agreements).

<sup>151</sup> *Chi. Bd. of Trade*, 246 U.S. at 238 (establishing that “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”); *Standard Oil Co. of N.J. v. United States*, 221 U.S. 1, 52 (1911) (applying a reasonableness



of competitive markets,” antitrust rules necessarily accept some coordination to enable competition in other domains, thereby maximizing consumer welfare and economic efficiency.<sup>152</sup>

The rule of reason requires antitrust doctrine to weigh the aggregate costs and benefits of judicial intervention—including prospective judicial error—on consumer welfare and economic efficiency. As Judge Robert Bork put it, competition is “a term of art signifying any state of affairs in which consumer welfare cannot be increased *by judicial decree*” (emphasis added).<sup>153</sup> Successful antitrust rules therefore minimize the total costs of (1) “anticompetitive practices that escape condemnation,” or false negatives; (2) “competitive practices that are condemned or deterred,” or false positives; and (3) the administrative costs of implementing such rules.<sup>154</sup> This is the ‘error-cost framework’: the application of decision theory “to evaluate whether legal rules promote ‘optimal deterrence.’”<sup>155</sup> Section 1’s per se rule is

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standard assessed with respect to a proto-consumer-welfare principle, considering that “[t]he evils which led to the public outcry against monopolies . . . may be thus summarily stated: 1. The power which the monopoly gave to the one who enjoyed it to fix the price and thereby injure the public; 2. The power which it engendered of enabling a limitation on production; and, 3. The danger of deterioration in quality of the monopolized article”).

<sup>152</sup> Frank H. Easterbrook, *The Limits of Antitrust*, 63 TEX. L. REV. 1, 1 (“A ‘competitive market’ is not necessarily the one with the most rivalry moment-to-moment. The auction in which atomistically small buyers and sellers continuously shout out bids and ask prices, the picture of “perfect competition” found in economic texts, is a hypothetical construct. Every market entails substantial cooperation over some domain in order to facilitate competition elsewhere. Every firm has webs of internal cooperation . . . such cooperation is the basis of economic productivity.”); *see also* R.H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386 (1937) (arguing that firms exist when organizing transactions internally through cooperation is more efficient than relying on competitive market mechanisms).

<sup>153</sup> ROBERT H. BORK, *THE ANTITRUST PARADOX: A POLICY AT WAR WITH ITSELF* 48 (Bork Publishing 2021).

<sup>154</sup> Easterbrook, *supra* note 152, at 16; *see also* Continental T.V., Inc. v. GTE Sylvania Inc., 433 U.S. 36, 50 n.16 (1977) (explaining that antitrust rules rely on “broad generalizations about the social utility of particular commercial practices”).

<sup>155</sup> Jonathan B. Baker, *Taking the Error Out of “Error Cost” Analysis: What’s Wrong with Antitrust’s Right*, 80 ANTITRUST L.J. 1, 7 (2015), <http://dx.doi.org/10.2139/ssrn.2333736>; Herbert Hovenkamp, *Antitrust Error Costs*, 80 ANTITRUST L.J. 293, 293 (2015), <http://dx.doi.org/10.2139/ssrn.3853282> (“When we act on imperfect

its paradigmatic application: direct evidence of an agreement to fix prices, rig bids, or allocate markets establishes unreasonableness without further inquiry,<sup>156</sup> not as a departure from the rule of reason but as a “particularized” application of it.<sup>157</sup> Because naked restraints are so predictably and overwhelmingly anticompetitive, with negligible offsetting

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information, we must estimate not only the probability of an event but also the expected costs of making an error.”). The concept of the error-cost framework was popularized by Judge Easterbrook in his endorsement of a hands-off approach to antitrust. *See* Easterbrook, *supra* note 152, at 3 (“[J]udicial errors that tolerate baleful practices are self-correcting, while erroneous condemnations are not.”).

<sup>156</sup> *Socony-Vacuum*, 310 U.S. at 224 n.59 (“[A] conspiracy to fix prices violates § 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.”).

<sup>157</sup> Gavil et al., *supra* note 42, at 191 (“[T]he ‘per se rule’ is thus not a distinct ‘rule’ at all, but a particularized approach to applying the rule of reason.”).

efficiencies,<sup>158</sup> the per se rule minimizes false negatives and administrative costs<sup>159</sup> despite the rare false positive.<sup>160</sup>

The rule of reason is operationalized through a “three-step, burden-shifting framework,” under which (1) the plaintiff must show anticompetitive effects; (2) the defendant may offer procompetitive justifications; and (3) the plaintiff may then show that those benefits can be achieved through less restrictive

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<sup>158</sup> The *Socony* decision was essentially a reaffirmation of Judge Taft’s naked restraints doctrine from *Addyston Pipe*, in which Taft recognized that practices such as the defendants’ price-fixing agreement serve no purpose but to restrain and are thereby always unreasonable; Taft anticipated modern error-cost logic by observing that such naked restraints are so plainly anticompetitive that entertaining context-specific reasonableness defenses would require courts to “set sail on a sea of doubt!” *United States v. Addyston Pipe & Steel Co.*, 85 F. 271, 283 (6th Cir. 1898); before *Socony* reaffirmed the naked restraints doctrine in the form of a per se rule, the decision in *Chicago Board of Trade* led courts astray by opening the floodgates for defendants to argue that their restraints were reasonable, leading to false-negative errors. *See Appalachian Coals, Inc. v. United States*, 288 U.S. 344, 359–60 (1933) (applying the full-blown rule of reason to a price-fixing agreement and holding it lawful).

<sup>159</sup> *United States v. Container Corp. of Am.*, 393 U.S. 333, 393 (1969) (Marshall, J., dissenting) (“Per se rules always contain a degree of arbitrariness. They are justified on the assumption that the gains from imposition of the rule will far outweigh the losses and that significant administrative advantages will result.”); *State Oil Co. v. Khan*, 522 U.S. 3, 10 (1997) (emphasizing that certain restraints “have such predictable and pernicious anticompetitive effect, and such limited potential for procompetitive benefit, that they are deemed unlawful *per se*”); Robert H. Bork & Ward S. Bowman, Jr., *The Crisis in Antitrust*, 65 COLUM. L. REV. 363, 365 (1965) (“The rule that price-fixing and similar cartel arrangements are illegal per se, that is, incapable of legal justification, must be ranked one of the greatest accomplishments of antitrust.”).

<sup>160</sup> *See United States v. Topco Assocs., Inc.*, 405 U.S. 596, 610 (1972) (holding that horizontal territorial restraints imposed by a cooperative buying association of small and medium-sized grocery chains were unlawful per se under § 1 of the Sherman Act); Gavil et al., *supra* note 42, at 171 (“[T]he territorial restraints adopted by Topco were designed to permit its members to better compete against integrated national chains by offering a low-cost private label brand.”); Harlan M. Blake & William K. Jones, *Toward a Three-Dimensional Antitrust Policy*, 65 COLUM. L. REV. 422, 425 (1965) (“It is entirely conceivable that economic efficiency would be enhanced by the formation of an industry-wide cartel.”).

means.<sup>161</sup> The per se rule can be understood as foreclosing certain reasonableness defenses at step two—such as the purported necessity of competitors to cease competition to charge ‘reasonable’ prices—reflecting the accumulated judicial experience that such defenses lack sufficient justification.<sup>162</sup>

Apply this framework to tacit collusion. Tacit collusion satisfies step one: it is plainly anticompetitive. However, at step two, its core mechanism—communication through public prices—supplies a legitimate efficiency justification: it is ancillary to productive trade and inseparable from the operation of competitive markets. Moreover, that efficiency cannot be salvaged through “less restrictive means,”<sup>163</sup> because any conceivable rule prohibiting communication through basic public price signals would undermine the very process through which markets transmit information about supply and demand to efficiently allocate resources. The false-positive error costs of prohibiting tacit collusion exceed the false-negative error costs

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<sup>161</sup> *Ohio v. Am. Express Co.*, 585 U.S. 529, 565 (2018) (Breyer, J., dissenting). The full-blown rule of reason inquiry requires courts to undertake an extensive inquiry into “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 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.” *Chi. Bd. of Trade v. United States*, 246 U.S. 231, 238 (1918). 97% of cases evaluated under the full-blown rule of reason standard are dismissed at the first stage of showing an anticompetitive effect. See Michael A. Carrier, *The Rule of Reason: An Empirical Update for the 21st Century*, 16 *GEO. MASON L. REV.* 827, 828 (2009).

<sup>162</sup> *United States v. Trenton Potteries Co.*, 273 U.S. 392, 397 (1927) (“The reasonable price fixed today may, through economic and business changes, become the unreasonable price of tomorrow.”); see also Thomas G. Krattenmaker, *Per Se Violations in Antitrust Law: Confusing Offenses With Defenses*, 77 *GEO. L.J.* 165 (1988) (arguing that per se rules are better understood as precluding certain affirmative defenses than as categorically defining classes of unlawful conduct).

<sup>163</sup> The agencies have indicated that one way of assessing whether a restraint is “reasonably necessary” for some efficiency-enhancing purpose is by asking whether the same benefit could be achieved through “practical, significantly less restrictive means.” See U.S. DEP’T OF JUSTICE & FED. TRADE COMM’N, *ANTITRUST GUIDELINES FOR COLLABORATIONS AMONG COMPETITORS* 9 (Apr. 2000), [https://www.ftc.gov/sites/default/files/documents/public\\_events/joint-venture-hearings-antitrust-guidelines-collaboration-among-competitors/ftcdojguidelines-2.pdf](https://www.ftc.gov/sites/default/files/documents/public_events/joint-venture-hearings-antitrust-guidelines-collaboration-among-competitors/ftcdojguidelines-2.pdf) [<https://perma.cc/S845-48LP>].

of permitting it, rendering tacit collusion a *reasonable* restraint of trade.

This legal justification rests on two foundations: first, the absence of a workable remedy; second, the evidentiary inability of parallel conduct, standing alone, to distinguish an efficient from an inefficient means of coordination. The following subsections examine each in turn.

### *1. The Problem of Remedy*

The first reasonableness defense for tacit collusion is the problem of remedy. The two conceivable remedial approaches—barring disclosure of public prices or imposing judicial price controls—would deter more efficient conduct than inefficient.

The root difficulty is that tacit collusion is unavoidable in oligopolistic competition.<sup>164</sup> In a market with one hundred sellers, a firm that cuts price and doubles output captures only one ninety-ninth of each rival's sales—a negligible effect; in a market with three sellers, the same move costs each rival half its sales, inviting retaliation.<sup>165</sup> Oligopolists therefore cannot help but take their rivals' anticipated reactions into account when setting prices,<sup>166</sup> making their conduct functionally indistinguishable from that of the firm in the competitive market: both are simply “setting the ‘profit-maximizing’ price in light of all market facts.”<sup>167</sup> Even if a court determined that firms had coordinated using public prices, “there would be nothing practical that a court could order the parties to do to correct it.”<sup>168</sup>

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<sup>164</sup> Turner, *supra* note 49, at 665–66 (“[T]he rational oligopolist is behaving in exactly the same way as is the rational seller in a competitively structured industry”).

<sup>165</sup> *Id.* at 665 (“They will inevitably react, for example, to a price cut on his part because otherwise the price cut will make a substantial inroad on their sales”).

<sup>166</sup> *Id.* (“The rational oligopolist simply takes one more factor into account—the reactions of his competitors to any price change that he makes.”).

<sup>167</sup> *Id.* at 666 (“In a significant sense, 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.”).

<sup>168</sup> Gavil et al., *supra* note 42, at 318; *see also In re Ins. Brokerage Antitrust Litig.*, 618 F.3d 300, 321 n.19 (3d Cir. 2010) (“[Conscious parallelism] is not, without more, sufficient evidence of a § 1 violation”).

Interdependence is an unavoidable product of oligopoly, a mere condition of the market. The antitrust laws, meanwhile, prohibit *conduct*, not mere conditions of the market<sup>169</sup>—Section 1 of the Sherman Act prohibits contracts, combinations, and conspiracies,<sup>170</sup> while Section 5 prohibits unfair methods<sup>171</sup>—

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. . . because it is resistant to judicial remedies.”); *In re Flat Glass Antitrust Litig.*, 385 F.3d 350, 359–60 (3d Cir. 2004) (“[J]udicial remedies are incapable of addressing the anticompetitive effects of consciously parallel pricing.”); Page, *supra* note 23, at 599 (“Courts recognize that simple interdependence is a form of collusion, but one that oligopolists cannot rationally avoid and that courts cannot profitably penalize or enjoin.”); *Clamp-All Corp. v. Cast Iron Soil Pipe Inst.*, 851 F.2d 478, 484 (1st Cir. 1988) (“[I]t is close to impossible to devise a judicially enforceable remedy for ‘interdependent’ pricing. How does one order a firm to set its prices without regard to the likely reactions of its competitors?”).

<sup>169</sup> *Ethyl*, 729 F.2d at 137 (“The mere existence of an oligopolistic market structure in which a small group of manufacturers engage in consciously parallel pricing of an identical product does not violate the antitrust laws . . . [Oligopoly] represents a condition, not a ‘method.’”). This principle is also core to Section 2 doctrine: monopoly power, standing alone, is not unlawful. Liability requires exclusionary or anticompetitive conduct beyond the mere possession of power, including “growth or development as a consequence of a superior product, business acumen, or historic accident.” *United States v. Grinnell Corp.*, 384 U.S. 563, 571 (1966). To hold otherwise would be to punish competition on the merits—when firms out-compete their rivals on price, quality, or innovation—which is precisely the behavior antitrust law is meant to encourage. *Verizon Comm’n Inc. v. Law Offs. of Curtis V. Trinko, LLP*, 540 U.S. 398, 407 (“The opportunity to charge monopoly prices—at least for a short period—is what attracts ‘business acumen’ in the first place; it induces risk taking that produces innovation and economic growth.”); *Brunswick Corp. v. Pueblo Bowl-O-Mat, Inc.*, 429 U.S. 477, 488 (1977) (“[T]he antitrust laws . . . were enacted for the ‘protection of competition, not competitors.’” (quoting *Brown Shoe Co. v. United States*, 370 U.S. 294, 344 (1962))). The same logic applies to oligopoly: condemning concentrated market structure alone, without more, risks deterring competitive vigor.

<sup>170</sup> 15 U.S.C. § 1.

<sup>171</sup> 15 U.S.C. § 45(a). Although the FTC Act extends beyond the Sherman Act in some respects, it is generally understood at least to incorporate the Sherman Act’s efficiency-oriented rule-of-reason logic. See Fed. Trade Comm’n, *Statement of the Federal Trade Commission on the Issuance of Enforcement Principles Regarding “Unfair Methods of Competition” Under Section 5 of the FTC Act 1* (Aug. 13, 2015), <https://www.federalregister.gov/documents/2015/09/21/2015-23498/statement-of-enforcement-principles-regarding-unfair->

and the only conduct courts might condemn is inseparable from ordinary competitive behavior.

The first conceivable remedy—barring firms from publicly disclosing prices—is plainly untenable. Prices transmit critical information about supply and demand to consumers and firms alike. In defense of what the Martha’s Vineyard gas stations admitted to be “cooperative” pricing, the defendants rhetorically asked if they should “not post their prices?”<sup>172</sup> The court “agreed with the implicit answer.”<sup>173</sup> The mechanism of tacit collusion and the mechanism of market communication are inseparable: prohibiting firms from signaling to their rivals through prices necessarily prohibits them from communicating to consumers through prices as well.

The second conceivable remedy—judicial price regulation—fares no better. Faced with parallel price increases, a court could do little more than instruct firms not to charge those prices, effectively imposing price controls. Courts themselves recognize they are “ill-suited” to administer such regimes,<sup>174</sup> for good reason: market prices reflect dispersed knowledge about scarcity and value that no central planner can replicate.<sup>175</sup>

Either remedy would tend to impose greater costs on efficient conduct than the costs of tolerating unavoidable tacit collusion.

