Not from Concentrate: Collusion in Collaborative Industries

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ABSTRACT: The chief principle of antitrust law and theory is that reducing market concentration—having more, smaller firms instead of fewer, bigger ones—reduces anticompetitive behavior. We demonstrate that this principle is fundamentally incomplete.

In many industries, collaborating with rivals is important. Firms in such "Collaborative Industries" are interdependent, and they can use their interdependence to collude. Reducing market concentration does not change this dynamic, and thus does not prevent collusion. Worse, if smaller firms depend on collaboration more than larger ones do, reducing market concentration can actually encourage collusion.

Antitrust enforcers have observed that Collaborative Industries are more prone to collusion. Yet conventional economic models, and the antitrust laws and policies built upon them, do not reflect Collaborative Industries' dynamics. Our findings have important implications for antitrust doctrine, how regulators choose and present cases, the public guidance that agencies issue, and the methods that regulators employ to fight collusion.

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INTRODUCTION

A longstanding, fundamental principle of antitrust law is that concentrated markets are more likely to exhibit anticompetitive behavior.[1] Conversely, less concentrated markets are less likely to exhibit anticompetitive behavior. The logic of this "Concentration Principle" is straightforward: When an industry is comprised of many small firms, it is more difficult for them to collude on a

1. *See, e.g.*, Tops Mkts., Inc. v. Quality Mkts., Inc., 142 F.3d 90, 99 (2d Cir. 1998) (citing 2A PHILLIP E. AREEDA & HERBERT HOVENKAMP, ANTITRUST LAW ¶ 532a, at 161 (1995)); Oahu Gas Serv., Inc. v. Pac. Res. Inc., 838 F.2d 360, 365–67 (9th Cir. 1988); U.S. DEP'T OF JUST. & FED. TRADE COMM'N, HORIZONTAL MERGER GUIDELINES § 5, at 15 (2010) [hereinafter HMG], https://www.justice.gov/sites/default/files/atr/legacy/2010/08/19/hmg-2010.pdf [https://perma.cc/T8UZ-MA28]; *see* ANDREW I. GAVIL, WILLIAM E. KOVACIC & JONATHAN B. BAKER, ANTITRUST LAW IN PERSPECTIVE: CASES, CONCEPTS AND PROBLEMS IN COMPETITION POLICY 39 (2002); ANDREU MAS-COLLEL, MICHAEL D. WHINSTON & JERRY R. GREEN, MICROECONOMIC THEORY 383 (1995); RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 372 (8th ed. 2011); George J. Stigler, *A Theory of Oligopoly*, 72 J. POL. ECON. 44, 44 (1964).

high price, and more likely that a firm will "cheat," undercutting the collusive price in order to attract more customers.[2]

The Concentration Principle is unquestioned and ubiquitous in antitrust law and theory. It is literally textbook antitrust economics.[3] A large body of academic literature, both theoretical and empirical, takes it as a given.[4] Courts have repeatedly invoked it,[5] and the Department of Justice ("DOJ") and the Federal Trade Commission ("FTC") explicitly incorporate it into their regulations and decision-making processes.[6]

Yet the Concentration Principle is fundamentally incomplete. The economic models underlying the Concentration Principle assume that rival firms only interact through competition. In this view, a firm can only affect its peers by competing more or less aggressively. For example, suppose that firms in an industry agree to charge high prices—i.e., not to compete. If a firm breaks that agreement, the only way for the rest of the industry to punish that firm is to slash their own prices in response—i.e., to also compete aggressively.

The real world is more complicated. Many industries' dynamics resemble the Classical Model's, but in many others, rival firms collaborate as well as compete. For example, consider residential realtors. Rival realtors compete for clients. However, realtors benefit when their clients consummate

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2. Policing the cartel becomes harder; there are more potential cheaters, and the lure of increased market share is often more attractive for smaller firms than larger ones. *See, e.g.*, HMG, *supra* note 1, § 5, at 15 ("For example, if a price reduction to gain new customers would also apply to a firm's existing customers, a firm with a large market share may be more reluctant to implement a price reduction than one with a small share."); POSNER, *supra* note 1, at 372; Christopher R. Leslie, *Trust, Distrust, and Antitrust*, 82 TEX. L. REV. 515, 564–65 (2004); *cf.* Jordan M. Barry, John William Hatfield & Scott Duke Kominers, *Coasean Keep-Away: Voluntary Transaction Costs* 24–28 (San Diego Legal Stud. Working Paper, Paper No. 14-149, 2014) (describing an individual firm's incentives to resist contributing to a common enterprise if its nonparticipation does not doom the enterprise).

3. *See, e.g.*, GAVIL ET AL., *supra* note 1, at 39 ("Antitrust law primarily is concerned with two of the features associated with perfect competition: the numbers of buyers and sellers, and conditions of entry."); DOUGLAS F. GREER, INDUSTRIAL ORGANIZATION AND PUBLIC POLICY 403–04 (3d ed. 1992); POSNER, *supra* note 1, at 372; DON E. WALDMAN & ELIZABETH J. JENSEN, INDUSTRIAL ORGANIZATION: THEORY AND PRACTICE 91 (2d ed. 2001).

4. *See, e.g.*, Peter C. Carstensen, *Concentration and the Destruction of Competition in Agricultural Markets: The Case for Change in Public Policy*, 2000 WIS. L. REV. 531, 532–33; John M. Connor, *Empirical Challenges in Analyzing Market Performance in the U.S. Food System*, 72 AM. J. AGRIC. ECON. 1219, 1221–23 (1990); Ronald W. Cotterill, *Food Mergers: Implications for Performance and Policy*, 5 REV. INDUS. ORG. 189, 190–93 (1990); Dennis C. Mueller, *Further Comment on the Social Benefits from an Effective Antimerger Policy*, 12 REV. INDUS. ORG. 701, 701 (1997); *see* Richard Schmalensee, *Inter-Industry Studies of Structure and Performance*, *in* 2 HANDBOOK OF INDUSTRIAL ORGANIZATION 951, 969–87 (Richard Schmalensee & Robert D. Willig eds. 1989).

5. *See, e.g.*, *Tops Mkts.*, 142 F.3d at 99; *Oahu Gas Serv. Inc.*, 838 F.2d at 365–67.

6. For example, the Department of Justice generally exempts mergers from antitrust review when market concentration is low enough. HMG, *supra* note 1, § 5.3, at 19. In contrast, horizontal mergers are presumed to have unacceptable anticompetitive effects when market concentration is above a specified level. *Id.*

transactions.[7] Thus, realtors also collaborate to encourage transactions: They work together to show sellers' properties to interested buyers and to present buyers' offers to sellers. Once an offer is accepted, realtors jointly shepherd the transaction to completion.

To take another example, consider market makers—brokers that facilitate the buying and selling of publicly traded securities. Market makers seek to fulfill their clients' orders—that means matching those looking to buy shares of a particular stock with those looking to sell. Market makers interact with each other frequently, pairing their buyers with their rivals' sellers and vice versa.

The U.S. market for underwriting initial public offerings ("IPOs") of corporate equity (the "IPO Underwriting Market") provides a third example. Underwriters compete to win underwriting business from companies that are going public. But once a company chooses its lead underwriter, that underwriter puts together a "syndicate" of underwriters to execute the IPO—in other words, the lead underwriter subcontracts some of the work to its erstwhile rivals.[8]

Residential real estate agents' commissions total one hundred billion dollars annually[9]; market-making and underwriting are also enormous markets. Yet they are but a few examples of a much larger phenomenon. Collaborative interactions among rivals are commonplace and important in many industries ("Collaborative Industries"), including law, finance, entertainment, sports, construction, manufacturing, art, transportation, energy, and telecommunications.[10] These interactions are particularly important for antitrust, for two principal reasons.

First, because collaborative interactions give firms an additional mechanism to punish and reward each other, they make it easier to enforce collusion. In particular, firms can refuse to collaborate with any rival that cuts its price below the collusive price. Thus, collaborative interactions make collusion more feasible in general.

Second, reducing industry concentration may not reduce the harm a firm suffers from being ostracized. Isolation can hurt smaller firms more than larger ones. Accordingly, lower market concentration can *encourage* collusive behavior—the polar opposite of what the Concentration Principle predicts. To understand the intuition, consider a small realtor with few clients: Almost every property sale she works on will feature a buyer or seller represented by a rival realtor. If she has trouble working with her peers, it may significantly

7. Realtors benefit directly because they are paid when transactions close. They benefit indirectly to the extent that clients prefer realtors who close more transactions.

8. *See infra* notes 114–15 and accompanying text.

9. Peter Robison & Noah Buhayar, *The National Association of Realtors Is Sorry About All the Discrimination*, BLOOMBERG (Dec. 21, 2021, 9:00 AM), https://www.bloomberg.com/news/features/2021-12-21/real-estate-agents-want-to-fix-housing-discrimination-but-keep-their-commission [https://perma.cc/VFK4-5VB8?type=image].

10. *See infra* notes 116–17 and accompanying text.

damage her business. She thus has powerful incentives to stay in her rivals' good graces.[11]

Collaborative Industry dynamics can illuminate behaviors that are otherwise difficult to explain. For example, U.S. realtors have charged six percent commissions on residential home sales for decades.[12] Over that period, the internet has made it much easier for home buyers and sellers to find each other, yet realtors' market share and pricing have largely remained unchanged. The uniformity in pricing and resistance to change, despite this technological shock, suggests collusive pricing—as a pending multi-billion-dollar lawsuit alleges.[13] President Biden has even issued an executive order specifically calling upon the FTC to investigate anticompetitive practices among real estate agents.[14] At the same time, the industry features low levels of concentration and low barriers to entry.[15] Conventional economic theory predicts that such circumstances should force firms to compete aggressively; the observed pattern "of commission rates presents an enormous puzzle."[16]

Similarly, U.S. underwriters' fees for small and mid-size IPOs are extremely uniform.[17] A U.S. Securities and Exchange Commission ("SEC") study found

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11. *See* Competitive Impact Statement at 24–26, United States v. Alex. Brown & Sons, Inc., 169 F.R.D. 532 (S.D.N.Y. 1996) (No. 96-5313), ECF No. 2 [hereinafter DOJ NASDAQ Statement], https://www.justice.gov/atr/case-document/file/484141/download [https://perma.cc/TZX9-VJAP] (describing how smaller market makers were particularly reliant on their peers and how the industry adopted rules that used this vulnerability to prevent smaller firms from undercutting the collusive pricing).

12. *See* Chang-Tai Hsieh & Enrico Moretti, *Can Free Entry Be Inefficient? Fixed Commissions and Social Waste in the Real Estate Industry*, 111 J. POL. ECON. 1076, 1077 (2003).

13. *See* Class Action Complaint at 25–27, Moehrl v. Nat'l Ass'n of Realtors, 492 F. Supp. 3d 768 (N.D. Ill. 2019) (No. 19-cv-01610), ECF No. 1, https://www.courthousenews.com/wp-content/uploads/2019/03/119cv1610-USDC-Northern-Illinois.pdf [https://perma.cc/WZ8U-SJY4]; *see also* Competitive Impact Statement at 1–4, United States v. Nat'l Ass'n of Realtors, No. 05-cv-05140, (N.D. Ill. 2008), ECF No. 239 [hereinafter DOJ Realtor Statement], https://www.justice.gov/atr/case-document/file/505766/download [https://perma.cc/88ZV-KCU7] (describing terms of settlement of 2005 to 2008 DOJ lawsuit against realtors, alleging collusion against realtors offering extensive internet-based services in which DOJ obtained substantially all requested concessions).

14. Exec. Order No. 14,036 § 5(h)(vi), 86 Fed. Reg. 36,987, 36,992 (July 9, 2021), https://www.govinfo.gov/content/pkg/FR-2021-07-14/pdf/2021-15069.pdf [https://perma.cc/MA69-DF28].

15. *See, e.g.*, Jason Beck, Frank Scott & Aaron Yelowitz, *Concentration and Market Structure in Local Real Estate Markets*, 40 REAL EST. ECON. 422, 422 (2012); FED. TRADE COMM'N & U.S. DEP'T OF JUST., COMPETITION IN THE REAL ESTATE BROKERAGE INDUSTRY 32–33 (2007), https://www.ftc.gov/sites/default/files/documents/reports/competition-real-estate-brokerage-industry-report-federal-trade-commission-and-u.s.department-justice/v050015.pdf [https://perma.cc/35WJ-5C3B].

16. Hsieh & Moretti, *supra* note 12, at 1086; *see also* Steven D. Levitt & Chad Syverson, *Market Distortions When Agents Are Better Informed: The Value of Information in Real Estate Transactions*, 90 REV. ECON. & STAT. 599, 599–601 (2008) (making a similar argument). *See generally* B. Douglas Bernheim & Jonathan Meer, *Do Real Estate Brokers Add Value When Listing Services Are Unbundled?*, 51 ECON. INQUIRY 1166 (2013) (arguing that real estate agents provide poor service at high prices despite low barriers to entry).

17. *See* Hsuan-Chi Chen & Jay R. Ritter, *The Seven Percent Solution*, 55 J. FIN. 1105, 1105 (2000).

that, from 2001 to 2016, "over 96% of midsized IPOs featured a [fee] of exactly 7%" of the value of stock sold.[18] Non-U.S. underwriters charge significantly lower and less uniform fees.[19] Several commentators argue that the industry's strange pricing behavior suggests collusion.[20] Others reject this view, arguing that the market is "unconcentrated" under DOJ and FTC guidelines.[21]

There is less debate about market makers: A DOJ investigation found that NASDAQ market makers priced stocks collusively for years, enriching themselves at investors' expense.[22] One might nonetheless wonder how this collusion happened. There were numerous market makers—more than fifty made a

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18. Robert J. Jackson Jr., Former Sec. & Exch. Comm'r, Speech at the Greater Cleveland Middle Market Forum: The Middle-Market IPO Tax (Apr. 25, 2018), https://www.sec.gov/news/speech/jackson-middle-market-ipo-tax [https://perma.cc/PQ52-ZLZR].

19. *See, e.g.*, Sami Torstila, *The Clustering of IPO Gross Spreads: International Evidence*, 38 J. FIN. & QUANTITATIVE ANALYSIS 673, 688 (2003).

20. *See, e.g.*, Mark Abrahamson, Tim Jenkinson & Howard Jones, *Why Don't U.S. Issuers Demand European Fees for IPOs?*, 66 J. FIN. 2055, 2078–79 (2011); Chen & Ritter, *supra* note 17, at 1106–07, 1125–26; Ari Kang & Richard Lowery, *The Pricing of IPO Services and Issues: Theory and Estimation*, 2 REV. CORP. FIN. STUD. 188, 190–91 (2014); Evgeny Lyandres, Fangjian Fu & Erica X. N. Li, *Do Underwriters Compete in IPO Pricing?*, 64 MGMT. SCI. 925, 925–27 (2018). To quote SEC Commissioner Robert Jackson, Jr.:

> You see, when I was a banker [around twenty years ago], we charged a standard fee for a middle-market IPO: seven percent. . . . [O]ur fee was *always* seven percent. Whatever industry the company was in, whatever its growth profile, however qualified its management team was, if they were a smaller firm, they always paid seven percent.
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> . . . I assumed that technology and competition would eventually lead bankers to give middle-market companies better pricing . . . . [b]ut . . . nothing has changed: middle-market entrepreneurs still have to pay 7% . . . .
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> . . . I think it's high time to ask whether middle-market companies are paying too high a price for access to America's capital markets.

Jackson, *supra* note 18.

21. *See, e.g.*, Robert S. Hansen, *Do Investment Banks Compete in IPOs?: The Advent of the "7% Plus Contract,"* 59 J. FIN. ECON. 313, 344 (2001); *see also* Torstila, *supra* note 19, at 691 (finding that U.S. IPO spreads are low and not necessarily collusive). For their part, issuers have taken a negative view of the IPO Underwriting Market and have increasingly avoided traditional IPOs in recent years. *See, e.g.*, Matt Levine, *SPACs Aren't Cheaper Than IPOs Yet*, BLOOMBERG (July 27, 2020, 10:59 AM), https://www.bloomberg.com/opinion/articles/2020-07-27/spacs-aren-t-cheaper-than-ipos-yet [https://perma.cc/U7C2-ZQUB?type=image] ("People complain about . . . IPO fees and IPO pops . . . constantly[,] . . . saying that the IPO process is broken and that something needs to replace it. Last year that something was direct listings; this year SPACs are getting all the attention."); Yun Li, *SPACs Outpace Traditional IPOs 2 Months Straight, Bringing 2020 Issuance to a Record $33 Billion*, CNBC (Sept. 9, 2020, 12:34 PM), https://www.cnbc.com/2020/09/09/spacs-outpace-traditional-ipos-2-months-straight-bringing-2020-issuance-to-a-record-33-billion.html [https://perma.cc/LP5S-QQZA?type=image].

22. DOJ NASDAQ Statement, *supra* note 11, at 4–7; *see also* William G. Christie & Paul H. Schultz, *Why Do NASDAQ Market Makers Avoid Odd-Eighth Quotes?*, 49 J. FIN. 1813, 1838–39 (1994) (analyzing "spreads for 100 NASDAQ stocks" and stating they could not "envision any scenario in which 40 to 60 dealers . . . would simultaneously and consistently avoid using odd-eighth quotes without an implicit agreement to post quotes only on the even price fractions").

market in Apple stock, for example—and new firms could easily enter the market.[23] How could such a large group, peddling identical products, sustain a collusive pricing scheme?

Our analysis explains how these markets could produce collusive outcomes despite being unconcentrated: These industries are Collaborative Industries.[24] Collaborative interactions can support collusion, even when industry concentration is low.[25]

In this Article, we present a game-theoretic model that gives new insight into how collaborative interactions affect firms' ability to collude. Our analysis suggests that firms in Collaborative Industries have greater ability to collude and will therefore engage in more collusive behavior, than existing theory suggests. This insight yields four chief implications for antitrust law and policy.

First, our analysis directly impacts multiple antitrust doctrines. For example, in many instances, collusive behavior only violates antitrust laws when it is conducted pursuant to an agreement; industry-wide supra-competitive pricing without an agreement is generally legal.[26] However, an agreement need not be explicit; fact-finders can infer one from circumstantial evidence, sometimes referred to as "plus factors."[27] Our analysis identifies two suspect industry behaviors that accompany and facilitate collusion: (1) refusing to transact with firms that cut prices; and (2) rewarding firms that refuse to transact with firms that cut prices. Courts and agencies should count both behaviors as plus factors supporting the existence of an agreement.

Second, our results inform how regulators and other plaintiffs should select and present cases. Industries in which firms have many interconnections merit additional scrutiny. The DOJ and FTC have observed this phenomenon through their experience and have incorporated it into their formal guidance

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23. Christie & Schultz, *supra* note 22, at 1813, 1835.

24. We make no causal claims about pricing in the IPO Market or any other specific market. While we present suggestive evidence supporting the dynamics we identify, more in-depth analysis is necessary to determine whether and how much those dynamics have raised prices and reduced output in specific contexts. We leave that important project for future scholarship.

25. IPO Underwriters can use the same approaches we discuss here to collusively extract value from issuers in other ways, such as systematically mis-pricing IPOs. *See, e.g.*, Patrick M. Corrigan, *The Seller's Curse and the Underwriter's Pricing Pivot: A Behavioral Theory of IPO Pricing*, 13 VA. L. & BUS. REV. 335, 342 (2019); Bloomberg, *Silicon Valley Investors Call a Summit to Rethink the IPO Business*, L.A. TIMES (Sept. 30, 2019, 6:31 PM), https://www.latimes.com/business/story/2019-09-30/silicon-valley-investors-call-summit-to-disrupt-ipo-business [https://perma.cc/2P5N-LFJA].

26. *See, e.g.*, Brooke Grp. Ltd. v. Brown & Williamson Tobacco Corp., 509 U.S. 209, 227 (1993) ("Tacit collusion, sometimes called oligopolistic price coordination or conscious parallelism, describes the process, not in itself unlawful, by which firms in a concentrated market might in effect share monopoly power, setting their prices at a profit-maximizing, supracompetitive level by recognizing their shared economic interests and their interdependence with respect to price . . . .").

27. *See, e.g.*, Christopher R. Leslie, *The Probative Synergy of Plus Factors in Price-Fixing Litigation*, 115 NW. U. L. REV. 1581, 1583 (2021).

to some extent.[28] Our results support the agencies' observation and, for the first time, ground it in a rigorous theoretical foundation. Similarly, agencies have explicitly incorporated the Concentration Principle into their case selection process.[29] In certain contexts, agencies assume that, if industry concentration is low enough, firms cannot collude.[30] Our results belie this assumption and favor more contextualized evaluations.

Third, our results should inform the public guidance that antitrust agencies issue. These documents help businesses comply with the antitrust laws and help potential victims of anticompetitive behavior identify and report it.[31] For instance, the DOJ issues guidance to help market participants detect and respond to "Price Fixing, Bid Rigging, and Market Allocation Schemes."[32] This document identifies conditions that make an industry more susceptible to collusion.[33] High market concentration is the first condition listed[34]; however, the list of conditions does not include the degree of collaborative interactions within an industry.[35] These and other documents should be updated to reflect the increased scope for collusion in Collaborative Industries.

Fourth, our analysis suggests that policymakers can reduce collusion in Collaborative Industries by making firms less reliant on each other. Policymakers can increase firms' independence by altering market structure or increasing firms' capacity. Market structure exerts powerful effects on the likelihood that firms will collude and the ways in which they will do so. Further, many Collaborative Industries are heavily regulated; the overarching legal regimes that govern these industries influence their organizational structures. For example, U.S. securities laws strongly encourage firms that wish to conduct IPOs to retain underwriters, which strengthens any potential underwriting

28. U.S. DEP'T OF JUST., PRICE FIXING, BID RIGGING, AND MARKET ALLOCATION SCHEMES: WHAT THEY ARE AND WHAT TO LOOK FOR 5–6 (rev. 2021) [hereinafter DOJ, IDENTIFYING VIOLATIONS], https://www.justice.gov/atr/file/810261/download [https://perma.cc/QT26-K6N9].

