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Plus Factors and Agreement in Antitrust Law

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PLUS FACTORS AND AGREEMENT IN ANTITRUST LAW[†]

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Plus factors are economic actions and outcomes, above and beyond parallel conduct by oligopolistic firms, that are largely inconsistent with unilateral conduct but largely consistent with explicitly coordinated action. Possible plus factors are typically enumerated without any attempt to distinguish them in terms of a meaningful economic categorization or in terms of their probative strength for inferring collusion. In this Article, we provide a taxonomy for plus factors as well as a methodology for ranking plus factors in terms of their strength for inferring explicit collusion, the strongest of which are referred to as "super plus factors."

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Introduction

Competition law treats agreements among rival firms to set the terms on which they trade as extremely serious offenses.[1] Most of the world's approximately 120 systems of competition law assign the prosecution of cartels a high priority. The consequences of detection can be severe. The annual global sum of civil fines and treble damages for cartel participants today routinely exceeds hundreds of millions—indeed, even billions—of dollars, and individuals in a growing number of countries face potent criminal sanctions.[2]

Central to the operation of laws that aggressively punish collusion are the definition and proof of concerted action. Powerful consequences flow from whether price increases observed in the marketplace emerge from individual or collective initiative. A firm acting alone ordinarily can set its prices as high as it likes.[3] If the same firm cooperates with its competitors to

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  1. *See* Organization for Economic Cooperation and Development, *Cartels: Sanctions Against Individuals*, 9 J. Competition L. & Pol'y 7, 36–46 (2007) (reviewing modern enforcement trends); David E. Vann Jr. & Ellen L. Frye, *Overview*, *in* Cartel Regulation 3 (William Rowley & Martin Low eds., Jan. 2009) ("In the past decade, nearly every jurisdiction with general competition legislation has either enacted specific anti-cartel statutes, significantly enhanced the civil penalties for cartel violations or added criminal sanctions for corporate executives who commit cartel violations. Indeed, in recent years regulators have been enforcing anti-cartel legislation with increased vigour, and have grown more sophisticated and savvier in their investigative and analytical techniques.").

  2. *See* William E. Kovacic, *Criminal Enforcement Norms in Competition Policy: Insights from U.S. Experience*, *in* Criminalising Cartels: Critical Studies of an International Regulatory Movement 45, 66–67 (Caron Beaton-Wells & Ariel Ezrachi eds., 2011) (discussing modern trends in sanctions for cartel offenses).

  3. If implemented by a single firm, high prices have been said to be a sign of a healthy competitive process. Justice Scalia's opinion for the Court in *Verizon Communications Inc. v. Law Offices of Curtis V. Trinko, LLP*, 540 U.S. 398, 407 (2004), states, "The mere possession of monopoly power, and the concomitant charging of monopoly prices, is not only not unlawful; it is an important element of the free-market system."

achieve price increases, however, its executives may go to prison. Despite the crucial role of the concept of concerted action to this framework, few elements of modern antitrust analysis in the United States and in other jurisdictions are more perplexing than the design of evidentiary standards to determine whether parallel conduct stems from collective or from unilateral decisionmaking.[4]

In the case of oligopolies, authorities have struggled to develop suitable evidentiary standards for identifying agreements. Firms in an oligopolistic industry recognize their mutual interdependence, understand that they are players in a repeated game, and act accordingly.[5] In antitrust decisions about allegations of collusive pricing, this pattern of interaction—which courts and commentators describe as "conscious parallelism"—is viewed as insufficient to establish that firms are engaged in concerted action. This is because such pricing can emerge from firms acting noncollusively where they understand their role as players in the repeated oligopoly game.[6] In antitrust cases, courts permit the fact of agreement to be established by circumstantial evidence,[7] but they have required that economic circumstantial evidence go beyond parallel movement in price to reach a finding that the conduct of firms potentially violates section 1 of the Sherman Act.[8] The

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4.   As Professor William Page observes, the lack of satisfying standards is a "remarkable ambiguity at the heart of antitrust law." William H. Page, *Communication and Concerted Action*, 38 Loy. U. Chi. L.J. 405, 417 (2007). The Organisation for Economic Co-operation and Development ("OECD") has analyzed the role agreement plays in non-U.S. antitrust policy. *See* Competition Comm'n, Org. for Econ. Co-operation & Dev., Pub. No. DAF/COMP/GF(2006)7, Prosecuting Cartels Without Direct Evidence of Agreement (Sept. 2006), *available at* http://www.oecd.org/dataoecd/19/49/37391162.pdf; *see also* Albertina Albors-Llorens, *Horizontal Agreements and Concerted Practices in EC Competition Law: Unlawful and Legitimate Contacts Between Competitors*, 51 Antitrust Bull. 837 (2006).

5.   *See* Jonathan B. Baker, *Two Sherman Act Section 1 Dilemmas: Parallel Pricing, the Oligopoly Problem, and Contemporary Economic Theory*, 38 Antitrust Bull. 143 (1993).

6.   *See* Andrew I. Gavil et al., Antitrust Law in Perspective: Cases, Concepts and Problems in Competition Policy 267–68 (2d ed. 2008).

7.   In *In re Text Messaging Antitrust Litigation*, No. 10-8037, 2010 U.S. App. LEXIS 26299, at *16 (7th Cir. Dec. 29, 2010), Judge Richard Posner observed, "Direct evidence of conspiracy is not a sine qua non . . . . Circumstantial evidence can establish an antitrust conspiracy."

8.   *See* Brooke Group Ltd. v. Brown & Williamson Tobacco Corp., 509 U.S. 209, 227 (1993) (holding that "conscious parallelism" is "not in itself unlawful"); Theatre Enters., Inc. v. Paramount Film Distrib. Corp., 346 U.S. 537, 541 (1954) ("Circumstantial evidence of consciously parallel behavior may have made heavy inroads into the traditional judicial attitude toward conspiracy; but 'conscious parallelism' has not read conspiracy out of the Sherman Act entirely." (footnote omitted)); *see also* 6 Phillip E. Areeda & Herbert Hovenkamp, Antitrust Law ¶ 1433(a) (3d ed. 2010) (noting that "[t]he courts are nearly unanimous in saying that mere interdependent parallelism does not establish the contract, combination or conspiracy" required for application of section 1 of the Sherman Act). *See generally* 15 U.S.C. § 1 (2006) (prohibiting agreements in restraint of trade).

additional economic circumstantial evidence is collectively referred to as "plus factors."[9]

The interpretation of plus factors in the decision to prosecute and in the resolution of litigated cases has proved to be a vexing task for enforcement officials and judges. Many commentators have catalogued plus factors and discussed the critical mass of circumstances that ought to justify an inference that observed behavior is the product of concerted action.[10] Numerous judicial decisions have wrestled with the evaluation of plus factors in cases dealing with questions of agreement.[11] For all this effort, there is persistent dissatisfaction with the analytical methods commonly used in antitrust enforcement and litigation to distinguish plus factors in terms of their probative value.

The frailties of the existing analytical tests for assessing plus factors have at least two implications. First, they impede the economically sensible resolution of many high-stakes antitrust cases where decisions made on the issue of conspiracy are decisive. Second, the inadequacies of the existing analytical framework may well be magnified in the future. The expanded use of powerful means of detection—including amnesty programs that give certain informants full dispensation from criminal penalties—and ever stronger remedies will encourage firms to achieve consensus through more subtle techniques that fall short of an express exchange of assurances in a covert meeting.[12] If would-be cartel members take this path, then government prosecutors and private plaintiffs may often find themselves relying more extensively on circumstantial proof to establish the fact of coordination. Such a development would place still heavier weight on a proper understanding of plus factors in the treatment of conspiracy questions.

This Article offers a way to increase understanding of plus factors and to improve the manner in which enforcement agencies and courts interpret them in individual cases. We advocate the use of basic probability theory to rank individual plus factors, and groups of plus factors, in terms of their probative value.[13] We refer to plus factors, or groups of plus factors, that

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9. ABA Section of Antitrust Law, Antitrust Law Developments 11–16 (6th ed. 2007).

10. *See* Richard A. Posner, Antitrust Law 55–93 (2d ed. 2001) (collecting and analyzing plus factors).

11. *See* Antitrust Law Developments, *supra* note 9, at 11–16 (collecting authorities); ABA Section of Antitrust Law, Proof of Conspiracy Under Federal Antitrust Laws 69–92 (2010).

12. For a discussion of modern trends involving the expanded use of amnesty systems and the increase of sanctions for collusion, see Scott Hammond & Ann O'Brien, *The Evolution of Cartel Enforcement over the Last Two Decades: The U.S. Perspective*, *in* Polish Office of Competition & Consumer Prot., Changes in Competition Policy over the Last Two Decades 11 (Malgorzata Krasnodebska-Tomkiel ed., 2010). On the historical tendency of firms to take countermeasures to respond to improvements in government anticartel enforcement programs, see Kovacic, *supra* note 2, at 55–56.

13. For an introductory discussion of Bayes' Theorem, see Bernard W. Lindgren, Statistical Theory 37–41 (4th ed. 1993).

lead to a strong inference of explicit collusion as "super plus factors."[14] The taxonomy as well as the framework we provide for assessing the probability of explicit collusion given a plus factor, or given a group of plus factors, provides an improved foundation from which enforcement authorities and courts can analyze potentially collusive conduct.

In this Article, we provide a foundation for courts and agencies to adjust the framework they now use to determine the existence of an agreement when the plaintiff lacks direct testimony or documents that prove concerted action but instead relies on circumstantial evidence that the defendants conspired to fix prices or restrict output.[15] Such an approach focuses on modern economic understandings of what cartel participants do to coordinate their behavior.

A key issue in assessing whether firm conduct is rooted in an agreement to suppress interfirm rivalry is the reaction of buyers to the actions of sellers in a marketplace. Each product/industry/market that is the subject of scrutiny for a potential violation of section 1 of the Sherman Act[16] involves a distinct set of participants, actions, and payoffs. The role of buyers, and their potential resistance to actions by sellers that increase seller payoffs at the expense of buyers, appears to be significant in the implicit thinking of many policymakers and courts that consider whether an observed conduct or outcome in the marketplace is the consequence of explicit collusion.[17] Yet this underpinning for assessing plus factors has not been explicitly recognized. We believe that every producer selling a product in an industry conditions its

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14.   We use the term "explicit collusion" to mean an agreement among competitors that relies on explicit communication, transfers, or both to suppress rivalry.

15.   Direct evidence would include a record of meetings or communication to discuss and agree on the components of cartel activity, which may include any of the following: pricing, allocations of the collusive gain, monitoring, or enforcement of the agreements.

16.   15 U.S.C. § 1 (2006) ("Every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce among the several States, or with foreign nations, is declared to be illegal.").

17.   Courts often implicitly assume a rational buyer response. For example, the Eleventh Circuit evaluated plus factors as follows:

> Oligopolists behaving in a legal, consciously parallel fashion could achieve high and rising prices, even as costs remained stable, by engaging in price leadership. The odds that they could achieve a price and profit increase and maintain incredibly high incumbency rates—that is, maintain the very same distribution of municipal contracts year after year—are miniscule, however, unless the oligopolists were communicating with one another.

City of Tuscaloosa v. Harcros Chems., Inc., 158 F.3d 548, 572 (11th Cir. 1998) (emphasis omitted) (citation omitted). The clear presumption of the court in this case was that buyers, the municipalities in Alabama, would conduct competitive procurements and push back against price increases by the sellers to the effect that incumbency rates would be volatile. *Id.* at 572–73. The court did not presume that the buyers were passive. *Id.* Rather, the court presumed that the buyers were players in the game. This active buyer response differs substantially from the passive view advanced in the well-known gas station example. *See* Dennis W. Carlton et al., *Communication Among Competitors: Game Theory and Antitrust*, 5 GEO. MASON L. REV. 423, 428–30 (1997).

attempts to raise prices on the extent and nature of buyer reactions, whether the actions of sellers are part of coordinated cartel conduct or not.[18]

The Article proceeds as follows. Part I describes the existing legal standards that courts and antitrust enforcement agencies use to define concerted action and reviews the existing literature regarding plus factors. Part II discusses seller agreements as well as buyer responses to actions of oligopolistic sellers and the implications of each for plus factors. Part III presents a taxonomy for plus factors and identifies several super plus factors. Part IV offers a methodology, grounded in basic probability theory, for ranking plus factors in terms of their probative value.