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methods-of-competition-under-section-5-of-the (“Section 5 is aligned with the other antitrust laws, which have evolved over time and are guided by the goal of promoting consumer welfare and informed by economic analysis. The result of this evolution is the modern ‘rule of reason.’”); *see also* Fed. Trade Comm’n, *Policy Statement on Unfairness* (Dec. 17, 1980), <https://www.ftc.gov/legal-library/browse/ftc-policy-statement-unfairness> (articulating that the FTC Act—like the Sherman Act—considers the “countervailing benefits to consumers or competition that the practice produces”).

<sup>172</sup> Brief for Defendants-Appellees at 31, *White v. R.M. Packer Co.*, 635 F.3d 571 (1st Cir. 2011).

<sup>173</sup> *White*, 635 F.3d at 585.

<sup>174</sup> *Trinko*, 540 U.S. at 408 (“[This] requires antitrust courts to act as central planners, identifying the proper price, quantity, and other terms of dealing—a role for which they are ill-suited.”).

<sup>175</sup> *See* Hayek, *supra* note 47, at 524–26 (arguing that market prices aggregate dispersed information held by individual actors to coordinate economic activity, a feat central planners cannot replicate).

## 2. The Problem of Proof

The second reasonableness defense for tacit collusion is the problem of proof. Parallel price movements arise for many reasons, not all of them inefficient. Therefore, courts require evidence of an inefficient means of coordination to infer an unlawful agreement, lest they chill beneficial conduct.<sup>176</sup>

Express agreements are proven using direct evidence: hot documents, paper trails, testimony. In their absence, courts can infer an unlawful agreement—tacit or express—from circumstantial evidence, or ‘plus factors’: “avoidable acts that indirectly prove a shared commitment to a common cause.”<sup>177</sup> There is no strict set of plus factors, but common examples include actions against self-interest, invitations to collude, inter-competitor communications, and information exchanges.<sup>178</sup>

The need for plus factors reflects two distinct evidentiary problems. First, without such evidence, parallelism is not even clearly anticompetitive. It may reflect entirely independent—though incidentally identical—responses to shared market conditions. In *Theatre Enterprises, Inc. v. Paramount Film Distributing Corp.*, multiple distributors refused to grant first-run licenses to a suburban theater.<sup>179</sup> Though their conduct was identical, each distributor had an independent economic incentive—irrespective of its rivals’ decisions—to do the same: exclusive licenses with downtown theatres were more profitable because downtown theatres attract more foot traffic.<sup>180</sup> The Supreme Court concluded that this parallel conduct did not,

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<sup>176</sup> *White v. R.M. Packer Co.*, 635 F.3d at 577–78 (“[A]ntitrust doctrine has developed evidentiary standards to minimize the risk that legal conduct will be chilled or punished.”) (citation omitted).

<sup>177</sup> Gal, *supra* note 20, at 102; *Todd v. Exxon Corp.*, 275 F.3d 191, 198 (2d Cir. 2001) (“[I]n the absence of direct ‘smoking gun’ evidence, a horizontal price-fixing agreement may be inferred on the basis of conscious parallelism, when such interdependent conduct is accompanied by circumstantial evidence.”).

<sup>178</sup> *Flat Glass*, 385 F.3d at 360 (“There is no finite set of such criteria; no exhaustive list [of plus factors] exists.”); Christian Bergqvist & Camila Ringeling, *Finding the Ghost in the Shell: EU and US Antitrust Enforcement of AI Collusion*, in *ARTIFICIAL INTELLIGENCE & COMPETITION POLICY* 151, 171 (Alden Abbott & Thibault Schrepel eds., Concurrences 2024).

<sup>179</sup> *Theatre Enters.*, 346 U.S. at 539.

<sup>180</sup> *Id.* at 540.



standing alone, establish a conspiracy.<sup>181</sup> As Judge Posner articulated, the “essential teaching” of *Theatre Enterprises* is that parallel movement does not imply movement toward noncompetitive outcomes.<sup>182</sup> Professor Turner similarly characterized the conduct as “identical but unrelated responses” to common market conditions—not anticompetitive “by any stretch of the imagination.”<sup>183</sup> Parallel price increases may stem from market-wide supply shocks, natural disasters, or a wide range of factors consistent with competition.<sup>184</sup> Inferring agreement from parallel conduct alone would risk false positives, chilling legitimate competition.<sup>185</sup>

Second, even clearly noncompetitive parallelism may not stem from an inefficient means of coordination. In *American Tobacco Co. v. United States*, the Supreme Court inferred a conspiracy between the Big Three cigarette manufacturers—together controlling approximately 90% of the market—from exactly identical price hikes, high market concentration, and declining costs over the alleged period of conspiracy.<sup>186</sup> Yet this evidence has been criticized as “barely sufficient and at worst

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<sup>181</sup> *Id.* at 537 (“[P]roof of parallel business behavior does not *conclusively* establish agreement, nor does such behavior *itself* constitute a Sherman Act offense”) (emphasis added).

<sup>182</sup> Posner, *supra* note 137, at 1578.

<sup>183</sup> Turner, *supra* note 49, at 658.

<sup>184</sup> Posner, *supra* note 137, at 1577–78 (“Suppose that there is a rise in the price of a raw material used in fabricating widgets. It would not be surprising if this led to a rise in the market price of widgets. If so, not only would every producer have raised his price, but each would know that the others had raised their price. In this sense, their collective action in raising the price of widgets would be ‘consciously parallel.’ But no inference that the price rise was the result of an understanding to move from a competitive to a monopolistic price by contracting output could be drawn. One might, if he liked, say that the widget producers had acted in concert or even by agreement. But there was no agreement in restraint of trade, no interference with market forces.”).

<sup>185</sup> Ezrachi & Stucke, *supra* note 18, at 238 (“The problem is that if one were to reject the prevailing legal viewpoint, we may quickly shift to a Type I error (false positive), where courts reach a positive result (finding the defendants liable for price-fixing) when they should reach a negative one (finding the defendants not liable because they never agreed with one another).”).

<sup>186</sup> *Am. Tobacco Co. v. United States*, 328 U.S. 781, 814–15 (1946) (explaining all three firms raised their list prices to exactly \$6.85 per thousand cigarettes on the same day, and between 1928 and the trial in 1943, they made only seven price changes—each identical across the three firms—despite declining input and manufacturing costs).

inadequate” to establish an unlawful agreement.<sup>187</sup> While clearly noncompetitive,<sup>188</sup> the behavior was equally consistent with either an agreement or mere oligopolistic interdependence.<sup>189</sup> Absent evidence of the former, inferring liability effectively collapses into a prohibition on interdependence itself. Reflecting this concern, the Court has since emphasized that evidence of “conduct as consistent with permissible competition as with illegal conspiracy” does not support liability.<sup>190</sup>

The agreement doctrine accounts for the *paradox of proof*, as Professor Louis Kaplow terms it.<sup>191</sup> Evidence that market conditions make an unlawful agreement sustainable—such as market concentration, homogeneous products, and transparent prices—also make mere tacit collusion more sustainable, “restat[ing] the phenomenon of interdependence” rather than distinguishing it from agreement.<sup>192</sup> If anything, the easier it is to coordinate pricing at a distance, the less firms are incentivized to do so by risky and unlawful means, making such evidence particularly susceptible to false-positive inferences.<sup>193</sup> Courts therefore require evidence of an ‘avoidable act’ to avoid chilling lawful conduct. Hence, the “most important evidence” tends to be that which points to a “traditional conspiracy”: ‘plus factors’

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<sup>187</sup> Gavil et al., *supra* note 42, at 358.

<sup>188</sup> Turner, *supra* note 49, at 661 (“Any economist worthy of the name would immediately brand this price behavior as noncompetitive.”).

<sup>189</sup> *Twombly*, 550 U.S. at 554 (“The inadequacy of showing parallel conduct or interdependence, without more, mirrors the behavior’s ambiguity: consistent with conspiracy, but just as much in line with a wide swath of rational and competitive business strategy unilaterally prompted by common perceptions of the market.”).

<sup>190</sup> *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 475 U.S. 574, 588 (1986).

<sup>191</sup> KAPLOW, *supra* note 52, at 133–45; William H. Page, *Pleading, Discovery, and Proof of Sherman Act Agreements: Harmonizing Twombly and Matsushita*, 82 ANTITRUST L.J. 123, 130 (2018) (“[T]he more concentrated the market, the more likely the rivals will be able to coordinate a price increase by mere interdependence.”); *see also* Christopher R. Leslie, *Antitrust’s Interdependence Paradox*, 111 VA. L. REV. 787 (2025) (arguing that federal courts have paradoxically made price-fixing conspiracies most difficult to prove in oligopoly markets—precisely those most susceptible to collusion).

<sup>192</sup> *Flat Glass*, 385 F.3d at 360–66; Hay, *supra* note 132, at 467 (observing that plus factor analysis often does not adequately “separate out conduct that should survive antitrust scrutiny”).

<sup>193</sup> Kaplow, *supra* note 47, at 760.

which serve as “proxies for direct evidence of an agreement.”<sup>194</sup> However, as the next Section illustrates, evidence suggesting a traditional conspiracy is not the only way to tie coordination to an avoidable and inefficient practice.

In this sense, the evidentiary demands of the agreement doctrine “hedge[] against false inferences from identical behavior.”<sup>195</sup> The problems of remedy and proof together explain why tacit collusion is treated as a reasonable restraint: the law cannot feasibly prohibit it without condemning conduct that is inseparable from competitive markets. Nonetheless, the law properly reaches avoidable acts that courts can target without generating those same error costs.

## B. TACIT AGREEMENT

Contrary to lawful tacit collusion, firms strike an unlawful *tacit agreement* when they coordinate without resorting to the ‘forbidden process,’ but nonetheless through “means that do not benefit consumers and that courts can practically identify and deter in litigation.”<sup>196</sup> Tacit agreements are struck through ‘avoidable acts,’ or “facilitating practices,” which constitute “plus factors.”<sup>197</sup> While interdependence is an unavoidable product of oligopolistic competition, tacit agreements involve an “extra something” that is clearly inefficient and that courts can feasibly prohibit.<sup>198</sup> That is, the error-cost problems of remedy

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<sup>194</sup> *Flat Glass*, 385 F.3d at 360–61 (“The most important evidence will generally be non-economic evidence . . . of traditional conspiracy, or 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.”) (quoting PHILLIP E. AREEDA & HERBERT HOVENKAMP, *ANTITRUST LAW* 243 (2d ed. 2000)).

<sup>195</sup> *Twombly*, 550 U.S. at 554 (writing that the Court’s doctrine “hedge[s] against false inferences from identical behavior”).

<sup>196</sup> Page, *supra* note 23, at 599.

<sup>197</sup> *Todd v. Exxon Corp.*, 275 F.3d at 198 (“[A] horizontal price-fixing agreement may be inferred on the basis of conscious parallelism, when such interdependent conduct is accompanied by circumstantial evidence and plus factors such as defendants’ use of facilitating practices.”).

<sup>198</sup> Gavil et al., *supra* note 42, at 381 (“If agreement is evidenced by something beyond merely parallel price behavior, then a court can, in principle, enjoin that extra ‘something.’ But absent that extra ‘something,’ the only injunctive remedy is judicial price regulation—objectionable on a number of grounds.”); Hay, *supra* note 132, at 486

and proof that foreclose liability for mere tacit collusion do not justify exonerating tacit agreements. The doctrine of tacit agreement thus occupies the middle ground between express agreement and tacit collusion: the act facilitating coordination may not be as nakedly without justification as an express agreement, but its costs nonetheless outweigh its benefits, rendering it an unreasonable restraint of trade.

A paradigmatic category of tacit agreement—and an instructive contrast to coordination through public prices—results from communication “with no public purpose.”<sup>199</sup> Unlike public price announcements, which communicate useful information to consumers and other market actors, purely private price announcements or suggestions—particularly those regarding future price changes, which strongly facilitate coordination—serve no such efficiency-enhancing purpose. In *United States v. Foley*, a group of Washington, D.C. realtors gathered for a private dinner, at which the host stood up and announced that, while “he did not care what the others did,” he planned to increase his commission rate from six to seven percent.<sup>200</sup> This announcement reached only other competitors,<sup>201</sup> several of whom ultimately followed.<sup>202</sup> Although no explicit promises were exchanged, the private communication served no consumer-facing purpose and constituted an avoidable act, such that prohibiting it carries minimal risk of substantial error costs.

As technology has evolved, so have the means of executing tacit agreements, broadening the scope of the doctrine to include nominally public, though functionally private, information exchanges. In *United States v. Airline Tariff Publishing Co.*, the Airline Tariff Publishing Company (“ATPCO”) operated a central clearinghouse for distributing information about airline

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(“[Tacit agreement is when] the defendants have taken specific avoidable acts that produce a consensus on the price”).

<sup>199</sup> *Holiday Wholesale Grocery Co. v. Philip Morris, Inc.*, 231 F. Supp. 2d 1253, 1277 (2002).

<sup>200</sup> *United States v. Foley*, 598 F.2d 1323, 1332 (4th Cir. 1979); see also Gavil et al., *supra* note 42, at 363 (“If firm representatives meet for dinner one day, and all raise price the next, courts may conclude that the firms reached an unlawful price-fixing deal over dessert.”).

<sup>201</sup> Page, *supra* note 23, at 615–16 (“The statements had no credible efficiency justification or purpose; they conveyed no information to consumers . . . because only competitors were present.”).

<sup>202</sup> *Foley*, 598 F.2d at 1332 (“[E]ach defendant did in fact begin to take substantial numbers of seven percent listings . . .”).

fares, through which airlines could submit proposed future fare changes visible to rival airlines, travel agents, and consumers alike.<sup>203</sup> The airlines exploited this infrastructure to signal planned fare increases days in advance, and, using nominally administrative fare identifiers, linked proposals across routes in ways that rivals could interpret but consumers could not.<sup>204</sup> If the proposed increase was not matched, the airline would delay the effective date, holding the invitation open until competitors followed.<sup>205</sup> The resulting coordination arose without any express agreement.

The airlines argued that their conduct therefore amounted to mere lawful interdependence—that “all firms price in response to the actions of their competitors.”<sup>206</sup> They further contended that advance disclosure benefitted consumers by informing them of upcoming price changes<sup>207</sup>—a legitimate justification, since public announcements of future prices can in principle be efficiency-enhancing and are sometimes mandated by other domains of law.<sup>208</sup> The DOJ countered, however, that consumers could not purchase tickets at the proposed fares, rendering them inert for consumers while functioning as a potent language for coordination between rivals.<sup>209</sup> Whatever certainty advance disclosure might in principle provide, it could be achieved through less restrictive means: for instance, airlines could simply guarantee that fares would not increase for a defined window after a purchase, delivering price certainty directly to consumers

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<sup>203</sup> United States v. Airline Tariff Pub. Co., 836 F. Supp. 9, 10 (D.D.C. 1993).

<sup>204</sup> Severin Borenstein, *Rapid Communication and Price Fixing: The Airline Tariff Publishing Company Case (1994)*, in JOHN E. KWOKS & LAWRENCE J. WHITE, *THE ANTITRUST REVOLUTION: ECONOMICS, COMPETITION, AND POLICY* 310, 312–16 (3d ed. 1999), <https://www.law.berkeley.edu/wp-content/uploads/2015/04/Borenstein-Airline-Tariff-Publishing-Case-Antitrust-Revolution-3d-ed-1999.pdf> [https://perma.cc/UXB8-UBW8]; see Page, *supra* note 23, at 633–34.

<sup>205</sup> Borenstein, *supra* note 204, at 316.

<sup>206</sup> *Id.* at 317.

<sup>207</sup> *Id.* at 317–18.

<sup>208</sup> See Richard M. Steuer, John Roberti & Daniel Jones, *The Application of Antitrust to Public Companies' Disclosures*, 63 ADMIN. L. REV. 159, 159–60 (2011) (exploring the tension created when public companies' disclosure obligations under securities law can facilitate price coordination among competitors and arguing for immunity to be extended to most statements made on investor calls).