29. *See, e.g.*, HMG, *supra* note 1, § 5.3, at 18–19; FED. TRADE COMM'N & U.S. DEP'T OF JUST., ANTITRUST GUIDELINES FOR COLLABORATIONS AMONG COMPETITORS § 3.33, at 17–18 (2000) [hereinafter COLLABORATION GUIDELINES], https://www.ftc.gov/sites/default/files/documents/public_events/joint-venture-hearings-antitrust-guidelines-collaboration-among-competitors/ftcdojguidelines-2.pdf [https://perma.cc/MHK6-EWZL].

30. HMG, *supra* note 1, § 5.3, at 19; COLLABORATION GUIDELINES, *supra* note 29, § 4.2, at 26.

31. To some extent, this category overlaps with agencies' internal analyses described in the previous paragraph. For example, the horizontal merger guidelines help private actors to anticipate how regulators will respond to different potential transactions and thus plan accordingly. *See supra* text accompanying notes 28–30.

32. DOJ, IDENTIFYING VIOLATIONS, *supra* note 28, at 1 (emphasis omitted).

33. *Id.* at 5–6.

34. *Id.* at 5.

35. *See id.* 5–6. The document does identify personal connections among competitors as such a condition, and horizontal subcontracting as a potentially problematic behavior. *Id.* at 3–4, 6.

cartel.[36] Changing the law to make underwriters less central to IPOs would weaken underwriters' position, thereby discouraging collusive behavior.[37]

Similarly, firms with greater productive capacity are often less dependent on their rivals. Because interdependence among firms can foster collusion, increasing firms' capacity can undermine collusion. For example, in "Syndicated Markets,"[38] firms with greater capacity may face higher potential rewards from cheating on a cartel and may also be less susceptible to punishment by other firms. In the context of IPO underwriters, greater capacity means having access to a larger pool of potential IPO investors. Changing securities laws to broaden the pool of IPO investors could thus impede collusion in the IPO Underwriting Market.[39]

This Article proceeds as follows. Part I provides a brief primer on U.S. antitrust law and theory. Part II gives background on Collaborative Industries, with special focus on two specific types of Collaborative Industries: (1) Syndicated Markets, such as the IPO Underwriting Market; and (2) "Brokered Markets," such as the markets for residential realtor and market-making services. Part III presents an overarching model of Collaborative Industries and the implications of that model. It grounds this overarching model in models of Syndicated and Brokered Markets.[40] Part IV considers the Collaborative Industries Model's application to real-world environments. Part V discusses policy implications of our analysis. We then briefly conclude.

I. A BRIEF ANTITRUST PRIMER

We begin with some brief antitrust background. We first provide a brief overview of the high points of U.S. antitrust law and the Concentration

36. A regulation that encourages issuers to use underwriters raises issuers' reservation price for underwriting services, which enables an underwriter cartel to potentially charge higher prices. *See infra* Section V.D.1.

37. There are countervailing reasons why one might not wish to make this change. Our analysis simply adds one more factor to the policy decision.

38. Syndicated Markets are discussed further in Section II.A.

39. There are countervailing concerns. We merely highlight one new argument pushing in favor of moving in this direction.

40. These models were first and formally presented in two companion papers. All four coauthors of this Article are coauthors of John William Hatfield, Scott Duke Kominers, Richard Lowery & Jordan M. Barry, *Collusion in Markets with Syndication*, 128 J. POL. ECON. 3779 (2020) [hereinafter *Syndicated Markets*]; Hatfield, Kominers, and Lowery are coauthors of John William Hatfield, Scott Duke Kominers & Richard Lowery, *Collusion in Brokered Markets* (Harv. Bus. Sch., Working Paper No. 20-023, 2020) [hereinafter *Brokered Markets*], https://www.hbs.edu/ris/Publication%20Files/20-023_05c30778-2b91-4698-8a4e-f466bda12eee.pdf [https://perma.cc/2TJR-FPTL]. As the coauthors of these companion papers are subsets of the coauthors of this Article, for ease of exposition, we use the terms "we" and "our" when referring to these two companion papers and their contents at various points throughout this Article. For the avoidance of doubt, we note that not all coauthors of this Article are coauthors of both companion pieces.

Principle's prominent role.[41] We then turn to antitrust economic theory, the intellectual underpinning of modern antitrust law.[42]

A. ANTITRUST LAW

The Sherman Antitrust Act of 1890 (the "Sherman Act") is the wellspring of U.S. antitrust law.[43] Section 1 of the Sherman Act forbids any "contract, combination[,] . . . or conspiracy, in restraint of trade."[44] This sweeping language prohibits a wide variety of anticompetitive conduct. At the same time, several important limitations reduce the scope of its prohibitions. Two are of particular importance to our analysis here.

First, courts have long applied different standards to different forms of trade-restraining conduct.[45] Courts have found that Section 1 straightforwardly prohibits some behaviors, such as price-fixing, quantity-fixing, and dividing territory among competitors.[46] These activities are sometimes referred to as "per se" violations.[47] Other behaviors are not automatically prohibited and must be analyzed under the more contextualized "rule of reason."[48]

Rule of reason analysis seeks to determine the actual effects of particular conduct.[49] It involves three steps:

> [T]he plaintiff has the initial burden to prove that the challenged restraint has a substantial anticompetitive effect that harms consumers in the relevant market. If the plaintiff carries its burden, then the

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41. While we generally do not discuss non-U.S. antitrust law, we note that the issues discussed in Section I.A are also present in many other countries' bodies of law.

42. *See, e.g.*, Merrick B. Garland, *Antitrust and State Action: Economic Efficiency and the Political Process*, 96 YALE L.J. 486, 486 (1987) ("The analysis of legal doctrine in terms of its contribution to economic efficiency originated in antitrust law."); David W. Barnes, *Nonefficiency Goals in the Antitrust Law of Mergers*, 30 WM. & MARY L. REV. 787, 790 (1989) ("Antitrust scrutiny of [mergers and acquisitions] relies heavily, if not exclusively, on economics.").

43. *See, e.g.*, United States v. Topco Assocs., Inc., 405 U.S. 596, 610 (1972) ("[T]he Sherman Act [is] the Magna Carta of free enterprise."); Appalachian Coals, Inc. v. United States, 288 U.S. 344, 359–60 (1933) ("As a charter of freedom, the Act has a generality and adaptability comparable to . . . constitutional provisions.").

44. Sherman Act, ch. 647, § 1, 26 Stat. 209, 209 (1890) (codified as amended at 15 U.S.C. § 1 (2018)).

45. Standard Oil Co. v. United States, 221 U.S. 1, 59–60 (1911); Ohio v. Am. Express Co., 138 S. Ct. 2274, 2283 (2018) ("This Court has long recognized that, '[i]n view of the common law and the law in this country' when the Sherman Act was passed, the phrase "restraint of trade" is best read to mean "undue restraint."'" (alteration in original) (quoting *Standard Oil Co.*, 221 U.S. at 59–60)).

46. *See, e.g.*, COLLABORATION GUIDELINES, *supra* note 29, § 1.2, at 3.

47. *See, e.g.*, *Am. Express Co.*, 138 S. Ct. at 2283–84 (emphasis omitted).

48. *Id.* at 2284.

49. Copperweld Corp. v. Indep. Tube Corp., 467 U.S. 752, 768 (1984); *see also* Erik Hovenkamp, *Platform Antitrust*, 44 J. CORP. L. 713, 715–16 (2019) ("Many practices evaluated in antitrust have countervailing pro- and anticompetitive effects. The rule of reason attempts to address this tension by working through the countervailing considerations incrementally. It does so by structuring the analysis into a multi-stage burden-shifting framework.").

> burden shifts to the defendant to show a procompetitive rationale for the restraint. If the defendant makes this showing, then the burden shifts back to the plaintiff to demonstrate that the procompetitive efficiencies could be reasonably achieved through less anticompetitive means.[50]

Plaintiffs may also be able to triumph if, at the third step, they establish "that the legitimate objective does not outweigh the harm that competition will suffer—i.e., that the agreement 'on balance' remains unreasonable."[51]

In practice, the size of defendants' market share plays a pivotal role in rule of reason analysis.[52] Defendants' market share closely relates to the market's level of concentration: In a highly concentrated market, a small group of defendants will often have sizable market share. For example, consider an industry that features three firms of roughly equal size. In a suit alleging an illegal agreement among two of those firms, the defendants command a combined market share of two-thirds. Conversely, in a highly unconcentrated market, even a large group of defendants may have a small combined market share.[53] Thus, the level of concentration in an industry directly and significantly affects an antitrust plaintiff's likelihood of success.

Defendants can generally rebut an inference of market power by showing that it is easy for new firms to enter the market.[54] The logic is that, when entry

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50. *Am. Express Co.*, 138 S. Ct. at 2284 (citations omitted).

51. *Id.* at 2291 (Breyer, J., dissenting) (quoting 7 PHILLIP E. AREEDA & HERBERT HOVENKAMP, ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION ¶1507a, at 442).

52. To carry their initial burden, plaintiffs must establish substantial anticompetitive effects. Plaintiffs can do this by both (1) establishing that defendants have market power, and (2) bringing forth "some evidence that the challenged restraint harms competition." *Id.* at 2284 (majority opinion). The question of market power often becomes a question of market share. As the Eleventh Circuit stated:

> Market power is the ability to raise price significantly above the competitive level without losing all of one's business. Market share is frequently used in litigation as a surrogate for market power for two reasons. First, market power is conceptually difficult to define in any given case. Second, its measurement requires sophisticated econometric analysis. Therefore, market power is not well suited to presentation in an adversary proceeding.

Graphic Prods. Distribs., Inc. v. Itek Corp., 717 F.2d 1560, 1570 (11th Cir. 1983) (citation omitted); *see, e.g.*, Spanish Broad. Sys. v. Clear Channel Commc'ns, Inc., 376 F.3d 1065, 1069 (11th Cir. 2004); Tops Mkts., Inc. v. Quality Mkts., Inc., 142 F.3d 90, 96–98 (2d Cir. 1998); Valley Liquors, Inc. v. Renfield Imps., Ltd., 678 F.2d 742, 745 (7th Cir. 1982).

53. In a market with one thousand comparably sized firms, a suit against fifty firms would mean defendants have only five percent combined market share.

54. *See, e.g.*, *Tops Mkts, Inc.*, 142 F.3d at 99 ("[C]ourts generally allow the defendant to rebut inferences of market power by showing easy entry conditions." (quoting 2A PHILLIP E. AREEDA & HERBERT HOVENKAMP, ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION ¶ 532a, at 161 (1995))); Oahu Gas Serv., Inc. v. Pac. Res. Inc., 838 F.2d 360, 366 (9th Cir. 1988) ("A high market share, though it may ordinarily raise an inference of monopoly power, will not do so in a market with low entry barriers . . . ." (citation omitted)); Int'l Distrib. Ctrs, Inc. v. Walsh Trucking Co., 812 F.2d 786, 792 (2d Cir. 1987).

is easy, new competitors are always waiting in the wings. If existing firms raise their prices to supra-competitive levels, new firms will flood into the industry, which will push prices back down.[55]

Second, courts have interpreted Section 1's "contract, combination . . . or conspiracy"[56] language to require an agreement among firms. Industry-wide supra-competitive pricing without an agreement, sometimes referred to as "conscious parallelism," is not itself illegal.[57] In the words of Justice Breyer:

> Courts have noted that the Sherman Act prohibits *agreements*, and they have almost uniformly held . . . that . . . individual pricing decisions (even when each firm rests its own decision upon its belief that competitors will do the same) do *not* constitute an unlawful agreement under section 1 of the Sherman Act. That is not because such pricing is desirable (it is not), but because it 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?[58]

Section 1 does not require an explicit, formal agreement among competitors. An agreement may be implicit and may be inferred from circumstantial evidence. A fact finder can infer an agreement from supra-competitive pricing combined with one or more "plus factors." For example, courts have found that communication among firms prior to an industry-wide price increase, an industry's history of collusion, announcing price changes before they go into effect, or other practices that facilitate coordinated pricing can suggest an agreement to raise prices.[59]

Another plus factor is whether firms' actions demonstrate "a conscious commitment to a common scheme."[60] This can arise if firms' actions would

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55. *See, e.g.*, Ball Mem'l Hosp., Inc. v. Mut. Hosp. Ins., Inc., 784 F.2d 1325, 1335 (7th Cir. 1986) ("[T]he lower the barriers to entry, . . . the less power existing firms have.").

56. Sherman Act, ch. 647, § 1, 26 Stat. 209, 209 (1890) (codified as amended at 15 U.S.C. § 1).

57. *See, e.g.*, Brooke Grp. Ltd. v. Brown & Williamson Tobacco Corp., 509 U.S. 209, 227 (1993).

58. Clamp-All Corp. v. Cast Iron Soil Pipe Inst., 851 F.2d 478, 484 (1st Cir. 1988) (citations omitted); *see also Brooke Grp. Ltd.*, 509 U.S. at 227 ("Tacit collusion, sometimes called oligopolistic price coordination or conscious parallelism, describes the process, not in itself unlawful, by which firms in a concentrated market might in effect share monopoly power, setting their prices at a profit-maximizing, supracompetitive level by recognizing their shared economic interests and their interdependence with respect to price and output decisions.").

59. *See, e.g.*, Blomkest Fertilizer, Inc. v. Potash Corp. of Saskatchewan, 203 F.3d 1028, 1039 (8th Cir. 2000) (Gibson, J., dissenting); United States v. Foley, 598 F.2d 1323, 1323 (4th Cir. 1979); GAVIL ET AL., *supra* note 1, at 277, 282–83. *See generally* Leslie, *supra* note 27 (analyzing how judges in price-fixing litigation evaluate circumstantial evidence).

60. *See, e.g.*, Monsanto Co. v. Spray-Rite Serv. Corp., 465 U.S. 752, 768 (1984); Va. Vermiculite, Ltd. v. Hist. Green Springs, Inc., 307 F.3d 277, 281 (4th Cir. 2002); Toscano v. Pro. Golfers Ass'n, 258 F.3d 978, 983 (9th Cir. 2001); Spectators' Commc'n Network Inc. v. Colonial Country Club, 253 F.3d 215, 220 (5th Cir. 2001); *Blomkest Fertilizer, Inc.*, 203 F.3d at 1039 (Gibson, J., dissenting); *In re* Baby Food Antitrust Litig., 166 F.3d 112, 117 (3d Cir. 1999); *see also* Gregory J. Werden, *Economic Evidence on the Existence of Collusion: Reconciling Antitrust Law with Oligopoly*

only make sense if conducted pursuant to an underlying agreement.[61] Similarly, it can also arise if firms engage in behavior that is only economically rational if all other firms in the industry engage in the same behavior.[62] Attempts to coerce a rival to act in particular ways can qualify.[63] Coercion can take a variety of forms, ranging from simply calling a competitor and complaining to more economically injurious behaviors.[64]

Finally, antitrust law attempts to prevent anticompetitive behavior before it occurs.[65] In particular, certain mergers require pre-approval from antitrust authorities. The Concentration Principle undergirds this regime: Mergers consolidate an industry, making firms fewer and larger,[66] which can facilitate collusion or monopoly.[67] Thus, in evaluating mergers, the industry's concentration level is a key factor. If an industry is sufficiently concentrated, or a merger will substantially increase industry concentration, the DOJ and FTC presume that it is anticompetitive.[68] Conversely, a merger can avoid agency review entirely if industry concentration is low enough.[69] Similarly, mergers are generally deemed unproblematic if entry is sufficiently "timely, likely, and sufficient in its magnitude."[70]

FTC enforcement decisions powerfully demonstrate how central concentration and entry are to regulators.[71] From 1996 through 2005, almost ninety percent of FTC enforcement actions against horizontal mergers were against mergers that would have left three or fewer competitors in an

Theory, 71 ANTITRUST L.J. 719, 777 (2004) (repeating the same formulation about parties consciously committing to a scheme together).

61. GAVIL ET AL., *supra* note 1, at 283; *see also* Leslie, *supra* note 27, at 1617–18 (stating that another important point of inquiry is "whether defendants have taken actions that would be against their independent economic interests unless a conspiracy is afoot").

62. GAVIL ET AL., *supra* note 1, at 283; Leslie, *supra* note 27, at 1617–18.

63. *See, e.g.*, Mod. Home Inst., Inc. v. Hartford Accident & Indem. Co., 513 F.2d 102, 111 (2d Cir. 1975); *In re* Nasdaq Market-Makers Antitrust Litig., 894 F. Supp. 703, 713–14 (S.D.N.Y. 1995).

64. *Foley*, 598 F.2d at 1333; *Nasdaq Market-Makers Antitrust Litig.*, 894 F. Supp. at 707.

65. In addition to the merger review discussed herein, Section 2 of the Sherman Act prohibits attempts and conspiracies to monopolize. Sherman Act, ch. 647, § 2, 26 Stat. 209, 209 (1890) (codified as amended at 15 U.S.C. § 2).

66. Merging two firms would also obviate the need for an (illegal) agreement between them. *See supra* notes 60–61 and accompanying text.

67. HMG, *supra* note 1, §§ 6.4, 7.2, at 23, 25–27.

68. *See id.* § 5.3, at 19.

69. *Id.*

70. *Id.* § 9, at 28.

71. Entrants are so central that they have been called "the superheroes of consumer welfare." *See* Maurice E. Stucke, *Behavioral Economists at the Gate: Antitrust in the Twenty-First Century*, 38 LOY. U. CHI. L.J. 513, 563 (2007); *cf.* Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 590–92 & n.15 (1986) (providing that the petitioners, who allegedly engaged in "predatory pricing conspiracies" lacked sufficient market share for a monopoly and finding "no reason to suppose that entry into the relevant market [was] especially difficult"); Tops Mkts., Inc. v. Quality Mkts., Inc. 142 F.3d 90, 99 (2d Cir. 1998) (finding an absence of monopoly power in part because of a lack of evidence showing "barriers to entry").

industry[72]; ninety-eight percent were against mergers that would have left five or fewer.[73] In addition, "empirical studies of FTC enforcement confirm the near outcome-determinative effect of easy entry. If entry is not impeded, enforcement action is very unlikely."[74] Courts generally take a similar approach.[75]

The direct incorporation of the Concentration Principle into agency merger guidelines, agencies' patterns of enforcement, and judicial decision-making are among the many ways that antitrust law reflects antitrust theory—a topic to which we now turn.

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72. FED. TRADE COMM'N, HORIZONTAL MERGER INVESTIGATION DATA, FISCAL YEARS 1996–2005, at 16 tbl.4.1 (2007), https://www.ftc.gov/sites/default/files/documents/reports_annual/horizontal-merger-investigation-data-fiscal-years-1996-%E2%80%93-2005/p035603horizmergerinvestigationdata1996-2005_0.pdf [https://perma.cc/364P-2USM] (amounting to 512 of 578 enforcement actions). A horizontal merger is a merger of two firms in the same industry. We note that the FTC and DOJ issued new guidelines in 2010 that purport to take a more holistic approach. *See* HMG, *supra* note 1, § 1, at 1–2.

73. *See* FED. TRADE COMM'N, *supra* note 72, at 16 tbl.4.1 (amounting to 567 of 578 enforcement actions); *see also* Mary Coleman, *The FTC and DOJ's Horizontal Guidelines Review Project: What Changes Might Be in Store for Merger Review?*, GCP: ANTITRUST CHRON., Dec. 2009, at 1, 4, https://www.competitionpolicyinternational.com/assets/0d358061e11f2708ad9d62634c6c40ad/ColemanDEC-09(1).pdf [https://perma.cc/9NMW-EFZR] ("[M]ergers are generally never challenged with post-merger HHIs less than 1,800 or with a change less than 250.").

74. Malcolm Coate, *An Overview of Transparency at the Federal Trade Commission: Generalities and Innovations in Merger Analysis*, GCP: ANTITRUST CHRON., Dec. 2009, at 1, 11 (2009) (footnote omitted), https://www.competitionpolicyinternational.com/assets/0d358061e11f2708ad9d62634c6c40ad/CoateDEC-09(1).pdf [https://perma.cc/RZG2-KRA5] (collecting studies).

75. *See, e.g.*, ProMedica Health Sys., Inc. v. FTC, 749 F.3d 559, 566–67 (6th Cir. 2014); Saint Alphonsus Med. Ctr.-Nampa Inc. v. St. Luke's Health Sys., Ltd., 778 F.3d 775, 788 (9th Cir. 2015); FTC v. Sysco Corp., 83 F. Supp. 3d 271, 274–75 (D.D.C. 2015); *see also* Edith Ramirez, Chairwoman, Fed. Trade Comm'n, Remarks at the Ninth Annual Global Antitrust Enforcement Symposium: The Horizontal Merger Guidelines Five Years Later 3 (Sept. 29, 2015), https://www.ftc.gov/system/files/documents/public_statements/805441/ramirez_-_georgetown_antitrust_enforcement_symposium_9-29-15_0.pdf [https://perma.cc/4LE2-YT5H] ("[E]ntry . . . ha[s] retained [its] important place in merger analysis today.").