I. Definition of Concerted Action in Antitrust Law

Modern competition law makes the detection, prosecution, and punishment of concerted horizontal price and output restraints the chief priority of antitrust policymaking.[19] Commentators generally regard the enforcement of stringent rules against such agreements as antitrust's most important positive contribution to economic performance.[20] With increasing intensity, antitrust authorities around the world prosecute bid-rigging, price-fixing, and market allocation schemes.[21] Since the mid-1990s, a growing number of other juris-

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18. As described in Robert C. Marshall et al., *Cartel Price Announcements: The Vitamins Industry*, 26 Int'l J. Indus. Org. 762, 766–67 (2008), the notion of price acceptance and resistance has received attention in European Commission ("EC") decisions in cartel cases. In the EC decision in *Vitamins*, resistance to price increases was described as follows: "When BASF's customers resisted the increase, Roche supported the rise by also announcing an increase to DEM 46/kg . . . . According to Daiichi, the concerted increase was unsuccessful because of customer resistance and the huge differential between D-calpan and the equivalent in DL-calpan." Commission Decision of 21 November 2001 Relating to a Proceeding Pursuant to Article 81 of the EC Treaty and Article 53 of the EEA Agreement, 2003 O.J. (L 6) 1, para. 325. In the EC decision in *Cartonboard*, cartonboard producers sometimes faced resistance from converters to whom they sold their products:

> There is on the other hand an upper limit in practical terms on the amount of any price increase that could be imposed unilaterally by the cartonboard producers on the converters. The converters have on some occasions resisted a proposed price increase for cartonboard on the ground that their own customers would in their turn refuse to accept a price increase for packaging . . . .

Commission Decision of 13 July 1994 Relating to a Proceeding Under Article 85 of the EC Treaty, 1994 O.J. (L 243) 1, para. 19. The notion of acceptance of price increases by buyers appears in the EC decision in *Amino Acids*: "The five companies . . . exchanged information on the acceptance of the price increases in the different regions." Commission Decision of 7 June 2000 Relating to a Proceeding Pursuant to Article 81 of the EC Treaty and Article 53 of the EEA Agreement, 2001 O.J. (L 152) 24, para. 81.

19. William E. Kovacic, *An Integrated Competition Policy To Deter and Defeat Cartels*, 51 Antitrust Bull. 813, 814 (2006). *See generally* Hammond & O'Brien, *supra* note 12, at 11 (describing U.S. and international experiences).

20. *See, e.g.*, Robert H. Bork, The Antitrust Paradox 263 (rev. ed. 1993) (praising the per se ban against horizontal price fixing and market divisions and concluding that "[i]ts contributions to consumer welfare over the decades have been enormous").

21. *See* Int'l Competition Policy Advisory Comm. to the Attorney Gen. and Assistant Attorney Gen. for Antitrust, Final Report 164 (2000) ("U.S. enforcement

dictions have amended their laws to permit the prosecution of cartel offenses as criminal offenses.[22] Private suits in U.S. courts to recover damages on behalf of cartel victims have generated substantial recoveries,[23] and a number of jurisdictions outside the United States are contemplating an expansion of private rights to facilitate the compensation of victims of cartel offenses.

The litigation of agreement issues has inspired judicial complaints about conceptual uncertainty and doctrinal confusion concerning the boundary that separates lawful unilateral conduct from illegal collective behavior.[24] Despite extensive judicial experience with the issue and major contributions by economists and lawyers concerning possible adjustments in the existing analytical framework,[25] the definition and proof of concerted action remain litigated issues in horizontal restraints cases under section 1 of the Sherman Act.[26] Courts continue to struggle to develop a satisfactory calculus for determining whether, without direct proof of agreement, the plaintiff has shown that the defendants conspired to restrain trade.

A. *Doctrine Governing the Use of Circumstantial Evidence to Prove an Agreement*

Antitrust litigants devote much effort to determining whether conduct stems from an agreement and therefore implicates section 1's ban against collective trade restraints. A law whose reach hinges on the existence of an agreement requires courts to decide when challenged conduct constitutes an agreement and how such an agreement may be proved in a trial.

Modern judicial efforts in the United States to define concerted action originate in four Supreme Court decisions, beginning with *Interstate*

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successes appear to be occurring amidst a heightened degree of international consensus among enforcers that cartels should be detected and prosecuted."); Harry First, *The Vitamins Case: Cartel Prosecutions and the Coming of International Competition Law*, 68 ANTITRUST L.J. 711, 733–34 (2001) (suggesting that the prosecution of the vitamins cartel illustrates a broader international acceptance of an anticartel norm).

22.   Hammond & O'Brien, *supra* note 12, at 17–18; Kovacic, *supra* note 19, at 814.

23.   First, *supra* note 21, at 720 (describing remedies obtained in private cases challenging the vitamins cartel).

24.   *See, e.g.*, Holiday Wholesale Grocery Co. v. Philip Morris, Inc., 231 F. Supp. 2d 1253, 1270 (N.D. Ga. 2002), *aff'd sub nom.* Williamson Oil Co. v. Philip Morris USA, 346 F.3d 1287 (11th Cir. 2003) (noting that the law governing existence of an agreement provides "little guidance" to determine when inference of concerted action is appropriate).

25.   A substantial literature has developed concerning the role of economics in antitrust law. *See, e.g.*, 6 AREEDA & HOVENKAMP, *supra* note 8, ¶¶ 1410–15; Gregory J. Werden, *Economic Evidence on the Existence of Collusion: Reconciling Antitrust Law with Oligopoly Theory*, 71 ANTITRUST L.J. 719 (2004); William H. Page, *A Neo-Chicago Approach to Concerted Action* (Univ. of Fla. Levin Coll. of Law Res. Paper No. 2011-07, 2011), *available at* http://ssrn.com/abstract=1782896.

26.   15 U.S.C. § 1 (2006). On the frequency and importance of the agreement issue in modern antitrust litigation, see PROOF OF CONSPIRACY UNDER FEDERAL ANTITRUST LAWS, *supra* note 11, at 69–92.

Circuit, Inc. v. United States[27] in 1939 and ending with *Theatre Enterprises v. Paramount Film Distributing Corp.*[28] in 1954. In sustaining the conviction of movie exhibitors for fixing the prices to be charged for first-run films, the *Interstate Circuit* Court defined the concerted action requirement in these terms:

> While the District Court's finding of an agreement of the distributors among themselves is supported by the evidence, we think that in the circumstances of this case such agreement for the imposition of the restrictions upon subsequent-run exhibitors was not a prerequisite to an unlawful conspiracy. It was enough that, knowing that concerted action was contemplated or invited, the distributors gave their adherence to the scheme and participated in it.[29]

The Court explained that "[a]cceptance by competitors, without previous agreement, of an invitation to participate in a plan, the necessary consequence of which, if carried out, is restraint of interstate commerce, is sufficient to establish an unlawful conspiracy under the Sherman Act."[30]

Seven years later, in *American Tobacco Co. v. United States*,[31] the Court addressed the agreement issue in reviewing conspiracy to monopolize charges under section 2 of the Sherman Act. The Court stated that "[n]o formal agreement is necessary to constitute an unlawful conspiracy."[32] The Court explained that a finding of conspiracy is justified "[w]here the circumstances are such as to warrant a jury in finding that the conspirators had a unity of purpose or a common design and understanding, or a meeting of minds in an unlawful arrangement."[33]

In the 1948 case *United States v. Paramount Pictures, Inc.*,[34] the Court reiterated *Interstate Circuit*'s agreement formula. With regard to section 1 and section 2 conspiracy claims, the Court said that "[i]t is not necessary to find an express agreement in order to find a conspiracy. It is enough that a concert of action is contemplated and that the defendants conformed to the arrangement."[35]

This formative period of agreement decisions ended in 1954 with *Theatre Enterprises*.[36] There the Court said that "[c]ircumstantial evidence of consciously parallel behavior may have made heavy inroads into the tradi-

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27.   306 U.S. 208 (1939).

28.   346 U.S. 537 (1954).

29.   *Interstate Circuit*, 306 U.S. at 226.

30.   *Id.* at 227.

31.   328 U.S. 781 (1946).

32.   *Am. Tobacco*, 328 U.S. at 809.

33.   *Id.* at 810.

34.   334 U.S. 131 (1948).

35.   *Paramount Pictures*, 334 U.S. at 142.

36.   346 U.S. 537 (1954).

tional judicial attitude toward conspiracy; but 'conscious parallelism' has not read conspiracy out of the Sherman Act entirely."[37]

As a group, the four cases established three conceptual points of reference. First, courts would characterize as concerted action interfirm coordination realized by means other than a direct exchange of assurances. Second, courts would allow agreements to be inferred by circumstantial proof suggesting that the challenged conduct more likely than not resulted from concerted action. Third, courts would not find an agreement where the plaintiff showed only that the defendants recognized their interdependence and simply mimicked their rivals' pricing moves.

Subsequent Supreme Court decisions have tried to capture these principles in a new formula. In 1984, while addressing minimum resale price maintenance ("RPM") conspiracy allegations in *Monsanto Co. v. Spray-Rite Service Corp.*,[38] the Court observed as follows:

> The correct standard is that there must be evidence that tends to exclude the possibility of independent action by the [parties]. That is, there must be direct or circumstantial evidence that reasonably tends to prove that [the parties] had a conscious commitment to a common scheme designed to achieve an unlawful objective.[39]

Neither *Monsanto* nor any earlier case provides a useful basis for identifying concerted action.[40] These tests show that the concept of agreement encompasses more than a direct exchange of assurances, yet they offer no useful operational means for determining when the defendants have engaged in something more than consciously parallel conduct.

For example, under the *Monsanto* formula, one could deem interdependent conscious parallelism to be a "conscious commitment to a common scheme."[41] Each firm in an oligopoly knows that the effect of its acts depends on the reactions of its rivals. All producers perceive that price increases will be accepted only if all firms raise prices. Realizing their interdependence, each firm decides, without consulting its rivals, to match competitors' price increases. Repeated efforts to match rivals' price moves arguably indicate the firm's conscious commitment to achieve higher prices. The sole interfirm "communication" consists of each firm's observation of its rivals' price changes. By calibrating its own moves to conform to the decisions of its rivals, each firm can be said to have "consciously committed" itself to participate in a "common scheme." As we discuss below, it is possible to improve on this formula by focusing more precisely on the forms of behavior that firms use to communicate their intentions and to execute the tasks needed to achieve coordination on pricing, output, and other dimensions of effective collusion.

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37. *Theatre Enters.*, 346 U.S. at 541.

38. 465 U.S. 752 (1984).

39. *Monsanto*, 465 U.S. at 768.

40. *See generally* Page, *supra* note 4, at 410–23.

41. *Monsanto*, 465 U.S. at 768.

B. *Plaintiff's Burden of Proof*

Plaintiffs in section 1 cases bear the burden of establishing the fact of an agreement. The "conscious commitment to a common scheme" can be shown with direct or circumstantial evidence.[42] As elaborated in later decisions, *Monsanto*'s articulation of the burden of proof has considerable importance where the defendant files a motion to dismiss or a motion for summary judgment on conspiracy issues.

The fear that mistaken inferences from ambiguous evidence might deter procompetitive or benign conduct led the Supreme Court in *Matsushita Electrical Industrial Co. v. Zenith Radio Corp.*[43] to extend and apply *Monsanto*'s conspiracy standards to horizontal agreements.[44] Where the plaintiff relies on circumstantial evidence to establish concerted action, *Matsushita* said that "antitrust law limits the range of permissible inferences from ambiguous evidence in a § 1 case" and emphasized that "conduct as consistent with permissible competition as with illegal conspiracy does not, standing alone, support an inference of antitrust conspiracy."[45]

Quoting *Monsanto*, the *Matsushita* Court then specified the plaintiff's burden of proof when the defendant seeks summary judgment or a directed verdict when only circumstantial evidence is introduced to establish collective action:

> To survive a motion for summary judgment or for a directed verdict, a plaintiff seeking damages for a violation of § 1 must present evidence "that tends to exclude the possibility" that the alleged conspirators acted independently. . . . [Plaintiffs] in this case, in other words, must show that the inference of conspiracy is reasonable in light of the competing inferences of independent action or collusive action that could not have harmed [plaintiffs].[46]

As in *Monsanto*, the Court in *Matsushita* sought to reduce error costs associated with the excessively broad application of liability standards.[47] In *Matsushita*, Japanese suppliers of electronics equipment allegedly conspired to price below cost in the United States, drive American firms from the market, and later raise prices to monopoly levels. In such a case, the Court

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42.   *See, e.g.*, ES Dev., Inc. v. RWM Enters., 939 F.2d 547, 554 (8th Cir. 1991) (holding that an antitrust plaintiff may prove existence of combination or conspiracy "by providing either direct or circumstantial evidence sufficient to 'warrant a . . . finding that the conspirators had a unity of purpose or common design and understanding, or a meeting of the minds in an unlawful arrangement'" (quoting Am. Tobacco Co. v. United States, 328 U.S. 781, 810 (1946))).