<sup>209</sup> Borenstein, *supra* note 204, at 320.

without broadcasting intended future prices to competitors.<sup>210</sup> The consent decree ultimately required the airlines to cease using fare basis codes and footnote designators to convey anything beyond basic fare information, to stop linking fares across routes through such codes, and to cease pre-announcing planned price increases except in the context of widely advertised sales.<sup>211</sup>

The logic of the DOJ's argument and of the resulting consent decree was that the purported efficiencies of the shared database were achievable via a practical and significantly less anticompetitive means, pointing to the "extra ingredient[s]" constitutive of an unlawful tacit agreement rather than mere interdependence.<sup>212</sup> This logic anticipates the theory of algorithmic tacit agreement developed in Part III.

The scope and bounds of tacit agreement are not fixed. The purpose of the doctrine is to fill the gap between the antitrust rules governing express agreement and tacit collusion. It makes clear that the 'forbidden process' is sufficient *but not necessary* to establish an unlawful agreement under Section 1.

### III. ALGORITHMIC TACIT AGREEMENT

Having explained the doctrine of tacit agreement in Part II, this Article makes the case in Part III that ATC constitutes a tacit agreement.

Pricing algorithms make collusion identifiable, remediable, and therefore avoidable in ways human tacit collusion is not. Courts can examine an algorithm's code or test its behavior to determine whether it implements a collusive reward-punishment strategy rather than independently optimizing prices (solving the problem of proof).<sup>213</sup> And courts can instruct firms to avoid those specific properties without suppressing public price information, imposing price controls, or chilling the algorithmic properties

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<sup>210</sup> *Id.*

<sup>211</sup> *United States v. Airline Tariff Publ'g Co.*, No. 92-2854, 1994 WL 502091 (D.D.C. Mar. 17, 1994) (final judgment).

<sup>212</sup> Kovacic et al., *supra* note 132, at 405.

<sup>213</sup> Harrington, *supra* note 27, at 350–51 ("The strategy determining price is written down in the algorithm's code which means that it can, in principle, be accessed . . . by 1) an expert's examination of the pricing algorithm's code to determine whether it is a prohibited pricing algorithm; or 2) entering data into the pricing algorithm and monitoring the output in terms of prices to determine whether the algorithm exhibits a prohibited property.").

that enhance efficiency (solving the problem of remedy).<sup>214</sup> That is, courts can be certain to avoid improperly deterring procompetitive behavior, including the use of efficiency-enhancing algorithms. Therefore, the costs of permitting ATC exceed the costs of prohibiting it, making it an unreasonable tacit agreement.

Before examining each scenario, this Part justifies why ATC warrants different legal treatment from ‘human’ tacit collusion and outlines the appropriate doctrinal approach.

#### A. LEGAL APPROACH

This Article does not propose to reinvent the Sherman Act. ATC is unlawful because the logic of the statute and of the rule of reason, properly applied, compels that conclusion when the mechanism of coordination is an algorithm rather than a sign in front of a gas station.

Consider the contrary argument that treating ATC as unlawful “unjustifiably differentiate[s]” between humans and algorithms.<sup>215</sup> In a 2017 speech, former Acting FTC Chair Maureen Ohlhausen introduced the ‘Bob Test’: “[e]verywhere the word ‘algorithm’ appears, please just insert the words ‘a guy named Bob.’”<sup>216</sup> On this logic, separate firms employing their

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<sup>214</sup> Francisco Beneke & Mark-Oliver Mackenrodt, *Remedies for Algorithmic Tacit Collusion*, 9 J. ANTITRUST ENF’T 152, 170 (2021) (“If the benign properties of algorithms can be left unharmed in the case that the software is programmed in such a way as to avoid collusive outcomes, then an injunction or an order to not price interdependently can be feasible. The algorithm could be ordered to avoid profit-maximizing strategies that involve, for example, matching price hikes or raising price because of an expectation that other companies will follow suit.”).

<sup>215</sup> Gal, *supra* note 20, at 106 (“Conscious parallelism that results from algorithms simply mimicking human conduct . . . should not constitute an agreement. Any other rule would unjustifiably differentiate between algorithms and humans.”).

<sup>216</sup> Maureen K. Ohlhausen, Acting Chair, FTC, *Should We Fear the Things That Go Beep in the Night? Some Initial Thoughts on the Intersection of Antitrust Law and Algorithmic Pricing* FTC (May 23, 2017), at 10, [https://www.ftc.gov/system/files/documents/public\\_statements/1220893/ohlhausen\\_-\\_concurrences\\_5-23-17.pdf](https://www.ftc.gov/system/files/documents/public_statements/1220893/ohlhausen_-_concurrences_5-23-17.pdf) [<https://perma.cc/UD3N-U9NP>]; Maxime C. Cohen, *How AI Is Reshaping Pricing Litigation*, ANTITRUST MAG., Spring 2026, [https://www.americanbar.org/groups/antitrust\\_law/resources/magazin](https://www.americanbar.org/groups/antitrust_law/resources/magazin)

own algorithms to play interdependent strategies are “unlikely to create novel liability scenarios,” because firms are “free to set their prices on the basis of all the information legally available to them.”<sup>217</sup> Algorithms are just an added tool, the argument goes, to aid in the collection and analysis of those market facts. As an analogy, if the owners of two gas stations opposite an intersection buy binoculars to better observe each other’s price changes, no court would “ban the use of binoculars just because they can be used to assist in conscious parallelism.” If the court can prohibit pricing algorithms, can it prohibit the use of Excel’s =AVERAGE function,<sup>218</sup> or “the use of math” altogether?<sup>219</sup>

The difference is that the competitive effects of binoculars (or of math, broadly construed) are ambiguous. They may be used to assist conscious parallelism, but they may just as easily be used to compete more effectively. After all, watching a rival’s prices to respond aggressively is the essence of competition. One could not, with confidence, discern whether the resulting strategies are anticompetitive or benign. Even setting that aside, one could not reliably attribute any anticompetitive effect to the binoculars as the specific mechanism of coordination. And even if one could, banning binoculars would chill their procompetitive uses as much as their anticompetitive ones. In other words, the binoculars hypothetical runs into the same error-cost problems of proof and remedy that justify exonerating tacit collusion, as elaborated in Part II.

However, algorithms do not ambiguously observe market information; they codify a set of rules about how to process that information. And crucially, “the properties of pricing algorithms

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e/2026-spring/how-ai-is-reshaping-pricing-litigation/ (referring to Ohlhausen’s quip as the “Bob Test”); see Hannah Garden-Monheit & Ken Merber, *Price Fixing by Algorithm Is Still Price Fixing*, FTC BUS. BLOG (Mar. 1, 2024), <https://web.archive.org/web/20250302174734/https://www.ftc.gov/business-guidance/blog/2024/03/price-fixing-algorithm-still-price-fixing> (“[Y]our algorithm can’t do anything that would be illegal if done by a real person.”).

<sup>217</sup> Ohlhausen, *supra* note 216, at 4.

<sup>218</sup> Complaint at 21, *RealPage, Inc. v. James*, No. 25-cv-9847 (S.D.N.Y. 2025) (arguing that a New York state law regulating algorithmic collusion could be applied to regulating the use of Microsoft Excel to set prices).

<sup>219</sup> *RealPage Sues Berkeley over Unconstitutional Ordinance*, REALPAGE (Apr. 2, 2025), <https://www.realpage.com/news/realpage-sues-berkeley-over-unconstitutional-ordinance/> [<https://perma.cc/7ZXV-P8KB>].



that serve legitimate competitive purposes would not be useful for promoting collusion, while the properties that promote collusion seem quite distinct from those that enhance efficiency.”<sup>220</sup> Therefore, courts can deter the use of algorithms specifically designed to engineer anticompetitive outcomes without chilling their procompetitive alternatives. The underlying claim is that algorithms solve the problem of proof and the problem of remedy. Take each in turn.

First, pricing algorithms can help make the logic behind a firm’s strategies more apparent. Traditionally, courts could not get “inside the heads of managers” to determine whether they are implementing collusive reward-punishment strategies.<sup>221</sup> However, algorithms automate the price-setting process wholesale, and the strategic logic they execute follows predictable computational patterns that can be observed, examined, and tested, meaning one can read the algorithm’s “mind.”<sup>222</sup> While parallel price increases are typically subject to false inferences—they may result from either tacit collusion or from shocks to supply or demand, for instance—algorithms offer insight into the strategic logic behind price setting. Therefore, algorithms solve the problem of proof.

Second, algorithms are remediable. The objection that any remedy would “inevitably lead to price regulation”<sup>223</sup> does not apply. Redesigning, retraining, or deleting an algorithm requires neither price controls nor the suppression of public price information. Hard-coded collusive rules, machine learning models trained to replicate collusive strategies, and subscriptions to anticompetitive third-party pricing algorithms are all ‘extra somethings’—severable mechanisms of harm that courts can practicably prohibit.<sup>224</sup> Moreover, because the specific properties that make algorithms collusive are entirely separate from those which enhance efficiency, a remedy prohibiting the former

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<sup>220</sup> Harrington, *supra* note 27, at 354.

<sup>221</sup> *Id.* at 340.

<sup>222</sup> *Id.* at 360.

<sup>223</sup> Ohlhausen, *supra* note 216, at 4–5.

<sup>224</sup> See David O. Fisher, *Tacit Agreements to Collude: Enforcing Section 1 of the Sherman Act in the Age of Algorithms*, ANTITRUST, Fall 2025, at 30, 32 (“Courts . . . infer[] a tacit agreement only when the defendants engage in communication, information sharing, or other conduct that can be enjoined. In cases where an algorithmic hub serves as a cartel manager, couldn’t courts similarly enjoin the use of shared pricing algorithms that facilitate oligopoly pricing?”) (citations omitted).

would not deter the latter. Therefore, algorithms solve the problem of remedy.

Accordingly, the “design and use” of an anticompetitive algorithm is “an avoidable and intentional act”<sup>225</sup>—a plus factor supporting the inference of an unlawful tacit agreement. The separability of the anticompetitive properties of pricing algorithms from any procompetitive efficiencies establishes unreasonableness, as any purported efficiencies are achievable through less restrictive means.

Algorithms not only defuse the risk of overdeterrence; they also sharply raise the cost of underdeterrence. Traditional doctrine tolerates tacit collusion partly on the assumption that it is hard to sustain—that firms face a constant temptation to defect and that markets tend to self-correct absent explicit communication.<sup>226</sup> Even setting aside the substantial economic literature undermining these premises,<sup>227</sup> they are markedly weaker in the algorithmic context.<sup>228</sup> Traditionally, a gas station owner monitoring his rivals had to drive around town noting prices off competitors’ signs before climbing a ladder to change his own.<sup>229</sup> Meanwhile, machines ingest real-time data and adjust

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<sup>225</sup> Gal, *supra* note 20, at 110.

<sup>226</sup> RICHARD A. POSNER, ANTITRUST LAW: AN ECONOMIC PERSPECTIVE 53 (1976) (“[Cartels] are usually quite unstable even when not forced underground by antitrust enforcement.”); Fisher, *supra* note 224, at 32 (“[S]teadily heightening evidentiary standards [are] premised on long-held assumptions . . . that cartel agreements by nature are unstable.”).

<sup>227</sup> See Baker, *supra* note 155, at 12 (“[C]ontemporary economic scholarship does not support the assertion that oligopolies typically perform competitively . . . many cartels have been long-lasting.”).

<sup>228</sup> Ezrachi & Stucke, *supra* note 18, at 230 (“Some critics, however, have questioned the likelihood of sustainable algorithmic tacit collusion even in these markets. As we explain below, their arguments, however, have failed to persuade enforcers and courts with respect to tacit collusion in the brick-and-mortar economy. Nor are they likely to gain traction in the digital economy.”).

<sup>229</sup> *Id.* at 245 (“To monitor pricing, the gas station owners in Germany would drive past specified competitor gas stations several times a day and note their prices.”); Ohlhausen, *supra* note 216, at 4 (“At 6:00AM one bright clear Monday morning, the owner of the first gas station gets out his ladder and leans it against the big price sign out front. He then climbs up the ladder and changes the price, making it five cents a gallon more expensive . . . . At 10:00AM, he gets the ladder back out and lowers his price back down five cents so his price is now the same as everybody else’s price.”).

prices within milliseconds.<sup>230</sup> Data-driven pricing algorithms amplify the conditions that sustain coordination—transparency, speed, and precision—meaning “algorithmic tacit collusion can arise in markets where such tacit collusion previously among humans would have been unstable.”<sup>231</sup> Accordingly, the expected costs of false negatives—failing to condemn anticompetitive coordination—are substantially higher in the algorithmic context.

Both sides of the error-cost ledger point in the same direction: ATC can be targeted with relatively low risk of overdeterrence, while the costs of underdeterrence are significantly amplified.

### 1. *Doctrinal Approach*

Because the deployment of an anticompetitive pricing algorithm can serve as a plus factor supporting the inference of an unlawful tacit agreement, this subsection outlines a corresponding doctrinal approach to operationalize that showing.

Facilitating practices, such as information exchanges, may support an inference of a per se unlawful price-fixing agreement,<sup>232</sup> but they may also be evaluated directly under the full-blown rule of reason.<sup>233</sup> The distinction between these approaches is not always clear,<sup>234</sup> as both are applications of the same underlying inquiry into a given practice’s reasonableness. However, because some facilitating practices (like information exchanges) can have procompetitive efficiencies and thereby proffer legitimate defenses, they are generally not *in themselves* unlawful per se.<sup>235</sup>

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<sup>230</sup> Ezrachi & Stucke, *supra* note 18, at 246 (highlighting the “shift from a world where rivals drive around town to see the price that their rivals charge to a world in which pricing algorithms can achieve this same price monitoring mechanism within milliseconds”).

<sup>231</sup> *Id.* at 221.

<sup>232</sup> *Todd v. Exxon Corp.*, 275 F.3d 191, 198 (2d Cir. 2001) (“Information exchange is an example of a facilitating practice that can help support an inference of a price-fixing agreement.”).

<sup>233</sup> *Id.* (“There is a closely related but analytically distinct type of claim, also based on § 1 of the Sherman Act, where the violation lies in the information exchange itself.”).

<sup>234</sup> *Id.* (“The state of the law on this issue was not always so clear.”).

<sup>235</sup> *United States v. Citizens & S. Nat’l Bank*, 422 U.S. 86, 113 (1975) (clarifying that “the dissemination of price information is not itself a per se violation of the Sherman Act”); *United States v. U.S.*

Likewise, the adoption of a pricing algorithm is not in itself a *naked* restraint for which the only purpose is to suppress competition. Pricing algorithms can generate various efficiencies, or reasonableness defenses. Nevertheless, the tests developed in the following Sections tend to clearly reveal a coordination-facilitating logic—exhibited only by anticompetitive properties, separate from procompetitive properties—making a full-blown rule of reason inquiry unnecessarily burdensome.

ATC is therefore best analyzed under an abbreviated or ‘quick look’ rule of reason test, reserved for “restraints that are not per se unlawful but are sufficiently anticompetitive on their face that they do not require a full-blown rule of reason inquiry.”<sup>236</sup> The quick-look approach effectively compresses the rule of reason’s three-step burden-shifting analysis: the anticompetitive harm is typically apparent, the burden shifts forcefully to the defendant, and a successful rebuttal proves difficult—though not categorically foreclosed, as under the per se rule.<sup>237</sup>

Apply this to ATC. First, plaintiffs can establish anticompetitive effects using the technical and economic tests developed in the following sections, which reveal when pricing algorithms’ strategies rely on a collusive logic. Second, defendants may respond that those algorithms generate efficiencies. However, at step three, plaintiffs show those efficiencies are separable from the coordination-facilitating properties at issue, and thus achievable via less restrictive (anticompetitive) means. The analysis thus converges quickly on unreasonableness without the need for a full-blown rule of reason inquiry.<sup>238</sup>

The sections that follow specify the relevant tests for each ATC scenario and explain how courts can implement them in practice.

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Gypsum Co., 438 U.S. 422, 441 n.16 (1978) (“[S]uch practices can in certain circumstances increase economic efficiency and render markets more, rather than less, competitive.”).