B. ANTITRUST THEORY

A large body of antitrust literature models firms' and consumers' behavior under a range of assumptions.[76] Many of these variations build from the same starting point (the "Classical Model").[77]

The Classical Model posits a group of firms and consumers who play a "repeated game."[78] Essentially, this means that firms interact repeatedly over a long period of time, and that they have memories—firms can take past interactions into account when deciding how to act in later periods.[79]

Each period, every firm sets the price at which it is willing to sell. Firms are homogenous; they all produce the same product and have the same costs of production.[80] Consumers take prices into account and purchase products at the lowest price they can.[81]

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76. *See, e.g.*, MAS-COLLEL ET AL., *supra* note 1, at 383–428 (describing the concept of market power with a focus on monopolies and oligopolies undermining competition). There are entire textbooks devoted to antitrust economics; unfortunately, we cannot cover the entire field here for reasons of space. However, for interested readers, we note a few topics that bear some relation to our work in this article. *See generally*, B. Douglas Bernheim & Michael D. Whinston, *Multimarket Contact and Collusive Behavior*, 21 RAND J. ECON. 1 (1990) (modeling how firms that interact across multiple industries have greater ability to collude because of their greater ability to punish each other and that this dynamic challenges standard heuristics for market concentration); Chaim Fershtman & Neil Gandal, *Disadvantageous Semicollusion*, 12 INT'L J. INDUS. ORG. 141 (1994) (arguing that firms may collude on one dimension, such as price, while competing on other dimensions, such as product quality, that are harder to observe and police); Mort I. Kamien, Lode Li & Dov Samet, *Bertrand Competition with Subcontracting*, 20 RAND J. ECON. 553 (1989) (modeling dynamics of horizontal subcontracting in a one-period game); Volker Nocke & Lucy White, *Do Vertical Mergers Facilitate Upstream Collusion?*, 97 AM. ECON. REV. 1321 (2007) (modeling vertical integration).

77. We refer to "the" Classical Model for simplicity. However, a more precise formulation would posit two Classical Models: the Bertrand Model, discussed here, in which firms set their prices, and the Cournot Model, in which firms set their production quantities. *See, e.g.*, MAS-COLLEL ET AL., *supra* note 1, at 387–94. Both models share many important commonalities; in particular, firms interact solely as competitors and would be happy if their rivals disappeared. *See id.*

78. *Id.* at 400–05 (emphasis omitted).

79. Consumers have memories and can act on them, too, but they are generally assumed to be too small, or in the market too briefly, for the effect to matter.

80. Variations on the base model vary firms' product features or production capacities. *See, e.g.*, Avinash K. Dixit & Joseph E. Stiglitz, *Monopolistic Competition and Optimum Product Diversity*, 67 AM. ECON. REV. 297, 297–98 (1977).

81. If multiple firms offer the same price, consumers split their purchases among those firms or randomly choose among the firms with the lowest price. There is also an extensive literature on non-price competition among firms. *See, e.g.*, MAS-COLLEL ET AL., *supra* note 1, at 395–400; Dixit & Stiglitz, *supra* note 80, at 297–98; Steven C. Salop, *Monopolistic Competition with Outside Goods*, 10 BELL J. ECON. 141, 141–42 (1979); Michael Spence, *Product Selection, Fixed Costs, and Monopolistic Competition*, 43 REV. ECON. STUD. 217, 217–18 (1976); *see also* Fershtman & Gandal, *supra* note 76, at 141–44 (showing that "product market collusion may lead to lower overall profits as it might trigger aggressive competition" in other strategic areas).

Firms discount their profits based on when they earn them; a dollar earned earlier is more valuable than one earned later.[82] A parameter called the "discount factor" captures how much future profits are discounted relative to present profits.[83] When the discount factor is larger, future profits are relatively more important and thus count for more in a firm's decision-making process.

In general, the game's outcomes of interest are those that constitute Nash Equilibria—scenarios in which each firm and each consumer behaves in a way that provides it with the best possible outcome, given what everyone else is doing.[84] Nash Equilibria are useful conceptually because they are, in a particular sense, rational and stable: No one has a course of action available to her that would make her better off. As a result, no one has an incentive to change her behavior. Accordingly, reasoning that no one will deviate from a Nash Equilibrium, and that such an outcome will therefore persist, seems defensible.[85]

There are many potential Nash Equilibria under the Classical Model.[86] From an antitrust perspective, one is of particular interest: the Nash Equilibrium that is best for firms as a group and worst for consumers as a group. This Nash Equilibrium represents, in a sense, an outer bound on the worst possible outcome that self-interested firms can sustain.[87] We term this the "Collusion-Maximizing Outcome."

Under the Collusion-Maximizing Outcome, firms act like divisions of a single monopolist firm: Each firm sets its price at the level that a monopolist would charge (the "monopoly price"). As a group, firms then earn monopoly profits each period; that is the largest amount of profit that firms can hope to

82. For instance, to give up one dollar today, a firm might require that it be paid one dollar and ten cents in one period, one dollar and twenty-one cents in two periods, or one dollar and thirty-three cents in three periods, and so forth. This tracks standard finance theory about discounting and the time value of money. *See, e.g.*, IVO WELCH, CORPORATE FINANCE 22–23 (4th ed. 2018).

83. The discount factor is between zero and one. In the example of footnote 82, the discount factor implies a ten percent discount rate per period.

84. More precisely, all of the equilibria that we discuss are subgame-perfect Nash Equilibria: Each actor's prescribed action is a best response for that actor at the time it would be undertaken. This eliminates equilibria built on threats that are not credible. *See* MAS-COLLEL ET AL., *supra* note 1, at 268–82.

85. Some game theory makes groups the unit of analysis instead of individual actors—i.e., one considers whether any groups can make themselves better off via coordinated changes in their behavior. *See* ROGER B. MYERSON, GAME THEORY: ANALYSIS OF CONFLICT 427–36 (1991); Jordan M. Barry, John William Hatfield & Scott Duke Kominers, *On Derivatives Markets and Social Welfare: A Theory of Empty Voting and Hidden Ownership*, 99 VA. L. REV. 1103, 1139–40 (2013).

86. *See* James W. Friedman, *A Non-cooperative Equilibrium for Supergames*, 38 REV. ECON. STUD. 1, 1–4 (1971).

87. This outcome is worst for consumers; for firms, this outcome is best.

earn,[88] and they divide the bounty evenly. The monopoly price is higher than the price that vigorous competition would produce (the "competitive price"), so consumers pay more for the good than they would in a competitive market.[89]

If any firm deviates from the strategy described above—for example, by lowering its price to make more sales—the other firms retaliate by slashing their prices. More specifically, firms stop setting their prices at the monopoly level and instead price at their cost of production in all future periods. This response, known as a "grim trigger," is quite harsh; if a firm lowers its price once—by even a small amount—no firm ever earns a profit again. From the firms' perspective, this is the worst possible outcome.[90]

Yet a powerful logic underlies the harshness of the grim trigger. It is best for the firms as a group if they can keep colluding, with all firms offering consumers the monopoly price. Firms thus want to make "not deviating" from collusive pricing as attractive as possible compared to "deviating."

Consider the choice that a firm faces when deciding whether to cut its price, thereby deviating from the Collusion-Maximizing Outcome. In the short run, a small price reduction raises profits: The lower price attracts more customers. And, while a lower price reduces profit per sale, for a small price cut, the increase in sales more than makes up the difference.[91]

To counteract this, other firms want a deviation to cost the deviating firm as much future profit as possible. The grim trigger deprives a deviating firm of *all* future profits. Thus, it is the biggest threat that firms can bring to bear against would-be deviators. Accordingly, the grim trigger makes collusion as attractive as possible, thereby maximizing the industry's ability to collude.

However, in certain circumstances, even the grim trigger is not enough to deter deviations. When this happens, collusion breaks down, and firms compete aggressively, which drives prices down to firms' cost of production. This is the worst outcome from firms' perspective, but the best from the consumers' and society's perspectives.[92]

Two parameters of the Classical Model are particularly important in determining whether the grim trigger is sufficient to maintain collusion: the discount factor and the number of firms. The more important that future

88. This is essentially true by definition; a monopolist can pick any spot on the demand curve, and thus picks the one she prefers most.

89. HAL R. VARIAN, INTERMEDIATE MICROECONOMICS: A MODERN APPROACH 405–07 (4th ed. 1996).

90. Grim triggers represent an entire class of strategies. This particular strategy is also sometimes referred to as Bertrand Reversion. *See, e.g.*, *Syndicated Markets*, *supra* note 40, at 3788–97.

91. More precisely, a small enough price cut increases a firm's profits in the current period.

92. *See* VARIAN, *supra* note 89, at 301.

profits are, the more firms benefit from colluding relative to deviating.[93] The discount factor reflects the value that firms place on future profits.

The number of firms matters because, under the Collusion-Maximizing Outcome, firms split monopoly profits. When more firms share the same total amount of profit, each colluding firm receives less. In contrast, the payoff for deviating does not vary with the number of firms.[94] Therefore, the more firms there are, the more attractive deviating becomes and the harder it becomes to sustain collusion.

Under the Classical Model, for any given discount factor, there is some number of firms that serves as a cutoff for when collusion can be maintained. When the number of firms is below this threshold, colluding is more profitable than deviating. Consequently, firms can maintain the Collusion-Maximizing Outcome and maximize their combined profits. When the number of firms rises above this threshold, however, everything falls apart. Each firm finds deviating more attractive than colluding, and firms end up competing with each other. That competition pushes total firm profits down to zero, their minimum possible level.[95] Thus, the number of firms in a market strongly affects whether that market will be characterized by competition or collusion.

Figure 1 below graphically illustrates these dynamics for a particular set of parameters.[96] In this example, the competitive price is one and the monopoly price is twenty-five dollars. The far-left side of the graph represents an infinitely unconcentrated market, featuring numerous tiny firms, while the far-right side represents a market with only a single large firm.[97] When concentration is high enough, firms can collude at the monopoly price.[98] When concentration drops below a threshold, no collusion is possible, and the market reverts to competitive pricing.

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93. Recall that collusion allows firms to continue to earn profits every period, whereas deviating results in firms changing behavior and earning zero profits in future periods. *See supra* text accompanying notes 89–90.

94. A deviating firm offers the lowest price that period, so it captures the entire market. *See supra* text accompanying note 91.

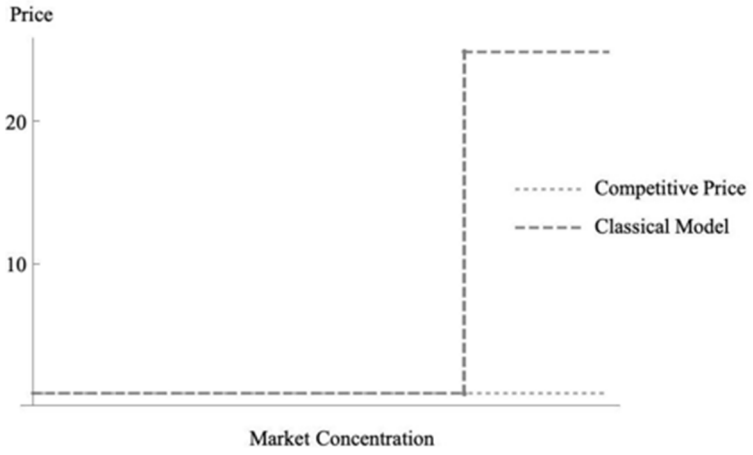
95. This means zero economic profits, not zero literal profits. VARIAN, *supra* note 89, at 391–92.

96. The discount factor is 0.75; firms value one dollar in one period at seventy-five cents now.

97. The zero bound on concentration is not achievable because we assume a finite number of firms, but we can get arbitrarily close to it by considering scenarios with appropriately large numbers of firms.

98. Market concentration is defined as a fraction equal to one divided by the number of firms. When firms are of equal size, as they are here, this measures market concentration well. The highest possible market concentration is one, when there is only a single firm; the lowest is zero, when there are infinitely many firms. Market concentration in this instance can only take on discreet values; however, we display a continuous line for visual and conceptual clarity. *See Syndicated Markets*, *supra* note 40, at 3785–86.

Figure 1: Highest Sustainable Price Under Classical Model as a Function of Market Concentration



A slight clarification is in order before continuing. The Classical Model assumes that all firms are identical, but in practice this is not the case; firms vary in size and hence in capacity, which can affect market dynamics. For example, imagine a market with a hundred firms, one of which is much larger than the rest combined. That situation may resemble a market with only one firm more than a market with a hundred equal-sized firms. Market concentration, which reflects both the number of firms and their relative sizes, measures the state of the market better than the number of firms alone.[99] Variations on the Classical Model account for this, as does antitrust law.[100]

II. COLLABORATIVE INDUSTRIES

The Classical Model makes assumptions about the ways that firms interact with each other. In particular, it assumes that firms do not transact with each other directly; firms only transact with consumers. Firms are fundamentally competitors, who would be perfectly happy if their rivals suddenly ceased to exist.

In practice, relationships among firms are often more complex than the Classical Model envisions.[101] In some industries, firms can potentially reap

99. *See* DOJ, IDENTIFYING VIOLATIONS, *supra* note 28, at 5 ("Collusion may . . . occur when the number of firms is fairly large, but there is a small group of major sellers and the rest are 'fringe' sellers who control only a small fraction of the market.").

100. *See supra* Section I.A.

101. *See, e.g.*, GAVIL ET AL., *supra* note 1, at 80 ("Partnerships, joint ventures and strategic alliances among rivals are ubiquitous . . . ."); *see also* sources cited *supra* notes 76–81 and accompanying

large gains from working together, independent of the prices that they charge consumers. Such firms thus have more mechanisms to reward or punish each other than the Classical Model contemplates.

For instance, consider the market for legal services. Yes, lawyers and firms compete with each other for clients. But many transactions, and almost all lawsuits, feature unrelated attorneys working on both sides. Managing a lawsuit through the discovery process, or a contract through negotiations and drafting, requires repeated interaction with opposing counsel—including many opportunities to make things easier or more difficult for them. Counsel can agree to extend filing deadlines, consent to reschedule motion hearings, and choose whether to file motions midweek or right before a holiday weekend. Larger matters often feature multiple counsel on each side of a lawsuit or transaction, creating further opportunities for noncompetitive interaction.

For a practicing lawyer, a colleague may be a competitor in certain areas but a source of business in others. Consider Alice and Bob, two lawyers with broad generalist practices, each of whom also has different specialized expertise; Alice is an antitrust guru, while Bob is a bankruptcy expert. Alice and Bob may compete for general business litigation or transactional work. However, when Alice encounters a complicated bankruptcy issue, she may bring in Bob to address it. Bob may act similarly when he encounters antitrust questions. An attorney can also find herself unable to take on a new matter due to a conflict of interest or because she already has too many engagements. When this happens, she can choose to refer the new matter to a competitor. For many attorneys, such referrals are an important source of business.[102]

Thus, while competition plays an important role in the market for legal services, attorneys do not view other attorneys solely as competitors who they wish would disappear. Indeed, without plaintiffs' attorneys or prosecutors, defense counsel would have no practice.

Law is not unique in this regard; direct interactions between firms are both common and important in many other industries. Sports leagues are a famous example: No matter how much Michigan fans may loathe Ohio State,[103] they would have little to cheer if every non-Michigan team disbanded.

Companies frequently conduct joint research with competitors.[104] Texaco has partnered with Chevron; Apple with Dell; and Texas Instruments with

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text (supporting the proposition that the Classical Model simplifies the relationships of firms in practice).

102. Many attorneys who leave a large firm to found a smaller one find referrals by their former coworkers to be an important source of business. Such referrals are typically matters that are too small for the large firm to handle economically.

103. And they do.

104. Tomaso Duso, Lars-Hendrik Röller & Jo Seldeslachts, *Collusion Through Joint R&D: An Empirical Assessment*, 96 REV. ECON. & STAT. 349, 349 (2014) ("[R]esearch joint ventures . . . are a prominent phenomenon especially in many high-tech sectors of the economy . . . .").

Advanced Micro Devices ("AMD"), to name but a few examples.[105] Companies often join multiple research joint ventures simultaneously, creating sizable networks that can span an industry.[106] Similarly, rivals regularly cross-license each other's patents, including Intel, IBM, and Hewlett-Packard.[107] These agreements often provide access to future patents, enabling collaboration for years to come.[108]

To take yet another example, rival pharmaceutical companies conduct joint drug trials. For example, Gilead Sciences and Eli Lilly conducted a joint study which found that Gilead's remdesivir and Eli Lilly's baricitinib are more effective against the coronavirus in combination than either is alone.[109] Another study examined remdesivir in combination with Roche Pharmaceuticals' tocilizumab.[110]

We refer to industries in which direct interactions between rivals are important as Collaborative Industries. The exact boundaries of the category are somewhat nebulous. However, little turns on these boundaries' exact locations—the importance of rival firms' non-competitive interactions—is a

105. *Id.* at 350 n.8.

106. *Id.* at 349, 350 n.9 (noting six linked petroleum firms, sixteen linked computer firms, and twenty-one industrial machinery firms); John William Hatfield & Scott Duke Kominers, *Multilateral Matching*, 156 J. ECON. THEORY 175, 176 (2015).

107. *See, e.g.*, Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, 1 INNOVATION POL'Y & ECON. 119, 129–30 (2001); *see also* Erik Hovenkamp & Herbert Hovenkamp, *Patent Pools and Related Technology Sharing*, *in* CAMBRIDGE HANDBOOK OF ANTITRUST, INTELLECTUAL PROPERTY, AND HIGH TECH 358, 358–59 (Roger D. Blair & D. Daniel Sokol, eds. 2017) (discussing patent pools, in which firms combine related patent rights into a joint pool that all contributors, and some outsiders, can access); Jonathan M. Barnett, *The Anti-Commons Revisited*, 29 HARV. J.L. & TECH. 127, 161–62 (2015) ("Patent pools improve upon the limitations of standard-setting entities by providing licensees with a well-defined package of licensing terms and a clear party against whom to bring legal action in the event those terms are breached."); Jonathan M. Barnett, *The Host's Dilemma: Strategic Forfeiture in Platform Markets for Informational Goods*, 124 HARV. L. REV. 1861, 1868 (2011) ("[Rival smartphone firms] have sought to elicit developer adoption of operating systems by forming nonprofits and other consortia to develop [smartphone operating] systems . . . .").

108. *See* Shapiro, *supra* note 107, at 129–30. Rivals also agree on standards, which often involves extensive coordination and cross-licensing. *See, e.g.*, Erik Hovenkamp, *Tying, Exclusivity, and Standard-Essential Patents*, 19 COLUM. SCI. & TECH. L. REV. 79, 80–81 (2017); *see also* Jonathan M. Barnett, *Antitrust Overreach: Undoing Cooperative Standardization in the Digital Economy*, 25 MICH. TECH. L. REV. 163, 167 (2019) (arguing that "patents and patent licenses *support* the standardization mechanisms that have driven the exceptional success of the smartphone markets"); Jonathan M. Barnett, *From Patent Thickets to Patent Networks: The Legal Infrastructure of the Digital Economy*, 55 JURIMETRICS 1, 6 (2014) (observing that "standards have been widely adopted in technology markets and users and suppliers regularly make significant investments in those standards").

109. A.C. Kalil et al., *Baricitinib Plus Remdesivir for Hospitalized Adults with Covid-19*, 384 NEW ENG. J. MED. 795, 801 (2021), https://www.nejm.org/doi/pdf/10.1056/NEJMoa2031994?articleTools=true [https://perma.cc/X7TL-G6DL].

110. *See, e.g.*, Agence France Presse, *Roche, Gilead to Test Drug Cocktail Against Severe COVID-19*, BARRON'S (May 28, 2020), https://www.barrons.com/news/roche-gilead-to-test-drug-cocktail-against-severe-covid-19-01590662104 [https://perma.cc/4F8Y-84FS].

question of degree, not of kind.[111] Almost all industries feature some cooperative interaction among rivals; the key question is how important those collaborative interactions are relative to the standard competition that the Classical Model captures. The more collaborative interactions that firms have, and the more important they are relative to interfirm competition for customers, the more collaborative the industry.

While there are many Collaborative Industries, two broad classes are particularly relevant for this Article and thus merit extra attention: Syndicated Markets and Brokered Markets.[112]

A. SYNDICATED MARKETS

In many industries, rival firms compete to win contracts and then collaborate to fulfill those contracts. Markets with this general structure are known as Syndicated Markets.[113]

An example helps illustrate this point. Consider the IPO Underwriting Market. In an IPO, an underwriter purchases stock from a company (the "issuer"), then resells that stock to interested investors shortly thereafter. Underwriters profit by charging the issuer a percentage of the total funds raised in the IPO (a "spread").[114] For example, suppose investors pay a total of one hundred million for an issuer's stock. If the spread is two percent, the underwriter pockets two million dollars, and the issuer receives the remaining ninety-eight million dollars.

Underwriting firms compete to win business from issuers. However, that competition ends when the issuer selects its lead underwriter. That lead underwriter often subcontracts large portions of the underwriting work to other underwriters. The resulting syndicate works together to find buyers for the issuer's stock.

Syndication is extremely common in the IPO Underwriting Market; ninety-seven percent of mid-size U.S. IPOs conducted between 1970 and 2014 were syndicated.[115] Many other financial markets also feature syndication,

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111. The same is true of Syndicated Markets and Brokered Markets. *Cf.* Elizabeth Pollman & Jordan M. Barry, *Regulatory Entrepreneurship*, 90 S. CAL. L. REV. 383, 397 (2017) ("Regulatory entrepreneurship is best thought of as a matter of degree. . . . [T]he exact location of the boundary is [not] the main issue . . . .").

112. Again, the exact boundaries of the terms Syndicated Markets and Brokered Markets, and thus the precise classifications of specific industries, are of little consequence to our larger analysis.