43.   475 U.S. 574 (1986).

44.   *Matsushita*, 475 U.S. at 588.

45.   *Id.*

46.   *Id.* (citation omitted) (quoting *Monsanto*, 465 U.S. at 764).

47.   *Id. Monsanto* emphasized the dangers of discouraging legitimate discussions between producers and their dealers. 465 U.S. 752, 763 (1984).

emphasized that mistaken inferences of conspiracy could injure consumers by deterring firms from offering low prices.[48]

Matsushita had a strong effect on the litigation of cases in which the plaintiff relied on circumstantial evidence to prove the fact of concerted action. Among other effects, *Matsushita* expanded the ability of defendants to obtain summary judgment by inviting lower courts to scrutinize the economic plausibility of the plaintiff's evidence of conspiracy.[49] As it had done in *Monsanto*,[50] the Court in *Matsushita* emphasized the costs that could flow from a failure to apply the agreement standard with sufficient rigor.[51] *Monsanto* mentioned the availability of treble damages in private cases and suggested that resale price maintenance arrangements—like all other conduct forbidden by the Sherman Act—could be prosecuted as a crime.[52] As noted above, *Matsushita* warned that careful examination of the economic plausibility of the plaintiff's evidence was necessary to ensure that mistaken inferences of agreement did not lead to treble damage awards, which would deter firms from offering low prices.

In 2007, the Supreme Court extended *Matsushita*'s plausibility screen to the pleading stage of antitrust litigation. In *Bell Atlantic Corp. v. Twombly*,[53] the Court considered allegations that Bell Atlantic and other incumbent local exchange carriers ("ILECs") had conspired to impede entry by competitive local exchange carriers ("CLECs") and had agreed among themselves not to enter each other's traditional service territories. The Court reiterated the principle that proof of conscious parallelism alone is inadequate to establish conspiracy and endorsed the application of the *Matsushita* plausibility standard to evaluate motions to dismiss.[54] In that context, "an allegation of

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48.   *Matsushita*, 475 U.S. at 593–94. *Matsushita*'s policy rationale should have less significance for horizontal conspiracy cases that do not involve claims of collective below-cost pricing. Horizontal agreements to raise prices or cut output pose greater competitive dangers than the concerted low pricing challenged in *Matsushita* and therefore might be subject to more liberal standards of proof.

49.   *See* GAVIL ET AL., *supra* note 6, at 279–80 (discussing the application of *Matsushita* to grant summary judgment where court concluded that a plaintiff's claim lacked economic plausibility). For two important modern illustrations of the application of *Matsushita* to grant summary judgment against a plaintiff's conspiracy claims, see *Williamson Oil Co. v. Philip Morris USA*, 346 F.3d 1287 (11th Cir. 2003), and *Blomkest Fertilizer, Inc. v. Potash Corp. of Saskatchewan, Inc.*, 203 F.3d 1028 (8th Cir. 2000).

50.   *Monsanto*, 465 U.S. at 762–64.

51.   *Matsushita*, 475 U.S. at 593–97.

52.   *Monsanto*, 465 U.S. at 763. The Department of Justice ("DOJ") seldom prosecutes resale price maintenance as a crime. Yet, when the Supreme Court issued the *Monsanto* decision in 1984, it had been barely three years since the DOJ's most recent use of criminal process to challenge an RPM agreement. *See* United States v. Cuisinarts, Inc., No. H80-559, 1981 WL 2062 (D. Conn. Mar. 27, 1981) (accepting the proposed consent decree).

53.   550 U.S. 544 (2007).

54.   *Twombly,* 550 U.S. at 554, 560–61 & n.7. On *Twombly*'s significance as an extension of the principle of *Matsushita* to the assessment of pleading requirements in the context of a motion to dismiss, see GAVIL ET AL., *supra* note 6, at 279–83.

parallel conduct and a bare assertion of conspiracy will not suffice."[55] For purposes of pleading an antitrust claim, the plaintiff must present "enough facts to state a claim to relief that is plausible on its face."[56] The Court observed that a more rigorous examination of the plaintiff's pleadings was necessary to limit the plaintiff (and classes of plaintiffs) from setting in motion the costly process of civil discovery and extracting unjustified settlements from defendants.[57]

As a group, the Court's antitrust conspiracy cases highlight the interdependence among the six key elements of a competition law system: the substantive scope of the legal command, the volume and quality of evidence required to prove a violation, the means for detecting violations, the prosecution of violations, the adjudication process that determines innocence or guilt, and the sanctions imposed for infringements. The Court's decisions about the evidentiary standard—here, the circumstantial evidence needed to establish an agreement for Sherman Act purposes—are influenced by other elements of the system. Perceived excesses with private rights of action (the prosecution element) and the mandatory trebling of damages for victorious plaintiffs (the remedy element) have caused the Court to engage in "equilibration"[58]—the adjustment of one element of the antitrust system (namely, the evidentiary standard) to offset imperfections in other elements. The inclination to demand a more powerful evidentiary showing—to increase confidence that observed behavior truly results from concerted action—is reinforced by the Justice Department's routine application of criminal sanctions to cartels and the availability of a per se rule of condemnation for cartels, in which the only issue is whether an illicit agreement was formed and in which considerations of actual effects are irrelevant.

Examination of the links among liability rules, evidentiary standards, identity of the prosecutorial agent, and remedies reveals several possible paths for future adjustments to the treatment of conspiracy issues. One approach is to adjust the evidentiary standards to account for the institutional context in which the litigation of antitrust claims takes place. Specifically, one might lighten the evidentiary demands that the plaintiff must bear when the institutional setting suggests that the case does not pose severe error costs. For example, the concern for overdeterrence should diminish when the plaintiff is a public prosecutor proceeding in a civil suit in which the remedy sought consists entirely of forward-looking injunctive relief. Given the crucial role that institutional factors play in shaping the evidentiary test, there should be a difference in the proof required when the Federal Trade Commission uses its administrative adjudication process and seeks injunc-

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55. *Twombly*, 550 U.S. at 556.

56. *Id.* at 570.

57. *Id.* at 559–60.

58. This concept originated in Stephen Calkins, *Summary Judgment, Motions To Dismiss, and Other Examples of Equilibrating Tendencies in the Antitrust System*, 74 GEO. L.J. 1065 (1986).

tive relief compared with a private class action that will be tried before a jury and will result in an automatic trebling of any damages awarded.

Another path, discussed in more detail below, is to develop a better analytical approach to evaluating the probative value of various plus factors and, as this Article suggests, to apply economic theory and past enforcement experience to identify factors or clusters of factors whose presence typically reveals the existence of concerted action. If enforcement agencies, courts, and juries have more confidence in the probative value of certain factors, then presumably there will be less hesitation to impose severe sanctions (e.g., treble damages or criminal punishment) when those factors suggest that the defendants have engaged in pernicious misconduct.

C. *Interdependence and the Role of Plus Factors*

As the Introduction to this Article noted, in markets characterized by interdependence, each firm realizes that the effect of its actions depends on the responses of its rivals. In highly concentrated markets, the recognition of interdependence can lead firms to coordinate their conduct simply by observing and reacting to their competitors' moves. In some instances, such oligopolistic coordination yields parallel behavior (e.g., parallel price movements) that approaches the results that one might associate with a traditional agreement to set prices, output levels, or other conditions of trade.

The line that distinguishes tacit agreements (which are subject to section 1 scrutiny) from mere tacit coordination stemming from oligopolistic interdependence (which eludes section 1's reach) is indistinct. The size of the safe harbor that *Theatre Enterprises* recognized depends on what conduct courts regard as the "extra ingredient of centralized orchestration of policy which will carry parallel action over the line into the forbidden zone of implied contract and combination."[59] Courts enjoy broad discretion to establish the reach of section 1 by defining this "extra ingredient" broadly or narrowly.

Legal scholars have recognized that certain industry structures, firm histories, and market environments are conducive to and/or facilitate collusion.[60] However, courts have relied on operational criteria known as plus factors to determine whether a pattern of parallel conduct results from an agreement. The chief plus factors have included:

- Actions contrary to each defendant's self-interest unless pursued as part of a collective plan.

- Phenomena that can be explained rationally only as the result of concerted action.

- Evidence that the defendants created the opportunity for regular communication.

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59.   Louis B. Schwartz et al., Free Enterprise and Economic Organization: Antitrust 439 (6th ed. 1983).

60.   *See, e.g.*, Posner, *supra* note 10, at 69–79.

- Industry performance data, such as extraordinary profits, that suggest successful coordination.

- The absence of a plausible, legitimate business rationale for suspicious conduct (such as certain communications with rivals) or the presentation of contrived rationales for certain conduct.[61]

Two basic problems have attended judicial efforts to identify and evaluate plus factors. One problem involves the absence of a methodology for ranking plus factors according to their likely probative value. The second problem arises from the suggestion in the economics literature regarding repeated games that market outcomes associated with collusive schemes can result from interdependent, consciously parallel conduct in some industries. We look at each of these in turn.

First, courts have failed to present a hierarchy of such factors and to establish an analytical framework that explains why specific plus factors have stronger or weaker evidentiary value. Antitrust agreement decisions rarely rank plus factors according to their probative merit or specify the minimum critical mass of plus factors that must be established to sustain an inference that conduct resulted from concerted acts rather than from conscious parallelism.[62] A relatively small number of judicial opinions have extensively and skillfully evaluated the economic significance of each factor.[63] These opinions stand in contrast to decisions that either forego a careful discussion of the economic meaning of individual plus factors or attempt such an inquiry without a sure grasp of the economic concepts in question.[64] Such tendencies make judgments about the resolution of future cases problematic and give an impressionistic quality to judicial decisionmaking on agreement-related issues

The failure in modern cases to provide a hierarchy of plus factors and to explain the competitive significance of each might be attributed to one of the least discussed but most important Supreme Court decisions of the 1960s. In *Continental Ore Co. v. Union Carbide & Carbon Co.*, the Court stated that "plaintiffs should be given the full benefit of their proof without tightly

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61.   *See* GAVIL ET AL., *supra* note 6, at 310–11.

62.   Page, *supra* note 4, at 416 (observing that courts use the term "plus factor" as "a conclusory label to describe evidence that actually satisfies the plaintiff's burden of production").

63.   The most sophisticated analysis of the probative value of various forms of evidence, direct and circumstantial, offered to establish the existence of concerted action appears in various opinions of Judge Richard Posner for the U.S. Court of Appeals for the Seventh Circuit. These include Judge Posner's opinion in *In re High Fructose Corn Syrup Antitrust Litig.*, 295 F.3d 651 (7th Cir. 2002), and his opinions in three decisions involving alleged collusion among drug manufacturers and their wholesalers. *In re* Brand Name Prescription Drugs Antitrust Litig., 288 F.3d 1028 (7th Cir. 2002); *In re* Brand Name Prescription Drugs Antitrust Litig., 186 F.3d 781 (7th Cir. 1999); *In re* Brand Name Prescription Drugs Antitrust Litig., 123 F.3d 599 (7th Cir. 1997).

64.   This category includes decisions such as *Blomkest Fertilizer, Inc. v. Potash Corp. of Saskatchewan, Inc.*, 203 F.3d 1028 (8th Cir. 2000). *See* HERBERT HOVENKAMP, THE ANTITRUST ENTERPRISE 134–35 (2005) (criticizing *Blomkest*).

compartmentalizing the various factual components and wiping the slate clean after scrutiny of each. . . . [T]he duty of the jury was to look at the whole picture and not merely at the individual figures in it."[65] At first glance, this passage might be criticized as an invitation to relax what should be a rigorous examination of evidence—a suggestion that lower courts are free to dispense with a careful assessment of the importance of each element of proof and fulfill their responsibilities by dropping difficult conceptual issues into the lap of the jury. There is another, more sympathetic interpretation. The holding in *Continental Ore* is consistent with the possibility, which we discuss below, that certain *clusters* of factors warrant especially close attention, and that some constellations of factors have competitive significance that cannot be understood by looking at each factor in isolation.