<sup>236</sup> Cal. Dental Ass’n v. FTC, 128 F.3d 720, 727 (9th Cir. 1997); *see also* Nat’l Collegiate Athletic Ass’n v. Bd. of Regents of Univ. of Okla., 468 U.S. 85 (1984); FTC v. Ind. Fed’n of Dentists, 476 U.S. 447 (1986) (employing abbreviated rule of reason, or ‘quick look,’ test).

<sup>237</sup> Gavil et al., *supra* note 42, at 209.

<sup>238</sup> A version of this burden-shifting framework has been proposed; *see* Gal, *supra* note 20, at 112.

## B. PREDICTABLE AGENT

The *Predictable Agent* scenario is straightforward from an evidentiary standpoint, because the algorithm's pricing rules are hard-coded and can be read directly. A court could invite technical experts to perform a *static test*—an “examination of the program's code without running the program”<sup>239</sup>—to determine whether the algorithm interdependently conditions a firm's price on a rival's behavior, a strategy which plainly contradicts the competitive equilibrium where firms are price takers.<sup>240</sup> Both probability-based algorithms like Amazon's Project Nessie and simple price-matching rules of the form  $[\text{Price} = 0.998 \times (\text{rival's price})]$  are unambiguous examples: an expert examining the code can observe that the algorithm rewards price increases by its rivals with price increases of its own and likewise instantaneously punishes defections.<sup>241</sup>

The properties which tend to facilitate coordination are distinct from the potentially efficiency-enhancing properties of simple pricing algorithms. Instead of being programmed to execute interdependence, simple pricing rules could independently optimize for changing market demand, such as by automatically lowering price in response to declining sales volume.<sup>242</sup>

Unlike human tacit collusion, interdependent algorithms are severable from firm decision-making without chilling efficient practices. Amazon deactivated Project Nessie several times during regulatory investigations.<sup>243</sup> A court could order a similar deactivation by injunction.<sup>244</sup> This approach is

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<sup>239</sup> Harrington, *supra* note 27, at 354.

<sup>240</sup> Gal, *supra* note 20, at 158 (“Under perfect competition a single firm has no influence on the market price but is a price taker.”).

<sup>241</sup> *Id.* at 170 (“The algorithm could be ordered to avoid profit-maximizing strategies that involve, for example, matching price hikes or raising price because of an expectation that other companies will follow suit.”).

<sup>242</sup> Gregory D. Schwartz, Note, *Anticompetitive Interdependence in “Gullible” Pricing Algorithms*, 78 STAN. L. REV. 191, 198 (2026).

<sup>243</sup> Amazon (eCommerce): Revised Redacted Complaint at 126, FTC v. Amazon.com, Inc., No. 2:23-cv-01495-JHC (W.D. Wash. Nov. 2, 2023).

<sup>244</sup> Ariel Ezrachi and Maurice Stucke analogize this approach to a 2014 case of algorithmic fraudulent trading, where the Securities and Exchange Commission charged high frequency trading firm Athena Capital Research with market manipulation for creating an algorithm code-named “Gravy” designed to make a number of rapid-fire trades in

resemblant of *algorithmic disgorgement*: the “enforced deletion of algorithms developed using illegally collected data.”<sup>245</sup> While the approach has more prominently been used in the law of unfair or deceptive trade practices, first employed in the FTC’s 2019 settlement with Cambridge Analytica,<sup>246</sup> this type of remedy can extend to antitrust. An algorithm expressly designed to inflict unlawful injury to competition should be erased entirely.

### C. DIGITAL EYE

The *Digital Eye* scenario requires a slightly different evidentiary approach because machine learning (“ML”) pricing algorithms often operate as “black boxes,” meaning their developers cannot easily trace the specific steps or reasoning behind their outputs.<sup>247</sup> Consequently, rather than cracking open the code and statically inspecting it for specific rules, as in the *Predictable Agent* scenario, experts can employ *dynamic testing*, where a “program is run for selected inputs and the output is observed.”<sup>248</sup> A simple intuition: to decipher an unknown mathematical function that takes X and outputs Y, a reasonable strategy is to experiment with many X’s, observe the Y’s, and back out what the actual function is. In a 2018 study by OpenAI,

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the last two seconds before the market closed in order to artificially inflate stock prices. EZRACHI & STUCKE, *supra* note 44, at 67–68 (“If the executives, for example, call their algorithm Gravy, and tinker with it to better manipulate the market . . . liability could be established.”); *see SEC Charges New York-Based High Frequency Trading Firm With Fraudulent Trading to Manipulate Closing Prices*, SEC Press Release No. 2014–229 (Oct. 16, 2014), <https://www.sec.gov/newsroom/press-releases/2014-229> [<https://perma.cc/65AB-7KYM>].

<sup>245</sup> Bruce D. Sokler, Alexander Hecht & Christian Tamotsu Fjeld, *Algorithmic Disgorgement: An Increasingly Important Part of the FTC’s Remedial Arsenal*, NAT’L L. REV. (Jan. 24, 2024), <https://natlawreview.com/article/algorithmic-disgorgement-increasingly-important-part-ftcs-remedial-arsenal-ai> [<https://perma.cc/G48J-XPX2>].

<sup>246</sup> Cambridge Analytica, LLC, Docket No. 9383 (Fed. Trade Comm’n Sept. 30, 2024) (final order) at 3, [https://www.ftc.gov/system/files/documents/cases/d09389\\_comm\\_final\\_orderpublic.pdf](https://www.ftc.gov/system/files/documents/cases/d09389_comm_final_orderpublic.pdf) [<https://perma.cc/MV3M-AHU4>].

<sup>247</sup> Cynthia Rudin, *Stop Explaining Black Box Machine Learning Models for High-Stakes Decisions and Use Interpretable Models Instead*, 1 NAT. MACH. INTEL. 206, 206–15 (2019), <https://doi.org/10.1038/s42256-019-0048-x>.

<sup>248</sup> Harrington, *supra* note 27, at 354–55.

researchers trained a reinforcement-learning agent to play a platform game called CoinRun, in which a coin always appeared at the far end of the level.<sup>249</sup> The agent appeared to have learned to seek the coin, but when researchers relocated the coin, the agent ignored the coin entirely and proceeded to the same location as before; all it had learned was to move toward a fixed point, not to collect the coin.<sup>250</sup> By slightly modifying the agent's environment, the researchers were able to decipher the agent's learned policy.

This method works for algorithmic collusion too. In the landmark study by Calvano et al., the researchers confirmed that supracompetitive parallelism between two ML pricing algorithms arose from systematic reward and punishment, rather than by fluke, by simulating a defection by one algorithm and observing that the other consistently “punished” it with prolonged phases of low prices.<sup>251</sup> Hence, when evidence of parallel conduct emerges between ML pricing algorithms, enforcers can apply the same test: “running an isolated copy of the algorithm in a controlled environment” to determine its learned policy.<sup>252</sup> A policy that consistently rewards cooperation and punishes competition is unambiguously anticompetitive.

ML algorithms, however, call for a different kind of remedy than the *Predictable Agent* scenario. There is no single line of code to delete, because such algorithms are not given explicit rules in the first place; they learn through trial and error. Deleting one collusive algorithm does not prevent the next one from learning the same policy. Therefore, the remedy must target the parameters of the training process, and there are two ways to do that: (1) bounding historical memory, or (2) building penalties for collusion into the agent's reward function.

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<sup>249</sup> Karl Cobbe, Oleg Klimov, Chris Hesse, Taehoon Kim & John Schulman, *Quantifying Generalization in Reinforcement Learning*, 97 PROC. MACH. LEARNING RSCH. 1282 (2019), <https://doi.org/10.48550/arXiv.1812.02341>.

<sup>250</sup> Lauro Langosco, Jack Koch, Lee Sharkey, Jacob Pfau & David Kruger, *Goal Misgeneralization in Deep Reinforcement Learning*, 162 PROC. MACH. LEARNING RSCH. 12004 (2022), <https://proceedings.mlr.press/v162/langosco22a/langosco22a.pdf>.

<sup>251</sup> Pastorello et al., *supra* note 93.

<sup>252</sup> Renato Nazzini & James Henderson, *Overcoming the Current Knowledge Gap of Algorithmic “Collusion” and the Role of Computational Antitrust*, 4 STAN. COMPUTATIONAL ANTITRUST 1, 26 (2024), <https://law.stanford.edu/wp-content/uploads/2024/02/Algorithmic-Collusion.pdf> [<https://perma.cc/RA9C-FWQ5>].

First, consider bounding historical memory, incentivizing agents “to act as if in a one-shot game,” a proposal initially proffered as a remedy to tacit collusion by humans.<sup>253</sup> Collusion depends on repeated interactions: rewarding cooperation over time and disincentivizing one-period defections by retaliating in *subsequent* periods. Without repeated play, cooperation is never rational. In a one-shot game, where each firm sets its price only once, the dominant strategy is always to compete near marginal cost, since undercutting a supracompetitive price captures the whole market and matching a competitive price avoids losing all sales. While it is unclear how to implement such a rule for tacit collusion by humans, algorithms may present a tractable avenue. As Calvano et al. show, “memoryless agents are unable to punish rivals’ past defections and thus cannot genuinely collude.”<sup>254</sup> A workable rule could therefore prohibit including rivals’ past prices in an ML algorithm’s state space. Bounding memory in this way would make each pricing period resemble an isolated round of Bertrand competition: the algorithm could still respond to a rival’s current or recent prices, but could not draw on historical patterns to sustain a reward-punishment scheme over time.

Second, consider penalizing collusion directly in the agent’s reward function.<sup>255</sup> To be sure, “unlike humans, the computer does not fear detection and possible financial penalties or incarceration.”<sup>256</sup> However, that incentive-compatible deterrent can be artificially approximated, where the expected financial penalty is internalized in the objective for which the algorithm optimizes. Firms would include the risk of expected penalties in the ML’s reward function, so that when learning to maximize profits, agents receive a lower reward if an attempted strategy resembles a collusive reward-punishment logic.

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<sup>253</sup> This is a proposal originally formulated for conventional conscious parallelism by Professor Louis Kaplow. Gal, *supra* note 20, at 100 (citing LOUIS KAPLOW, COMPETITION POLICY AND PRICE FIXING 8 (Princeton Univ. Press 2013)).

<sup>254</sup> Calvano et al., *supra* note 89, at 3280.

<sup>255</sup> Beneke & Mackenrodt, *supra* note 214, at 165–66 (“If the decision on which strategy to follow depends on the relative pay offs, then fines address this variable directly. Reinforcement learning, which works based on a function of rewards, would be particularly sensitive to such incentives if the prospect of fines is embedded in the algorithm.”) (citation omitted).

<sup>256</sup> EZRACHI & STUCKE, *supra* note 44, at 76.



## D. HUB-AND-SPOKE

This section lays out the appropriate rule for the *Hub-and-Spoke* scenario, endorsing the ‘price-adoption test’ developed by Professor Joseph Harrington, which infers a tacit agreement when the average price of subscribers to a third-party pricing algorithm (“TPPA”), controlling for exogenous factors, increases as the proportion of adopting firms increases.<sup>257</sup> Upon finding a tacit agreement, the TPPA must be required to sever its contracts with the adopting firms.

To avoid false positives, courts must deter the *anticompetitive scenario* without deterring the *procompetitive scenario*, in which a TPPA recommends efficient prices to each client independently, unrelated to the recommendations given to other clients. The price-adoption test distinguishes between the two because the pattern it tests for is only expected if the TPPA is facilitating coordination, i.e., a tacit agreement.

The expected pattern in the *anticompetitive scenario* mirrors how a single firm’s monopoly power grows with its market share. A TPPA commanding only a small slice of the downstream market has little collective pricing power to exploit: even if its subscribers tried to set supracompetitive prices, non-adopting rivals would simply undercut them, costing subscribers business and making the TPPA’s service worth little to both current and prospective clients. As adoption grows, however, the group’s collective pricing power increases with it, while the price-disciplining power of the shrinking pool of non-adopters falls. If the TPPA’s subscribers together hold 60% of the market and strike a tacit agreement, one would expect prices considerably above competitive levels; if they hold 100%, prices should approach monopoly levels. In contrast, the *procompetitive scenario* generates no such pattern, as each client’s recommendation is independent of every other client’s, so prices should not move with adoption at all, regardless of how many firms subscribe.

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<sup>257</sup> Joseph E. Harrington, Jr., *An Economic Test for an Unlawful Agreement to Adopt a Third-Party’s Pricing Algorithm*, 40 ECON. POL’Y 263, 284 (2025), <https://joeharrington5201922.github.io/pdf/ep25.pdf> [<https://perma.cc/M34R-UY7G>] (“[T]he average price of adopters . . . increasing in the adoption rate . . . [is] evidence of an agreement between a third-party developer who designed a pricing algorithm and the firms who adopted it”).

Hence, an appropriate test establishing a tacit agreement is as follows: the average price of TPPA adopters should increase in the adoption rate if and only if the TPPA is facilitating coordination.<sup>258</sup> Because this pattern can only emerge from anticompetitive coordination and not from the procompetitive use of a TPPA, the price-adoption test minimizes the risk of error costs. To operationalize the test, one would need to “regress[] adopters’ prices on the adoption rate” using the following: data on when firms adopted the TPPA; prices set by the adopting firms; and data on exogenous variables—like supply shocks, cost changes, and macroeconomic events—that could affect prices, for which the regression must control.<sup>259</sup> Such data is typically accessible in the course of litigation.<sup>260</sup>

Empirical evidence bears this pattern out. In the rental housing context, a leading study found that, across markets, “a higher penetration of algorithm pricing software leads to higher rents and lower occupancy.”<sup>261</sup> A 2023 study by the Biden administration’s Council of Economic Advisors estimates that the greater the rate of penetration in American cities by RealPage’s pricing algorithms, the higher the rents—totaling an estimated \$3.8 billion in costs to renters in 2023 alone.<sup>262</sup> While the report estimated that one in four landlords nationwide uses a RealPage pricing algorithm,<sup>263</sup> that penetration is worse in some local geographic housing markets, where competition really occurs. A ProPublica investigation revealed that in one Seattle neighborhood, ten property managers collectively controlling 70% of the apartments *all* relied on RealPage.<sup>264</sup>

A study on the German retail gasoline market found similar results: investigating the effects of an AI pricing software called a2i Systems, the study found that in duopoly markets,

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<sup>258</sup> *Id.*

<sup>259</sup> *Id.* at 286 (“An empirical implementation of [the test] would involve regressing adopters prices on the adoption rate. The data required are: 1) whether (and possibly when) a firm adopted the third-party developer’s pricing algorithm; 2) prices of the firms who adopted; and 3) other variables that could affect observed prices.”).

<sup>260</sup> *Id.* at 287 (“[I]t is straightforward to obtain this information from the third-party and adopting firms through the legal discovery process.”).

<sup>261</sup> Calder-Wang & Kim, *supra* note 31, at 2.

<sup>262</sup> COUNCIL ECON. ADVISERS, *supra* note 120.

<sup>263</sup> *Id.* (“[W]e estimate that in the multifamily housing sector nearly 1 in every 4 rental uses a RealPage pricing algorithm,” while noting that “usage rates vary widely across metropolitan areas.”).

<sup>264</sup> Vogell, *supra* note 9.

where only two gas stations are within a kilometer of one another, the pricing algorithm showed no effect on prices if only one station adopted, yet average price-cost margins increased by 29% if both stations adopted.<sup>265</sup> One company even admitted it hired a2i Systems because its gas stations were “suffering” from price wars.<sup>266</sup>

Courts have relied on versions of this logic, albeit without the precision of the price-adoption test. For instance, in the private multidistrict litigation against RealPage, the Tennessee district court denied defendants’ motion to dismiss largely because plaintiffs plausibly alleged that landlords, upon becoming clients of RealPage, “prioritiz[ed] raising rent prices over decreasing vacancy rates.”<sup>267</sup> The court cited numerous statements by executives that, “[a]fter outsourcing rent prices and lease terms to RealPage,” landlords shifted their pricing strategy from “‘heads in beds’ to ‘price over volume.’”<sup>268</sup> One executive at a property management company admitted that, while landlords used to “worship[] the occupancy gods,” RealPage “turns the industry upside down,”<sup>269</sup> another claimed that RealPage prompted landlords to move from “push[ing] occupancy” to “maximizing rents.”<sup>270</sup> The court rightly found such conduct constitutive of ‘acts against independent economic interest’—strategies contrary to those consistent with an individual firm’s self-interest in a competitive market, like expanding output.<sup>271</sup> An Illinois district court similarly found merit in denying defendants’ motion to dismiss in the private

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<sup>265</sup> See Stephanie Assad, Robert Clark, Daniel Ershov & Lei Xu, *Algorithmic Pricing and Competition: Empirical Evidence from the German Retail Gasoline Market*, 132 J. POL. ECON. 723, 731–32 (2024), <https://doi.org/10.1086/726906>.