113. This behavior is also referred to as horizontal subcontracting. *See, e.g.*, Yossef Spiegel, *Horizontal Subcontracting*, 24 RAND J. ECON. 570, 570 (1993).

114. *See Syndicated Markets*, *supra* note 40, at 3783.

115. We define a midsized IPO as one in which the issuer sold between twenty and one hundred million dollars' worth of stock. The Securities Data Company dataset reports 4,576 such IPOs; 4,438 were syndicated. The entire dataset contains 11,982 IPOs for this period; ninety percent were syndicated. *See Syndicated Markets*, *supra* note 40, at 3788 n.25.

including the debt, reinsurance, venture capital, and private equity markets.[116] Syndication extends beyond finance, to the construction, automobile, telecommunications, aircraft, computer, and transportation industries, among other examples.[117]

Economists generally agree that syndicated production is driven by cost savings from joint production.[118] In other words, the syndicate leader subcontracts to competitors because farming out some of the work is cheaper than completing the entire project singlehandedly. This can occur when the syndicate leader has limited productive capacity and when increasing capacity lowers the per-unit cost of production.[119] Industries with these features tend to display significant amounts of syndication.[120]

B. BROKERED MARKETS

Would-be buyers and sellers often employ agents to facilitate transactions.[121] In Brokered Markets, buyers' and sellers' agents work together to consummate transactions.[122] For example, a person looking to buy Microsoft stock generally contacts a stockbroker, who has access to brokers representing many would-be sellers and is thus able to effectuate transactions. Prominent examples of Brokered Markets include the securities, commodities, and residential real estate markets. Buy- and sell-side brokers also work together

116. *See, e.g.*, Micah S. Officer, Oguzhan Ozbas & Berk A. Sensoy, *Club Deals in Leveraged Buyouts*, 98 J. FIN. ECON. 214, 215, 217–18 (2010); *Syndicated Markets*, *supra* note 40, at 3780–85; Jian Cai, Frederik Eidam, Anthony Saunders & Sascha Steffen, Loan Syndication Structures and Price Collusion 1–3 (Oct. 9, 2018) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3250817 [https://perma.cc/N9VS-XK8A].

117. *See, e.g.*, Elemary v. Holzmann, 533 F. Supp. 2d 116, 119–21 (D.D.C. 2008); Miller v. Holzmann, 563 F. Supp. 2d 54, 73–74 (D.D.C. 2008); United States v. Anderson, 326 F.3d 1319, 1322–26 (11th Cir. 2003); New York v. Hendrickson Bros., 840 F.2d 1065, 1068–72 (2d Cir. 1988); Rothery Storage & Van Co. v. Atlas Van Lines, Inc., 792 F.2d 210, 211–13 (D.C. Cir. 1986); United States v. Inryco, Inc., 642 F.2d 290, 291–92 (9th Cir. 1981); Spiegel, *supra* note 113, at 570; Pio Baake, Jörg Oechssler & Christoph Schenk, *Explaining Cross-Supplies*, 70 J. ECON. 37, 37–40 (1999). For instance, Ford subcontracted most of the Ford Probe's production to Mazda; it owned a twenty-five percent interest in Mazda at the time. James Risen, *Hot Ford Hybrid Is in Short Supply*, L.A. TIMES (May 19, 1988, 12:00 AM), https://www.latimes.com/archives/la-xpm-1988-05-19-fi-4753-story.html [https://perma.cc/KPW6-KT4A].

118. *See, e.g.*, Baake et al., *supra* note 117, at 38–39; Spiegel, *supra* note 113, at 572.

119. In the IPO context, underwriters place shares with investors. If each underwriter has a different network of investors, a group of underwriters can reach more investors than any individual underwriter can. In other financial contexts, syndication can enable greater diversification, overcome credit constraints, or provide regulatory benefits.

120. *See* Baake et al., *supra* note 117, at 37–40.

121. For example, brokers are common when it would otherwise be difficult for buyers and sellers to find each other on their own.

122. Every transaction in a market need not fit these criteria for the market to constitute a Brokered Market. For example, some individuals buy and sell houses without using brokers, and the same realtor sometimes represents both buyer and seller. The question is whether enough transactions fit these criteria that brokers care about their ability to work with other brokers. *See* discussion *supra* note 112.

to connect would-be buyers and sellers of businesses, trucking, shipping, yachts, aircraft, financial derivatives, and numerous other goods and services.[123]

Brokered Markets vary widely in their specifics. But across all Brokered Markets, an agent's ability to connect potential buyers and sellers is vital to her business. Thus, being able to work with other agents, and thereby gain access to those agents' clients, is important. This makes agents interdependent and makes Brokered Markets Collaborative Industries.

Real estate agency provides a good example; a seller's broker wants other brokers to tell potential buyers about the property, and vice versa. A real estate agent who is shunned by her peers will suffer financially. Similar dynamics apply in other Brokered Markets, such as securities trading. Consider the DOJ's description of NASDAQ market makers' interactions:

> The Nasdaq market is highly interdependent . . . . Market makers rely on each other to provide order flow, information, and cooperation to help them trade positions profitably. They actively work to develop and maintain friendly relationships with traders from other firms. Traders do not want other market makers to perceive them as being uncooperative, "unethical," or "unprofessional" because that very perception may result in their loss of access to the trader networks that provide order flow, information, and cooperative trading opportunities.[124]

NASDAQ market makers' mutual dependence "ma[de] it easy" for the industry to persistently collude, at investors' expense.[125] The DOJ's investigation

123. *See, e.g.*, WILLIAM FINLAY & JAMES E. COVERDILL, HEADHUNTERS: MATCHMAKING IN THE LABOR MARKET 6–7 (2002); Yalin Gündüz, Torsten Lüdecke & Marliese Uhrig-Homburg, *Trading Credit Default Swaps Via Interdealer Brokers*, 32 J. FIN. SERVS. RSCH. 141, 141–43 (2007); Veronica Blatt, *What Is a Split Placement?*, NPAWORLDWIDE, https://npaworldwide.com/blog/2018/07/03/what-is-a-split-placement [https://perma.cc/6J3Q-T72N]; Jeanne Craig, *Co-Brokerage: What the Yacht Buyer Needs to Know*, YACHTWORLD (Oct. 20, 2013), https://www.yachtworld.com/research/co-brokerage-what-the-yacht-buyer-needs-to-know [https://perma.cc/GW7N-8FET]; Ari Ashe, *More Double-Brokering Ups Threat to US Truck Shippers*, JOC.COM (Mar. 28, 2018, 2:55 PM), http://americangloballogistics.com/wp-content/uploads/JoC_More-Double-Brokering-Ups-Threat-to-US-Truck-Shippers_03282018.pdf [https://perma.cc/EG8G-M2MP] (discussing co-brokering); *Frequently Asked Questions on Becoming an Aircraft Broker*, PUGET AIRCRAFT, http://puget soundcommericalaircraftbrokers.com/frequently-asked-questions-on-becoming-an-aircraft-broker [https://perma.cc/2463-X7G9]; Michele Schechter, *An Intermediary to Lead the Process: Investment Banker or Business Broker?*, FIN. POISE (June 22, 2020), https://www.financialpoise.com/investment-banker-business-broker [https://perma.cc/4RXY-HSCH]; Krishna Prasad, Changing Role of Ship-Brokers: A Study of the Impact of Modern Communication in Practical Ship-Broking 1–2 (unpublished manuscript), https://www.academia.edu/7849425/CHANGING_ROLE_OF_SHIP-BROKERS_A_study_of_the_impact_of_modern_communication_in_practical_ship-broking [https://perma.cc/577V-2J37]. To be clear, not every transaction in these settings involves rival brokers connecting the buyer and the seller. *See supra* notes 111–12, 122.

124. DOJ NASDAQ Statement, *supra* note 11, at 20.

125. *Id.*

implicated conduct by dozens of firms over multiple years[126]—conduct that showed no signs of abating prior to outside intervention.[127]

These dynamics among NASDAQ market makers are not unique. To the contrary, our models illustrate how firms in other Collaborative Industries can collude in a similar fashion.

III. THE COLLABORATIVE INDUSTRY MODEL

As discussed in Part II, firms in Collaborative Industries interact in ways that the Classical Model does not contemplate. Thus, the Classical Model's predictions may not apply to Collaborative Industries; we need a new model.

We now present a generalized, game-theoretic Collaborative Industries Model.[128] We begin by presenting the model's basic mechanics before describing the Collusion-Maximizing Outcome. Firms use the threat of ostracism to deter price deviations and maximize collusion. We then explain why ostracizing price deviators is in each individual firm's self-interest and the resulting implications. Finally, we turn to the key takeaways from our model.

A. BASIC MECHANICS

The mechanics of our Collaborative Industries Model track those of the Classical Model as closely as possible in order to isolate the effects of collaboration on firms' ability to collude. As in the Classical Model, we posit a repeated game played by firms and consumers. Like the Classical Model, our base case features identical firms; each firm produces the same product and has the same costs of production.[129]

As in the Classical Model, in each period, each firm sets the price at which it is willing to sell, and consumers patronize the firm that offers the lowest price.[130] If multiple firms offer the same price, consumers spread themselves among those firms.

As in the Classical Model, each firm and consumer seeks to maximize its own payoffs. Payoffs track the Classical Model's: Each consumer's payoff is its consumer surplus—the difference between the value it receives from the goods

126. *Id.* at 4–7.

127. William G. Christie, Jeffrey H. Harris & Paul H. Schultz, *Why Did NASDAQ Market Makers Stop Avoiding Odd-Eighth Quotes?*, 49 J. FIN. 1841, 1841–43 (1994); *see also* Christie & Schultz, *supra* note 22, at 1838–39 (documenting behavior involving at least sixty firms and stretching back years further).

128. Our work here builds upon our prior work formally modeling Syndicated Markets and Brokered Markets. *See Syndicated Markets*, *supra* note 40, at 3780–85; *Brokered Markets*, *supra* note 40, at 2–5. As noted previously, not all coauthors of this Article are coauthors of both companion pieces. *See supra* note 40.

129. We also model scenarios in which firms have different productive capacities. *See* discussion *infra* Section IV.A.1.

130. We assume that there are new consumers each period. As in the Classical Model, this eliminates coordinated consumer behavior (for example, monopsony) and focuses the model on firms' strategic behavior.

it purchases and the price that it pays to purchase those goods. Each firm's payoff is its profits—i.e., the difference between its revenues and its costs. Firms discount profit from successive periods in the same way that they do in the Classical Model.

There is one key difference between the Collaborative Industry Model and the Classical Model: Each period, after consumers choose which firms to contract with, firms have the opportunity to profitably collaborate with each other ("Collaborative Profits").[131] The nature of this collaboration varies, depending on the specifics of the Collaborative Industry in question. But in general, this step involves firms engaging in some sort of transaction with the potential to benefit all involved.

For example, in our Syndicated Markets Model, firms can collaborate by syndicating production: Each period, after a consumer contracts with a firm, that firm (the "Syndicate Leader") can invite other firms to join its syndicate to jointly fulfill the contract.[132] Syndication is profitable (and socially beneficial) because bringing in more firms brings in additional productive capacity, which reduces overall production costs.[133]

The Brokered Markets Model considers another type of intra-industry collaboration. In that model, firms connect buyers and sellers, who cannot transact directly. Firms can collaborate by forming networks; they specify which other firms they will work with and on what terms.[134] Being part of a larger network benefits both a firm and its clients.[135]

Finally, the Collaborative Industry Model generally assumes that firms observe the transactions that their rivals propose and consummate.[136] As we

131. Collaborative Profits may arise from increased revenues, decreased costs, or both. The key point is that collaboration with rivals increases the firm's profits.

132. We model this as the Syndicate Leader simultaneously offering contracts to whichever firms it chooses. Each invited firm then accepts or rejects its offer. The Syndicate Leader, along with any accepting firms, then fulfill the contract together. *Syndicated Markets*, *supra* note 40, at 3786–87.

133. More precisely, the Syndicate Leader can earn Collaborative Profits from cost savings, which it may share with syndicate members via syndication fees. *Id.*

134. More specifically, agents specify the amount, if any, that the seller's agent will pay the buyer's agent for each consummated transaction. *Brokered Markets*, *supra* note 40, at 7. This mirrors many real-world Brokered Markets. *See, e.g.*, Elizabeth Weintraub, *How Do Home Buyers' Agents Get Paid?*, BALANCE (Mar. 26, 2022), https://www.thebalance.com/how-do-buyer-s-agents-get-paid-1798872 [https://perma.cc/A5XJ-7K4A].

135. When a firm's network grows, its clients gain access to more potential counterparties, which makes them more likely to consummate transactions and at more favorable prices. Potential clients consider the size of a firm's network when choosing whether to patronize it. Firms earn profits when their clients consummate transactions. *See Brokered Markets*, *supra* note 40, at 6–8.

136. *Cf. Syndicated Markets*, *supra* note 40, at 3786–87 (specifying that syndication offers, and decisions to accept or reject them, are quickly and publicly observable); *Brokered Markets*, *supra* note 40, at 6–7 ("Each invitation . . . is publicly observed. . . . [A]ll agents observe which invitations are accepted.").

will see below, this knowledge helps firms construct and maintain the Collusion-Maximizing Outcome.

B. THE COLLUSION-MAXIMIZING OUTCOME

Under the Collusion-Maximizing Outcome, all firms offer the buyer a collusively high price (the monopoly price, for example).[137] The net effect is that the firms split supra-competitive profits among themselves. In addition, all firms collaborate, and thus earn Collaborative Profits.[138] This behavior resembles successful collusion under the Classical Model's Collusion-Maximizing Outcome.

However, under the Collaborative Industry Model, firms can sustain collusion under more circumstances—and thus can earn significantly higher profits—than they can under the Classical Model. The intuition behind this result is that the potential to earn Collaborative Profits makes firms interdependent in a way that they are not under the Classical Model. Firms have a new way to punish a "Price Deviator" that undercuts a collusive arrangement: They can deny the Price Deviator Collaborative Profits by refusing to transact with it. This threat can be a powerful deterrent against deviations.[139] As a result, firms can maintain collusive pricing arrangements in many more circumstances than the Classical Model predicts.[140]

To better understand why it is easier to sustain collusion under the Collaborative Industry Model than under the Classical Model, consider the choices that a firm faces in each instance. In both models, the key question is the relative attractiveness of deviating as compared to colluding; when deviating becomes more attractive than colluding, the industry falls into competition.

Under the Classical Model, each firm chooses between: (1) deviating by cutting its price—thereby growing its market share for one period but resigning itself to zero future profits; or (2) colluding by offering the supra-competitive price—thereby earning a fraction of monopoly profits for many consecutive periods.

But in the Collaborative Industry Model, a firm chooses between: (1) deviating by cutting its price—thereby growing its market share for one period, *but losing Collaborative Profits that period and every future period*[141] and

137. Faced with identical offers, buyers randomly distribute their purchases across the industry. *Syndicated Markets*, *supra* note 40, at 3791–96; *Brokered Markets*, *supra* note 40, at 19.

138. *See Syndicated Markets*, *supra* note 40, at 3791–96; *Brokered Markets*, *supra* note 40, at 19.

139. We explain later in this Article why this threat is in each firm's interest and thus is credible. *See infra* Section III.C.

140. More precisely, there are many instances in which the highest price supported by a subgame perfect Nash Equilibrium in the Collaborative Industries Model is strictly higher than the highest price supported by a Nash Equilibrium in the Classical Model.

141. In the Collaborative Industry Model, growing market share may be immediately unprofitable. For example, in the Syndicated Market Model, a Price Deviator will be forced to produce alone, which may generate negative profits in-period—a worse outcome than continued collusion. *Syndicated Markets*, *supra* note 40, at 3801. This is not true in the Classical Model.

resigning itself to zero future profits; or (2) colluding by offering the supra-competitive price—thereby earning a fraction of monopoly profits, *and also earning Collaborative Profits*, for many consecutive periods.

The opportunity to earn Collaborative Profits always makes colluding relatively more attractive than it is in the Classical Model. Thus, collusion is easier to sustain in Collaborative Industries.

Further recall that, under the Classical Model, firms revert to pure, cutthroat competition once the monopoly price becomes unsustainable.[142] That is not the case in Collaborative Industries. In both models, the benefits of deviating increase as the collusive price increases;[143] Collaborative Profits generally do not. If the collusive price is low enough, a Price Deviator will immediately lose more Collaborative Profits than it can gain from growing its market share. Thus, at an appropriately chosen collusive price, firms always find colluding more profitable than deviating, even in the short run. This effect persists no matter how diffuse the industry becomes.[144]

Worse, in some instances interfirm collaboration becomes more important as industry concentration declines, enabling firms to collude at *higher* prices.[145] This is the exact opposite of what the Classical Model and the Concentration Principle predict.

The Syndicated Markets Model illustrates this dynamic well. Figure 2, below, shows the highest sustainable collusive price under the Syndicated Markets Model at varying levels of market concentration.[146] As in Figure 1, the competitive price is one and the monopoly price is twenty-five dollars.[147]

142. *See supra* Section I.B.

143. A deviating firm's profits are given by [profit per sale] * [number of sales]. The profit per sale equals revenue per sale (i.e., price paid by buyer) minus production cost per sale. To attract new business, the firm must offer a price that is less than the collusive price that other firms are offering. Thus, the collusive price limits the profits that a Price Deviator can earn.

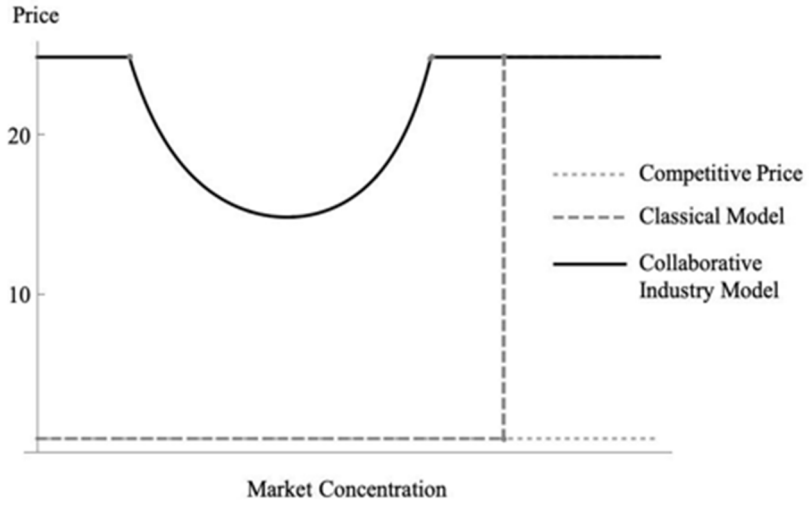
144. For example, under the Collusion-Maximizing Outcome for the Brokered Markets Model, sellers' agents charge monopoly prices, no matter how many firms enter the market. Buyers' agents' prices depend on several parameters. *See Brokered Markets*, *supra* note 40, at 10–11.

145. *Syndicated Markets*, *supra* note 40, at 3790–91. Consumers' willingness to pay means the same monopoly price cap will apply as in the Classical Model.

146. A variant of this diagram appears in *Syndicated Markets*. *Id.*

147. *See supra* Figure 1. In Figure 2, the production cost is s^2/m, where s is the amount produced and m is the capacity deployed. Firms value one dollar in one period at seventy-five cents now. Firms' total combined capacity is one. Buyer wishes to purchase one unit, and its reservation price is twenty-five dollars.

Figure 2: Highest Sustainable Price Under Syndicated Market Model as a Function of Market Concentration



When market concentration is high—i.e., there are relatively few firms in the market—then firms can collude at the monopoly price. This set of outcomes is depicted in Figure 2 as the flat bar to the right of the "half-pipe" shape, which shows a highest sustainable price of twenty-five dollars. This collusion resembles the collusion predicted by the Classical Model; it is enforceable chiefly via the threat of future price competition. However, as Figure 2 illustrates, this bar extends further to the left than it does in the Classical Model. This corresponds to maximal collusion under circumstances that—according to the Classical Model—render collusion impossible.

When market concentration drops below a specified threshold, firms cannot maintain collusion at the monopoly price. But, unlike in the Classical Model, firms do not revert to pure competition; firms can still collude at a supra-competitive price below the monopoly price. The highest sustainable price drops further as market concentration decreases. This is depicted in Figure 2 as the right half of the half-pipe shape.

As market concentration continues to fall, each firm's capacity declines.[148] That makes producing alone, without a syndicate, more expensive and thus less palatable. Firms become increasingly reliant on syndication and therefore on each other. The threat of ostracism becomes increasingly powerful. Eventually, the highest sustainable price begins creeping upward again.[149] This appears in Figure 2 as the left half of the "half-pipe" shape.

148. Assuming identical firms and fixed total industry capacity, increasing the number of firms reduces each firm's capacity. *See infra* note 166.

149. *Syndicated Markets*, *supra* note 40, at 3789–91.

This dynamic—reduced firm capacity increasing the gains from syndication, thereby enabling collusion at higher prices—continues until firms are again able to collude at the monopoly price. At that point, the highest sustainable price levels out; this is the flat bar showing a price of twenty-five dollars to the left of the half-pipe in Figure 2.

In the Syndicated Market Model, firms have the least ability to collude at an intermediate level of market concentration.[150] However, even at their most constrained, firms may still be able to collude at a price far above the competitive price. For example, in Figure 2, firms can always sustain a collusive price of at least fifteen dollars.[151] This is significantly less than the monopoly price (twenty-five dollars)—but it is closer to the monopoly price than to the competitive price (one dollar).[152]

C. WHY RIVALS SHUN PRICE DEVIATORS

The preceding Section demonstrates how refusing to work with Price Deviators plays a central role in supporting the Collusion-Maximizing Outcome. It is worthwhile to briefly explain why such refusals are in each rival firm's interest. Suppose that a Price Deviator, after lowering its price and growing its market share, makes an offer (a "Defector Offer") to another firm (a "Prospect"), thereby inviting the Prospect to collaborate with it. What are the consequences to the Prospect of accepting or rejecting, respectively?