The variation in judicial analyses of plus factors also suggests that the outcome in many agreement cases depends on the Court's unarticulated intuition about the likely cause of observed parallel behavior. Our interpretation is that judges vary in their acceptance of the proposition in *Theatre Enterprises* that conscious parallelism, standing alone, does not demonstrate concerted behavior. Some judges may regard pricing uniformity as a sign of likely collaboration. After considering *Theatre Enterprises,* these judges will expand the range and reduce the quantum of conduct that, when added to parallel behavior, can support a finding of agreement. Other judges may view parallelism as a desirable, natural manifestation of rivalry. They will be more reluctant to give weight to asserted plus factors and will be more sympathetic to the defendants' explanations about why such plus factors implicate conduct that is either procompetitive or essentially benign.

The second problem results from the development of new arguments, rooted in the modern economics literature dealing with repeated games, that market performance associated with collusive schemes can result from interdependent, consciously parallel conduct in some industry settings. Firms in a number of industry settings may be able to achieve collusive outcomes without resorting to conduct that might be characterized as an agreement.[66] Under *Matsushita*, defendants might argue successfully that observed parallelism is just as consistent with what agreement doctrine recognizes as independent action—namely, the recognition and response to interdependence—as with an inference of collusive behavior. Moreover, under *Matsushita*'s implausibility test, firms could assert that it makes no economic sense for them to use tactics that violate section 1 of the Sherman Act when the recognition of interdependence can yield the same market results. Where the recognition of interdependence alone accounts for the market outcome, the difficulties in identifying and prescribing avoidable conduct will likely preclude effective antitrust intervention.

The refinement of federal merger enforcement policy in the past twenty years has increasingly relied on economic theories that illuminate the conditions in which consolidation is likely to have net anticompetitive effects.

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    65.   370 U.S. 690, 699 (1962) (citation omitted).

    66.   For the formative treatment of this point, see Baker, *supra* note 5, at 149–98.

Among other features, the DOJ and FTC Horizontal Merger Guidelines is-
sued in 1992 and in 2010 focus on how a transaction might increase the
ability of firms to coordinate their activity.[67] The economic understanding of
the process by which firms cooperate successfully guides the analysis of
coordinated anticompetitive effects.

A similar, economically oriented reformulation of agreement jurispru-
dence in circumstantial evidence cases would focus on the components of
successful cooperation by rivals. As a general rule, firms that successfully
collude (i) reach a consensus on pricing, output, or other terms of trade;
(ii) design allocation mechanisms that divide the collusive gain; and
(iii) monitor compliance and stand prepared to punish noncontrite deviant
behavior.[68]

A reformulated standard in circumstantial evidence cases would seek to
fulfill these conditions. Where the evidence of collaboration is wholly cir-
cumstantial, the plaintiff's prima facie case would consist of introducing
proof that demonstrates how the defendants achieve consensus, divide the
collusive gain, and monitor compliance. To survive a motion for summary
judgment or a motion to dismiss, the plaintiff would need to provide a plau-
sible explanation for how defendants executed these tasks. The defendants
could rebut this prima facie case by advancing benign or procompetitive
rationales for specific challenged acts or by demonstrating that the observed
market outcomes resulted from the recognition of interdependence alone.

The most important threshold element of proof in this framework would
consist of evidence showing how the defendants communicated their inten-
tions and confirmed their commitment to a proposed course of action.
Perhaps the most probative proof of the mechanism for achieving consensus
would consist of evidence demonstrating that a pattern of extensive commu-
nication among the defendants preceded a complex, parallel adjustment in
behavior that could not readily be explained as the product of the defend-
ants' independent efforts to identify and adhere to focal points for
organizing their conduct.[69] The existence of a means for dividing the collu-
sive gain might be revealed by establishing the existence of transactions
among the firms at nonmarket prices, swaps, or patent cross-licensing
agreements.[70] The existence of a means for monitoring compliance might be

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67. U.S. Dep't of Justice & Fed. Trade Comm'n, Horizontal Merger Guidelines
§ 2.1 (2010), *available at* http://ftc.gov/os/2010/08/100819hmg.pdf; U.S. Dep't of Justice &
Fed. Trade Comm'n, Horizontal Merger Guidelines 18–22 (rev. ed. 1997), *available at*
http://www.justice.gov/atr/public/guidelines/hmg.pdf.

68. This three-step process is a simplification of the larger range of tasks that a cartel
must perform in order to succeed. *See* Randall Heeb et al., *Cartels as Two-Stage Mechanisms:
Implications for the Analysis of Dominant Firm Conduct*, 10 Chi. J. Int'l L. 213, 218–23
(2009).

69. On the usefulness of evidence of negotiation, see Gavil et al., *supra* note 6, at
335–37.

70. We derive these possibilities from our review of the published records of the vita-
mins cartel and other producer conspiracies prosecuted in Europe and in the United States. *See*

uncovered by establishing a pattern of bilateral exchanges of pricing information between competitors or of exchanges of data through trade associations.[71]

II. Agreements to Suppress Rivalry Assessed through the Reactions of Buyers

Firms in oligopolistic industries recognize their mutual interdependence and act on that recognition.[72] It would be unreasonable to expect firms not to do so. As noted above, court decisions have not clarified what constitutes an agreement when firms are given the right to recognize and act on their mutual interdependence.

Consider the following example of a repeated game. Suppose a duopoly produces a commodity. The product is not differentiated except for the identity of the producing firm, and there are high entry barriers. Each firm can produce as much of the product as it wants for a marginal cost of $10 per unit. Each firm recognizes that the joint-profit-maximizing price for the product is $25. In each and every period, the firms simultaneously and publicly announce prices to all potential customers. There is no other interaction of any form that occurs between the two firms—they interact only as rivals in the marketplace.

If each firm announces a price of $10, then no one who would characterize that pricing as being an agreement—from an economist's viewpoint, pricing at marginal cost yields zero profits for each of the two firms and maximizes welfare.[73] However, suppose that in one period, firm *A* calls out a price of $10, but firm *B* calls out $25. Firm *A* gets all the demand that period. In the next period, firm *A* calls out $15, while firm *B* calls out $25—now firm *A* gets all the demand but earns a profit of $5 per unit. Suppose we get to a period where firm *A* calls out $25 and firm *B* calls out $25—now each firm splits market demand and earns profit of $15 per unit. Suppose firm *B* deviates one period and calls out $24.50 and captures all demand. But, in the following period, firm *A* calls out $10 and continues to call out $10 for a large number of periods until it finally calls out $25 again. Suppose after a large number of periods each firm continues to call out $25, dividing the demand equally, and earning a profit of $15 per unit.

Consider the question whether the price of $25 per unit, which each firm is now charging, has emerged from an agreement. It is clear that the price of $25 emerged from a substantial amount of interfirm communication through a sequence of public price announcements by each firm to potential customers.

William E. Kovacic et al., *Lessons for Competition Policy from the Vitamins Cartel*, *in* The Political Economy of Antitrust 149 (Vivek Ghosal & Johan Stennek eds., 2007).

71.   On the potential importance of these information exchange arrangements as monitoring devices, see Gavil et al., *supra* note 6, at 283–301.

72.   *See, e.g.*, Dennis W. Carlton & Jeffrey M. Perloff, Modern Industrial Organization 153 (3d ed. 2000) ("Thus, oligopoly differs from competition and monopoly in that a firm *must* consider rival firms' behavior to determine its own best policy.").

73.   *Id.* at 71–72 (discussing welfare maximization at the competitive equilibrium).

But it is also clear that the pricing outcome emerged from their recognized mutual interdependence. Additionally, given the nature of this duopoly industry, it is perfectly reasonable that each firm would learn of the other's pricing for the current period at the end of the period. Yet, the $25 price outcome is highly profitable and highly damaging to consumer surplus. Were courts to decide the issue without regard to remedies, they would likely hold that such conduct is an agreement in violation of section 1 of the Sherman Act. As discussed in Part I, courts and enforcement agencies cannot address the agreement question without awareness of remedial issues that stand in the background. Courts are left with a substantial conundrum because they cannot meaningfully instruct firms not to react to their rivals' pricing.

Staying with our example, there has been an unarticulated assumption that the buyers are passive in this market and will accept prices as called out by the two firms.[74] But consider an alternative scenario in which the buyers are not passive. Rather, suppose that buyers strongly resist price increases. Specifically, when each firm calls out a price of $25, each buyer does whatever it can to get a special deal with one seller or the other. For example, one buyer may offer to contract at $22.50 with a particular seller for many time periods. At the same time, a buyer may falsely represent a secret offer made by one of the sellers as they try to generate a lower price offer from another seller. Or, a buyer may threaten to use a foreign supplier or alternative input if prices are not decreased.

Without any kind of additional interfirm communication between the sellers beyond the calling out of prices or assurances between sellers that any deviant conduct will be rectified through an interfirm transfer, it seems unlikely that the price of $25 can survive as a stable outcome in the market. There is an important implication of this observation—if the buyers are active players in the oligopoly game and if the price of $25 persists, then the firms must be communicating beyond the simple announcement of prices and potentially also transferring resources among one another, since without such seller conduct the price would tumble toward $10 given the strength of the buyer resistance.

In this circumstance, in which there is an expectation of an aggressive buyer reaction, an agreement would violate section 1 of the Sherman Act, but, unlike the earlier scenario, the courts would be more likely to deny the defendants' motion for summary judgment. Although in each case there would be an agreement, the critical issue for determining whether an agreement violates the antitrust laws is the assumption regarding the reaction of a third party, the buyers, to elevated prices. The same pricing outcome by sellers would be viewed by the courts in completely different ways depending on whether the buyers were passive, as in the first scenario, or aggressive, as in the second scenario.

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74.   For example, the well-known "gas station" oligopoly model presumes that buyers are passive. *See* Carlton et al., *supra* note 17, at 428–30 (providing an example in which two gas stations in a town both call out the monopoly price).

The two scenarios above presume that the courts have an understanding of the firms' costs and of the demand for their product. In the absence of such information the court would not know if $10 was a low price, if $25 was a high price, or if some other price, say $100, was the joint-profit-maximizing price. If $100 were conjectured as a possible joint-profit-maximizing price, then $25 might be viewed as the consequence of active buyer resistance. In that scenario, the court may find itself unable to find a section 1 violation.

Overall, firms in an oligopoly are players in a repeated game. The typical game has incomplete information and substantial information asymmetries. The sellers know many things that buyers do not. And each seller has information that other sellers do not have. Courts can attempt to resolve information asymmetries through discovery, but that process is only a partial solution.

When the firms in an industry are players in a repeated game with substantially incomplete and asymmetric information, courts can examine buyer actions to attempt to distinguish between conduct that is an agreement in violation of section 1 of the Sherman Act and conduct that is not. Indeed, the way individual consumers ordinarily buy products and services is not the way industrial buyers typically buy products and services. Individual consumers are accustomed to transacting in a posted-price environment. None of us conducts a competitive procurement for the toothpaste we want this month—we go to a pharmacy or grocery store and purchase toothpaste at the posted price. We are not players in an oligopoly game when we buy toothpaste or bread or gasoline. In such cases, the only active or strategic players are the oligopolistic producers.

In contrast, even relatively small firms have procurement divisions or at least substantial resources devoted to procurement. Such buyers typically use competitive procurement processes under which firms that are qualified potential suppliers are invited to submit bids. Buyers use the competitive bidding as a way to police the market. Because suppliers are aware that others are bidding, they must account for that as they seek the highest expected profit. Expected profit equals the profit in the event a given firm wins times the probability that the firm wins. These two measures are inversely related, and a bidder seeks the optimal balance between them. Buyers rely on competitive bidding processes to police the market through their ability to reveal information that buyers may not have known about the suppliers, their products, or pricing. When buyers are engaged in competitive procurements to buy from suppliers and can undertake a number of actions in that context to enhance their surpluses, they become active players in the oligopoly game.

Suppliers recognize this policing function and, consistent with playing in a repeated game, may attempt to mitigate the policing function of the competition. If the sellers' bids yield to pressure from buyers, then it may have been the case that the sellers, who are players in a repeated game with substantial incomplete and asymmetric information, had not suppressed competition among themselves other than by recognizing their long-run interaction in a game setting. However, if the sellers do not yield and hold to

their initial bids, which are seemingly at high prices, then each buyer must consider whether the price increase is a legitimate response to some under-lying market conditions or the result of an agreement between sellers to suppress competition.