<sup>266</sup> Sam Schechner, *Why Do Gas Station Prices Constantly Change? Blame the Algorithm*, WALL ST. J.

(May 8, 2017), <https://www.wsj.com/articles/why-do-gas-station-prices-constantly-change-blame-the-algorithm-1494262674> [<https://perma.cc/J39N-HVHW>].

<sup>267</sup> *In re RealPage, Inc. (No. II)*, No. 3:23-md-03071 at 25 (citation omitted).

<sup>268</sup> *Id.*

<sup>269</sup> *Id.*

<sup>270</sup> *Id.*; see also Amended Complaint, *United States v. RealPage, Inc.*, *supra* note 109, at 1.

<sup>271</sup> *In re RealPage, Inc. (No. II)*, No. 3:23-md-03071 at 18; *Flat Glass*, 385 F.3d at 360–61 (“Evidence that the defendant acted contrary to its interests means evidence of conduct that would be irrational assuming that the defendant operated in a competitive market.”).

action against MultiPlan: compensation rates calculated by Data iSight for health insurers are lower as compared to benchmarks used in the past, suggesting that health insurers pay compensation rates below competitive levels. This contradicts any individual health insurer's independent economic self-interest because it risks losing subscribers, "as providers will stop providing their services to patients who use third-party payors known for underpayments."<sup>272</sup>

Courts have also credited a related but less rigorous plus factor: 'choosing the worse algorithm.'<sup>273</sup> For example, in *MultiPlan*, the court considered the allegation that the health insurers acted against their independent self-interest by adopting MultiPlan's Data iSight algorithm despite the existence of cheaper alternatives. Theoretically, that is evidence of a tacit agreement to converge onto the same TPPA's platform. However, it is difficult to define 'worse algorithm.' A more expensive algorithm may be justified for its quality and may be in high demand because of its access to troves of data, ultimately used only to recommend competitive prices. Accordingly, the *MultiPlan* court found this plus factor to be the "least convincing" that plaintiffs proffered.<sup>274</sup>

These approaches gesture at the same underlying concern as the price-adoption test—the group's strategies look consistent with collective rather than independent self-interest—but the price-adoption test is more precise: it attributes that effect specifically to the algorithm, rather than to mere oligopolistic interdependence. Tacit collusion, after all, is also reflective of collective rather than independent self-interest; only by pinning the coordination to adoption of the TPPA, the avoidable act, does it become reachable as a tacit agreement.

Upon finding an unlawful tacit agreement, one appropriate remedy is to bar the adopting firms from continuing to contract with the TPPA. This remedy makes two contributions. First, it imposes a strong financial disincentive on the TPPA against facilitating coordination among its subscribers, without chilling the uses of TPPAs that optimize price recommendations independently of one another. Second, it cuts off the convergence

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<sup>272</sup> *In re MultiPlan Health Ins. Provider Litig.*, No. 24-cv-6795 at 36.

<sup>273</sup> Gal, *supra* note 20, at 113 (proposing as a plus factor evidence that "[s]uppliers consciously use similar algorithms even when better algorithms are available to them").

<sup>274</sup> *In re MultiPlan Health Ins. Provider Litig.*, No. 24-cv-6795 at 35.

onto a common platform that the scheme depends on, breaking the feedback loop<sup>275</sup> that sustains it. The severed firms remain free to use pricing algorithms, including other TPPAs, so long as they have not used those platforms to establish a similar tacit agreement. Any attempt to re-coordinate would require tacitly reaching consensus on a new common platform all over again.

Aside from establishing and remedying any particular tacit agreement, enforcers should also be attentive to a related structural risk: monopolization of the upstream TPPA market itself. Such monopolization concentrates the power to disseminate supracompetitive recommendations in a single entity, amplifying the downstream spokes' joint-profit-maximizing pricing power. For example, the DOJ had alleged that RealPage monopolized the commercial revenue management market for rental housing, so much so that one executive even claimed RealPage "does not have any true competitors."<sup>276</sup> RealPage's \$300 million acquisition of its largest competitor in the commercial revenue management market helped to "cement[] its dominant market position,"<sup>277</sup> doubling its share to 80% of the market.<sup>278</sup> Agencies should scrutinize such mergers between TPPAs with the highest levels of scrutiny because they increase the potential joint-profit-maximizing pricing power of the downstream firms.<sup>279</sup> And

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<sup>275</sup> Amended Complaint, *United States v. RealPage, Inc.*, *supra* note 109, at 49 ("[A]s adoption of AIRM and YieldStar increases among peer competitors, the use of AIRM and YieldStar can push prices up through a feedback effect.").

<sup>276</sup> *Id.* at 68 ("[A] RealPage senior vice president explained in a strategy document that RealPage's unique nonpublic data on leasing decisions was a 'data moat,' protecting RealPage from competitors").

<sup>277</sup> Complaint at 14, *District of Columbia v. RealPage, Inc.* (D.C. Super. Ct. Nov. 1, 2023), <https://oag.dc.gov/sites/default/files/2023-11/DC%20OAG%20RealPage%20Complaint%20-%20Filed.pdf> [<https://perma.cc/RQ9Z-4GE3>].

<sup>278</sup> Amended Complaint, *United States v. RealPage, Inc.*, *supra* note 109, at 62; Heather Vogell, *Department of Justice Opens Investigation into Real Estate Tech Company Accused of Collusion with Landlords*, PROPUBLICA (Nov. 23, 2022), <https://www.propublica.org/article/yieldstar-realpage-rent-doj-investigation-antitrust>.

<sup>279</sup> Stucke, *supra* note 20 ("[A]gencies would scrutinize mergers involving: leading vendors of price optimization algorithms (here the concern is not solely the potential increase in prices to the companies using the vendors' services, but the softening of competition in downstream markets).").

where a TPPA market is already monopolized, enforcers and courts should consider structural remedies, including divestitures.<sup>280</sup>

#### IV. THE ALGORITHMIC ANTITRUST PARADOX

The assumptions that justify exonerating tacit collusion do not hold when applied to ATC. Tacit collusion is welfare-reducing and would be actionable under the antitrust laws but for the error costs of judicial intervention. Part III showed that those error costs do not apply to ATC. It follows that to deny ATC is unlawful would contradict the very assumptions that justify the agreement doctrine, and with it the consumer welfare principle embodied in the modern rule of reason. Yet prevailing arguments hold that ATC fails to constitute an agreement because it lacks some formal property traditionally associated with conspiracy: collective decision-making, the exchange of nonpublic information, or subjective intent. This Article terms that contradiction the *algorithmic antitrust paradox*.

Each argument substitutes a formalistic line-drawing exercise for the functional, economic inquiry that Section 1 demands. None of the three criteria is a reliable measure of liability; none is a necessary or sufficient condition of anticompetitive harm. The result is an underinclusive conception of agreement that exonerates anticompetitive conduct with no offsetting efficiency justification.

These arguments share in common the following premise: a *deontological* conception of agreement, which evaluates the act itself and the psychology behind it rather than its consequences.<sup>281</sup> On this view, liability essentially requires

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<sup>280</sup> Beneke & Mackenrodt, *supra* note 214, at 168.

<sup>281</sup> Deontological theories evaluate actions based on the nature of the act itself and the intentions behind it, independent of consequences. See Larry Alexander & Michael Moore, *Deontological Ethics*, in STANFORD ENCYCLOPEDIA OF PHILOSOPHY (Edward N. Zalta & Uri Nodelman eds., Winter 2024 ed. 2024), <https://plato.stanford.edu/entries/ethics-deontological/> (defining deontological ethics as theories in which certain acts are intrinsically right or wrong independent of their consequences); IMMANUEL KANT, GROUNDWORK OF THE METAPHYSICS OF MORALS (Mary Gregor trans., Cambridge Univ. Press 1997) (1785) (grounding morality in the will behind an act rather than its outcomes). As Holmes observed, “[t]he law is indeed the witness and external deposit of our moral life.” Oliver Wendell Holmes, *The Path of the Law*, 10 HARV. L. REV. 457, 459 (1897). Criminal law reflects society’s condemnation of conduct

evidence of “‘traditional conspiracy,’ or ‘proof that the defendants got together and exchanged assurances of common action.’”<sup>282</sup> That premise is incompatible with the *consequentialist* logic that has long governed antitrust law.

Part IV proceeds in four steps. Section A refutes the deontological account and defends the consequentialist conception of agreement. Sections B, C, and D then rebut the three arguments in turn: that ATC requires formally collective rather than independent decision-making; that ATC requires an exchange of nonpublic information; and that ATC requires a showing of subjective intent.

#### A. CORE PRINCIPLES OF ‘AGREEMENT’

Formalistic line drawing misreads the agreement doctrine. It is tempting to think ‘agreement’ is foremost about ‘traditional conspiracies.’ First, Section 1’s text includes the word “conspiracy.”<sup>283</sup> The Supreme Court has analogized the Sherman Act’s per se rule to the common-law treatment of traditional conspiracies, explaining that because the Act is “on the common law footing,” agreements to fix prices, rig bids, or divide markets are unlawful regardless of whether they succeed in harming

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“revolting to the moral sentiments of society.” JEROME HALL, *GENERAL PRINCIPLES OF CRIMINAL LAW* 157, 182 (1947) (encompassing both the actor’s culpability supplied by intent and the moral wrongfulness of the action as judged by social consensus); *see also* Stuart P. Green, *Why It’s a Crime to Tear the Tag Off a Mattress: Overcriminalization and the Moral Content of Regulatory Offenses*, 46 EMORY L.J. 1533, 1570–80 (1997). Collusive conspiracies have revolted the moral sentiments of society since antiquity: when an Athenian price-fixing ring of grain dealers was exposed in the fourth century B.C., the senate was so appalled that some members called for the dealers’ execution without trial. Lambros E. Kotsiris, *An Antitrust Case in Ancient Greek Law*, 22 INT’L LAW. 451, 455 (1988). Modern antitrust scholarship has reinforced this moral valence, characterizing hard-core cartel conduct as a violation of the norm of fairness. Maurice E. Stucke, *Morality and Antitrust*, 2006 COLUM. BUS. L. REV. 443, 495 (2006), <https://doi.org/10.7916/cblr.v2006i3.2992>. The flip side of this account, however, is that tacit collusion escapes moral condemnation because it crosses no moral boundary—to hold otherwise, as Rahl warned, would “imply criminality generally as to large enterprise in America.” James Rahl, *Price Competition and the Price Fixing Rule—Preface and Perspective*, 57 NW. U. L. REV. 137, 147 (1962).

<sup>282</sup> *Flat Glass*, 385 F.3d at 361.

<sup>283</sup> 15 U.S.C. § 1.

competition.<sup>284</sup> Conversely, the Court has justified its permissive treatment towards tacit collusion on the basis that the threat of “‘conscious parallelism’ has not yet read conspiracy out of the Sherman Act entirely.”<sup>285</sup> The deontological reading here is that the ‘forbidden process’ characteristic of traditional conspiracy is a bright line: the parties are liable when it is present and exonerated when it is not, with no regard to economic effects.<sup>286</sup>

That reading is mistaken. Courts and scholars have understood the Sherman Act’s attention to concerted action not as condemning some intrinsically wrongful act limited to ‘traditional conspiracies,’ but as targeting the suddenness with which previously dispersed economic power is joined—the “banding together of . . . cartels or trusts” to end competition and charge monopoly prices.<sup>287</sup> The words “contract, combination . .

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<sup>284</sup> *Nash v. United States*, 229 U.S. 373, 378 (1913) (“[T]he Sherman act punishes the conspiracies at which it is aimed on the common law footing—that is to say, it does not make the doing of any act other than the act of conspiring a condition of liability.”); *Socony-Vacuum*, 310 U.S. at 224 n.59 (citing *United States v. Rabinowich*, 238 U.S. 78, 86 (1915) (“A person may be guilty of conspiring, although incapable of committing the objective offense.”)); *United States v. Trenton Potteries Co.*, 273 U.S. 392, 402 (1927) (holding it is “immaterial” whether “the purpose of the conspiracy was accomplished in whole or in part”); *Plymouth Dealers’ Ass’n of N. Cal. v. United States*, 279 F.2d 128, 132–33 (9th Cir. 1960) (explaining that even if the “plan . . . did not ultimately succeed,” defendants are not thereby “absolve[d]”); *see also* U.S. Statement of Interest at 10, *Duffy v. Yardi Sys., Inc.*, No. 2:23-cv-04547 (C.D. Cal. Mar. 4, 2024) (citing *United States v. Torres*, 503 F.2d 1120, 1124 n.2 (2d Cir. 1974) (“[A] conspiracy is punishable even if unsuccessful.”)); *United States v. Paluch*, 84 F. App’x 740, 744 (9th Cir. 2003) (with respect to a criminal conspiracy outside the antitrust context, “the mere fact that his acts in furtherance of the conspiracy were unsuccessful does not relieve [the defendant] of liability”).

<sup>285</sup> *Theatre Enters.*, 346 U.S. at 541.

<sup>286</sup> *In re Text Messaging Antitrust Litig.*, No. 10-8037, 2010 WL 5367383, at \*4 (7th Cir. Dec. 29, 2010) (explaining that the Sherman Act “does not require sellers to compete; it just forbids their agreeing or conspiring not to compete”).

<sup>287</sup> Posner, *supra* note 137, at 1578 (“The statute is addressed to concerted activity because the evil against which the framers were legislating was the banding together of rivals, as in cartels or trusts, to extract monopoly profits by agreeing to end competition and charge the joint maximizing price.”); *Copperweld Corp. v. Indep. Tube Corp.*, 467 U.S. 752, 768–69 (1984) (“Congress treated concerted action more strictly than unilateral behavior because concerted activity inherently is



. or conspiracy” progress from the loosest to the tightest kinds of integration, capturing a wide range of economic coordination.<sup>288</sup> Thus, concerted action has a broad economic meaning: the joining of otherwise separate centers of economic decision-making.<sup>289</sup>

The differential treatment of express and tacit collusion confirms this economic, rather than deontological, foundation. As Part II explained, express conspiracies are per se unlawful—even absent proof of harm—because that rule minimizes false-negative error costs; meanwhile, tacit collusion is per se lawful—even when it reduces competition—because that rule minimizes false-positive error costs.<sup>290</sup> The Court’s oft-quoted suggestion in *Theatre Enterprises* that conscious parallelism has not read ‘conspiracy’ out of the Sherman Act is therefore best read as dicta, peripheral to the case’s “essential teaching” that purely independent, incidentally parallel conduct is not anticompetitive.<sup>291</sup> Even Professor Turner—who opposed expanding Section 1 to reach conscious parallelism—conceded that *Theatre Enterprises* does not preclude an inference of “conspiracy on the basis of conscious parallelism alone” (emphasis added).<sup>292</sup> Instead, his objection articulated the countervailing error costs to doing so. Both express and tacit collusion are forms of coordination between separate economic actors, so both fall within Section 1’s concerted-action requirement. They diverge in legal treatment only because the former is practically regulable in an efficiency-maximizing way while the latter is not.

The consequentialist principle—that antitrust attends to competitive effects rather than to the nature, form, or intent of business practices—is also better supported by the history and logic of the antitrust laws. Early political economists in this

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fraught with anticompetitive risk . . . . This not only reduces the diverse directions in which economic power is aimed but suddenly increases the economic power moving in one particular direction.”); Gavil et al., *supra* note 42, at 305 (“[W]hen separate economic actors combine, the threat to competition is often greater than when single firms act.”).