Acceptance. If a Prospect accepts a Defector Offer, it immediately earns whatever profit the Defector Offer provides it. But in the future, other firms will punish the Prospect, driving its future profits to zero[153]—the worst possible equilibrium outcome for any firm.[154]

Rejection. If a Prospect rejects a Defector offer, it forgoes any immediate profits that would accompany that deal. However, future play shifts to "Collusive Punishment."[155]

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150. *Id.*

151. *See supra* Figure 2. More precisely, 14.93. *Id.*

152. To be clear, we are not suggesting that prices in real-world syndicated industries are generally set at fifteen times their competitive levels.

153. This can be done in a number of ways: For instance (as in the Classical Model), all firms could offer consumers the competitive price each period. Alternatively, a Collusive Punishment arrangement could assign both the Prospect and the Price Deviator zero future profits. *Syndicated Markets*, *supra* note 40, at 3793–96. This raises the question of whether it is in other firms' interests each period to punish the Prospect. It is, because any firm that fails to punish the Prospect in the prescribed way will itself be punished instead. *Id.*

154. We assume a firm can always earn zero profits by earning zero revenues and incurring zero costs. More specifically, it can offer a price that no consumer will accept and refuse to transact with other firms. Therefore, in any Nash Equilibrium, no firm can have negative expected profits. *See id.* at 3787.

155. We refer to Collusive Punishment as a singular result. More precisely, it captures a range of outcomes, depending on the nature of the Defector Offers that the Price Deviator made. *See id.* at 3793–94. This analysis also assumes that other Prospects reject their Defector Offers. *Id.*

Under Collusive Punishment, firms once again offer consumers a collusive price each period,[156] which creates positive, supra-competitive profits for the industry.[157] Firms allocate these profits throughout the industry by changing the price and other terms of interfirm transactions.[158] Prospects that rejected attractive Defector Offers are rewarded via favorable interfirm transactions.[159] For example, in the Syndicated Markets Model, firms that reject attractive Defector Offers receive attractive syndication offers from grateful rivals in subsequent periods.[160] When executed correctly, this technique isolates the Price Deviator.[161]

As a result, each firm's most profitable defection is to undercut the collusive price and resign itself to isolation ("Lone Deviation").[162] Thus, the attractiveness of Lone Deviation relative to continued collusion determines whether firms can sustain collusion. The more important that transactions with other firms are—and thus the larger the gap between the cost of lone production and the competitive price—the easier it is to sustain collusion. But even under market parameters that make collusion difficult, a Collaborative Industry can still sustain supra-competitive prices.[163]

D. KEY IMPLICATIONS

There are four key takeaways from the Collaborative Industry Model. First, collaborative interactions facilitate collusion. This is because collaborative interactions make firms more interdependent, and thus better able to punish and reward each other, than the Classical Model contemplates. As a result, collusion is feasible in more situations than the Classical Model predicts.

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156. This price may be lower than the collusive price offered before the Price Deviator emerged. *Id.* at 3792–94.

157. Collusive Punishment is a Nash Equilibrium and thus can be sustained. *See id.* The possibility of future collusive punishment phases makes Lone Deviation every firm's most attractive deviation; the collusive price is chosen so that it is not a profitable deviation. *See id.* at 3796–98.

158. *Cf. Syndicated Markets*, *supra* note 40, at 3786–87 (describing how fees are paid to members of the syndicate and how overall payoffs are defined).

159. *See id.* at 3792–97. The industry wants to maximize Prospects' incentives to reject Defector Offers, which means maximizing the future profits of Prospects that reject attractive Defector Offers (Prospects will already reject unattractive Defector Offers). No firm can have a negative expected profit in any Nash Equilibrium. *See supra* note 154 and accompanying text. Accordingly, the Nash Equilibrium that maximizes Prospects' incentives to reject Defector Offers assigns all future industry profits to those Prospects that reject attractive Defector Offers, and zero profits to all other firms.

160. *Syndicated Markets*, *supra* note 40, at 3793–94.

161. This assumes that firms value the future above a minimal level. In particular, the combined value of receiving one dollar in every future period must be at least as large as the value of receiving one dollar immediately. *See id.* at 3790.

162. A Price Deviator can make a Prospect such a rich offer that the Prospect earns more profit from accepting than from rejecting. However, paying that much is not profitable for the Price Deviator; it would be better off operating on its own. Thus, a rational Price Deviator will not make such an offer. *See id.*

163. *See supra* notes 139–45 and accompanying text.

Second, when firms have collaborative interactions, low market concentration does not prevent collusion. Firms can maintain supra-competitive pricing, even as market concentration drops to zero.[164]

Worse, if collaborative interactions become more important when firms are smaller, reducing market concentration can actually facilitate collusion and raise prices.[165] The Syndicated Markets Model illustrates this well: When markets are unconcentrated, firms are smaller and thus have less capacity relative to consumer demand.[166] As a result, firms gain more from forming syndicates.[167] Conversely, being prevented from forming a syndicate becomes increasingly costly. When market concentration drops low enough, the threat of isolation becomes powerful enough to support collusion at the monopoly price.[168]

This result is particularly noteworthy because, as noted previously, it violates the Concentration Principle, which is foundational to antitrust law and theory.[169] In the Classical Model, once market concentration drops low enough, firms cannot maintain any type of collusion. Antitrust law similarly presumes that more concentrated markets are more susceptible to collusion, and that firms in unconcentrated markets will find collusion difficult or impossible.[170] The Collaborative Industry Model suggests that the conventional wisdom is fundamentally incomplete.

Third, increasing firms' capacity may lower market prices and total firm profits. Antitrust models generally predict the opposite dynamic: Greater capacity makes production less costly. In other contexts, these cost savings generally translate into increased profits for firms.

To understand why increasing capacity in Collaborative Industries can hurt firms, consider its two separate effects:

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164. Reducing concentration can still be helpful. For example, in the Brokered Markets Model, reducing market concentration makes collusion more difficult, which causes prices to decline—but not all the way to the competitive price. *Brokered Markets*, *supra* note 40, at 11.

165. Similarly, under the right circumstances, mergers between competitors (which also reduce market concentration) may reduce collusion. *See infra* notes 301–04 and accompanying text. Agencies and courts should marshal appropriate skepticism when firms raise such self-serving arguments.

166. This analysis holds total industry capacity constant in order to isolate the effect of industry concentration. If all firms are the same size, firm size must therefore shrink as industry concentration falls. In *Syndicated Markets*, we consider the case in which firm size is held constant, and industry capacity increases as industry concentration falls. *Syndicated Markets*, *supra* note 40, at 3815. In that scenario, reducing concentration reduces the highest sustainable price, but not to the competitive level. *See id.* Industry profits always exceed competitive levels and may increase as market concentration decreases. *Id.* at 3815–17.

167. *Id.* at 3786–87.

168. *Id.* at 3791–92.

169. *See supra* Part I.

170. *See supra* Section I.A.

1. Increasing capacity lowers production costs. Assuming constant revenues, lowering costs raises firms' profits, just as it does in the Classical Model.

2. Increasing capacity can reduce firms' interdependence, which can make collusion more difficult. That pushes prices—and therefore revenues—downward, lowering firms' profits.

The second effect can be more powerful than the first. For instance, in the Syndicated Markets Model, increasing firms' capacity lowers the highest sustainable collusive price more than it lowers the cost of production.[171] Firms' revenues thus fall faster than their costs, reducing both market price and total firm profits.[172] Increasing capacity lowers prices in the Brokered Markets Model in a similar way.[173]

Finally, market entry may not reduce collusion. Worse, it can raise the highest sustainable collusive price and increase firm profits.[174] This is another surprising result that runs contrary to antitrust conventional wisdom. In the Classical Model, increasing the number of firms makes collusion more difficult. Antitrust law takes the same approach, presuming that new entrants—or even potential entrants—reduce the chance of collusion.[175]

To see why new entrants can raise prices, consider the Syndicated Markets Model. A new firm entering the market can produce two possible effects:[176] First, the new entrant could become a Price Deviator, making it more difficult for the industry to maintain the collusive price. However, as established previously, a Price Deviator will find itself isolated and forced to fulfill the

171. Increased capacity reduces the cost of completing the project alone. That reduces the advantages of syndicate production relative to lone production, which weakens colluding firms' threat to not join a Price Deviator's syndicate. Deviating becomes more attractive, which puts downward pressure on the collusive price. *Syndicated Markets*, *supra* note 40, 3799–800.

172. *Id.* at 3800.

173. In the Brokered Markets Model, capacity refers to the volume of buyers and sellers that an agent can service. As in the Syndicated Markets Model, increasing capacity either reduces or does not affect the highest sustainable collusive price. Again, the key constraint on collusive pricing is an ostracized firm's ability to generate profit, and ostracism is less costly for a firm with more capacity. At the extreme, a firm with enough capacity can cut its price and form a network that encompasses the entire market, removing rivals' ability to ostracize it. *Brokered Markets*, *supra* note 40, at 6, 9–11.

174. Obviously, it does not raise the buyer's reservation price. So, if the collusive price is the monopoly price, a new entrant will not raise the market price further—though it will increase total firm profits.

175. *See, e.g.*, Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 591 n.15 (1986) ("Respondents offer no reason to suppose that entry into the relevant market is especially difficult, yet without barriers to entry it would presumably be impossible to maintain supracompetitive prices for an extended time.").

176. Alternatively, a new firm could join a Price Deviator's syndicate, which would make it more difficult to maintain collusion. *Syndicated Markets*, *supra* note 40, at 3801. However, the Collusive Punishment system prevents this. *See supra* Section IV.C.

contract on its own.[177] For some entrants—small ones, for example—fulfilling the contract alone is not profitable.[178] Accordingly, such entrants will never be Price Deviators, and this effect will not apply.[179]

Second, the new entrant brings with it additional productive capacity, which reduces the cost of efficient joint production. This makes collusion more profitable, and therefore more attractive relative to deviating. This effect always applies, and so entry by a small enough entrant raises the highest sustainable collusive price.[180]

IV. REAL-WORLD VALIDITY

When using a model to craft policy, one should consider how well that model reflects the real world. This Part takes up that question with respect to the Collaborative Industries Model. We first approach this question from the perspective of theory. We examine the assumptions underlying our models and the extent to which they hold. We conclude that real-world markets' violations of those assumptions do not threaten our key results. We next consider the question from an empirical perspective. Preliminary empirical testing of the model has been favorable; we summarize these results. We also discuss a number of observed behaviors that are difficult to reconcile with the Classical Model but that are consistent with the Collaborative Industries Model.

A. THEORETICAL CONSIDERATIONS: ASSUMPTIONS REVISITED

As an initial matter, because the Collaborative Industries Model closely mirrors the Classical Model, it should retain the Classical Model's strengths—strengths that have made the Classical Model and its progeny so influential in antitrust law and theory for decades. In particular, the Collaborative Industries Model is a repeated game, in which firms interact over a long time horizon. This enables a much larger set of equilibrium behaviors than if firms only interact once.

At the same time, the Collaborative Industries Model extends existing models. In many models, firms only interact with each other as competitors, and only through one channel of competition, such as product pricing. In the Collaborative Industries Model, firms interact in more complex ways. This better reflects reality; real-world firms are competitors in some fields and collaborators in others.[181] Personal and business relationships tie them together

177. *See supra* Sections III.B–.C.

178. *Id.* More specifically, to cover its costs, the firm would need to charge a price that is higher than the collusive price, and thus it cannot undercut the collusive market price. *Id.*

179. *Id.*

180. *Id.* Similarly, if new entrants cannot contract with clients directly and can only join syndicates, then only the second effect described in text will apply, which will increase the highest sustainable collusive price.

181. For example, Netflix relies on Amazon Web Services to deliver its content, all while competing against Amazon Prime Video for subscribers. *Netflix & Amazon Kinesis Data Streams*

in a complicated mesh.[182] These other channels of interaction and influence enable firms to punish each other without slashing prices, which can be as costly to the punish-or as the punish-ee.[183] They also give firms ways to reward each other as well.

The Collaborative Industries Model gives firms a relatively large menu of possible actions each period. Combined with a long time horizon, this geometrically magnifies the breadth and complexity of firms' interactions. The net effect is a much richer environment that more closely resembles the real world—and thus captures important real-world dynamics that the Classical Model does not.

Nonetheless, the Collaborative Industries Model, like all economic models, makes assumptions. It is important to consider both how far the real world diverges from the model's assumptions and the implications of the model's assumptions being violated. To these topics we now turn.

1. Heterogeneous Capacity

For simplicity, the preceding analysis assumes that all firms have the same capacity—i.e., that they are the same size. In reality, this clearly is not the case: Firms vary in size, from tiny one-person operations to massive corporations with thousands of employees.

In our companion papers, we formally analyze the implications of firms having varying sizes.[184] In general, the basic picture remains the same: All of our key results hold and for the same reasons.[185] Thus, this assumption is not a problem for our analysis.[186]

Case Study, AWS (2017), https://aws.amazon.com/solutions/case-studies/netflix-kinesis-data-streams/#:~:text=Netflix%20uses%20Amazon%20Web%20Services,100%2C000%20server%20instances%20on%20AWS [https://perma.cc/GG7P-Z9PR]; Dan Moskowitz, *Who Are Netflix's Main Competitors?*, INVESTOPEDIA (Oct. 12, 2018), https://www.investopedia.com.cach3.com/articles/markets/082715/it-time-cash-out-netflix.asp.html [https://perma.cc/ART7-CKRD]; *see also* Erik N. Hovenkamp & Herbert Hovenkamp, *The Viability of Antitrust Price Squeeze Claims*, 51 ARIZ. L. REV. 273, 273–74 (2009) (analyzing antitrust issues pertaining to vertically integrated firms selling essential inputs to firms they compete with downstream).

182. *See, e.g.*, 1 ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS 134 (George Bell & Sons 1896) ("People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends . . . in some contrivance to raise prices.").

183. Dean Harvey, *Anticompetitive Social Norms as Antitrust Violations*, 94 CALIF. L. REV. 769, 777–78 (2006).

184. *Syndicated Markets*, *supra* note 40, at 3801; *Brokered Markets*, *supra* note 40, at 20–24.

185. *See Syndicated Markets*, *supra* note 40, at 3802. Collaborative interactions facilitate collusion. Reducing market concentration does not eliminate collusion and can facilitate it. Increasing firms' capacity may lower market prices and total firm profits. Small entrants can raise market prices. *See id.*

186. A heterogeneous industry can be more or less able to maintain collusion than a homogenous one. *See id.* at 3783. Firms with higher capacities earn more profits, though the profit that each firm earns likewise depends on the specific distribution of capacity across the industry: In equilibrium, the most tempting deviation is to undercut the collusive price and fulfill the contract alone. *See id.* at 3801. That option is most attractive to the firms with the most

2. Information

The Collaborative Industry Model assumes that firms have, and act upon, two key pieces of information. First, firms know the capacities of other firms in their industry.[187] This assumption seems broadly unproblematic. Firms often know a great deal about the competitive environment in which they operate, including basic information about their main competitors, such as their rough size.

Of course, firms' information and estimates may be imperfect. Firms' uncertainty will limit their ability to alight upon the Collusion-Maximizing Outcome. For example, firms may collude at a price below that of the Collusion-Maximizing Outcome simply because they do not realize the industry could maintain collusion at a higher price. But these effects are at the margin. Small errors in estimating firms' capacities are unlikely to prevent collusion altogether or even to put a significant damper on it. Thus, this assumption is of little concern.

Second, the Collaborative Industry Model assumes that all firms know the key terms of interfirm offers, including those that are rejected.[188] If other firms cannot observe rejected offers, they cannot calibrate rewards based on them. That reduces firms' ability to isolate Price Deviators, which in turn makes collusion more difficult to sustain.

But even if firms do not see full offers, they generally have some sense of goings-on in their industry. Firms with imperfect knowledge of rejected offers can still (imperfectly) reward firms that ostracize Price Deviators. Worse-tailored rewards have less of a deterrent effect on would-be deviators, but they still have a deterrent effect.[189] The maximum sustainable collusive price may fall, but it will remain above the competitive price. Accordingly, this assumption seems broadly unproblematic.

3. Transaction Costs

Like the Classical Model, the Collaborative Industry Model assumes away transaction costs. This is a common modeling assumption that is never strictly true in reality.[190]

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capacity. *Id.* Thus, to maintain the highest collusive price possible, larger firms must receive more profits.

187. *See id.* at 3786–87.

188. *See id.* at 3787, 3793–94.

189. *See* Presentation from John William Hatfield & Richard Lowery, Collusion with Hidden Syndication Recruiting 33 (on file with authors).

190. Barry et al., *supra* note 85, at 1163; *see also* R. H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 15–19 (1960) (exploring the results that would follow if this assumption were literally true in reality); Jordan M. Barry & John William Hatfield, *Pills and Partisans: Understanding Takeover Defenses*, 160 U. PA. L. REV. 633, 701–03 (2012) (exploring same assumption in different context).

The main way that this assumption impacts our models is that it makes collaborative interfirm transactions easier. In reality, putting together such deals requires time and other resources. The "no transaction cost" assumption eliminates these transactional roadblocks, making our idealized collaborative transactions more attractive prospects than real-world ones.[191] This likely increases collaborative interactions' theoretical importance, which in turn makes ostracism a more potent punishment.

However, this difference is a matter of degree, and not of kind. The main results of our model continue to apply under a world in which collaborative transactions between firms become less frequent and less important. Thus, the "no transaction cost" assumption seems relatively untroubling.

4. Perfect Individual Rationality

Finally, our models assume that firms are perfectly rational and single-mindedly pursue their self-interest. This leads to results that some may find hard to swallow. For example, the Collusion-Maximizing Outcome calls for firms to respond to certain transgressions with extremely long-lasting punishments—i.e., shunning a Price Deviator forever. One might question whether firms will really stick with this course of action when the time comes.[192]

These types of issues are common in repeated game economic models.[193] In particular, the Classical Model suffers from the same issue, and to an even greater extent: It relies heavily on a Grim Trigger—which guarantees that no firm earns any profits, ever—to discourage deviations from the prescribed strategy.[194] Thus, any critique of the Collaborative Industry Model on this basis applies with even greater force to the Classical Model.[195]

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191. For example, our Syndicated Markets Model assumes that, at equilibrium, every firm in a syndicated industry participates in every syndicate; this does not happen in practice. *Syndicated Markets*, *supra* note 40, at 3798–99. Transaction costs could be roughly constant for each new member brought into a syndicate, while the production cost savings from adding a new firm likely decline as total syndicate capacity increases. If so, once a certain number of firms join the syndicate, the transaction costs of adding another member outweigh the efficiency gains. At this point, the syndicate leader will stop recruiting firms, presumably smaller firms. We might also expect smaller firms to earn smaller profits than larger firms. *See id.* at 3799; *supra* Section IV.A.1.

192. Similarly, the Collusion-Maximizing Outcome calls for a specific profit allocation when firms reject Defector Offers. *See Syndicated Markets*, *supra* note 40, at 3792–98. One might question whether real-world firms will execute this plan exactly.

193. *See, e.g.*, Ariel Rubinstein & Asher Wolinsky, *Renegotiation-Proof Implementation and Time Preferences*, 82 AM. ECON. REV. 600, 601–03 (1992) (discussing this concept).

194. In the Collaborative Industry Model, firms can generally deny a Price Deviator any profits and maximally punish any Prospect that accepts a Defector Offer while simultaneously earning profits themselves. *See Syndicated Markets*, *supra* note 40, at 3793; *Brokered Markets*, *supra* note 40, at 13.

195. The Classical Model has some responses to this attack. For instance, once an industry reaches competitive equilibrium, it may be difficult to escape it: So long as one firm prices competitively, the others have no incentive to raise their prices, as they will simply lose volume to the competitively pricing firm. Corralling all firms to change their behavior simultaneously may

More importantly, however, this critique is conceptually misguided. There may be situations in which firms cannot execute the precise strategies contemplated by our models; if so, firms may be less able to maintain collusion than our models predict. This is unsurprising and largely unproblematic. Generalized formal models like ours and the Classical Model are not intended to provide hard and fast rules on when collusion will happen—one would not want to conclude, based on the Classical Model, that an industry with seven firms is susceptible to collusion, but that an industry with eight is not.[196] The value of generalized formal models is that they can map the broad contours of what may happen and how those contours change as different parameters fluctuate. If firms are imperfectly rational, that changes neither the model's basic dynamics nor the resulting policy implications.

B. EMPIRICAL EVIDENCE

Although direct empirical investigations of our models are still in their initial stages, they have been supportive so far. Motivated by our work, Jian Cai and her coauthors investigated how industry concentration affected the interest rates (i.e., prices) that banks offered borrowers in the syndicated loan market.[197] Consistent with our theory, they find that prices are U-shaped with respect to market concentration; both high and low levels of market concentration were associated with high interest rates.[198] They also record anecdotal evidence of "blacklists" in the syndicated loan market—banks refused to deal with other banks that undermined collusive pricing.[199] This suggests that firms in Collaborative Industries employ the types of punishment strategies that we identify.

Moreover, our theoretical findings offer a new explanation for some important and longstanding empirical findings regarding collusion.[200] Under the Classical Model, collusive behavior becomes more likely as industry concentration increases. However, a review of the empirical literature reports that "[t]here is no simple relationship between industry concentration and the likelihood of collusion,"[201] and some researchers have found that industries with lower levels of concentration are *more* likely to produce cartels.[202] Richard

be challenging, especially since legally enforceable contracts are generally unavailable as a direct tool for cartel assembly.