Buyers design the procurement mechanism that they use. Obviously, they are self-interested designers.[75] If the mechanism produces results that are inconsistent with their expectations for surplus, then the buyers will change the procurement design, in real time, in an attempt to secure greater surplus. This redesign can be costly. But, after seeing an initial round of bids, it can become quite clear to a buyer that the expected payoff from re-sistance more than offsets the increased costs. For example, qualifying a new seller might have such a low ex ante expected return that a buyer does not qualify the seller and thus initially excludes the new entrant. But after seeing an exceptionally high lowest bid from the procurement, a buyer may void the initial bidding and incur the expense of qualifying the new entrant so as to generate an extra bidder at a new procurement.

In a nutshell, buyers can be wholly passive and thus not be players in the oligopoly game; be vigorous in their pursuit of incremental surplus from sellers; or be anything in between, depending on the specific nature of the product/industry/market under consideration. In our view, courts need to understand the oligopoly game of a given product/industry/market before evaluating any economic circumstantial evidence with regard to its probative value. The example proffered by Professor Carlton and his colleagues of two gasoline stations in a small town achieving monopoly price without communication seems quite compelling,[76] but it quickly wilts when con-trasted with the market for vitamin A500 USP, which was produced by only two firms throughout the 1990s. Despite being repeat cartel offenders (Roche and BASF), the vitamin manufacturers needed an explicit agreement (communication and transfers) to elevate prices to monopoly levels. When duopolistic firms like Roche and BASF need an explicit agreement to move towards a monopoly price, it becomes increasingly clear that the Carlton et

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75. For example, concerns regarding agency problems have sometimes led auction designers to emphasize "transparency in bidding," particularly with respect to federal govern-ment procurements. *See generally* Robert C. Marshall & Leslie M. Marx, *The Vulnerability of Auctions to Bidder Collusion*, 124 Q.J. Econ. 883 (2009) (discussing how preauction and postauction transparency affects the probability of collusion).

76. Carlton et al., *supra* note 17, at 428–30. This example fits well within the standard Folk Theorem environment. *See* Jean Tirole, The Theory of Industrial Organization 246 (1989) (describing the "Folk Theorem" as the statement that in repeated oligopoly games, the set of payoffs that can be achieved in equilibrium generally includes payoffs greater than those associated with single-shot interaction). In the example, two firms compete by setting prices, where those prices are perfectly observable and can be adjusted instantaneously, and the profit of each firm is determined by the two prices and a fixed demand curve. In this envi-ronment, one would not be surprised to find that tacit collusion can support the monopoly outcome. *See id.* (providing one example of such collusion). Any deviations from monopoly pricing would be immediately observed and met by a response from the other firm. The buyers in this environment are not players in the game and thus have no ability to take actions that might disrupt the ability of the two firms to maintain their tacit agreement.

al. example is only a pedagogical device to illustrate the importance of understanding the specifics of the product/industry/market posed by each case and the extent to which the buyers are players in the oligopoly game.

One need only make small changes to the environment of Carlton et al., however, in order to reach an environment in which tacit agreement is insufficient to achieve the monopoly price. For example, if prices are not observable and demand has at least a small random component,[77] then one enters the environment described by Professors Green and Porter.[78] Green and Porter show that in their environment equilibria exist that allow the firms to obtain supracompetitive profits, but they argue that such equilibria would be expected to require an explicit agreement among the firms.[79]

Other changes in the environment reinforce the need for an explicit agreement, including moving away from posted prices to, for example, competitive procurements and allowing buyers to be true players in the game. When buyers are players, they have an incentive to pursue strategies that disrupt equilibria that allow the sellers to capture supracompetitive profits. Buyer resistance limits the ability of firms to maintain collusive prices through only tacit agreement because buyer resistance exploits the lack of communication, monitoring, and enforcement that characterizes a tacit agreement.

III. Taxonomy of Cartel Conduct

If an effective cartel uses a market share allocation scheme, then we will observe fixed relative market shares among those firms. This statement is not logically equivalent to the statement that "if we observe fixed relative market shares among a subset of firms, then the firms exhibiting relatively fixed shares are effectively colluding through the use a market share allocation scheme." Since "*A* implies *B*" does not logically yield "*B* implies *A*," what then is a plus factor?

One issue with the current characterization of plus factors is that they lack a taxonomy. Relatedly, plus factors are not ranked, even within broad groupings, by their relative probative value. It is common to note that much depends on the nature of a specific product, industry, or marketplace in considering a given plus factor; at the current time, however, all plus factors tend to reside in the same five-gallon bucket, essentially without distinction.

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77.   This situation is consistent with Stigler's assumption that firms do not observe their rivals' prices but rather infer them imperfectly from their own demand. *See* George J. Stigler, *A Theory of Oligopoly*, 72 J. Pol. Econ. 44, 48 (1964).

78.   Edward J. Green & Robert H. Porter, *Noncooperative Collusion Under Imperfect Price Information*, 52 Econometrica 87 (1984). The Green and Porter model is stated in terms of quantity competition. For a price competition model in the same spirit, see Tirole, *supra* note 76, at 262–65.

79.   Green & Porter, *supra* note 78, at 89 n.5 ("It is logically possible for this agreement to be a tacit one which arises spontaneously. Nevertheless, in view of the relative complexity of the conduct to be specified by this particular equilibrium and of the need for close coordination among its participants, it seems natural to assume here that the equilibrium arises from an explicit agreement.").

As an example, we can contrast two plus factors. Consider fixed relative market shares among a subset of firms in an industry as one plus factor. There are numerous noncollusive explanations that can exist for fixed relative market shares among firms in an industry.[80] In contrast, consider vertical foreclosure conduct by a subset of firms in an industry, targeted at one or a few small firms in the industry, in which no single firm in the subset has sufficient market power to act unilaterally as a dominant firm. The former plus factor appears quite weak while the latter appears strong and compelling. If ranking two plus factors is that easy, without describing any features of the product, industry, or marketplace, then at least a broad ranking of plus factors is possible. As will become clear from our examples, and as we formally establish below, the strength of any plus factor is crucially determined by the contrast between the likelihood of an action in the presence of an agreement and the likelihood without the presence of an agreement.

Accordingly, consider the following actions, broadly construed, of an explicit cartel.

A. Raise prices above what they would have been without the conspiracy.[81]

B. Reduce total industry-wide quantity below what it would have been without the conspiracy.[82]

C. Change intrafirm incentives so as to inhibit interfirm competition and foster higher prices.[83]

D. Allocate the collusive gains among members.[84]

E. Redistribute gains and losses among members so as to maintain compliance with the agreement.[85]

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80. *See* Joseph E. Harrington, Jr., *Detecting Cartels*, *in* Handbook of Antitrust Economics 213, 245 (Paolo Buccirossi ed., 2008) (discussing economic models involving fixed market shares and summarizing that "an optimal equilibrium can have firms keeping prices and market shares fixed, so there are indeed stable market shares").

81. *See* Stigler, *supra* note 77, at 46 (emphasizing "pricing structures" as opposed to the more narrow concept of elevating prices). A cartel may find price discrimination to be quite profitable. If so, then some buyers may actually experience price decreases as a consequence of profit-enhancing conduct by the cartel. In practice, however, this would be atypical. Also, this caveat would create an ongoing difficulty for exposition. Therefore, we only discuss price increases by a cartel.

82. It is well known that extensive price discrimination can actually increase quantities brought to the market (while extracting large amounts of consumer surplus). *See, e.g.*, Posner, *supra* note 10, at 79–80. Again, this would be highly atypical and, in addition, would create ongoing exposition difficulties. Therefore, we only discuss the restriction of quantity by a cartel.

83. *See* Commission Decision of 21 November 2001 Relating to a Proceeding Pursuant to Article 81 of the EC Treaty and Article 53 of the EEA Agreement, 2003 O.J. (L 6) 1, paras. 51–52, 200 (discussing the "price before volume" policy implemented by cartels in cartonboard and vitamins).

84. *See* Robert C. Marshall, Leslie M. Marx & Lily Samkharadze, *Dominant-Firm Conduct by Cartels* 25 (Ctr. for Study of Auctions, Procurements & Competition Policy, Working Paper, 2011), *available at* http://capcp.psu.edu/papers/2011/dominantfirm.pdf (describing the market allocation mechanism for a sample of cartel cases).

85. *See* Stigler, *supra* note 77, at 46 (discussing the need for cartels to have "an appropriate formula for redistribution of gains and losses from departures from quotas").

F. Monitor compliance with the agreement and communicate regularly regarding all relevant features of the conspiracy that require discipline.[86]

G. Stand ready to abandon collusive conduct if some cartel members continually engage in substantial noncompliant conduct.[87]

H. Once interfirm rivalry has been suppressed successfully, seek additional profits through activities such as dominant-firm conduct.[88]

If these are the eight components of cartel conduct, then any plus factor must be consistent with one or more of these components. At a minimum, plus factors can be classified by these eight actions. Consider the list of fourteen plus factors from Posner:

1. Fixed relative market shares

2. Marketwide price discrimination

3. Exchanges of price information

4. Regional price variations

5. Identical bids for nonstandard products

6. Price, output, and capacity changes at the formation of the cartel

7. Industry-wide resale price maintenance

8. Declining market shares of leaders

9. Amplitude and fluctuation of price changes

10. Demand elastic at the market price

11. Level and pattern of profits

12. Market price inversely correlated with number of firms or elasticity of demand

13. Basing-point pricing

14. Exclusionary practices[89]

Directly or indirectly, nine of these factors concern action A, cartel pricing (factors 2, 4–7, 9–10, 12–13). Only factor 3 concerns action F—interfirm communication and monitoring—which addresses only the exchange of price information. None of these plus factors concern action E—the redistribution of gains and losses among cartel members so as to maintain compliance with the agreement. Only factor 6 is related to action G—the threat of abandoning

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86. *See id.* (discussing role of monitoring in cartel enforcement).

87. *See* Ian Ayres, *How Cartels Punish: A Structural Theory of Self-Enforcing Collusion*, 87 COLUM. L. REV. 295, 306 (1987) (discussing cartel punishments and the possibility of "reverting to the competitive level of quality will be credible, because if all other firms are behaving competitively, no individual firm will have an incentive to deviate").

88. *See* Marshall, Marx & Samkharadze, *supra* note 84, at 4 (identifying cartel cases in which dominant-firm conduct by the cartel is reported).

89. *Id.* at 79–93.

collusive conduct if there is substantial noncompliant conduct—and that relation is quite indirect. Only factor 1 concerns action D—the allocation of the collusive gain among members—and factor 1 concerns only one type of allocation mechanism. Factors 7 and 14 address action H—a cartel undertaking dominant-firm conduct—but again in a restrictive sense.

None of the Posner plus factors address action C—changing intrafirm incentives. Nor do they address action B—reducing industry-wide quantity—even though in certain cases, effective cartel management may require these types of agreements.

The strength of an inference of collusion that can be drawn from individual Posner plus factors is a mixed bag. On the one hand, if we observe a subset of firms in an industry engaging in dominant-firm conduct, and none of the firms is large enough on its own to act as a dominant firm, then the inference of collusion is strong. On the other hand, the observation that a subset of firms experiences higher profits is consistent with entry barriers and a positive demand shock (and/or a negative factor price shock), so the inference of collusion is weak. Some of Posner's plus factors are relatively simple to observe in the marketplace (such as factor 13), whereas others require access to detailed internal records of the cartel members (such as factor 3), and still others require sophisticated econometric analysis (such as factor 12).

It is our contention that the actions of an explicit cartel, and the outcomes of those actions, should illuminate the path to identifying plus factors. Furthermore, any of those actions that almost surely do not result from unilateral conduct should be given special attention, because those lead to a strong inference of collusion. In addition, some individual plus factors do not lead to a strong inference of collusion, but two or more plus factors seen together may lead to a strong inference. Finally, some plus factors are relatively simple to observe and draw strong inferences from, while others are only available after considerable economic analysis.

A cartel must solve a multidimensional problem; the actions it takes will not be one dimensional, as our list of cartel actions above makes clear. We now consider in greater detail each of cartel actions A through H that can act both individually and jointly as plus factors.