<sup>288</sup> Robert H. Bork, *Legislative Intent and the Policy of the Sherman Act*, 9 J.L. & ECON. 7, 21–22 (1966).

<sup>289</sup> *Copperweld*, 467 U.S. at 769 (“[Concerted activity] deprives the marketplace of the independent centers of decisionmaking that competition assumes and demands.”).

<sup>290</sup> See Part II.A.

<sup>291</sup> Posner, *supra* note 137, at 1578.

<sup>292</sup> Turner, *supra* note 49, at 658.

tradition, such as Adam Smith and John Stuart Mill, denounced cartels and monopolists on distinctly utilitarian grounds.<sup>293</sup> Today, the antitrust laws are well-understood as directed towards economic goals,<sup>294</sup> often labeled “consumer welfare.”<sup>295</sup>

To be sure, the evidentiary standard for an unlawful agreement has come to resemble that of traditional conspiracy. However, the reason is the aforementioned *paradox of proof*: circumstantial evidence that market conditions make collusion more likely also supports the inference of mere interdependence. Evidence of a traditional conspiracy is not the only way to prove that coordination arose through inefficient means. As discussed, plus factors pointing to avoidable acts or facilitating practices can support the same finding.

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<sup>293</sup> ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS 69, 145 (Edwin Cannan ed., Univ. Chi. Press 1976) (1776) (“People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices.”); JOHN STUART MILL, ON LIBERTY 152 (David Bromwich & George Kateb eds., Yale Univ. Press 2003) (1859) (“Restrictions on trade, or on production for purposes of trade, are indeed restraints; and all restraint, qua restraint, is an evil.”).

<sup>294</sup> Jonathan B. Baker, *Economics and Politics: Perspectives on the Goals and Future of Antitrust*, 81 FORDHAM L. REV. 2175, 2180 (2013) (“Antitrust in the modern era has always had a generalized economic goal.”).

<sup>295</sup> *Reiter v. Sonotone Corp.*, 442 U.S. 330, 343 (1979) (“Congress designed the Sherman Act as a ‘consumer welfare prescription.’”) (citing BORK, *supra* note 153, at 63). Bork grounded this consumer welfare framework in “basic price theory,” a methodological choice that has attracted significant criticism. BORK, *supra* note 153, at 84; see Lina M. Khan, *Amazon’s Antitrust Paradox*, 126 YALE L.J. 710, 737–38 (2017) (critiquing the Chicago School’s focus on “short-term price effects” as the dominant metric of antitrust analysis). Some have characterized such debates as “pesky little detail[s]” because, generally, courts already look to a myriad of effects-based economic factors. See Baker, *supra* note 295, at 2180. See also U.S. DEP’T OF JUSTICE & FED. TRADE COMM’N, 2023 MERGER GUIDELINES 1 (Dec. 18, 2023), <https://www.justice.gov/d9/2023-12/2023%20Merger%20Guidelines.pdf> [https://perma.cc/D34D-ZTYB] (“[C]ompetition . . . [is a] process of rivalry that incentivizes businesses to offer lower prices, improve wages and working conditions, enhance quality and resiliency, innovate, and expand choice.”). Notwithstanding these debates over the precise contours of antitrust’s goals, all major interpretations ultimately rest on some form of economic effects analysis.

Finally, the Supreme Court has repeatedly clarified that the correct approach to antitrust doctrine is economic, not formal. In *Continental T.V., Inc. v. GTE Sylvania, Inc.*, the Supreme Court reversed a precedent from just ten years prior in holding that nonprice vertical restraints warrant full rule-of-reason analysis rather than per se condemnation, emphasizing that antitrust rules must be “based on demonstrable economic effect, rather than... upon formalistic line drawing.”<sup>296</sup> The Court echoed the point in *Ohio v. American Express*: “[l]egal presumptions that rest on formalistic distinctions rather than actual market realities are generally disfavored in antitrust law.”<sup>297</sup> And in *Broadcast Music, Inc. v. Columbia Broadcasting System, Inc.* the Court declined to condemn industry-wide blanket song licenses—a single license covering thousands of copyrighted songs—as per se unlawful price fixing, despite their formal resemblance to it, finding “redeeming competitive virtues” in the transaction-cost savings they generated; as the Court wrote, the Sherman Act has “always been discriminatingly applied in the light of economic realities.”<sup>298</sup> That is, the Sherman Act functions “not merely as a proscription of offenses well-recognized in 1890, but as a flexible instrument for enforcing a public policy in favor of competition and against monopoly.”<sup>299</sup>

#### B. UNILATERAL VS COLLECTIVE DECISION-MAKING

The first deontological line of argument asserts that ATC escapes liability because it lacks formally collective decision-making. Interdependent algorithmic decision-making is implemented *separately*, without firms explicitly “[s]etting prices together.”<sup>300</sup> Therefore, the argument goes, firms’ adoption of pricing algorithms, no matter their competitive effects, constitute unilateral action that the Sherman Act does not reach. Firms are presumptively entitled to use whichever tools

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<sup>296</sup> *Sylvania*, 433 U.S. at 59.

<sup>297</sup> *Ohio v. Am. Express Co.*, 585 U.S. 529, 542–43 (2018) (“[L]egal presumptions that rest on formalistic distinctions rather than actual market realities are generally disfavored in antitrust law”) (quoting *Eastman Kodak Co. v. Image Tech. Servs., Inc.*, 504 U.S. 451, 466–67 (1992)).

<sup>298</sup> *Broadcast Music, Inc. v. CBS, Inc.*, 441 U.S. 1, 13–14 (1979) (citations omitted).

<sup>299</sup> Donald F. Turner, *The Scope of Antitrust and Other Economic Regulatory Policies*, 78 HARV. L. REV. 1207, 1226 (1965).

<sup>300</sup> Ohlhausen, *supra* note 216, at 6.

they determine improve their “independent operational optimization”<sup>301</sup> and are generally free to set prices however they choose, “as long as they act *independently*” (emphasis added).<sup>302</sup> Following this logic, if a firm programs its own rules-based pricing algorithm (*Predictable Agent*), trains its own machine-learning model (*Digital Eye*), or comes to its own decision to contract with a TPPA provider (*Hub-and-Spoke*), that firm is engaged in conduct within the lawful bounds of independent decision-making, regardless of the resulting effects on competition.

Contrast this formalistic line with the functional distinction that actually matters for antitrust purposes. The only category of conduct that is under no circumstances concerted is when firms’ strategies are economically independent, i.e., they would have been rational no matter what one’s competitors did. ATC definitionally contradicts pure economic independence: interdependent decision-making is functionally collective, as it is joint-profit-maximizing. Strategies that are “interdependent although arrived at independently”<sup>303</sup> are lawful only because of the error-cost problems explicated in Part II, and those problems do not apply to ATC.

Formally collective decision-making is not a necessary condition for an unlawful agreement; the formalistic line directly contradicts established precedent. The Supreme Court has clarified that “[n]o formal agreement is necessary to constitute an unlawful conspiracy,”<sup>304</sup> and that “an unlawful conspiracy may be and often is formed without simultaneous action or agreement on the part of the conspirators.”<sup>305</sup> The doctrine of tacit agreement operationalizes that conclusion.

Neither is formally collective decision-making sufficient to establish an agreement. In *Copperweld Corp. v. Independence Tube Corp.*, the Supreme Court considered whether a parent

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<sup>301</sup> Barak Orbach, *Do Revenue Management Platforms Like RealPage Facilitate Illegal Algorithmic Collusion?*, PROMARKET (Apr. 18, 2024), <https://www.promarket.org/2024/04/18/do-revenue-management-platforms-like-realpage-facilitate-illegal-algorithmic-collusion/> [https://perma.cc/U5H7-WTE8] (“[I]t is far from clear that antitrust law should impose restrictions on firms’ independent operational optimization.”).

<sup>302</sup> Ohlhausen, *supra* note 216, at 4.

<sup>303</sup> PHILLIP E. AREEDA & DONALD F. TURNER, ANTITRUST LAW 175 (1986).

<sup>304</sup> *Am. Tobacco*, 328 U.S. at 809.

<sup>305</sup> *Interstate Circuit*, 306 U.S. at 227.

company could be found liable for conspiring to fix prices with its wholly owned subsidiary.<sup>306</sup> While employees or executives of the same corporation can conspire for unlawful ends of various kinds, the Court emphasized that the relevant question there was not merely “whether the term ‘conspiracy’ will bear a literal construction,” but whether the conduct satisfies the Act’s distinctive approach to concerted action in furtherance of its “economic” aims.<sup>307</sup> The Court explained that unlawful agreement “deprives the marketplace of the independent centers of decision making that competition assumes and demands.”<sup>308</sup> In this case, though, price fixing between different divisions within a single corporation did not increase market power—and therefore did not violate Section 1—because no previously independent firms had joined together to charge a joint-profit-maximizing price.<sup>309</sup> As the Court explained, “substance, not form, should determine whether a[n] . . . entity is capable of conspiring under Section 1”<sup>310</sup>—a principle of Sherman Act jurisprudence upon which courts have been insistent.<sup>311</sup>

### 1. *Single-Firm Use of Algorithms*

Scholars have largely assumed that the *Predictable Agent* and *Digital Eye* scenarios do not “trigger[] antitrust intervention” because firms technically use their own separate algorithms,

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<sup>306</sup> *Copperweld*, 467 U.S. at 776 (“[T]he logic underlying Congress’s decision to exempt unilateral conduct from scrutiny under § 1 of the Sherman Act similarly excludes the conduct of a parent and subsidiary.”).

<sup>307</sup> *Id.* at 789 (“As an economic matter, what is critical is the presence of market power.”).

<sup>308</sup> *Id.* at 769.

<sup>309</sup> *Id.* at 771 (“If a parent and a wholly owned subsidiary do ‘agree’ to a course of action, there is no sudden joining of economic resources that had previously served different interests, and there is no justification for § 1 scrutiny.”).

<sup>310</sup> *Id.* at 773 n. 21.

<sup>311</sup> *Am. Tobacco*, 328 U.S. at 809 (“[I]t is not the form of the combination or the particular means used but the result to be achieved that the statute condemns.”); *Am. Needle, Inc. v. Nat’l Football League*, 560 U.S. 183, 191–95 (2010) (“We have long held that concerted action under § 1 does not turn simply on whether the parties involved are legally distinct entities. Instead, we have eschewed such formalistic distinctions in favor of a functional consideration of how the parties involved in the alleged anticompetitive conduct actually operate.”).

rather than relying on a shared one.<sup>312</sup> However, firm strategies in these scenarios are unilateral only in a formal sense. As explained in Part III, courts can use technical tests to determine whether such pricing algorithms' strategies are systematically interdependent and therefore functionally collective. If so, such pricing algorithms can and should be prohibited.

The FTC's allegation that Amazon's Project Nessie algorithm violated the FTC Act survived a motion to dismiss.<sup>313</sup> However, the argument was carried by the premise that the FTC Act "reaches beyond the prohibitions in the Sherman Act."<sup>314</sup> The potential insufficiencies of even the FTC Act under this theory are further explored in Part IV.D,<sup>315</sup> but this theory assumes that the *Predictable Agent* scenario (and likely by extension the *Digital Eye* scenario as well) cannot constitute an agreement actionable under the Sherman Act—thus necessitating the FTC Act—simply because said algorithms are designed and operated from a standpoint of formal independence. That logic completely overlooks the doctrine of tacit agreement, which reaches formally unilateral but functionally collective conduct.

## 2. Hub-and-Spoke

Objections on grounds of unilateral decision-making are particularly prominent in the context of the *Hub-and-Spoke* scenario. In virtually every matter alleging ATC in the *Hub-and-Spoke* scenario, defendants have argued that, whatever price the TPPA recommends, subscribers retain independent discretion over whether to adopt it.<sup>316</sup> And while plaintiffs alleged that

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<sup>312</sup> Ezrachi & Stucke, *supra* note 18, at 220–21.

<sup>313</sup> Sealed Order on Defendant's Motion to Dismiss and Plaintiffs' Motion to Bifurcate, *FTC v. Amazon.com, Inc.*, No. 2:23-cv-01495-JHC, at 25-27 (W.D. Wash. Sept. 30, 2024), ECF No. 289.

<sup>314</sup> *Id.* at 25 (citation omitted).

<sup>315</sup> See *infra* Part IV.D.

<sup>316</sup> *Gibson v. Cendyn Grp., LLC*, No. 2:23-cv-00140-MMD-DJA, 2024 WL 2060260, at \*13 (D. Nev. May 8, 2024) (*Gibson II*) ("Defendants . . . argue . . . that Plaintiffs cannot make out a Sherman Act violation without alleging that Hotel Defendants are required to accept the pricing recommendations made by GuestRev."); Memorandum of Law in Support of the Statement of Interest of the United States at 22, *In re RealPage, Rental Software Antitrust Litig.* (No. II), No. 3:23-MD-3071 (M.D. Tenn. Nov. 15, 2023), ECF No. 628 ("[D]efendants claim that the complaints must be dismissed because RealPage recommends, rather than mandates, certain prices."); *In re*

RealPage,<sup>317</sup> MultiPlan,<sup>318</sup> and Cendyn<sup>319</sup> each engaged in per se illegal price fixing, the district courts in each case correctly disagreed.<sup>320</sup> The per se rule reflects accumulated judicial experience with patently naked restraints—experience courts simply do not have with conduct as novel as ATC—meaning, absent smoking-gun evidence of an express agreement, such cases should not be treated as presumptively illegal in the manner of a hardcore cartel.<sup>321</sup>

Nonetheless, that these arrangements fall short of requiring the total surrender of independent decision-making power—and hence fall short of a hardcore cartel<sup>322</sup>—does not preclude them from amounting to a tacit agreement. The courts in *RealPage* and *MultiPlan* reached that conclusion, denying defendants’ motions to dismiss on the basis of circumstantial evidence relating to the exchange of nonpublic data (discussed in detail in Part IV.C).<sup>323</sup>

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*RealPage, Inc. (No. II)*, No. 3:23-md-03071 at 19 (“In contrast to Plaintiffs’ characterization, Defendants argue that Plaintiffs have alleged, at most, a hub and spoke conspiracy with no rim”); *In re MultiPlan Health Ins. Provider Litig.*, No. 24-cv-6795 at 33 (“Because third-party payors can deviate from MultiPlan-calculated rates, the defendants argue, use of MultiPlan’s algorithm cannot be considered parallel conduct.”).

<sup>317</sup> *In re RealPage, Inc. (No. II)*, No. 3:23-md-03071 at 35.

<sup>318</sup> *In re MultiPlan Health Ins. Provider Litig.*, No. 24-cv-6795 at 27.

<sup>319</sup> *Gibson II*, 2024 WL 2060260, at \*2.

<sup>320</sup> *Id.* at 46 (“[B]ecause plaintiffs failed to allege that defendants] enforce acceptance of price recommendations . . . [the conduct was] not the straightforward form of horizontal price-fixing conspiracy for which courts apply the per se standard.”); *In re MultiPlan Health Ins. Provider Litig.*, No. 24-cv-6795 at 30 (concluding that contracts with TPPAs are not “‘smoking gun’ evidence of a horizontal agreement among the third-party payors themselves”); *Gibson II*, 2024 WL 2060260, at \*4–5.

<sup>321</sup> *In re RealPage, Inc. (No. II)*, No. 3:23-md-03071 at 47 (“[C]ourts are hesitant to apply the per se standard to new or ‘novel way[s] of doing business’ that have not yet been tested or studied.”).

<sup>322</sup> See *Am. Needle, Inc. v. Nat’l Football League*, 560 U.S. 183, 190 (2010) (holding that concerted action is unlawful under § 1 where it deprives the marketplace of independent centers of decision-making); *Anderson v. Shipowners’ Ass’n of the Pac. Coast*, 272 U.S. 359, 364–65 (1926) (holding unlawful a combination whereby each member surrendered his freedom of action and independent judgment to the control of the association).