196. *See* Stucke, *supra* note 71, at 552 ("'[I]t is impossible to specify a threshold figure above which collusion becomes an attractive proposition,' or below which collusion is unlikely." (footnote omitted) (quoting RICHARD A. POSNER, ANTITRUST LAW 70 (2d ed. 2001))).

197. For the result of the entire study, see generally Cai et al., *supra* note 116.

198. *Id.* at 22–24.

199. *Id.* at 2.

200. There are possible alternative explanations in the literature. *See* Margaret C. Levenstein & Valerie Y. Suslow, *What Determines Cartel Success?*, 44 J. ECON. LITERATURE 43, 58 & n.50 (2006).

201. *Id.* at 58.

202. *See* Andrew R. Dick, *Identifying Contracts, Combinations and Conspiracies in Restraint of Trade*, 17 MANAGERIAL & DECISION ECON. 203, 212–13 (1996); *see also* Levenstein & Suslow, *supra* note

Posner found "that a large proportion of [cartels are] . . . in industries not normally regarded as highly concentrated."[203] Fraas and Greer found that the average cartel that involved an industry trade association included more than thirty firms.[204] Clabault and Burton found no relationship between industry concentration and the likelihood of price-fixing.[205] They also report that, among prosecutions in national industries, approximately seventy percent of defendants came from industries that were not highly concentrated.[206]

There are also well-documented instances in which very unconcentrated industries have produced collusive behavior.[207] Many of these cases pose a challenge for the Classical Model but are entirely consistent with the Collaborative Industries Model.

For example, recall that the DOJ prosecuted dozens of market makers for collusively pricing NASDAQ stocks.[208] At the time, there were approximately sixty market makers operating on the NASDAQ; they "enjoy[ed] relatively free entry and exit" into individual stocks.[209] Many collusively priced stocks were household names, like Apple Computer, Microsoft, and Intel, and some were quoted by as many as fifty market makers[210]; yet, market makers maintained collusive pricing for many years.[211] They were able to do so because the industry is a Brokered Market, which gave market makers ample ability to reward and punish each other for "unprofessional[ly]" or "unethical[ly]" violating collusive pricing conventions.[212] The DOJ documented how market participants employed these tools to great effect.[213] Often, simply pointing out

200, at 58 (finding a "lack of a clear empirical relationship between industry concentration and cartel prevalence"). *But see* George A. Hay & Daniel Kelley, *An Empirical Survey of Price-Fixing Conspiracies*, 17 J.L. & ECON. 13, 26–27 (1974) (finding "that conspiracy among competitors may arise in any number of situations but it is most likely to occur and endure when numbers are small, concentration is high and the product is homogeneous"); George Symeonidis, *In Which Industries Is Collusion More Likely? Evidence from the UK*, 51 J. INDUS. ECON. 45, 66–67 (2003) (finding that collusion is less likely at both very high and very low levels of concentration).

203. Richard A. Posner, *A Statistical Study of Antitrust Enforcement*, 13 J.L. & ECON. 365, 410 (1970); *see also* Levenstein & Suslow, *supra* note 200, at 58 n.50 (noting that "collusion occurs in both very concentrated and very unconcentrated industries").

204. Arthur G. Fraas & Douglas F. Greer, *Market Structure and Price Collusion: An Empirical Analysis*, 26 J. INDUS. ECON. 21, 34 (1977) (noting that the median was sixteen; for the full sample, the mean was 16.7 and the median was eight).

205. JAMES M. CLABAULT & JOHN F. BURTON, JR., SHERMAN ACT INDICTMENTS 1955-1965: A LEGAL AND ECONOMIC ANALYSIS 135–37 (1966). More precisely, they look at industry structure, which is a broader concept than concentration, but includes it. *Id.*

206. *Id.* at 136.

207. *See* Levenstein & Suslow, *supra* note 200, at 58 n.50.

208. *See supra* Section III.B.

209. Christie & Schultz, *supra* note 22, at 1813.

210. *See id.* at 1813–14.

211. DOJ NASDAQ Statement, *supra* note 11, at 6.

212. *Id.* at 20.

213. *Id.* at 18–30.

offending behavior was sufficient to prompt a correction,[214] but participants were also capable of more forceful responses,[215] including refusing to transact with deviating firms.[216] The collusive behavior broke down when it was publicized.[217]

Similarly, in *Dahl v. Bain Capital Partners*, plaintiffs alleged that at least fifteen firms, including every major U.S. private equity firm, colluded over a multi-year period.[218] The alleged behavior largely matches that described in the Syndicated Markets Model: Private equity firms made investments in a syndicated manner ("club deals"),[219] and they stopped competing and took turns winning bids.[220] Plaintiffs alleged that defendants refused to work with outsiders (i.e., potential entrants and spoilers of collusion) who wanted to challenge collusive deals.

Plaintiffs also argued that firms received compensation for not competing against rivals.[221] This compensation came in the form of lucrative syndication

214. *Id.* at 23.

215. *Id.* at 23–24 ("On [some] occasions, traders resorted to more intimidating telephone calls to exact compliance . . . . Some of the more dramatic examples of these were captured on the audio tapes . . . . "); *id.* (quoting a market maker's statement that a non-conforming trader should "straighten up his [expletive deleted] act and stop being a moron" (alteration in original) (emphasis omitted)).

216. *Id.* at 24–26.

217. Christie et al., *supra* note 127, at 1850–51; DOJ NASDAQ Statement, *supra* note 11, at 34–35.

218. Fifth Amended Class Action Complaint for Violations of the Federal Antitrust Laws at 1–14, Dahl v. Bain Cap. Partners, LLC, 937 F. Supp. 2d 119 (D. Mass. 2013) (No. 07-cv-12388), ECF No. 588 [hereinafter *Dahl* Complaint]; *see* Jon Fougner, Comment, *Antitrust Enforcement in Private Equity: Target, Bidder, and Club Sizes Should Matter*, 31 YALE J. REGUL. ONLINE 25, 25–26 (2013).

219. *Dahl* Complaint, *supra* note 218, at 22 ("[Private equity firms] formed joint purchasing clubs . . . , refused to top one another's bids, and divided deals among themselves through a series of *quid pro quo* arrangements."); *id.* at 26 ("Defendants formed clubs in every single large LBO. These clubs would number as many as seven Defendants even when any one Defendant could have profitably purchased the target on its own." (emphasis omitted)). "LBO" is an abbreviation for "leveraged buyout," a type of transaction. *Id.* at 1.

220. "Defendants would allocate the deals among themselves, such that they each took a turn as the 'winner.'" *Id.* at 29. Plaintiffs documented how multiple firms' executives "admitted that forming clubs suppressed price competition" for target companies. *Id.* at 26. For example, "KKR bragged to its investors in 2005: 'Gone are the days when buy-out firms fought each other with the ferocity of cornered cats to win a deal.'" *Id.* at 25 (emphasis omitted). "Every time a Defendant's club signaled that it had a proprietary deal . . . the other Defendants refused to submit a better offer – even when" doing so meant, in the words of one defendant, "we let [a rival] get away with highway robbery." *Id.* at 27, 120 (emphasis omitted).

221. *Id.* at 26, 29–32.

offers, which firms were expected to reciprocate.[222] Plaintiffs provided "[n]umerous examples" of these alleged behaviors.[223] Perhaps most strikingly:

> [The firms] monitored compliance through . . . detailed 'scorecards' that listed the deals they worked on, who else was involved in those deals, and the resulting favors that they owed others and that others owed them. . . .
>
> . . . [For] instance, when Apollo co-founder Leon Black expressed his anger at Goldman Sachs' "lack of reciprocity" for two deals he had invited Goldman Sachs to join, Goldman Sachs' executives reviewed their scorecard and readily agreed that they "truly need[ed] to involve [Apollo] soon in a principal deal."[224]

Academic work by Micah S. Officer, Oguzhan Ozbas, and Berk A. Sensoy supported plaintiffs' allegations. The authors found that "target shareholders receive[d] . . . roughly 40% lower premiums, in club deals" than in other private equity transactions during the relevant time period.[225] Moreover, they found "little support for benign motivations for club deals."[226]

Dahl settled before trial, following seven years of litigation in which plaintiffs overcame "dozens of motions to dismiss and for summary judgment," and defendants produced millions of pages of documents.[227] In total, the fifteen firm defendants paid approximately six hundred million dollars.[228] Club deals became less frequent in the wake of *Dahl* and the related DOJ investigation.[229]

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222. *Id.* at 29–32. They also argued that in exchange "for not competing for large LBOs," defendants were "offered an invitation to participate in that LBO" or a future LBO "with its co-conspirators" "as a reward." *Id.* at 24, 29–32. Firms "invited into a current deal understood that they were required to invite their co-conspirators into a subsequent deal." *Id.* at 30.

223. *Id.* at 30.

224. *Id.* at 32–34 (sixth and seventh alteration in original) (emphasis omitted).

225. Officer et al., *supra* note 116, at 215.

226. *Id.* at 214.

227. Supplemental Memorandum of Law in Support of Named Plaintiffs' Motion for Preliminary Approval of Settlements, Including a Settlement with Defendants the Blackstone Grp. L.P., Kohlberg Kravis Roberts & Co. L.P. & TPG Cap., L.P. at 2, Dahl v. Bain Cap. Partners, LLC, 937 F. Supp. 2d 119 (D. Mass. 2014) (No. 07-cv-12388), 2014 WL 12718975 [hereinafter *Dahl* Settlement].

228. The exact number was $590.5 million. *Id.* at 1 (listing total payments from all non-Carlyle defendants at $475.5 million); Thomas Heath, *Carlyle Settles Collusion Case for $115 Million*, WASH. POST (Aug. 29, 2014), https://www.washingtonpost.com/business/capitalbusiness/carlyle-settles-collusion-case-for-115-million/2014/08/29/06bf9918-2fbe-11e4-bb9b-997ae96fad33_story.html [https://perma.cc/Q7HH-YCUR].

229. Peter Fogel, *Party's Over: Why PE Firms Are No Longer Clubbing*, PITCHBOOK (Apr. 23, 2014), https://pitchbook.com/news/articles/partys-over-why-pe-firms-are-no-longer-clubbing [https://perma.cc/54VZ-9MTW]; Alex Lykken, *Why Club Deals Might Be Making a Comeback*, PITCHBOOK (Sept. 28, 2018), https://pitchbook.com/news/articles/why-club-deals-might-be-making-a-comeback [https://perma.cc/NZY4-LAAD] ("[C]lub deals are also deemed less competitive, or at least they once were. . . . [This] perception[] stuck, which helped push down the frequency of those deals . . . . to only 20% today.").

Finally, we note that there are studies of specific collaborative practices and industries that support our analysis. For example, consider research joint ventures. A number of scholars have postulated that such ventures could theoretically foster collusion.[230] Empirical analyses employing different methodologies have also linked such ventures to collusion.[231] For example, Tomaso Duso, Lars-Hendrik Röller, and Jo Seldeslachts found that firms that enter into research joint ventures with non-competitor firms grow their market shares, consistent with the joint research fueling business growth.[232] But when firms conduct research with competitors, their market share shrinks, consistent with collusive behavior.[233] Moreover, this effect increases when a larger proportion of competitors are connected via a network of research joint ventures.[234] These findings support our own: Collaborative interactions can help rivals collude.

V. POLICY IMPLICATIONS

Our analysis shows that collusion is sustainable under a far wider range of circumstances than prior economic models generally recognize. Contra the Concentration Principle, neither low market concentration nor easy entry prevents collusion in Collaborative Industries. Worse, the Concentration Principle can be backwards—in some instances, reducing concentration can *facilitate* collusion. These points merit special emphasis because, as noted earlier, the Concentration Principle and ease of entry are so central to modern antitrust.[235]

To be clear, agencies and courts should consider market concentration and ease of entry. Both are important characteristics of an industry. But in

230. *See, e.g.*, Luís M.B. Cabral, *R&D Cooperation and Product Market Competition*, 18 INT'L J. INDUS. ORG. 1033, 1033–36 (2000); Russell W. Cooper & Thomas W. Ross, *Sustaining Cooperation with Joint Ventures*, 25 J.L. ECON. & ORG. 31, 31–33 (2009); Stephen Martin, *R&D Joint Ventures and Tacit Product Market Collusion*, 11 EUR. J. POL. ECON. 733, 733–35 (1995); Kaz Miyagiwa, *Collusion and Research Joint Ventures*, 57 J. INDUS. ECON. 768, 768–70 (2009); Evgenia Motchenkova & Olgerd Rus, *Research Joint Ventures and Price Collusion: Joint Analysis of the Impact of R&D Subsidies and Antitrust Fines* 2–5 (Vrije Universiteit Amsterdam, Fac. Econ. & Bus. Admin., Rsch. Memorandum 2011-25, 2011), https://research.vu.nl/ws/portalfiles/portal/2927953/rm+2011-25.pdf [https://perma.cc/DNH6-YPDL].

231. *See, e.g.*, Joanne E. Oxley, Rachelle C. Sampson & Brain S. Silverman, *Arms Race or Détente? How Interfirm Alliance Announcements Change the Stock Market Valuation of Rivals*, 55 MGMT. SCI. 1321, 1325–27 (2009); Michelle S. Goeree & Eric Helland, *Do Research Joint Ventures Serve a Collusive Function?* 1–7 (Inst. for Empirical Rsch. in Econ., Univ. of Zurich, Working Paper No. 448, 2012), https://www.econ.uzh.ch/static/wp_iew/iewwp448.pdf [https://perma.cc/F5EE-47DW]; *see also* Sigrid Suetens, *Does R&D Cooperation Facilitate Price Collusion? An Experiment*, 66 J. ECON. BEHAV. & ORG. 822, 834 (2008) (finding, in a laboratory experiment, that R&D cooperation facilitates collusion).

232. Duso et al., *supra* note 104, at 350.

233. *Id.*

234. *Id.*

235. *See supra* Part I.

Collaborative Industries, these features alone are insufficient to understand and predict industry behavior. Collaborative Industries are particularly susceptible to collusion and thus merit extra scrutiny.

This insight has four chief implications for antitrust law. First, it should inform antitrust doctrine. We focus on two key examples: the "plus factors" suggesting implicit agreements among firms and the application of the "rule of reason." Second, our models implicate the ways in which regulators and private plaintiffs select and present cases. Third, we discuss how our results should alter the public guidance that agencies issue. Fourth, our analysis suggests two potent tools for fighting collusion in Collaborative Industries: adjusting market structures and increasing firms' productive capacities.

A. Doctrinal Implications

Our models have implications for several doctrinal questions in antitrust law. We focus on two here: the definition of "agreement" and rule of reason analysis.

1. Agreement

As discussed previously, Section 1 of the Sherman Act forbids agreements in restraint of trade.[236] Such an agreement need not be explicit. At the same time, supra-competitive pricing alone generally does not suffice. Instead, plaintiffs and enforcement officials must demonstrate additional circumstances that suggest an agreement. What "plus factors" imply the existence of an agreement is a key question in U.S. antitrust law.[237]

Our analysis suggests two broad classes of behavior that should constitute significant plus factors. Both relate to how firms respond to deviations from collusive arrangements. At the outset, we note that firms may not refer to (or consider) existing industry practices as collusive. Firms may condemn deviations as violations of industry norms or of ethical or professional standards.[238] What matters is a practice's effect—maintaining noncompetitive outcomes that benefit firms and harm their counterparties.

The first class of behavior is refusing to deal with Price Deviators. In Collaborative Industries, such refusals can be powerful tools for fostering collusion: Because cooperative interactions are important, refusals to deal can impose heavy costs on Price Deviators. Turning down immediately lucrative Defector Offers is economically irrational, absent an underlying common

236. *See supra* Section I.A.

237. *See supra* Section I.A.

238. *See* DOJ NASDAQ Statement, *supra* note 11, at 19–22; *Brokered Markets*, *supra* note 40, at 22–23, 41.

scheme.[239] Courts should thus treat such refusals to deal as evidence of an implicit agreement.[240]

For example, consider investment bank W.R. Hambrecht.[241] The standard fee for a mid-sized IPO in the United States is seven percent;[242] W.R. Hambrecht charges roughly half that.[243] Other investment banks have resisted working with W.R. Hambrecht.[244] For instance, Morningstar hired Morgan Stanley to underwrite its IPO—but after Morgan Stanley learned it would have to work with W.R. Hambrecht, it walked away.[245] Allegedly, banks have refused to work with W.R. Hambrecht because its lower fees do not conform to industry norms.[246] If a firm's competitors are collectively working to punish it for pricing below prevailing levels, that suggests an implicit agreement.

Second, rewarding those firms that punish Price Deviators also plays an important role in sustaining collusion: Such rewards encourage firms to reject tempting Defector Offers. Moreover, rewarding a rival for rejecting a Defector Offer is only rational if done pursuant to some underlying arrangement.[247] Our models predict that these rewards come in the form of lucrative interfirm transactions. Plaintiffs and government agencies should be on the lookout to see whether firms reward rivals that refuse to work with Price Deviators, either via an increased volume of transactions or via transactions conducted at favorable prices or terms. Courts should recognize this behavior as indicative of an agreement and treat it accordingly.

Similarly, firms sometimes trumpet their refusals to work with Price Deviators. For example, online real estate broker Redfin charges lower

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239. *Cf.* Leslie, *supra* note 27, at 1617–18 (providing examples of seemingly irrational acts operating as plus factors in price-fixing litigation).

240. An organized refusal to deal with a price deviator can itself be illegal. *See* GAVIL ET AL., *supra* note 1, at 128–30.

241. *See* Joe Nocera, *Open and Fair: Why Wall St. Hates Auctions*, N.Y. TIMES, Mar. 18, 2006, at C1.

242. *See id.*; Jackson, *supra* note 18.

243. Randall Smith, *Heard on the Street: Why IPOs Still Use the Old Way*, WALL ST. J., July 6, 2005, at C1.

244. Nocera, *supra* note 241, at C1.

245. *Id.*

246. *See id.*; Matthias Hild, *The Google IPO*, 3 J. BUS. & TECH. L. 41, 52 (2008) ("I know . . . the kinds of pressures that got brought by Wall Street when we decided to go with Hambrecht. . . . I had white-shoe Wall Street bankers . . . . [j]ust threatening me." (internal quotation marks omitted) (emphasis omitted) (quoting The Motley Fool Radio Show, *Overstock.com CEO Patrick Byrne*, NPR (Jan. 30, 2004), https://www.npr.org/templates/story/story.php?storyId=1965512 [https://perma.cc/YXT5-GV7X] (statement of Patrick Byrne, CEO, Overstock.com))); *cf.* Christine Hurt, *Morningstar's Auction IPO*, CONGLOMERATE (May 4, 2005), https://www.theconglomerate.org/2005/05/morningstars_au.html [https://perma.cc/ZQ97-W2Y4] ("Many have charged that the biggest stumbling block to auction IPOs is the Wall Street machine of investment banks and analysts."). Of course, there are other reasons why rivals might not wish to work with W.R. Hambrecht's. We make no assertion as to their motivations here.

247. *Cf.* Leslie, *supra* note 27, at 1617–18 (noting that conduct inconsistent with self-interest can constitute evidence of collusion between firms).

commissions than traditional realtors.[248] Traditional realtors have discouraged their clients from transacting with Redfin clients[249] and have even outright refused to pass on Redfin buyers' offers to their clients.[250] In response, Redfin created a "Hall of Shame"—a website calling out traditional realtors who, against their own clients' interests, engage in acts of hostility against Redfin clients.[251] To Redfin's surprise, "agents immediately appl[ied] to appear there."[252] At first glance, this seems surprising; potential clients and regulators may take a dim view of such behavior, so why draw attention to it?

An agent might publicize her refusal to deal with Redfin agents in the hope that her peers will reward her for it.[253] For example, her peers might show her listings more frequently, or encourage their clients to accept offers from her clients. Courts should treat such behavior as evidence of an agreement.

Three additional points merit mention.[254] First, the length of time for which firms ostracize Price Deviators or reward faithful Prospects should not change the antitrust law consequences of such actions. Our models contemplate these behaviors continuing indefinitely.[255] In practice, firms may punish a defector, or reward a faithful rival, for a shorter period of time.[256] Such

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248. *See, e.g.*, James R. Hagerty, *Real-Estate War Traps Consumers in the Middle: Full-Service Brokers' Tactics to Rebuff Discount Rivals Sometimes Hurt the Customer*, WALL ST. J., June 17, 2006, at B1.

249. *See, e.g.*, *id.* (describing how, when he learned a couple was using Redfin, an "initially friendly and helpful" seller's broker "refused to show the condo to the couple again and said he would advise his client not to consider any offer they made"; the couple "gave up"); *The Changing Real Estate Market: Hearing Before the Subcomm. on Hous. & Cmty. Opportunity of the H. Comm. on Fin. Servs.*, 109th Cong. 97–98 (2006) (statement of Glenn Kelman, President & CEO, Redfin Corp.) [hereinafter Kelman Statement], https://www.govinfo.gov/content/pkg/CHRG-109hhrg31541/pdf/CHRG-109hhrg31541.pdf [https://perma.cc/7L6E-5MY6].

250. Kelman Statement, *supra* note 249, at 97–98. According to Redfin's CEO, "[s]ixty-three percent of [its] customers report meddling from other agents," including intimidation, "mak[ing] up grade-school legal mumbo-jumbo to scare [Redfin] clients," and even threats of violence. *Id.* at 97.

251. *Id.* at 98; Glenn Kelman, *The Hall of Shame*, REDFIN NEWS (Oct. 5, 2020), https://www.redfin.com/news/the_hall_of_shame [https://perma.cc/86GC-9B3F].