A. *Price Elevation*

Given that a plus factor is defined as something beyond conscious parallelism in conduct, such as parallel pricing, from which a court can infer collusion, it seems a bit odd that nine out of Posner's fourteen plus factors concern price. In fact, cartels have taken great comfort in the fact that, at the end of the day, courts typically will not rely on economic evidence about price to infer collusion.[90]

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90.   See Commission Decision of 13 June 1994 Relating to a Proceeding Under Article 85 of the EC Treaty, 1994 O.J. (L 243) 1, para. 73, which states the following:

Had they been challenged, the producers could as a result of this elaborate scheme of deception have attributed the series of uniform, regular and industry-wide price increases in

Nevertheless, many cartels spend a great deal of energy on coordinating price announcements. For example, international cartels in the vitamins industry coordinated announcements of price increases, including the designation of which company would lead the price increase.[91] And one of the components of the rubber chemicals conspiracy was "issuing price announcements and price quotations in accordance with the agreements reached."[92] Similar charges have been made against firms in sorbates,[93] monochloroacetic acid and organic peroxides,[94] polyester staple,[95] high pressure laminates,[96] amino acids,[97] carbonless paper,[98] cartonboard,[99] and graphite electrodes.[100]

Since prices are typically determined by a major industrial buyer through competitive procurements,[101] the direct manipulation of those prices

the cartonboard sector to the phenomenon of 'oligopoly behaviour'. They could argue that it made sense for all the producers to decide of their own volition to copy an increase initiated by one or other of the market leaders as soon as it became publicly known; unlawful collusion as such would not necessarily be indicated. Customers might well suspect and even accuse them of operating a cartel; and given the relatively large number of producers, economic theory would be stretched to its limits and beyond, but unless direct proof of collusion were forthcoming—and they went to some lengths to ensure it was not—the producers must have had hopes of defeating any investigation into their pricing conduct by the competition authorities by invoking the defense of oligopolistic interdependence.

91. Transcript of Plea of Guilty and Sentencing at 10–12, United States v. F. Hoffmann-La Roche Ltd., No. 99-184 (N.D. Tex. May 20, 1999), *reprinted in* Gavil et al., *supra* note 6, at 1107–08.

92. Press Release, U.S. Dep't of Justice, Crompton Corporation Agrees To Plead Guilty for Participating in Rubber Chemicals Cartel (Mar. 15, 2004), *available at* http://www.usdoj.gov/opa/pr/2004/March/04_at_160.htm.

93. Press Release, U.S. Dep't of Justice, Top Japanese Executives Indicted in Price-Fixing Conspiracy (July 25, 2000), *available at* http://www.justice.gov/opa/pr/2000/July/423at.htm.

94. Press Release, U.S. Dep't of Justice, International Chemical Corp. Agrees to Plead Guilty, Pay Fines for Participating in Multiple Criminal Antitrust Conspiracies (Mar. 14, 2002), *available at* http://justice.gov/opa/pr/2002/March/02_at_151.htm.

95. *See In re* Polyester Staple Antitrust Litig., 259 F. Supp. 2d 1376 (J.P.M.L. 2003).

96. *In re* High Pressure Laminates Antitrust Litig., No. 00 MDL 1368(CLB), 2006 WL 1317023, at *3 (S.D.N.Y. May 15, 2006) (discussing plaintiff's evidence of coordinated price announcements).

97. Commission Decision of 7 June 2000 Relating to a Proceeding Pursuant to Article 81 of the EC Treaty and Article 53 of the EEA Agreement, 2001 O.J. (L 152) 24, paras. 53, 164.

98. Commission Decision of 20 December 2001 Relating to a Proceeding Pursuant to Article 81 of the EC Treaty and Article 53 of the EEA Agreement, 2004 O.J. (L 115) 1, paras. 233, 236.

99. Commission Decision of 13 July 1994 Relating to a Proceeding Under Article 85 of the EC Treaty, 2004 O.J. (L 243) 1, paras. 20, 76.

100. Press Release, U.S. Dep't of Justice, German Company and Chief Executive Officer Each Agree To Pay Record Fines for International Conspiracy (May 4, 1999), *available at* http://www.justice.gov/atr/public/press_releases/1999/229767.pdf.

101. *See* William E. Kovacic, Robert C. Marshall, Leslie M. Marx, & Matthew E. Raiff, *Bidding Rings and the Design of Anti-Collusion Measures for Auctions and Procurements*, *in* Handbook of Procurement 381, 384 (Nicola Dimitri et al. eds., 2006) (noting that for many industrial cartels "the buyers obtain the commodity from cartel firms through 'competitive' procurements where the cartel members have rigged bids"); *see also* Laura Carpineti et

is a matter of bid-rigging by sellers, and given that many transactions do not occur at announced prices, even after the "effective" date, it is natural to wonder why oligopolistic firms go through such efforts regarding price announcements.

Sellers make price announcements to adjust buyers' expectations in a publicly observable way and, as a consequence, lower buyer resistance to price increases. To illustrate this, consider two scenarios. In the first scenario, there are no price announcements, but buyers are confronted with surprisingly high prices at their competitive procurements. In the second scenario, the same bids are submitted by sellers, but in the weeks prior to the bidding, the sellers make similar price announcements with similar justifications for the price increase. Buyers will be more apt to resist the higher prices in the first scenario than in the second. In the second scenario, buyers can be more confident that all their competitors confront similar price increases, whereas in the first scenario they have no such assurance. In the first scenario, buyers need to take measures to assure that their firm is not comparatively disadvantaged. This outcome is consistent with the fact that all procurement divisions at major firms have limited budgets and must allocate scarce administrative resources over all of their acquisitions to procure a large number of factors at least cost, both in absolute terms and relative to their competitors.[102] Any product market in which sellers regularly use price announcements is one in which sellers are fully cognizant of the fact that buyers will actively resist price increases if they are too high or unexpected.

Marshall, Marx, and Raiff emphasize the distinction between public price announcements and private notification by sellers to buyers.[103] A buyer that receives private notification of a price increase may resist because of concerns that it is being disadvantaged relative to other buyers. A public announcement mitigates this concern.

Marshall, Marx, and Raiff characterize collusive price announcements in the vitamins industry as (1) made relatively more frequently than noncollusive price announcements; (2) occurring at somewhat regular intervals;[104]

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al., *The Variety of Procurement Practice: Evidence from Public Procurement*, *in* Handbook of Procurement, *supra*, at 14, 19 (noting that "all organizations involved in the survey, both European and American, usually award contracts using paper-based sealed bid tendering").

102.   If procurement divisions at major firms had unlimited budgets, they would maximally resist all price increases, such that actions on the part of a cartel to minimize price resistance would have no effect. *See* Marshall et al., *supra* note 18, at 766 (stating that "acceptance of or resistance to a price increase is of concern in many industries" and describing that because resistance to price increases is costly to firms, procurement personnel "cannot resist all increases for all products").

103.   *Id.* at 774; *see also id.* at 767 n.36 ("In any industry with a sufficiently active trade press there will be no distinction because the trade press will unearth private announcements and report them.").

104.   The regularity of cartel price announcements reflects the common use by cartels of a regular meeting schedule. For example, each quarterly cartel meeting might be followed by a new price announcement, which gives a quarterly structure to the price announcements. That said, if buyers or enforcement authorities were to emphasize the regularity of price an-

(3) being gradual in the sense of involving relatively modest individual price increases; (4) typically involving "joint announcements," with one firm leading and others matching soon thereafter; and (5) typically having long lead times before the new price becomes effective.[105]

The gradualism of price increases as well as the use of joint announcements and lead times before the effective date of the price increase each directly addresses buyer resistance. The value of gradualism is apparent in *Electrical & Mechanical Carbon & Graphite Products*,[106] where cartel members faced buyer resistance because of the size of the price increase they announced.[107] Joint announcements are valuable because if buyers observe that all the firms in an industry, or at least an important subset of firms in an industry, have announced identical price increases, they will be less likely to expect that aggressive price negotiations with the firms will be worthwhile.[108] Lead times for the effective dates of public price announcements allow the cartel to monitor acceptance of the price increase and retract an announced increase that is heavily resisted by buyers before incurring disruptions in cartel market shares.[109]

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nouncements in detecting cartels, a cartel could move its price announcements to a more random schedule.

105.   Marshall et al., *supra* note 18, at 763.

106.   Commission Decision of 3 December 2003 Relating to a Proceeding Under Article 81 of the EC Treaty and Article 53 of the EEA Agreement, 2004 O.J. (L 124) 45.

107.   In addition, gradual price increases may reduce the probability that an illegal conspiracy to increase prices is detected. *See* Joseph E. Harrington, Jr., *How Do Cartels Operate?*, 2 Found. & Trends Microeconomics 1, 19 (2006).

108.   *See* Commission Decision of 21 November 2001 Relating to a Proceeding Pursuant to Article 81 of the EC Treaty and Article 53 of the EEA Agreement, 2003 O.J. (L 6) 1, paras. 203–204. The decision states:

> The parties normally agreed that one producer should first 'announce' the increase, either in a trade journal or in direct communication with major customers. Once the price increase was announced by one cartel member, the others would generally follow suit. In this way the concerted price increases could be passed off, if challenged, as the result of price leadership in an oligopolistic market.

Id.

109.   Approximately 50 percent of the price announcements made by the vitamins cartel were made well prior to the effective dates for the price increases; however, in an earlier benchmark period in which explicit collusion was unlikely, only 5 percent of price announcements were made prior to the effective dates for the price increases. Marshall et al., *supra* note 18, at 783. Because of the role that the preannouncement of price increases can play in supporting a collusive agreement, competition authorities have in certain cases prohibited the announcement of prices prior to their effective date. Such a prohibition was imposed on an association of sugar refiners in 1934 but reversed by the Supreme Court. *See* United States v. Sugar Inst., Inc., 15 F. Supp. 817, 908 (S.D.N.Y. 1934), *rev'd*, 297 U.S. 553 (1936). More recently, a prohibition on advance price announcements was included in the 1967 consent agreement in *United States v. Pennsalt Chemical Corp.*, 1967 Trade Cas. (CCH) ¶ 71,982 (E.D. Pa. 1967). In addition, in *In re Ethyl Corp.*, [1979–1983 Transfer Binder] Trade Reg. Rep. (CCH) ¶ 21,856, *enforcement denied sub nom.* E.I. Du Pont de Nemours & Co. v. FTC, 729 F.2d 128 (2d Cir. 1984), the Federal Trade Commission found that advance announcement of price changes had an anticompetitive effect.

Now turn to the actual bidding that occurs at the competitive procurements of the buyers. Identical bids can arise in many noncollusive environments. Further, it is difficult to imagine that participants in an explicit cartel would assemble in a hotel room and determine that the right procurement decision was to submit identical bids. The primary way to determine whether any bids at a procurement, or a set of procurements, came from an explicit cartel requires a benchmark that is considered noncollusive. A benchmark could be a time period, a geographic region, or a related but separate product. The analytic requirements are substantial when evaluating bid data relative to a benchmark. If that analysis is done well, the results can constitute a super plus factor—that is, actions or conduct (in this case, pricing) that are highly unlikely to occur in the absence of a collusive agreement.[110] One way to do this analysis well requires that a reliable predictive econometric model be estimated for a benchmark, usually a time period, where conduct is thought to be noncollusive.[111] The predictive model would account for those demand and cost factors specific to the product market that are not potentially manipulable by a cartel (and only those factors), and it would similarly account for industry characteristics that are not potentially manipulable by a cartel. This model would be used to predict prices during a time period in which there was a suspicion of collusion. If actual prices fall outside the range of prices that would have prevailed under the noncollusive benchmark, with the range determined by a specified high confidence level, then this outcome would constitute a super plus factor.

B. *Quantity Restrictions*

If we think of an industry-wide demand curve for the product in question, a cartel elevates price and reduces quantity relative to what would be accomplished if the sellers simply act as oligopolists in a repeated game without explicit collusion. A reduction in quantity often does not require even the mention of quantity by cartel members. Commitment to an increase in price along with a commitment to a market share allocation rule is all that a cartel needs to implement a supply restriction—nothing needs to be discussed about supply because the market share allocation accomplishes the supply restriction.

There are industries in which explicit restrictions in supply are needed for the implementation of the cartel agreement. As a well-known example, the Organization of the Petroleum Exporting Countries ("OPEC") cartel operates by establishing petroleum output limits for its member countries. By suppressing output of oil, they increase the market-clearing price for oil above what it would have been without the constraints. Likewise, the role of quantity reductions to increase prices is well understood by governmental agricultural price-support programs that pay farmers not to grow certain

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110.   "Super plus factors" are defined more precisely below.