<sup>323</sup> See *infra* Part IV.C.

The district court in *Gibson*, however, took a different view, holding that without a formal commitment to accept GuestRev's pricing recommendations, no agreement could be plausibly inferred.<sup>324</sup> Initially, it must be noted that Cendyn, just like RealPage,<sup>325</sup> "engaged in a 'never-ending battle' to convince clients not to override its pricing recommendation."<sup>326</sup> GuestRev's recommendations took effect automatically at the calculated room rate unless a hotel operator affirmatively intervened to override them.<sup>327</sup> The more evident the mechanisms of inducing compliance, the more likely the conduct crosses the threshold from recommendation into implementation, or "cartel management."<sup>328</sup>

Putting those factual allegations aside, though, the court's logic is fundamentally flawed because a formal agreement to enforce adoption of the TPPA's prices has no more an incentive-modifying effect than an informal tacit agreement; any such contractual obligation would be legally unenforceable as an antitrust violation. Technically, "parties to a cartel always have the legal ability to deviate," yet Cendyn was still able to induce a 90% acceptance rate for GuestRev's recommendations.<sup>329</sup> Compliance-inducing mechanisms such as monitoring and default settings warrant close scrutiny,<sup>330</sup> but they are not the only way a TPPA can deter defection. A TPPA can also weaponize the price recommendations themselves as a punishment mechanism by recommending retaliatory strategies to some subscribers in response to deviations by others. Hence, the core question of tacit agreement is not reducible to "control over implementation" of prices,<sup>331</sup> but to whether the firms' observed prices reflect a joint-profit-maximizing strategy as correlated with subscription to the TPPA. That determination is best made by the price-adoption test.

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<sup>324</sup> *Gibson II*, 2024 WL 2060260, at \*14.

<sup>325</sup> Memorandum of Law in Support of the Statement of Interest of the United States, *Rental Software Antitrust Litig. (No. II)*, No. 3:23-MD-3071 at 22 ("RealPage exerts pressure to enforce its recommendations and landlords have outsourced pricing decisions to RealPage.").

<sup>326</sup> *Gibson II*, 2024 WL 2060260, at \*15.

<sup>327</sup> Hovenkamp & Schrepel, *supra* note 125, at 7.

<sup>328</sup> *Id.* at 12–16.

<sup>329</sup> *Id.* at 11.

<sup>330</sup> *Id.* at 13.

<sup>331</sup> *Id.*



A related objection concerns not the formally independent *adoption* of the TPPA's price recommendations, but the formally independent *subscription* to the TPPA in the first place. After the district court dismissed plaintiffs' claims that Cendyn's conduct constituted a horizontal agreement, plaintiffs appealed to the Ninth Circuit, which addressed the question directly: could plaintiffs "state a Section 1 claim when they allege that the competing hotels independently purchased licenses for the same software?"<sup>332</sup> The plaintiffs argued that the individual contracts between hotel operators and Cendyn could themselves be challenged as vertical agreements in restraint of trade, subject to full rule-of-reason analysis—a pivot the DOJ similarly made in its posture towards RealPage.<sup>333</sup> The Ninth Circuit affirmed the lower court's ruling dismissing plaintiffs' claims, for two reasons. First, the vertical contract between Cendyn and any individual hotel operator does not restrain trade *as a vertical contract*, in the way that vertical restraints between firms at different levels of the supply chain—for instance, most-favored-nations clauses—can generate foreclosure or exclusion;<sup>334</sup> it can restrain trade only insofar as the TPPA's role as a potential cartel manager facilitates horizontal coordination. Second, the Ninth Circuit concluded that individual hotel operators' decisions to subscribe to the TPPA—even if motivated by an expectation of cooperation with their horizontal rivals—amounted to nothing more than parallel conduct, which lies beyond the reach of the antitrust laws.<sup>335</sup>

On the first point, the Ninth Circuit is correct: a vertical relationship alone is insufficient to establish harm to competition in the hub-and-spoke context. A hub-and-spoke conspiracy requires a "tacit rim," or evidence connecting the spokes to one another, proving that several vertical relationships collectively amount to horizontal coordination.<sup>336</sup> The second point,

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<sup>332</sup> *Gibson*, slip op. at 5.

<sup>333</sup> Brief in Support of Defendant RealPage, Inc.'s Motion to Dismiss Under Federal Rule of Civil Procedure 12(b)(6) at 9, *United States v. RealPage, Inc.*, No. 1:24-cv-00710-LCB-JLW (M.D.N.C. Dec. 3, 2024), ECF No. 44 ("Given the MDL court's rejection of the *per se* standard . . . [the DOJ] pivoted to asserting claims under Sections 1 and 2 of the Sherman Act that are governed by the rule-of-reason standard.").

<sup>334</sup> *Gibson*, slip op. at 15–16.

<sup>335</sup> *Id.* at 18–19.

<sup>336</sup> *Gibson II*, 2024 WL 2060260, at \*6 (characterizing the operative question as whether the spokes were part of a "tacit rim," to

however, is mistaken. The Ninth Circuit concluded that even if the hotel operators subscribed to Cendyn’s GuestRev algorithm with the knowledge and expectation that their rivals were doing the same, those decisions constituted nothing more than lawful parallel conduct.<sup>337</sup> Herein lies the erroneous formalistic line drawing: the court assumed that just because the firms subscribed to the TPPA separately, no rim—and hence no agreement—could be established. The court acknowledged that the firms’ decisions may have been interdependent but failed to consider whether that interdependence arose from an inefficient and practicably deterrable means of coordination, i.e., whether it could amount to a tacit agreement. Had it confronted that question, it would have been well-equipped to answer it using the approach outlined in Part III.D.

### C. PUBLIC VS NONPUBLIC DATA

This Section argues that the line between using public and nonpublic information does not cleanly distinguish procompetitive from anticompetitive pricing algorithms, yet courts have begun to make it nearly dispositive with respect to the *Hub-and-Spoke* scenario. The use of nonpublic data is neither a necessary nor a sufficient condition for anticompetitive harm. Treating it as such substitutes formalistic line drawing for the functional inquiry into whether the information is deployed to suppress or to promote competition.

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which the court concluded no); *Cornish-Adebisi v. Caesars Ent., Inc.*, No. 1:23-cv-02536-KMW-EAP, slip op. at 6 (D.N.J. Sept. 30, 2024) (identifying establishment of the rim as the “critical issue” in allegations against Cendyn’s GuestRev algorithm as operated by Atlantic City hotels); *Total Benefits Plan. Agency, Inc. v. Anthem Blue Cross & Blue Shield*, 552 F.3d 430, 436 (6th Cir. 2008) (“[T]he critical issue for establishing a per se violation with the hub and spoke system is how the spokes are connected to each other.”); *Kotteakos v. United States*, 328 U.S. 750 (1946) (holding that where multiple spokes shared a common hub but had no agreement or knowledge of one another, there was no single conspiracy but rather a series of independent ones); Stucke, *supra* note 20 (“[F]or the hub-and-spoke scenario, the challenge lies in determining whether the agreement is purely vertical or also horizontal.”); *United States v. Musical Instruments & Suppliers Retailers Council*, 798 F.3d 1186, 1192 (9th Cir. 2015) (describing hub-and-spoke conspiracy as “simply a collection of vertical and horizontal agreements”).

<sup>337</sup> *Gibson*, slip op. at 18–19.

Pricing algorithms vary in their informational inputs. Some operate entirely on publicly available price data, such as those characteristic of the *Predictable Agent* and *Digital Eye* scenarios; those are not at issue here. Others (typically, TPPAs) are trained on shared nonpublic data, including granular information about quantities sold, contract terms, future capacity, and more to compute profit-maximizing price recommendations. For instance, RealPage's AIRM service obligated client landlords to disclose proprietary data on unit characteristics, lease terms, rental applications, renewal offers and acceptances, and forward-looking occupancy—harvesting information from over eleven million units through more than fifty thousand monthly calls—which RealPage then aggregated across all clients to generate pricing recommendations.<sup>338</sup>

Courts have treated the presence of nonpublic data as something close to a liability threshold. In the *RealPage* multidistrict litigation, the district court found “the most persuasive evidence of horizontal agreement” to be that each client supplied proprietary data knowing its rivals would do the same, and that RealPage would use all of it to recommend prices to those same rivals.<sup>339</sup> The court in *MultiPlan* placed similar weight on the exchange of sensitive information as a plus factor, accordingly denying defendants’ motion to dismiss.<sup>340</sup>

Meanwhile, the absence of sharing or pooling nonpublic data across horizontal competitors has functioned as a safety zone. For example, Cendyn’s GuestRev tool utilizes only an individual user’s nonpublic data on prices and occupancy (quantity), but incorporates competitors’ *public* pricing data into its recommendations.<sup>341</sup> On that basis, the Nevada district court concluded that the conduct could not amount to an agreement

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<sup>338</sup> Amended Complaint, *United States v. RealPage, Inc.*, *supra* note 109, at 7, 12.

<sup>339</sup> *In re RealPage, Inc. (No. II)*, No. 3:23-md-03071 at 31; *see also* *Duffy v. Yardi Sys., Inc.*, No. 2:23-cv-01391-RSL, slip op. at 7 (W.D. Wash. Dec. 4, 2024) (“[Yardi] advertised its revenue management software to lessors as a means of increasing rates . . . [its software would work] as advertised . . . only if each lessor client divulges its confidential and commercially sensitive pricing, inventory, and market data.”).

<sup>340</sup> *In re MultiPlan Health Ins. Provider Litig.*, No. 24-cv-6795 at 42–43.

<sup>341</sup> *Gibson*, slip op. at 8–9 (“A ‘key part of what makes GuestRev effective’ is that it provides the ability for hotels to ‘use competitor pricing in implementing their own pricing.’”).

because “[t]here is nothing unreasonable about consulting public sources to determine how to price your product.”<sup>342</sup> The New Jersey district court in *Cornish-Adebiyi v. Caesars Entertainment*—involving GuestRev as deployed by Atlantic City hotels—reached the same conclusion: a plausible inference of agreement was undermined by the fact that plaintiffs failed to “allege that the [hotels’] proprietary data are pooled or otherwise commingled into a common dataset against which the algorithm runs.”<sup>343</sup>

This approach is mistaken in both directions because the “source of harm is shared objective, not shared data.”<sup>344</sup>

First, nonpublic data sharing is not necessary for coordination. Price data is typically public; quantity data is typically not.<sup>345</sup> It is easier for a TPPA to calculate a joint-profit-maximizing price by pooling all firms’ prices and quantities into a single dataset, but a TPPA can nonetheless reach the same result relying on only one firm’s own quantity data alongside the public price information of its rivals. The mechanism works as follows: a TPPA recommends small price increases—“inflators”—to the spokes and observes the effect on each firm’s profits via its individual quantity data, until the price increases stop translating to increased profits.<sup>346</sup> The price increases hold because the TPPA’s climbing recommendations are disseminated to ostensible competitors simultaneously. Therefore, a TPPA trying to increase its subscribers’ collective profits can recommend supracompetitive price recommendations without using the nonpublic data of rival firms.<sup>347</sup>

Moreover, nonpublic data sharing is not in itself sufficient for anticompetitive harm. A TPPA that pools sensitive competitor data will not produce supracompetitive prices if its objective is not to maximize joint profits. Such an algorithm might in fact be procompetitive: richer data yields more accurate predictions about market dynamics, and using those predictions to sharpen individual firms’ competitive strategies rather than to

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<sup>342</sup> *Gibson II*, 2024 WL 2060260 at \*9.

<sup>343</sup> *Cornish-Adebiyi*, slip op. at 3.

<sup>344</sup> Joseph E. Harrington, Jr., *A Critique of Recent Remedies for Third-Party Pricing Algorithms and Why the Solution Is Not Restrictions on Data Sharing*, 22 J. COMP. L. & ECON. 114, 128 (2025), <https://doi.org/10.1093/joclec/nhaf022>.

<sup>345</sup> *Id.* at 124 (“As would typically be the case, past quantities are nonpublic data and past prices are public data.”).

<sup>346</sup> *Id.* at 115–16.

<sup>347</sup> *Id.*

coordinate joint-profit-maximizing prices enhances efficiency.<sup>348</sup> Typically, antitrust law treats the sharing of competitively sensitive information as suspect on the grounds that it creates a transparent window through which competitors can easily track and monitor one another's behavior to reach a tacit understanding of cooperation—the more granular and recent the information, the greater the risk.<sup>349</sup> However, if shared data is being pooled into a dataset used only to compute a price recommendation rather than to provide extensive detail about the behavior of individual competitors, it serves a different function entirely. Greater transparency via data sharing is still riskier, as it allows the TPPA to overcome its cartel challenges with greater ease and precision, but the core harm lies in the objective function—how the algorithm translates that data into bespoke

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<sup>348</sup> Jay Ezrielev, *Premature Antitrust Standards in Algorithmic Pricing*, ANTITRUST, Fall 2025, at 50 (“[T]here are significant efficiency benefits from analyzing nonpublic data gathered across multiple firms. Such datasets may enable algorithms to gain additional insight into local market conditions and the inner workings of markets.”).

<sup>349</sup> See *Am. Column & Lumber Co. v. United States*, 257 U.S. 377 (1921) (holding unlawful a trade association's sharing of detailed, firm-specific, and near-real-time data on individual members' sales, prices, and production through a central clearinghouse, because it enabled members to monitor each other's behavior closely enough to sustain anticompetitive coordination); *Maple Flooring Mfrs.' Ass'n v. United States*, 268 U.S. 563 (1925) (holding lawful a trade association's sharing of aggregated, anonymized data on past prices, costs, and inventory, because historical and industry-wide averages reveal market trends without exposing individual firms' strategies or enabling the close mutual monitoring that easily facilitates coordination). The contrast between these two cases illustrates the principle that the anticompetitive risk of information sharing is proportional to its granularity and recency. Disaggregated, current data enables identification and retaliation against individual deviations, while aggregated historical data does not. Note that restrictions on the recency of shared data are made less effective in the age of algorithms. See Doha Mekki, Principal Deputy Assistant Att'y Gen., U.S. Dep't of Just. Antitrust Div., Remarks at GCR Live: Law Leaders Global 2023 (Feb. 2, 2023), <https://www.justice.gov/archives/opa/speech/principal-deputy-assistant-attorney-general-doha-mekki-antitrust-division-delivers-0> [<https://perma.cc/L4H6-9KBX>] (“[T]he suggestion that data that is at least three-months old is unlikely to be competitively sensitive or valuable is undermined by the rise of data aggregation, machine learning, and pricing algorithms that can increase the competitive value of historical data for some products or services.”).

prices, and whether those prices are competitive or not—rather than the dataset itself. The approach outlined in Part III.D sufficiently deters joint-profit-maximizing objective functions, regardless of the data being used.

The erroneous approach applied thus far insufficiently deters ATC. To render coherent its claim that RealPage’s AIRM product was anticompetitive due chiefly to the exchange of competitively sensitive information on which it was built, the DOJ asserted that RealPage’s legacy product, Lease Rent Options (“LRO”)—which RealPage acquired in 2017 and which was apparently designed “to head off any concerns about collusion” by relying only on public price data<sup>350</sup>—was the preferable procompetitive alternative to the anticompetitive AIRM.<sup>351</sup> With LRO, landlords “manually input competitor information into the system that they have obtained from public websites.”<sup>352</sup> As a result, when the DOJ settled with RealPage last year—following the model of various settlements with RealPage and its landlord clients<sup>353</sup>—the key proposed remedies restrict the nonpublic data from one’s competitors the algorithm can utilize to make price recommendations.<sup>354</sup> RealPage’s own

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<sup>350</sup> *In re* RealPage, Inc., Rental Software Antitrust Litig. (No. II), No. 3:23-cv-00381, slip op. at 10 (M.D. Tenn. Dec. 28, 2023).

<sup>351</sup> Amended Complaint, *United States v. RealPage, Inc.*, *supra* note 109, at 97 (“RealPage has the capability to modify its software products to eliminate competitive defects. LRO does not require the same type and quantity of nonpublic, transactional data pulled from competitors’ property management software.”).