252. Kelman Statement, *supra* note 249, at 98.

253. Agents may view the posting as an invitation to their peers to follow suit; if so, courts should treat it as evidence of an agreement, as discussed above. *Cf.* United States v. Foley, 598 F.2d 1323, 1331–35 (4th Cir. 1979) (finding realtor's statement, made to a group of realtors, "that he did not care what the others did" but "that his firm was changing its commission rate from six percent to seven percent" followed by group discussion and price changes, could support jury's finding of conspiracy).

254. At equilibrium, this behavior is never observed: As no firm deviates from the collusive price, there is no one to ostracize, and no one to reward for their role in that ostracism. The real world is messier, however.

255. *See supra* Section III.B. That is the optimal strategy to enforce collusion among perfectly rational, perfectly informed firms; in reality, those conditions seldom apply.

256. Such strategies are easier to implement and are less susceptible to certain types of error costs. For example, if other firms mistakenly believe that a firm deviated and that another firm agreed to work with it, the result is Bertrand Reversion; the entire industry earns zero profits

behaviors will encourage collusion in the same ways that our models envision.[257] The policy implications are the same, and the legal treatment should be as well.

Second, commentators continue to debate the extent to which parallel behavior absent a formal agreement should constitute an antitrust violation.[258] One could argue that the behaviors we describe above—boycotting deviators and rewarding those who maintain the boycott—fall into the category of independent parallel behavior and thus should not trigger antitrust liability. In this view, a firm that refuses to deal merely acts rationally, given how other firms will respond to its behavior—i.e., by rewarding it if it refuses to deal, and by punishing it otherwise.[259]

This argument is misguided. Firms that violate the antitrust laws reluctantly nonetheless violate the antitrust laws.[260] Moreover, to excuse a violation because a firm felt pressure is particularly problematic in this context: Each firm that conforms to the collusive pattern increases the pressure on the other firms in the industry to conform as well. Giving firms a free pass because they faced pressure, when all firms are pressuring each other, encourages more collusive behavior and unduly extends the scope of independent action. Nearly any behavior could be deemed independent, absent proof of an explicit agreement. Such a rule would contradict existing precedent and enervate antitrust law.[261]

Relatedly, circumstantial evidence viewed as a whole can suggest an agreement even when no individual piece of evidence does so on its own.[262] In conducting this analysis, courts should consider that Collaborative Industries

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forever. *See* Edward J. Green & Robert H. Porter, *Noncooperative Collusion Under Imperfect Price Information*, 52 ECONOMETRICA 87, 88 (1984).

257. These behaviors may sustain collusion less effectively than the behaviors our models prescribe, and thus they may produce a collusive outcome that is somewhat worse for firms (and better for society). However, that is merely a difference of degree, not a difference in kind.

258. *See, e.g.*, Michael D. Blechman, *Conscious Parallelism, Signalling and Facilitating Devices: The Problem of Tacit Collusion Under the Antitrust Laws*, 24 N.Y. L. SCH. L. REV. 881, 881 (1979); Paolo Buccirossi, *Does Parallel Behavior Provide Some Evidence of Collusion?*, 2 REV. L. & ECON. 85, 85–86 (2006); Richard A. Givens, *Parallel Business Conduct Under the Sherman Act*, 5 ANTITRUST BULL. 273, 273 (1960); Harvey, *supra* note 183, at 769–71; William E. Kovacic, *Antitrust Policy and Horizontal Collusion in the 21st Century*, 9 LOY. CONSUMER L. REP. 97, 97 (1997).

259. If one accepts this argument, these behaviors could still be prohibited directly, via new legislation or the FTC's authority to prohibit practices that facilitate anticompetitive behavior. *See* 15 U.S.C. § 45(a)(2). For further discussion, see *infra* Section V.D.1.

260. *See* GAVIL ET AL., *supra* note 1, at 130.

261. *See, e.g.*, United States v. Foley, 598 F.2d 1323, 1331–35 (4th Cir. 1979); DOJ NASDAQ Statement, *supra* note 11, at 7–16.

262. *See, e.g.*, Valspar Corp. v. E.I. Du Pont de Nemours & Co., 873 F.3d 185, 201–02 (3d Cir. 2017); *In re* Flat Glass Antitrust Litig., 385 F.3d 350, 357–61 (3d Cir. 2004); *In re* Baby Food Antitrust Litig., 166 F.3d 112, 121–22, 124 (3d Cir. 1999). *See generally* Leslie, *supra* note 27 (developing a typology of circumstantial plus factors and describing how the probative value of a single piece of evidence is enhanced as more pieces of evidence are added).

provide additional opportunities for collusion and thus make agreements more likely.

For instance, in *Valspar Corp. v. E.I. Du Pont de Nemours & Co.*, plaintiffs argued that titanium dioxide producers illegally agreed to fix prices.[263] Plaintiffs relied on thirty-one simultaneous industry-wide price increases and circumstantial evidence of agreement.[264] One piece of circumstantial evidence that plaintiffs raised was the fact that producers had sold to each other at non-market prices.[265] In affirming the district court's grant of summary judgment for defendants, the Third Circuit majority stated that intercompany sales did not have a large effect on market share, and thus did not suggest collusion.[266] Our analysis suggests that the court's view was too narrow. The fact that companies in the industry had collaborative interactions makes collusion, and thus agreement, more likely. This is true even if the parties did not use intercompany sales to allocate market share.

Finally, antitrust commentators and courts justify the "agreement" requirement on the grounds that, absent an agreement, courts cannot provide a remedy.[267] We believe that this is overly defeatist. Many collusive practices depend on industry-wide norms.[268] Industries support these norms in a variety of ways, ranging from formal industry codes of conduct to informal, individual decisions to collaborate.[269]

Formal industry rules can be good targets for antitrust authorities.[270] But regulators can also affect informal industry customs; the specter of antitrust enforcement can disrupt established patterns of behavior. The collusive behavior at issue in the NASDAQ market-maker litigation persisted for many years but ended shortly after *The Wall Street Journal* and *Los Angeles Times*, among other news outlets, reported on it.[271] Private equity club deals declined in the wake of *Dahl* and the related DOJ investigation.[272] Industry norms often rely

263. *Valspar*, 873 F.3d at 189–90.

264. *Id.*

265. *Id.* at 201.

266. *Id.*

267. *See, e.g.*, Clamp-All Corp. v. Cast Iron Soil Pipe Inst., 851 F.2d 478, 484 (1st Cir. 1988); Rsrv. Supply Corp. v. Owens-Corning Fiberglas Corp., 971 F.2d 37, 50–51 (7th Cir. 1992); Donald F. Turner, *The Definition of Agreement Under the Sherman Act: Conscious Parallelism and Refusals to Deal*, 75 HARV. L. REV. 655, 671 (1962); *see* 6 PHILLIP E. AREEDA & HERBERT HOVENKAMP, ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION ¶¶ 1432–33, at 241–70 (4th ed. 2017).

268. *See, e.g.*, DOJ NASDAQ Statement, *supra* note 11, at 11–13; *Brokered Markets*, *supra* note 40, at 23.

269. *See, e.g.*, DOJ Realtor Statement, *supra* note 13, at 10–11 (discussing successful DOJ attack on trade association rule that enabled realtors to hide their listings from discount brokers); *see* sources cited *supra* note 59 and accompanying text.

270. *See, e.g.*, DOJ Realtor Statement, *supra* note 13, at 10–11.

271. Christie et al., *supra* note 127, at 1841, 1851.

272. *See* sources cited *supra* note 229.

on everyone abiding by them. Once a norm erodes, it may be difficult for firms to reestablish it.[273]

2. Rule of Reason Analysis

Some conduct, such as price-fixing among competitors, is per se illegal under the Sherman Act.[274] Other conduct is subjected to a more nuanced test known as the rule of reason.

Recall that the rule of reason contemplates a three-step process: First, plaintiff must show that the challenged conduct has a substantial anticompetitive effect. If successful, defendant must come forward with a procompetitive rationale for the conduct. If defendant does so, then plaintiff must demonstrate that defendant could reasonably have achieved the same procompetitive results "through less anticompetitive means."[275]

The rule of reason is intended to be flexible. It seeks to determine the results of particular conduct, taking into account the specific behavior at issue and the context in which it occurs.[276] To engage in each step of the required three-step inquiry, courts must understand the dynamics of the industry at issue: To know what effects an action will have, anticompetitive or otherwise, one must know how the action affects competitors, customers, and suppliers.

The Collaborative Industries Model can help illuminate the dynamics among firms in Collaborative Industries. Courts should be on the lookout for firms enforcing collusive practices via collaborative transactions. Actions that facilitate refusals to deal with rival firms—especially rivals that deviate from established industry practice—can have significant anticompetitive effects.[277]

More generally, increasing the potential for collaboration within an industry also increases the potential for collusion in that industry. To be clear, we do not suggest prohibiting all collaborative activities. Collaboration can benefit firms and consumers in appropriate instances.[278] But any such benefits should be weighed against the costs of any reduction in competition. The rule of reason framework, which explicitly includes such a comparison, is well-equipped to accommodate such an inquiry.

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273. Firms could formally agree to reestablish the norm, but that agreement could trigger antitrust liability.

274. *See, e.g.*, Ohio v. Am. Express Co., 138 S. Ct. 2274, 2283–84 (2018).

275. *Id.* at 2284.

276. *See, e.g.*, FTC v. Ind. Fed'n of Dentists, 476 U.S. 447, 459 (1986); Nat'l Soc'y of Pro. Eng'rs v. United States, 435 U.S. 679, 688–92 (1978); Cont'l T.V., Inc. v. GTE Sylvania Inc., 433 U.S. 36, 49 (1977).

277. *See, e.g.*, DOJ Realtor Statement, *supra* note 13, at 10–14.

278. *See* Polk Bros., Inc. v. Forest City Enters., Inc. 776 F.2d 185, 188 (7th Cir. 1985) ("Cooperation is the basis of productivity. It is necessary for people to cooperate in some respects before they may compete in others, and cooperation facilitates efficient production."); *supra* notes 131–35 and accompanying text.

B. Case Selection and Presentation

The Department of Justice has already observed, through long experience, that links between ostensible competitors can facilitate collusion. DOJ guidelines identify horizontal subcontracting within an industry as a potential red flag that invites regulatory scrutiny.[279] Moreover, in many famous collusion cases, rival companies and their executives maintained close business and professional ties.[280] For example, in *United States v. Foley*, defendants conspired to fix real estate commissions in violation of the Sherman Act.[281] Leading industry players attended dinner parties together, and many "were close personal friends."[282] Foley himself was President of the Board of Realtors.[283] But, until now, there has never been a rigorous theory that explained why or how such markets produced these observed results.[284]

Our models provide a rigorous theoretical explanation for this result, grounded in economic interdependence. Theories matter. Theory determines what circumstances and conduct regulators find troubling and thus what they investigate. Theory also affects how regulators interpret the facts they see, and thus which cases they decide to bring.[285] Better theories improve regulators' ability to identify problematic markets, analyze them, and explain them to judges and juries.[286]

Explaining theories to judges is particularly important. Antitrust cases rarely proceed to trial; if a claim survives summary judgment, the parties generally settle.[287] At the summary judgment phase, courts consider whether

279. DOJ, IDENTIFYING VIOLATIONS, *supra* note 28, at 3.

280. *See, e.g.*, United States v. Foley, 598 F.2d 1323, 1327 (4th Cir. 1979); Christopher Rowland, *Investigation of Generic 'Cartel' Expands to 300 Drugs*, WASH. POST (Dec. 9, 2018, 7:33 PM), https://www.washingtonpost.com/business/economy/investigation-of-generic-cartel-expands-to-300-drugs/2018/12/09/fb900e80-f708-11e8-863c-9e2f864d47e7_story.html?utm_term=.af72682bc48e [https://perma.cc/YDF4-A8EF].

281. *Foley*, 598 F.2d at 1326, 1339.

282. *Id.* at 1332.

283. *Id.*

284. Previous explanations have generally centered on facilitating communication or building trust among cartel members. *See, e.g.*, Complaint at 29, Connecticut v. Sandoz, Inc., No. 20-cv-00802 (D. Conn. June 10, 2020), 2020 WL 3114176, ECF No. 1 (devoting a section to "The Cozy Nature of the Industry and Opportunities for Collusion"); DOJ, IDENTIFYING VIOLATIONS, *supra* note 28, at 6.

285. WERNER HEISENBERG, PHYSICS AND BEYOND: ENCOUNTERS AND CONVERSATIONS 63 (Ruth Nanda Anshen ed., Arnold J. Pomerans trans., 1971) ("It is the theory which decides what we can observe." (quoting Albert Einstein)).

286. *See* JOHN MAYNARD KEYNES, THE GENERAL THEORY OF EMPLOYMENT, INTEREST, AND MONEY 340 (Palgrave Macmillan 2018) (1936) ("[T]he ideas of economists . . . both when they are right and when they are wrong, are more powerful than is commonly understood. . . . Practical men, who believe themselves to be quite exempt from any intellectual influences, are usually the slaves of some defunct economist.").

287. Douglas H. Ginsburg & Joshua D. Wright, *Antitrust Settlements: The Culture of Consent* ¶ 1 (Geo. Mason Univ. L. & Econ., Research Paper No. 13-18, 2013) ("[The DOJ's Antitrust] Division

antitrust allegations make "economic sense."[288] If so, courts draw inferences that are favorable to plaintiffs.[289] Otherwise, they grant defendants summary judgment.[290]

Our models can inform how plaintiffs present their cases in court. They provide an intellectual framework to support an argument that particular firms are engaging in collusive behavior. One of our key results is that interdependence among firms facilitates collusion. We believe that the intuition underlying this result—that when firms depend on each other, the threat of being ostracized is a powerful mechanism for promoting conformity—fits many people's intuitions and lived experience. Accordingly, it may prove persuasive against claims that firms do not collude because they bid against each other for business, or that the industry is unconcentrated and thus incapable of collusion.[291] Plaintiffs may wish to emphasize this point in appropriate cases.

Case selection and presentation affect the landscape of antitrust law. Judges are often friendlier to well-trodden theories than to novel ones. *Dahl v. Bain Capital Partners*, the private equity litigation described previously, provides a notable example.[292] When plaintiffs presented their theory of industry-wide collusion with respect to club deals, the judge was skeptical, stating that he had "never heard or seen anything like it."[293] At a hearing on defendants' motion to dismiss, the judge continued:

> I don't know, has there ever been another antitrust case that has been pled this way? . . . I will tell you it doesn't happen too often. . . . This pleading is, at least is rare. And I have to be honest with you, it is causing me an awful lot of problems as how to intellectually grasp it. It is just almost overwhelming.[294]

Plaintiffs assuaged the judge's concerns by referring him to the NASDAQ market-maker litigation described earlier[295]—a case that arose because of academic research questioning the pricing of NASDAQ stocks.[296] The judge

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resolv[es] nearly its entire antitrust civil enforcement docket by consent decree . . . . Since 1995, the FTC has settled 93 percent of its competition cases.").

288. Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 587 (1986).

289. *Id.*

290. *Id.*

291. *See, e.g.*, Hansen, *supra* note 21, at 327; Torstila, *supra* note 19, at 674.

292. *See supra* text accompanying notes 218–29.

293. Omnibus Motion Hearing at 5–6, Klein v. Bain Cap. Partners, LLC, 937 F. Supp. 2d 119 (D. Mass. 2013) (No. 07-12388), 2012 WL 8704872.

294. *Id.* at 103–04.

295. *Id.*

296. *See generally* Christie & Schultz, *supra* note 22 (suggesting that the lack of odd-eighth quotes among market makers was likely due to an implicit agreement).

denied defendants' summary judgment motion, while simultaneously stating that the question was a close one due to plaintiffs' relatively novel framing.[297]

Other times, the lack of a clear theory has crippled enforcement efforts. For instance, the European Commission determined that Italian glass manufacturers had engaged in price-fixing behavior, and that they had sustained it by cross-supplying each other[298]; firms regularly solicited products from rivals, even when they produced the same product themselves.[299] "[T]he European Court of Justice overruled the Commission's decision," vacating its multimillion-dollar fine, largely "on the grounds that the Commission" had not proved that the cross-supply behavior was anticompetitive.[300] The lack of a strong economic theory cost regulators the case.

Similarly, the Horizontal Merger Guidelines provide for different presumptions and levels of scrutiny for proposed mergers of competing firms, depending on industry concentration before and after the proposed merger.[301] Our models suggest that, for Collaborative Industries, more nuance may be required. Low market concentration can sometimes be problematic and raising market concentration can be beneficial. Similarly, the merger of two maverick firms may facilitate competition: Firms can use collaborative interactions to isolate price deviators, thereby preventing maverick firms from working together to undercut industry collusion.[302] A merger of mavericks can change this dynamic and push the industry toward a more competitive outcome.[303]

We caution that agencies should be careful and reasoned and approach each market on a fact-specific basis. Collaborative Industries are not always collusive. They are not intrinsically problematic: Syndicated production can create cost efficiencies that benefit consumers. Similar logic applies with respect to brokered markets; consumers benefit from seeing other realtors' listings. Agencies should carefully evaluate how firms in Collaborative Industries behave and whether consumers are sharing in the benefits of collaborative production.

At the same time, decision-makers should beware of firms misapplying our arguments. For example, firms proposing to merge may argue that they are part of a Syndicated Market and that, pursuant to our model, increased

297. Dahl v. Bain Cap. Partners, LLC, 937 F. Supp. 2d 119, 138 (D. Mass. 2013) (noting that plaintiffs' framing of their claim "nearly warranted its dismissal").

298. Cases T-68/89, T-77/89, T-78/89, Società Italiana Vetro SpA v. Comm'n, 1992 E.C.R. II-01403, ¶¶ 1–4, 354–56, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A61989TJ0068 [https://perma.cc/B8US-RN2Z]; Baake et al., *supra* note 117, at 37.

299. *Società Italiana Vetro SpA*, 1992 E.C.R. II-01403, ¶¶ 19–20.

300. Baake et al., *supra* note 117, at 37–38.

301. *See* HMG, *supra* note 1, § 5.3, at 19 ("*Unconcentrated Markets:* Mergers resulting in unconcentrated markets are unlikely to have adverse competitive effects and ordinarily require no further analysis.").

302. *Syndicated Markets*, *supra* note 40, at 3789.

303. *Id.* at 3794.

concentration will produce lower prices. Agencies, juries, and judges should be sure to marshal appropriate skepticism against such self-serving arguments.[304]

C. AGENCY PUBLIC GUIDANCE

Antitrust regulators issue public guidance, both to help businesses comply with the antitrust laws and to help potential victims identify misconduct and respond. Our results have implications for these types of guidance.

For instance, the DOJ and FTC have jointly issued Antitrust Guidelines for Collaborations Among Competitors (the "Collaboration Guidelines").[305] These guidelines are intended to make businesses aware of the agencies' view of the antitrust laws so that they can plan accordingly.[306] The Collaboration Guidelines are important; antitrust lawyers and their clients rely on them when structuring joint ventures and other transactions.[307]

Yet the Collaboration Guidelines do not fully account for the ways that collaborative interactions can facilitate collusion. For example, they make no mention of syndicated markets, or similar terms such as subcontracting. They assume that higher market concentration always facilitates collusion and provide a market-share-based safe harbor.[308] They spend a significant amount of time and space discussing the potential procompetitive benefits of collaboration, particularly cost reductions.[309] The more benefits collaboration produces, the less suspect it becomes.[310]

But even when collaboration provides firms with identifiable benefits, that does not reduce its potential to foster anticompetitive behavior.[311] In our models, firms can collude so effectively *because* they benefit from collaboration.[312] The Collaboration Guidelines should be updated to reflect this dynamic.

The DOJ also issues guidance on how to detect price-fixing and similar schemes.[313] This guidance is intended to help potential victims of illegal anticompetitive behavior recognize that behavior and respond, including by

304. This happens with respect to the narrow "failing firm" exception in merger review. Ian Conner, *On "Failing" Firms — and Miraculous Recoveries*, U.S. FED. TRADE COMM'N (May 27, 2020), https://www.ftc.gov/news-events/blogs/competition-matters/2020/05/failing-firms-miraculous-recoveries [https://perma.cc/55WC-VEX2] ("[D]espite many claims[,] . . . the Bureau rarely finds that the facts support a failing firm argument. . . . [Y]ou had better actually be failing, and able to prove it.").

305. COLLABORATION GUIDELINES, *supra* note 29, at 1.

306. *Id.* at 1–3.

307. *See, e.g.*, Michael A. Lindsay, *A Matter of Perspective: Joint Ventures and the Competitor Collaboration Guidelines*, 30 ANTITRUST 11, 11 (2016).

308. *Id.* at 17–18, 26.

309. *See id.* at 3, 5–6, 23–25.

310. *See id.* 24–25.

311. Such benefits are significant for other reasons.

312. *See supra* Section III.B.

313. DOJ, IDENTIFYING VIOLATIONS, *supra* note 28, at 3–5.

informing authorities.[314] It includes a list of conditions for potential whistleblowers to keep in mind when considering whether they have seen illegal conduct.[315] The first item singled out for attention is that "collusion is more likely [when] there are few sellers."[316] Our results suggest that this guidance should be more nuanced. For example, in Syndicated Markets, low concentration can be as problematic as high concentration.[317]

The guidance also states that "[c]ollusion is more likely if the competitors know each other well through social connections, trade associations, legitimate business contacts, or shifting employment from one company to another."[318] We agree. However, the implicit logic is that closer personal ties help colluding competitors trust and monitor each other. But collaborative relationships also give market participants opportunities to punish and reward each other. Our analysis shows how that dynamic makes Collaborative Industries particularly fertile grounds for collusion. The DOJ's guidance should better inform potential whistleblowers.