111.   *See* Halbert L. White et al., *The Measurement of Economic Damages in Antitrust Civil Litigation*, A.B.A. Econ. Committee Newsl., Mar. 2006, at 17–22.

crops or to leave fields fallow. Recently, a produce wholesaler filed a suit claiming that the United Potato Growers of America and others "conspired to manipulate potato prices by controlling and reducing supply, taking coordinated steps including agreeing to limit potato planting acreages, to pay off farmers to destroy potatoes or not grow additional potatoes, and to diminish the overall number of potatoes available to direct purchasers."[112]

Reduced supply is often observed at the trough of a business cycle as a natural part of unilateral conduct in response to reduced demand in a recession. Supply restrictions that stem from a cartel agreement provide weaker evidence of collusion at the trough of a business cycle than if the same conduct occurred at the peak of economic activity. Restrictions in supply by subsets of firms when demand is strong, profits are high, and prices are relatively high, however, leads to the strong inference of collusion—namely, it is a super plus factor—for two reasons. First, there are substantial foregone profits from restricting supply when demand is strong. Second, buyers will take measures to resist price increases in such an environment, and it is quite unlikely that unilateral conduct by sellers would not take advantage of the opportunity to sell incremental units at high prices.

C. *Internal Incentive Shifts*

When a cartel forms, the firms participating in the conspiracy cannot issue a memorandum to all staff about the fact that upper management has opted to suppress interfirm rivalry through an agreement with other sellers. The issue of sales force incentives arose for the cartel in *Amino Acids*:

> During this meeting, ADM alluded to the importance of a company controlling its sales force in order to maintain high prices, and explained that its sales people have the general tendency to be very competitive and that, unless the producers had very firm control of their sales people, there would be a price-cutting problem.[113]

Cartel firms may likely find that they need to change the incentives of their sales force after the inception of the cartel in order to comply with the agreement. In the precartel period, many sales forces have incentives to pursue increases in market share. Such incentives run counter to cartel allocation agreements.

Consider a market share allocation. A sales force that has incentives to pursue increased market share will put upper management in a difficult position with respect to other cartel firms because the sales force will drop prices to secure incremental business, both of which are likely violations of the cartel agreement. To rectify this internal issue, cartel firms will often change the incentives of their sales forces to comply with "price before

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112.   Ben James, *'OPEC of Potatoes' Hit with Price-Fixing Action*, Law 360 (June 18, 2010), http://www.law360.com/classaction/articles/176084/-opec-of-potatoes-hit-with-price-fixing-action.

113.   Commission Decision of 7 June 2000 Relating to a Proceeding Pursuant to Article 81 of the EC Treaty and Article 53 of the EEA Agreement, 2001 O.J. (L 152) 24, para. 98.

volume."[114] This means that the sales force will be rewarded for maintaining prices at relatively high levels and will not be rewarded for gaining market share. In an industry where the product made by different firms is largely homogeneous, this kind of shift in the incentives of a sales force could not be justified as a unilateral noncollusive action. If a firm unilaterally acted in this manner, it would likely find itself losing market share to rivals at a re-markable pace. Buyers who resist price increases would shift away from such a firm to other sellers who were still pursuing increases in market share. In an industry where the product made by different firms is largely homogeneous, a shift in the incentives of sales forces across firms in an in-dustry to "price before volume" leads to the strong inference of explicit collusion—namely, it is a super plus factor.

D. *Allocation of Collusive Gains*

The allocation of collusive gains can occur through a market share agreement, a customer allocation, a geographic allocation, or some combi-nation of these. As noted above, a market share agreement is used to implement the supply restriction and not just to divide the collusive gain. If a firm sells more than its market share allocation, then it must be that some other firms are below their market share allocations. In this case, the firm selling too much will be required to buy product from a firm selling too little at cartel prices at the end of the year. The underselling firm is thus made whole while the overselling firm incurs a penalty for overselling—buying product at cartel prices that it could produce at much lower cost. Observa-tionally, each of the allocations has an implication—stable market shares for a subset of firms, no customer churn, and certain regions being serviced on-ly by specific firms, respectively. But each of these implications may arise as part of noncollusive conduct by oligopolists in a repeated game setting.

However, strong buyer resistance when firms act without explicit collu-sion will produce more variability in market shares, the sellers that customers select, and the penetration of geographic regions by sellers, than when firms act with explicit collusion. In the face of relatively high or rising prices, we expect stronger buyer resistance and thus more varia-bility in these three measures when firms act noncollusively. If these measures actually become more stable and have less variability when prices are relatively high or rising, especially when firms have excess capacity,

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114.   *See* Commission Decision of 21 November 2001 Relating to a Proceeding Pursuant to Article 81 of the EC Treaty and Article 53 of the EEA Agreement, 2003 O.J. (L 6) 1, para. 200 ("In their 'top-level' meeting in Zurich in September 1989, the divisional chairmen of Roche, BASF and Rhône-Poulenc had agreed to a policy of 'price before volume.' "). Furthermore, "[w]hile Managers are instructed to hold the worldwide market at 48%, they are ordered to put 'price target before quantity/market share target: do not overshoot quantity by not achieving price target' c.f. the 'price before tonnage' maxim." *Id.* para. 207. This "price before tonnage" policy is not unique. *See, e.g.*, Commission Decision of 13 July 1994 Relating to a Provision Under Article 85 of the EC Treaty, 1994 O.J. (L 243) 1, paras. 51–52 (discussing a similar policy).

then this is a super plus factor and leads to the inference of explicit collusion.[115]

E. *Redistribution of Gains and Losses*

Cartels will often need to redistribute gains and losses to maintain their agreements. In some circumstances, the observation that one seller buys output from another seller at market prices leads to the strong inference of collusion, such as when each seller has excess capacity, the product made by each seller is physically identical, and the value-to-weight ratio of the product is high. These types of transactions are consistent with "true-ups" to comply with the terms of a market share agreement in which one firm has produced more than its share while others have produced less.[116] In addition, if one seller buys anything from another at nonmarket prices, then a resource transfer is made for which there is no reasonable noncollusive explanation. Other transactions require scrutiny, such as patent licensing, cross-licensing, and patent pools, as well as the settlement of seemingly frivolous lawsuits.[117] In summary, if firms engage in interfirm transfers of resources that are largely void of productive unilateral motivations for one or both of the parties, then these transactions are super plus factors.

F. *Communication and Monitoring*

Communication is a central part of the operation of a cartel.[118] We are concerned with communication that reflects the ongoing nature of the conspiracy. In general, if a seller (receiver) knows something about another seller (sender) an immediate question arises: Was there no legitimate unilateral function for the sender in communicating such information to the receiver? Overall, information is a valuable commodity. For one seller to know information about a rival is to give that seller a competitive advantage. A competitor has no unilateral interest in disadvantaging itself relative to its rivals.

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115.   However, the inference is weaker if the sellers function at full capacity rather than with excess capacity when prices are rising. But collusive sellers who understand that this weakens the inference may be able to manipulate capacity utilization to give the appearance of full capacity.

116.   True-ups are described in the European Commission decision in *Vitamins*. For example, when Rhône-Poulenc did not meet its market share target, "the other two European producers would purchase product from it to compensate for the shortfall. Compensating purchases were made by Roche in 1996 and by Roche and BASF in 1997." Commission Decision of 21 November 2001 Relating to a Proceeding Pursuant to Article 81 of the EC Treaty and Article 53 of the EEA Agreement, 2003 O.J. (L 6) 1, para. 225.

117.   It is a relatively simple matter for firms in an oligopoly to engage in contractual relationships with regard to a broad range of activities, many of which are completely meaningless from a productivity standpoint, and to use allegations of contract breach, and ensuing settlements, to legitimize cartel side payments.

118.   *See generally* Page, *supra* note 4; Page, *supra* note 25.

Suppose one seller knows the customers who purchased from another seller in the past quarter and knows the price and quantity of each transaction with each customer during the past quarter. The receiver will argue that it wants to know these things in a competitive marketplace and that it cannot be expected to ignore such information when it comes to its attention. However, why would the sender convey such information? Sloppiness and incompetence in the management of critical business information are not legitimate reasons. The sender may argue that it did not convey the information, but rather that each buyer gave this information to the receiver. But how would a buyer gain by conveying information to a nonawardee about the terms offered by an awardee? In the absence of direct evidence that such conveyances were made, it is reasonable to assume that the sender transmitted the information to the receiver. But the sender would have no unilateral self-interest in doing so. Thus, the motivation must be explicit collusion, and there must be an expectation of reciprocation.

With regard to firm-specific production information, again there is no reasonable explanation for such a conveyance by a noncollusive seller to another noncollusive seller. Unilateral knowledge of a rival's capacity utilization, inventory levels, or production costs will increase expected returns in any competitive bidding process. The conveyance of firm-specific production and sales information is important for monitoring compliance with many cartel agreements. For example, market share allocations require knowledge of exactly this kind of information, as well as the ability of cartel members to verify such information. Sometimes cartels will use trade associations, export associations, or outside consultants to convey this inforinformation among themselves.

Other information conveyances also yield a strong inference of explicit collusion. One example is knowledge of transactions between two sellers by a third seller. If one seller buys a large amount of product from another seller, there is no reasonable noncollusive reason for a third seller to be aware of such a transaction. From a cartel perspective, however, every member wants assurance that the transactions necessary for the peaceful, stable maintenance of the cartel agreement have occurred between members.

Overall, each of the three information conveyances discussed above lead to a strong inference of collusion among the sender and receiver sellers, and thus each is a super plus factor.

G. *Enforcement*

Because courts will not enforce cartel agreements, a cartel must devise enforcement mechanisms and threats. A common threat is to hold excess capacity, but excess capacity is often observed in industries without collusion. The economics literature devotes much attention to the threats required to enforce outcomes in repeated games. What distinguishes those threats and enforcement mechanisms from the ones we would observe with explicit collusion? Cartels from the early 1900s often required members to post bond with the central committee of the cartel. A firm would forfeit its bond if it

had been deemed to have violated the cartel agreement.[119] This kind of obvious paper trail appears to be largely absent from modern cartels. Overall, it seems that modern cartels are more focused on monitoring, communication, and redistribution so as to prevent breakdowns in cartel discipline than on some punishment. A cartel's demise implies a return to a standard oligopoly repeated game. The ensuing drop in the price level is consistent with such a breakdown, but it may be consistent with many noncollusive factors as well.

H. *Dominant-Firm Conduct by Cartels*

Many cartels struggle to suppress interfirm rivalry and remain continually focused on solving that problem. Other cartels reach a peaceful and concordant equilibrium, and essentially act as a single firm in the marketplace. Once a cartel has solved the issues associated with suppression of interfirm rivalry and can act as a single firm, it looks to other ways to increase profits. One of these other ways is to adopt dominant-firm conduct.[120] Relevant conduct may include predation against noncartel producers, exclusive dealing, or other kinds of monopolization activities. This kind of conduct is relatively easy to observe and, if no member of the cartel is large enough to undertake dominant-firm conduct, it is an indication of the presence of a cartel. In other words, dominant-firm conduct by firms in an industry where there is no one dominant firm leads to the inference of collusion. The strength of the inference depends on the conduct as well as the product/industry/market.

A typical section 2 investigation begins with determining whether there is a dominant firm in the industry. If so, then specific dominant-firm conduct is analyzed to determine if it is anticompetitive. In contrast, we begin with the determination that there is no dominant firm in the industry, and then inquire whether there are specific conducts that are typically associated with dominant firms, regardless of whether the conduct is pro- or anticompetitive. We draw the inference of a cartel from the presence of that conduct.

Of course, some conduct that is the focus of section 2 investigations can be undertaken legitimately by smaller firms in an industry. Thus, the observation of dominant-firm conduct, by itself, does not necessarily imply collusion. But there are two general guideposts that can be used to strengthen the inference. First, is the conduct something that would be defeated by competitive forces? Consider an industry with three firms that each have 33

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119. The International Steel Cartel established a "common fund." GEORGE W. STOCKING & MYRON W. WATKINS, CARTELS IN ACTION: CASE STUDIES IN INTERNATIONAL BUSINESS DIPLOMACY 183 (1946). The Aluminum Alliance used "guarantee deposits," which were in proportion to the firms' sales quotas. *Id.* at 231–32. The incandescent electric lamp cartel required the deposit of "indemnity funds" established for cartel purposes. *Id.* at 337.