<sup>352</sup> *Id.* at 23.

<sup>353</sup> See Proposed Final Judgment, *United States v. RealPage, Inc.*, No. 1:24-cv-00710-LCB-JLW (M.D.N.C. Jan. 2025) (proposed DOJ consent judgment with Cortland); Proposed Final Judgment, *United States v. RealPage, Inc.*, No. 1:24-cv-00710-LCB-JLW (M.D.N.C. Aug. 8, 2025) (proposed DOJ consent judgment with Greystar); Press Release, Cal. Dep’t of Just., Attorney General Bonta Announces \$7 Million Settlement with Greystar for Participating in an Algorithmic Rent Alignment Scheme (Nov. 18, 2025), <https://oag.ca.gov/news/press-releases/attorney-general-bonta-announces-7-million-settlement-greystar-participating> [<https://perma.cc/7L5W-VFFW>] (announcing multistate \$7 million settlement with Greystar joined by California, Colorado, Connecticut, Illinois, Massachusetts, Minnesota, Oregon, and Tennessee).

<sup>354</sup> Press Release, U.S. Dep’t of Just., Justice Department Requires RealPage to End the Sharing of Competitively Sensitive Information and Alignment of Pricing Among Competitors (Nov. 24, 2025), <https://www.justice.gov/opa/pr/justice-department-requires-realpage->

counsel then expressed gratitude to the DOJ for “bless[ing] the legality of RealPage’s prior and planned product changes.”<sup>355</sup> For the reasons explained above, even a model complying with the DOJ’s proposed remedies harbors the potential and incentive to facilitate anticompetitive coordination.

To be sure, public price information is undoubtedly efficiency-enhancing. The approach argued for here does not imply the suppression of any public price information—only the unambiguous and deterrable manipulation of that data pursuant to anticompetitive objectives.

#### D. INTENT

This Section refutes the objection that ATC cannot constitute an agreement because it lacks the “unity of intent”<sup>356</sup> associated with traditional conspiracies.<sup>357</sup> This view rests on dicta framing agreement in terms like ‘meeting of the minds,’<sup>358</sup> which some

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end-sharing-competitively-sensitive-information-and  
[<https://perma.cc/6XLC-ASY7>].

<sup>355</sup> *RealPage Reaches Settlement with U.S. Department of Justice Regarding Revenue Management Software*, REALPAGE (Nov. 24, 2025), <https://www.realpage.com/news/realpage-reaches-settlement-with-us-department-of-justice/> [<https://perma.cc/55SJ-FLNW>].

<sup>356</sup> See Albert J. Harno, *Intent in Criminal Conspiracy*, 89 U. PA. L. REV. 624, 633 (1941).

<sup>357</sup> Ania Thiemann & Pedro Gonzaga, *Big Data: Bringing Competition Policy to the Digital Era*, OECD (Oct. 27, 2016), <https://doi.org/10.1787/a1c2d55c-en> (“[I]t may be very difficult, if not impossible, to prove an intention to coordinate prices.”); Daryl Lim, *Address Algorithmic Collusion with Compliance by Design*, PROMARKET (June 20, 2023), <https://www.promarket.org/2023/06/20/address-algorithmic-collusion-with-compliance-by-design/> [<https://perma.cc/R7T5-5RPS>] (“The law prohibits agreements, but algorithms may reach decisions without humans intending to help them reach collusive outcomes. Black box algorithms may independently determine the best way to maximize profit.”); Stucke, *supra* note 20 (doubting whether courts could find liability in the absence of “evidence of anticompetitive intent”); Schechner, *supra* note 266 (“Antitrust experts say it could be difficult to prove illegal intent as is often required in collusion cases.”).

<sup>358</sup> Gal, *supra* note 20, at 109 (excluding certain forms of algorithmic collusion from liability on the basis that “[a]greement requires a ‘meeting of minds’”); see also Christian Bergqvist & Camila Ringeling, *Finding the Ghost in the Shell: EU and US Antitrust Enforcement of AI Collusion*, in A.I. & COMPETITION POL’Y 151–52 (Alden Abbott & Thibault Schrepeel eds., 2024) (“Enforcers on both

scholars interpret to require intentional collusion by the algorithm's programmers or operators.<sup>359</sup>

To be sure, human intent is obscured and sometimes absent when decision-making is delegated to machines. In the *Hub-and-Spoke* scenario, a TPPA can recommend or set collusive prices without the subscribing firms' knowledge.<sup>360</sup> In the *Predictable Agent* scenario, a simple algorithm might "gullibl[y]" follow price increases, leading to noncompetitive outcomes without the intent of the managers.<sup>361</sup> Finally, in the *Digital Eye* scenario, autonomous pricing algorithms can learn to collude entirely

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sides of the Atlantic have sought to address this issue by identifying the ghost behind the shell. This is, the *human will* and responsibility in designing and implementing the AI, as well as the meeting of the minds to use it in a way that leads to collusive outcomes." (emphasis added).

<sup>359</sup> Gal, *supra* note 20, at 107 ("Engaging in an agreement requires the intent to do so. Algorithms cannot have a mental state of 'intent,' or any mental state . . . the intent of the programmer to create coordination through the use of algorithms, and the intent of the user to employ such an algorithm, can fulfill this requirement."); OREN BAR-GILL & CASS R. SUNSTEIN, *ALGORITHMIC HARM: PROTECTING PEOPLE IN THE AGE OF ARTIFICIAL INTELLIGENCE* 99 (2025) ("It can and should count as an 'agreement' when two CEOs actively choose to deploy pricing algorithms with predictable consequences.").

<sup>360</sup> See Monopolkommission, *Algorithms and Collusion*, in BIENNIAL REPORT XXII: COMPETITION 2018 24 (2018) ("Conversely, liability gaps can open up if the IT service provider brings about a collusive market outcome without the approval of the parties involved . . . users may not be able to recognize this collusive market outcome themselves—e.g., due to the complexity of the product or the market conditions—and therefore may not form a joint intention necessary to create a cartel."); Harrington, *supra* note 119, at 137 ("[A] third party may design its pricing algorithm to have anticompetitive effect without the consent or even knowledge of the firms who are adopting the pricing algorithm."); EZRACHI & STUCKE, *supra* note 44, at 52; see also Kevin Hopkins, *The Arguments Against RealPage Aren't Real, Part One*, R. ST. INST. (Oct. 9, 2024), <https://www.rstreet.org/commentary/the-arguments-against-realpage-arent-real-part-one/> [<https://perma.cc/9LNW-VF3P>] (suggesting that a lack of anticompetitive intent exonerates RealPage).

<sup>361</sup> See Schwartz, *supra* note 242, at 195–96 ("[S]imple, 'gullible' pricing algorithms . . . implement programs that automatically mimic competing prices . . . [and] can reliably collude on accident, without human agreement or intent.").



without human supervision.<sup>362</sup> In each case, managers might accidentally stumble into “unconscious parallelism.”<sup>363</sup>

Moreover, the pricing algorithms that displace human decision-making do not themselves exhibit understanding or intentionality. Philosopher John Searle’s Chinese Room thought experiment illustrates the point: a person can mechanically follow a rulebook to write fluent Chinese—analogous to how AI generates output—without understanding a single word.<sup>364</sup> Similarly, pricing algorithms only manipulate data according to formal rules without any subjective intent or *mens rea*.

Regardless, *mens rea* is not required for establishing antitrust liability: subjective intent is neither a necessary nor a sufficient condition thereof; it is relevant only insofar as it illuminates the economic or strategic logic of the practice in question, which goes to its potential anticompetitive effects.

Intent is certainly not a sufficient condition of antitrust liability. Mere conscious parallelism is often accompanied by explicit admissions of intent to coordinate, but is nonetheless lawful.<sup>365</sup> Practices are not unlawful unless they tend to distort market incentives and undermine allocative efficiency, even if done out of “pure malice.”<sup>366</sup> No subjective intent is negative enough to invite antitrust liability by itself.

Neither is intent necessary. Even if firms claim procompetitive, altruistic, or benevolent reasons for their

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<sup>362</sup> See EZRACHI & STUCKE, *supra* note 44, at 78 (“Lacking evidence of either an anticompetitive agreement or intent, prosecutors now have few, if any, tools to challenge [Digital Eye] tacit collusion.”); Calvano et al., *supra* note 89, at 3267–68 (suggesting that the *Digital Eye* scenario might “defy current antitrust policy”).

<sup>363</sup> Adam Woldson, Kevin Teruya, Debra Bernstein, Stegi Olson, Stephen Mavroghenis & Boris Bronfentrinker, *Artificial Intelligence and Antitrust: When Do Algorithms Violate Competition Laws?*, QUINN EMMANUEL URQUHART & SULLIVAN, LLP (June 7, 2021), <https://www.quinnemanuel.com/the-firm/publications/artificial-intelligence-and-antitrust-when-do-algorithms-violate-competition-laws/> [https://perma.cc/7ZC7-L7SV].

<sup>364</sup> John R. Searle, *Minds, Brains, and Programs*, 3 BEHAV. & BRAIN SCI. 417, 417–18 (1980).

<sup>365</sup> Page, *supra* note 23, at 593–94.

<sup>366</sup> See *Brooke Grp.*, 509 U.S. at 225 (“Even an act of pure malice by one business competitor against another does not, without more, state a claim under the federal antitrust laws.”); BORK, *supra* note 153, at 276 (“[I]t seems unfair to punish persons who may have had a wrongful intent but whose conduct cannot conceivably have succeeded in harming consumers.”).

conduct, they violate the law if their agreement even inadvertently results in harm to the competitive process.<sup>367</sup> As Justice Brandeis observed, intent evidence matters in evaluating restraints of trade “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 predict consequences.”<sup>368</sup> Similarly, the D.C. Circuit in *United States v. Microsoft* held that “the intent behind the conduct of a monopolist is relevant only to the extent it helps us understand the likely effect of the monopolist’s conduct.”<sup>369</sup> The agencies’ 2023 Merger Guidelines articulate the same principle: intent is sometimes a useful evidentiary indicator of competitive effects, but its absence does not preclude a finding of liability.<sup>370</sup>

Some commentators have suggested that absent intent, ATC might evade not only the Sherman Act but the FTC Act as well.<sup>371</sup> In *Ethyl*, the court held that Section 5’s prohibition on “unfair methods of competition” can reach *unilateral* facilitating practices, but only when paired with evidence of anticompetitive intent,<sup>372</sup> a point Amazon invoked when moving to dismiss the FTC’s claim against Project Nessie as evidence of “parallel

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<sup>367</sup> See *FTC v. Superior Ct. Trial Laws. Ass’n*, 493 U.S. 411, 427 (1990) (“No matter how altruistic the motives of respondents may have been, it is undisputed that their immediate objective was to increase the price that they would be paid for their services.”); *Nat’l Collegiate Athletic Ass’n v. Bd. of Regents of Univ. of Okla.*, 468 U.S. 85, 101 n.23 (1984) (“[It is] well settled that good motives will not validate an otherwise anticompetitive practice.”).

<sup>368</sup> *Chi. Bd. of Trade*, 246 U.S. at 238.

<sup>369</sup> *Microsoft*, 253 F.3d at 59.

<sup>370</sup> 2023 Merger Guidelines, *supra* note 295, at 34 (explaining that evidence of anticompetitive intent, such as plans to “coordinate with other firms, raise prices, reduce output or capacity” can be “highly informative in evaluating the effects of a merger on competition,” though the agencies “give little weight” to the absence of such evidence or even “expressed contrary intent”); see also *General Leaseways, Inc. v. National Truck Leasing Ass’n*, 744 F.2d 588, 595–96 (7th Cir. 1984) (arguing that what little weight should be given to evidence of anticompetitive intent is helpful only insofar as it casts light on “the central question in an antitrust case: actual or probable anticompetitive effect.”).

<sup>371</sup> Schwartz, *supra* note 242, at 220 (“Without intent, collusion by gullible agents circumvents even the FTC’s expanded antitrust stance.”).

<sup>372</sup> See *E.I. Du Pont De Nemours*, 729 F.2d at 139.

pricing” without an “agreement.”<sup>373</sup> The court denied that motion on the strength of the FTC’s allegations pointing to anticompetitive intent,<sup>374</sup> but the implication is that similar outcomes without such evidence would escape liability even under the FTC Act.

That concern is inapposite. *Ethyl* meant to expand the FTC Act beyond the Sherman Act to reach conduct falling short of even a tacit agreement.<sup>375</sup> Yet because the FTC Act nonetheless fails to reach mere interdependence, it requires “at least some indicia of oppressiveness,” such as evidence of anticompetitive intent.<sup>376</sup> Because ATC constitutes a tacit agreement, allegations of unlawful ATC simply need not invoke *Ethyl* or the expanded scope of the FTC Act.

Finally, it may seem counterintuitive that firms could be held liable for conduct not intended by any human actor. Yet liability is the mechanism through which the law deters wrongful behavior, including negligence towards anticompetitive outcomes. Firms are already responsible for the actions of managers and employees, which is why they invest in compliance programs. By the same logic, they should be held liable for the AI systems they deploy, incentivizing them to audit, design, and train their algorithms to avoid anticompetitive strategies. As former European Commissioner for Competition Margrethe Vestager observed, “[w]hat businesses can and must do is to ensure antitrust compliance by design... [w]hat businesses need to know is that when they decide to use an automated system, they will be held responsible for what it does.”<sup>377</sup>

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<sup>373</sup> Defendant Amazon.com, Inc.’s Motion to Dismiss at 25, *FTC v. Amazon.com, Inc.*, 71 F.Supp.3d 1158 (W.D. Wash. 2024) (No. 2:23-cv-01495-JHC).

<sup>374</sup> Sealed Order on Defendant’s Motion to Dismiss and Plaintiffs’ Motion to Bifurcate at 27, *FTC v. Amazon.com, Inc.* 7 F. Supp 3d 1158 (No. 2:23-cv-01495-JHC).

<sup>375</sup> *Ethyl*, 729 F.3d at 139 (“[B]efore business conduct in an oligopolistic industry may be labelled ‘unfair’ within the meaning of Sec. 5 a minimum standard demands that, absent a tacit agreement, at least some indicia of oppressiveness must exist such as (1) evidence of anticompetitive intent”).

<sup>376</sup> *Id.*

<sup>377</sup> Nicholas Hirst, *When Margrethe Vestager Takes Antitrust Battle to Robots*, POLITICO (Feb. 28, 2018), <https://www.politico.eu/article/trust-busting-in-the-age-of-ai/> [<https://perma.cc/PL6U-VST9>]; see also Mehra, *supra* note 20, at 1366 (“[I]n dealing with a robo-seller that takes anticompetitive actions there

## CONCLUSION

The agreement doctrine represents an economic judgment, faithful to the consumer welfare prescription at the foundation of Section 1, that the error costs of judicial intervention outweigh the anticompetitive effects of tacit collusion. When the assumptions underlying that judgment no longer hold, neither does the judgment itself. Pricing algorithms make collusion identifiable, remediable, and separable from its procompetitive counterparts, solving the problems of remedy and proof. Algorithmic tacit collusion, therefore, is anticompetitive without any countervailing efficiency justification—an unreasonable restraint of trade—fitting the doctrinal category of tacit agreement. To still posit that the agreement doctrine exonerates algorithmic tacit collusion contradicts the law’s fundamental principles—what this Article termed the algorithmic antitrust paradox.

The Sherman Act, our “Magna Carta of free enterprise,”<sup>378</sup> has always been a flexible instrument, capable of meeting evolving threats to free and competitive markets. The hope is that enforcers utilize the legal theory developed in this Article, wielding that instrument to protect consumers squeezed by a crisis of affordability.

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are three choices in attributing responsibility: to the robo-seller itself, to the humans who deploy it, or to no one.”); Hovenkamp & Schrepel, *supra* note 125, at 10 (“[H]uman actors are responsible not only for their affirmative instructions but also for the reasonably anticipated consequences of their actions.”).

<sup>378</sup> *Topco*, 405 U.S. at 610.