D. Fighting Collusion in Collaborative Industries

Neither low market concentration nor low barriers to entry prevents collusion in Collaborative Industries. Happily, our analysis suggests two powerful tools that may prove more effective: market structure and firm capacity. These approaches can both make firms more independent, which undermines the interdependence that enables collusion.

1. Market Structure

Market structure has important implications for the likelihood and severity of collusion. It is also malleable; there is more than one way for an industry to operate. For example, consider private equity's use of club deals. In the words of the *Dahl* plaintiffs: "From the 1980s through 2003, club bidding was relatively rare. In stark contrast, during the Conspiratorial Era, Defendants formed clubs in *every single* large LBO."[319] In the wake of *Dahl* and the DOJ's investigation, club deals declined sharply before rebounding somewhat.[320]

Changing how firms in an industry interact can limit their ability to punish and reward each other, which reduces their ability to collude. Firms

314. *Id.* at 1 ("Many [recent antitrust] prosecutions resulted from information uncovered by members of the general public who reported the information to the Antitrust Division.").

315. *Id.* at 3–5.

316. *Id.* at 6.

317. *See supra* Section III.B.

318. DOJ, IDENTIFYING VIOLATIONS, *supra* note 28, at 6.

319. *Dahl* Complaint, *supra* note 218, at 26.

320. *See, e.g.*, Michael Flaherty, *Buyout Firms Find Ways Around Club Deals*, REUTERS (Feb. 20, 2007), https://www.reuters.com/article/us-buyout-syndication/buyout-firms-find-ways-around-club-deals-idUSN20183729200702 20 [https://perma.cc/UWN4-G5CH]; Lykken, *supra* note 229.

understand this point well. For example, brokers and investors have repeatedly (and criminally) reorganized markets to rig public property auctions.[321] The group agrees that only one group member will bid at the public auction; compliance is easy to police. Then the group holds a subsequent auction among its members in which the highest bidder gets the property. The winning firm's payment is distributed among the other members of the group, ensuring that all group members profit. The second auction, though not strictly necessary, makes the bid rigging easier to administer and thus more robust.

The IPO Underwriting Market provides another example of how market structure can influence the potential for collusion. U.S. underwriters price IPOs through a "bookbuilding" process.[322] Underwriters collect information from potential investors about how much of a company's stock they would be willing to buy and at what price.[323] The underwriter hopes to find purchasers for all the stock the issuer wishes to sell.[324] This process relies on relationships with investors; the desire to access additional investors can drive underwriters to form syndicates.

But bookbuilding is not the only way to conduct an IPO. Alternatives, such as auction mechanisms, could render syndicates unnecessary.[325] Auctions have attractive theoretical properties,[326] and issuers in many countries have used them to price and distribute securities.[327] Some U.S. companies have

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321. *See, e.g.*, Press Release, U.S. Dep't of Just., 25 New York Real Estate Brokers Plead Guilty to Rigging Bids at Queens County Courthouse Foreclosure Auctions (Sept. 23, 1998), https://www.justice.gov/archive/atr/public/press_releases/1998/1961.htm [https://perma.cc/ZDV9-X7JU]; Press Release, U.S. Dep't of Just., Twelve Individuals Plead Guilty to Bid Rigging at Real Estate Foreclosure Auctions at Brooklyn County Courthouse (June 14, 1999), https://www.justice.gov/archive/atr/public/press_releases/1999/2487.htm [https://perma.cc/4YYU-9JV6]; *Division Update Spring 2016: Prosecuting Collusion and Fraud at Real Estate Foreclosure Auctions*, U.S. DEP'T OF JUST. (Apr. 8, 2016), https://www.justice.gov/atr/division-operations/division-update-2016/real-estate-foreclosure-auctions [https://perma.cc/88AT-3WGZ] ("More than 100 individuals have been charged . . . .").

322. *See, e.g.*, Corrigan, *supra* note 25, at 346.

323. Hild, *supra* note 246, at 45.

324. *See, e.g.*, STEPHEN J. CHOI & A.C. PRITCHARD, SECURITIES REGULATION: CASES AND ANALYSIS 490–92 (5th ed. 2019).

325. Hild, *supra* note 246, at 47. An auctioneer does not need close relationships with all participants.

326. *Id.* at 51.

327. Every Japanese IPO from 1989 until 1997 was conducted via an auction. *Id.* at 48. "When U.S.-style book-building [IPOs] became available in 1997," they produced less accurate, less predictable pricing. *Id.* Book-built IPOs gained an average of forty-eight percent on their first day of trading, with a standard deviation of 102.7 percent; auctioned shares gained an average of 11.4 percent, with a standard deviation of 15.5 percent. *Id.* at 48. French IPOs frequently use auctions, with historical average first-day returns of 6.6 percent (standard deviation 9.4 percent), compared to 16.9 percent (and 24.5 percent standard deviation) for book-building IPOs. *Id.* at 49; *see also* Torstila, *supra* note 19, at 676–78 (providing information on IPO spreads in markets throughout the world); Timo Lehmann & Matthias Weber, *IPO Underpricing and Aftermarket Price Accuracy: Auctions vs. Bookbuilding in Japan* 16–18 (Univ. St. Gallen Sch. Fin., Working Paper on

used auctions to go public, most notably Google.[328] Decreased use of bookbuilding could reduce interconnections among underwriters, thereby making collusive behavior more difficult to sustain.[329]

Alternatively, policymakers could make it easier for companies to go public without an underwriter. Reducing companies' need for underwriting services would reduce underwriters' ability to raise prices.

Many issuers are discontent with the IPO Underwriting Market, and some have embraced alternative paths to becoming public.[330] For example, a Special Purpose Acquisition Corporation ("SPAC") is a publicly traded company with no underlying business; it raises money with the plan of acquiring an existing business, to be identified later.[331] The target is generally a private company; it becomes public when it merges into the publicly traded SPAC.[332] Thus, for the target, merging with a SPAC is a way to become public without conducting an IPO.[333] There were more SPAC IPOs in 2020 than traditional IPOs.[334]

Finance No. 2021/02, 2021), https://osf.io/download/5ff6d0f2e80d37004da5a23e [https://perma.cc/DWQ2-PXRT] (analyzing statistical data from Japanese IPOs under both the bookbuilding and auction methods).

328. Hild, *supra* note 246, at 41.

329. Several commentators argue that auction mechanisms are superior and should replace bookbuilding. *See, e.g.*, Abrahamson et al., *supra* note 20, at 2056.

330. Levine, *supra* note 21.

331. *See, e.g.*, Li, *supra* note 21; Ciara Linnane, *2020 Is the Year of the SPAC—Yet Traditional IPOs Offer Better Returns, Report Finds*, MARKETWATCH (Sept. 16, 2020, 7:54 AM), https://www.marketwatch.com/story/2020-is-the-year-of-the-spac-yet-traditional-ipos-offer-better-returns-report-finds-2020-09-04 [https://perma.cc/G2LP-PDW5]; Michael Klausner, Michael Ohlrogge & Emily Ruan, *A Sober Look at SPACs* 3 (Eur. Corp. Governance Inst. Working Paper Series in Fin. Working, Paper No. 746/2021, 2022).

332. Levine, *supra* note 21.

333. *Id.* SPACs themselves generally require underwriters when they go public, but SPAC IPO fees are usually 5.5 percent, versus seven percent for typical mid-sized IPOs. *Id. But cf.* Matt Levine, *Money Stuff: The Elon Markets Hypothesis*, BLOOMBERG (Feb. 10, 2021, 5:15 PM), https://www.bloomberg.com/news/newsletters/2021-02-10/elon-musk-tweets-great-news-for-bitcoin-bad-news-for-econ-majors-kkzp2132 [https://perma.cc/VTH7-RBG4?type=image] ("SPACs are *absolutely an enormously lucrative investment banking product that banks love* . . . ."); Klausner et al., *supra* note 331, at 6 ("We find that the SPAC structure . . . entails costs that are subtle, opaque, and far higher than have been previously recognized.").

334. *See, e.g.*, Christopher M. Barlow, C. Michael Chitwood, Howard L. Ellin, P. Michelle Gasaway & Gregg A. Noel, *The Year of the SPAC*, SKADDEN, ARPS, SLATE, MEAGHER & FLOM LLP & AFFILIATES (Jan. 26, 2021), https://www.skadden.com/insights/publications/2021/01/2021-insights/corporate/the-year-of-the-spac [https://perma.cc/5AKM-L43T] (reporting 247 SPAC IPOs, constituting fifty-three percent of 2020 IPOs); *SPAC and U.S. IPO Activity*, SPAC ANALYTICS, https://www.spacanalytics.com [https://perma.cc/4NRB-HESG] (reporting 248 SPAC IPOs, constituting fifty-five percent of 2020 IPOs); *cf.* Sara B. Potter, *U.S. IPO Market: SPACs Drive 2020 IPOs to a New Record*, FACTSET (Jan. 7, 2021), https://insight.factset.com/u.s.-ipo-market-spacs-drive-2020-ipos-to-a-new-record [https://perma.cc/5YQX-FCGG] (finding 247 SPAC IPOs in 2020, accounting for exactly half of 2020 IPOs).

Spotify rejected the "broken" IPO Underwriting Market in favor of an alternative known as a direct listing.[335] Other high-profile companies, including Slack, Asana, and Palantir, have since followed Spotify's example and conducted their own direct listings.[336] Some commentators argue that direct listings have already affected the IPO market in important ways.[337]

It is also worth noting that many Collaborative Industries are heavily regulated. Laws and regulations significantly influence the structure of the IPO Underwriting Market—as well as construction markets, insurance markets, securities markets, and many others.[338] By changing relevant laws and regulations, the government can restructure markets to help fight improper collusion. Similarly, the government can target particular industry practices that facilitate collusion.[339]

For example, in the context of IPOs or government contracting, regulations could require that companies form syndicates before submitting bids to potential clients. This could potentially encourage competition between syndicate groups[340] and might produce better outcomes than ex post syndication.[341] Many other interventions are also possible.[342]

Altering market structure is a versatile and powerful option, and thus a promising technique in the regulatory toolbox. At the same time, the details

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335. *See, e.g.*, Barry McCarthy, *IPOs Are Too Expensive and Cumbersome*, FIN. TIMES (Aug. 7, 2018), https://www.ft.com/content/60cd1bb8-9970-11e8-88de-49c908b1f264 [perma.cc/P8TA-2JDL]. Spotify CEO Barry McCarthy gave investors five justifications for the direct listing; three were about problematic dynamics in the IPO Underwriting Market. *See* Josh Constine, *Here's Why Spotify Will Go Public Via Direct Listing on April 3rd*, TECHCRUNCH (Mar. 15, 2018, 5:12 PM), https://techcrunch.com/2018/03/15/spotify-direct-listing-date [https://perma.cc/N6EC-X44H?type=image].

336. Eric Eldon, *Airbnb Nears IPO as Asana and Palantir Land Their Direct Listings*, TECHCRUNCH (Oct. 3, 2020, 6:00 PM), https://techcrunch.com/2020/10/03/airbnb-nears-ipo-as-asana-and-palantir-land-their-direct-listings [https://perma.cc/CD85-5W5F?type=image]. Airbnb considered a direct listing as well. *See* Theodore Schleifer, *Airbnb and Slack Are Considering Untraditional IPOs That Box Out Bankers Like Spotify Did*, VOX (Dec. 10, 2018, 12:46 PM), https://www.vox.com/2018/12/10/18129880/airbnb-postmates-slack-direct-listing-ipo [https://perma.cc/Q9JW-LSC4].

337. *See, e.g.*, Matt Levine, Opinion, *How to Disrupt the IPO Pop*, BLOOMBERG (Oct. 4, 2019, 11:10 AM), https://www.bloomberg.com/opinion/articles/2019-10-04/how-to-disrupt-the-ipo-pop#xj4y7vzkg [perma.cc/J46N-7G8R] ("[The direct listing] has opened up the black box of the IPO and made every element subject to negotiation and refinement. If you're trying to disrupt IPOs, that's what you should be thinking about.").

338. *See generally* CHOI & PRITCHARD, *supra* note 324 (discussing how securities law affect the securities markets in general and IPOs in particular).

339. Congress can do this via legislation; the FTC can also prohibit certain anticompetitive practices. *See* 15 U.S.C. § 45.

340. This might let small players group up and compete for business.

341. Such competition might resemble oligopolistic price competition. Ex post syndication might create more efficient production but higher prices. *See supra* Section III.B (describing how, at equilibrium, ex post syndication enlists the industry's full productive capacity, minimizing production costs, but that firms charge supra-competitive prices).

342. For instance, a regulation could encourage inter-syndicate competition by requiring syndicates, once formed, to stay together for a year.

of an industry matter; market structure interventions generally must be tailored to the specific context. It offers no universal magic bullet.

However, we can identify a few broad principles. Firms can only punish or reward what they can detect. Accordingly, making it harder for firms to tell when rivals cut prices is likely to be useful.[343] Making interfirm transactions less visible may also be effective, by weakening collusive punishment schemes.[344] Similarly, in order to collude, firms must coalesce on a collusive price.[345] Practices and institutions that facilitate this process may also be productive targets for regulators.

Moreover, we note that regulators are often the only actors with both the incentive and ability to alter market structure. Incumbent firms are often content with market structures that support collusion—and, in Collaborative Industries, they have powerful tools to resist disruptive entrants. Individual customers will often lack sufficient incentive; most individuals buy few houses in their lifetimes, and a company only conducts one IPO.[346] Customers have strong incentives collectively, but high transaction costs may prevent organized action.[347] Thus, regulators occupy a unique and potentially vital role in reshaping market structure.

Finally, our results implicate market structure in a different way. Firms in Collaborative Industries can use their interdependence to construct a range of potential industry structures and institutions. Our results thus connect to a larger line of literature on private ordering—private actors' ability to arrange their affairs in the absence of government.

For example, in a prominent article, Lisa Bernstein details how diamond dealers opted out of public courts in favor of an industry-specific system of arbitration.[348] The diamond industry is a Collaborative Industry that in some ways operates as a Brokered Market[349]; market participants used their interdependence to create an effective dispute resolution system.[350]

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343. *See, e.g.*, Competitive Impact Statement at 6–9, United States v. Nat'l Ass'n of Realtors, No. 20-cv-03356 (D.D.C. Dec. 10, 2020), ECF No. 11.

344. *See supra* Section IV.A.2.

345. The same point applies to collusion on non-price terms.

346. A company could conduct multiple IPOs if it went private in between. Still, each company conducts relatively few IPOs in its lifecycle. There are some sophisticated repeat players on the issuer side, but underwriters may co-opt them by sharing their collusive profits. Corrigan, *supra* note 25, 386–88.

347. *See* MANCUR OLSON, THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS 53–65 (2d prtg. 1971). Also, certain collective action among customers could itself be an antitrust law violation.

348. Lisa Bernstein, *Opting Out of the Legal System: Extralegal Contractual Relations in the Diamond Industry*, 21 J. LEGAL STUD. 115, 115–17 (1992).

349. *See generally id.* (describing transactions among dealers); *see also id.* at 120 ("[P]rofitability depends largely on a dealer's network of contacts . . . .").

350. *Id.* at 119–20.

Others have argued that competitive markets prevent discrimination, obviating the need for civil rights laws.[351] Under this view, "if competitive market forces are allowed to work, the problem of discrimination will be solved by the entry of new firms who will cater to [under-served] markets, wholly without legal compulsion."[352] Yet, if firms are interdependent, they can enforce discriminatory norms, and new entrants may not be able to correct this.[353] The National Association of Realtors has formally apologized for promoting segregation and racial inequality, calling its actions during the 20th century "shameful," "an outrage," and "a betrayal of . . . fairness and equality."[354]

In short, our models illustrate how certain industries can establish norms and other patterns of behavior that more conventional economic models struggle to explain. As the examples above illustrate, such conduct may be socially beneficial or socially harmful. In grappling with these behaviors, both antitrust and other policymakers should consider the dynamics we identify.

2. Increasing Productive Capacity

Firms in Collaborative Industries can collude because they are interdependent. By the same token, reducing firms' interdependence renders collusion more difficult. Firms with larger productive capacities are more able to perform contracts alone and thus are less dependent on their rivals. Accordingly, increasing firms' capacities is a promising avenue for fighting collusive behavior in Collaborative Industries.[355]

A policy of increasing firms' capacities would likely have to be implemented on an industry-by-industry basis; specific policy measures are likely to be of help only in particular industries.[356] But, because regulation is so ubiquitous,

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351. *See generally* RICHARD A. EPSTEIN, FORBIDDEN GROUNDS: THE CASE AGAINST EMPLOYMENT DISCRIMINATION LAWS (1992) (making such an argument).

352. Richard A. Epstein, *The Problem with Antidiscrimination Laws*, HOOVER INST. (Apr. 13, 2015), https://www.hoover.org/research/problem-antidiscrimination-laws [https://perma.cc/F4EE-ZUU2].

353. *Cf.* Andrew Koppelman, *Richard Epstein's Imperfect Understanding of Antidiscrimination Law*, L. & LIBERTY (Jan. 12, 2016), https://lawliberty.org/forum/richard-epsteins-imperfect-understanding-of-antidiscrimination-law [https://perma.cc/LZB8-KEGZ] ("[Epstein] left culture out of his model. . . . Economic models should take account of this reality.").

354. *NAR President Charlie Oppler Apologizes for Past Policies That Contributed to Racial Inequality*, NAT'L ASS'N OF REALTORS (Nov. 19, 2020), https://www.nar.realtor/newsroom/nar-president-charlie-oppler-apologizes-for-past-policies-that-contributed-to-racial-inequality [https://perma.cc/WG4G-V2FG]; *see also* Robison & Buhayar, *supra* note 9 (providing further background on NAR's apology).

355. This analysis assumes that collaborative dynamics foster collusion in the industry in question. In contrast, if a monopolist engages in anticompetitive behavior, increasing its capacity may be ineffective or counterproductive.

356. For example, in the context of equity underwriting, policymakers could expand the pool of investors that can purchase securities in an IPO. Similarly, regulated entities such as insurance companies could be permitted to hold more publicly traded equities in their portfolios. Of

policymakers may have effective levers to increase capacity in many industries, especially Collaborative Industries.[357] Some regulatory provisions that single out small businesses for especially favorable treatment may merit reconsideration.[358] Small businesses may not be able to complete production in-house and thus might be dependent on other firms in ways that larger firms might not. Smaller firms may thus be more likely to go along with collusive industry pricing.

Our results also suggest that, contrary to conventional economic wisdom, easy entry may not prevent collusion in Collaborative Industries.[359] Entry seems least likely to help reduce collusion when new entrants are small. This is because small firms may be more dependent on transactions with other firms than their larger rivals are.[360] A Collaborative Industry with fewer, larger firms can sometimes be less susceptible to collusion than one with a greater number of smaller ones.

Similarly, removing barriers to entry in Collaborative Industries may not reduce collusion. Further, barriers to entry may discourage the smallest new entrants, but pose less of an obstacle to larger firms.[361] Under conventional economic theory, this is deeply problematic.[362] But in Collaborative Industries, the picture is murkier: The smallest entrants are the least likely to hinder collusion; restricting the market to fewer competitors with larger market shares can sometimes encourage competition.[363]

CONCLUSION

Firms frequently collaborate, but this dimension of interaction has been under-appreciated in antitrust law and theory. Our formal models show that collaborative interactions strongly increase firms' ability to collude. As a result,

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course, there are countervailing arguments against such policies. Our analysis simply suggests one new argument in their favor.

357. *See supra* Section V.D.1.

358. *See, e.g.*, Mirit Eyal-Cohen, *Down-Sizing the "Little Guy" Myth in Legal Definitions*, 98 IOWA L. REV. 1041, 1097–98 (2013); Mirit Eyal-Cohen, *Why Is Small Business the Chief Business of Congress?*, 43 RUTGERS L.J. 1, 55–56 (2011); Jordan M. Barry & Victor Fleischer, Tax and the Boundaries of the Firm 4–5 (Sept. 14, 2017) (unpublished manuscript), https://web.law.columbia.edu/sites/default/files/microsites/law-theory-workshop/tax-workshop/barry_and_fleischer_-_boundaries_of_the_firm_for_columbia.pdf [https://perma.cc/N2XK-45S2].

359. In some instances, entry can actually facilitate collusion. *See supra* notes 174–80 and accompanying text.

360. We note that entry lowers the cost of production, which is socially beneficial. *See supra* text accompanying note 92. Thus, entry by small firms can produce net social gains, even if it fosters anticompetitive pricing, if firms gain more than consumers lose. However, to the extent that society is choosing between a larger number of small entrants and a smaller number of larger ones, our results sometimes favor the latter.

361. For example, compliance burdens are a barrier to entry; they often feature economies of scale that favor large and medium-sized firms over smaller upstarts.

362. *See* sources cited *supra* notes 54–59 and 175 and accompanying text.

363. *See supra* notes 174–80 and accompanying text.

there is far greater scope for collusion than economic models conventionally recognize. The dynamics we identify can help regulators and private parties identify collusion, prove it, and respond.

Furthermore, many of our findings run directly counter to classical antitrust canons: Reducing market concentration does not prevent collusion and may even facilitate it. Easy entry does not prevent collusion, but barriers to entry can undermine it. Increasing firms' capacity can hurt firms and benefit consumers.

The law directly shapes the structure of many Collaborative Industries, including finance, real estate, and construction. Our results show how, by changing market structure, policymakers can alter firms' incentives and achieve pro-consumer results that they cannot achieve by simply adjusting the level of market concentration. Our work thus underscores policymakers' need to understand the dynamics of Collaborative Industries if they wish to oversee these industries effectively.