120. *See, e.g.*, Randal D. Heeb et al., *supra* note 68 (analyzing dominant firm conduct). New research has shown that once cartels are concordant in that they have suppressed interfirm rivalry, they then act as dominant firms. *See* Marshall, Marx & Samkharadze, *supra* note 84.

percent of the market and one firm that has 1 percent of the market. Suppose the three large firms control a critical factor input that the small firm needs for production. If one of the large firms refuses to sell to the small firm, but it is profitable for either of the other two large firms to sell to the small firm, it is unlikely that the refusal will continue in light of the competitive pressure from the other two large firms. Second, if conduct has industry-wide benefits, such as entry deterrence, it may be too costly for a single firm to undertake the conduct. Furthermore, if one firm undertakes the activity on its own, then it is automatically disadvantaged relative to rivals since it bears a cost that rivals did not, yet all share equally in the benefit.

With these guideposts in mind, the strongest inference of collusion comes from joint vertical foreclosure where, again, there is no dominant firm in the market. Bundling, tying, predation, and exclusive dealing can be compelling evidence of collusion depending on the product/industry/market. In general, if a subset of firms have sufficient market power in the aggregate and jointly engage in a dominant-firm conduct where no single firm has the market power to act unilaterally as a dominant firm, then there is a strong inference of a cartel—and thus such conduct is a super plus factor.

I. *Cartel Response to Factors Identified as Super Plus*

If collusive firms come to understand that super plus factors will be used by courts to infer section 1 violations, then colluding firms will try to avoid conduct that creates super plus factors. But to avoid super plus factors greatly encumbers the profitability and stability of a cartel, perhaps even deterring the conspiratorial conduct. For example, if cartels come to understand that interfirm transfers will be treated as super plus factors, then they will either need to avoid these transfers or further disguise them. The avoidance of such transfers can greatly increase the monitoring burden of a cartel. Specifically, the absence of interfirm transfers requires a market share cartel to have no year-end deviations from the agreed-on shares. Moreover, if the absence of market share variability in the face of relatively high or increasing prices and profits is treated as a super plus factor, then cartel firms will be forced to artificially manufacture market share volatility. This greatly threatens a market share cartel, especially if interfirm transfers are no longer possible. In a homogenous product industry, cartel cohesion could be disrupted if firms had to leave the incentives of the sales force intact so that the sales force could continue to pursue market share gains instead of enforcing higher price levels. Overall, because super plus factors are actions or outcomes that would almost never be observed in the absence of collusion, it is reasonable to presume that the cartel finds these conducts or outcomes important to the implementation and operation of the collusive structures.

IV. Inferences Based on Plus Factors

Detecting a cartel is much like diagnosing whether a disease is present. The plus factors are symptoms that can make the diagnosis more reliable. In

medicine, there are definite rules for arriving at a diagnosis based on the presence or absence of given symptoms. If these rules are useful in medical matters of life and death, they should also be useful in legal matters involving potentially vast sums of money and the health of firms and markets because the underlying principles are the same.

The rules we just alluded to are not rules of thumb, but are embodied in a precise mathematical formula for probabilities set forth almost 250 years ago by Thomas Bayes.[121] In the context of cartels, as in any legal setting, certainty is not always possible. Instead, uncertainty is common. Uncertainty can be measured by probabilities. Probabilities are numbers between 0 and 1, inclusive, that indicate the likelihood of an event.

We are interested in whether a cartel was operating given the evidence. We write the probability of this as

$$P[\text{collusion} \mid \text{evidence}],$$

or just $P[C \mid E]$, where "P" stands for "probability" and "|" is to be read as "given." When $P[C \mid E]$ is close to 1, the evidence indicates that a cartel was almost certainly operating. When it is close to 0, the evidence indicates a cartel was almost certainly not operating.

Consider how the evidence of plus factors can be used to assess $P[C \mid E]$. Suppose our evidence consists of just one plus factor. As a shorthand, write this as F (F is for "factor"). We would like to know the probability that a cartel was operating, given the evidence provided by the plus factor, F—that is, $P[C \mid F]$. According to Bayes' Theorem,[122]

$$P[C \mid F] = (P[F \mid C] \times P[C]) / (P[F \mid C] \times P[C] + P[F \mid \text{not } C] \times P[\text{not } C]),$$

where "not C" denotes the event "no collusion," so that $P[F \mid \text{not } C]$ is the probability of observing plus factor F given that there is no cartel.

The elements of this formula all have natural interpretations and can be computed more or less accurately from economic knowledge and/or experience. There are four different elements on the right side of the equation. We tackle each in turn.

The simplest element is $P[C]$. This is the "baseline" probability that a cartel was operating, in the absence of any evidence about firm conducts. $P[C]$ typically depends on the product/industry/market. For example, for certain chemical products $P[C]$ might be quite high, while for certain agricultural products it might be quite low. In addition, $P[C]$ presumes that parallel conduct, often in pricing, has already been observed.[123] For the sake

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121. Thomas Bayes, *An Essay Towards Solving a Problem in the Doctrine of Chances*, 53 Phil. Transactions Royal Soc'y London 370, 378–79 (1763).

122. Applying the definition of conditional probability gives $P[C \mid F] = P[C \text{ and } F] / P[F] = (P[F \mid C] \times P[C]) / P[F]$. The law of total probability states that $P[F] = P[F \mid C] \times P[C] + P[F \mid \text{not } C] \times P[\text{not } C]$. Substituting this last expression for $P[F]$ in the denominator of the expression obtained from the definition of conditional probability gives Bayes' Theorem.

123. It would be more precise to introduce as formal conditioning arguments the structural characteristics of a product/industry/market that predate the cartel or are outside the cartel's potential control or influence, along with parallel conduct (most likely pricing) but we

of illustration, suppose $P[C]$ is .25 (baseline odds of three to one against a cartel operating).

The next simplest element is $P[\text{not } C]$. This is the baseline probability a cartel was not operating.[124] We always have $P[\text{not } C] = 1 - P[C]$, so once we know $P[C]$, we also know $P[\text{not } C]$. If the baseline probability that a cartel was operating is .25, then the baseline probability that it was not operating is $.75 = 1 - .25$.

The next element is $P[F \mid C]$. This is where the plus factor is first taken into account. It represents the probability of observing the plus factor given that a cartel was operating. For example, suppose that the plus factor is the evidence that one or more of the alleged conspirators changed intrafirm sales incentives to "price before volume." We can estimate $P[F \mid C]$ as the proportion of the time that a known cartel changed incentives in this way. Suppose we observe this conduct in about 15 percent of relevant cartels. Then $P[F \mid C] = .15$.

The information provided by a plus factor is not determined only by the probability of observing that factor given the cartel. The final and crucial determinant of the plus factor's worth is whether it distinguishes cartel behavior from noncartel behavior. This is determined by the last element in the formula, $P[F \mid \text{not } C]$. This probability represents the probability of observing the plus factor given that a cartel was known *not* to be operating. Economics can often play a crucial role in assessing this value. Specifically, suppose the behavior is one in which a noncollusive rational competitor would be highly unlikely to engage, such as "price before volume" sales incentives. Then $P[F \mid \text{not } C]$ is quite small. Other behaviors with this property, depending on the product/industry/market, can be information conveyance, interfirm purchases at nonmarket prices, and dominant-firm conduct.

These latter examples clearly illustrate the concept of *super* plus factors: specifically, super plus factors are actions or conduct that could occur in the presence of a collusive agreement but that are highly unlikely to occur in its absence. Super plus factors necessarily have the property that $P[F \mid \text{not } C]$ is quite small.

Now put together the pieces. If $P[F \mid \text{not } C] = .001$, then from the formula above, we get

$$P[C \mid F] = (.15 \times .25) / (.15 \times .25 + .001 \times .75) = .9804$$

Because this plus factor is one that would almost never be observed in a noncollusive environment but that can occur in a collusive environment, we have a high degree of certainty (.9804) that a cartel was operating given this plus factor.

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suppress this for notational simplicity. The value of $P[C]$ for a product/industry/market may be larger as a result of such facilitating factors.

    124.   This probability implicitly conditions on all the same product/industry/market structural elements and parallel conduct (most likely pricing) that are in $P[C]$.

Now consider a different plus factor, say, stable market shares. Suppose we observe stable market shares in relevant cartels two-thirds of the time, so that $P[F \mid C] = .667$. Suppose we observe stable market shares in noncollusive markets one-fifth of the time, so that $P[F \mid not\ C] = .2$. Using Bayes' Theorem gives

$$P[C \mid F] = ((.667 \times .25) / (.667 \times .25 + .2 \times .75)) = .5264.$$

Now the evidence for cartel operation is not nearly as strong. Nevertheless, the evidence of this plus factor shows that it is more likely (.5264) than not (.4736) that a cartel was indeed operating.

As these examples suggest, the strength of a plus factor is governed by the relation between $P[F \mid C]$ and $P[F \mid not\ C]$. We let S represent the "strength" of a plus factor, calculated as the ratio

$$S = P[F \mid C] / P[F \mid not\ C].$$

In our first example (price before volume), we had $S = .15/.001 = 150$. In our second example (stable market shares), we had $S = .667/.2 = 3.33$. This directly shows the contrast between super plus factors (large S) and nonsuper plus factors (moderate S).

We can relate $P[C \mid F]$ directly to plus factor strength, S, by making use of the baseline odds against a cartel,

$$O = P[not\ C] / P[C].$$

A little math then gives

$$P[C \mid F] = 1 / (1 + O/S).$$

In our example, we have $P[not\ C] = .75$ and $P[C] = .25$, which gives $O = 3$ (baseline odds of three to one against a cartel).

From this relationship between $P[C \mid F]$ and S, we see that whenever S increases, so does $P[C \mid F]$, the probability of a cartel given the plus factor. And whenever S decreases, so does $P[C \mid F]$, which justifies calling S a measure of plus factor strength. We can also check that when $S = 1$ (unit strength), then $P[C \mid F] = P[C]$. Accordingly, F is formally defined to be a plus factor if and only if $S > 1$, because this is mathematically equivalent to the condition that taking F into account increases the likelihood of a cartel having operated—that is, $P[C \mid F] > P[C]$ if and only if $S > 1$.[125]

Plus factors are typically not observed in isolation. Just as there may be multiple symptoms in medicine, there may be multiple plus factors in cartel matters. Given the life-or-death stakes in medicine, multiple symptoms cannot be ignored or their information wasted; the same should be true in law. Thus, whether in medicine or in law, the proper way to treat multiple diagnostic factors is as a constellation, rather than in isolation. To see this, note that a particular constellation of symptoms can confirm or rule out a particular diagnosis that individual symptoms by themselves cannot resolve. The

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125.   In fact, there are also "minus" factors. These have S less than one and are associated with behaviors that are more likely to be engaged in by noncolluders than by colluders.

necessity in law of looking at the entire cluster of factors is precisely the principle articulated in *Continental Ore Co. v. Union Carbide & Carbon Co.*[126]

Mathematically, the information provided by a constellation of plus factors is properly accounted for by treating the joint occurrence of the plus factors as if this were a single plus factor. That is, when k plus factors, F_1, . . . , F_k, are observed, we let

$$F = F_1 \text{ and } F_2 \dots \text{ and } F_k .$$

With this convention in place, the remaining formulas remain unchanged. The challenge comes in determining the strength S of the plus factor constellation.[127] The particulars can vary from case to case. Nevertheless, economic experience and knowledge can often be applied to determine that the combination of plus factors increases strength beyond what one might obtain from a single plus factor. In fact, such a group or constellation can be a super plus factor even when none of the individual plus factors that make up the constellation is itself a super plus factor.

A. *Plus Factor Categorization*

To explore further the implications for this way of thinking about plus factors, assume that a court, in the absence of any direct evidence of a conspiracy, requires that the probability of collusion given the economic circumstantial evidence be greater than 90 percent in order to reach a guilty verdict in a criminal trial.[128] Given this hurdle for the probability of collu-

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126.   *See supra* note 65 and accompanying text.

127.   When many plus factors operate together, this can in principle result in the combination being either stronger or weaker than any single factor as an indicator of cartel operation. More specifically, as defined above, $P[C \mid F_1] = 1 / (1 + O_0/S_1)$, where $O_0 = O = P[\text{not } C] / P[C]$ is the odds against a cartel given zero plus factors, and $S_1 = P[F_1 \mid C] / P[F_1 \mid \text{not } C]$ is the strength of plus factor 1. With two plus factors, F_1 and F_2, then

$$P[C \mid F_1, F_2] = 1 / (1 + O_1/S_{2 \mid 1}),$$

where $O_1 = P[\text{not } C \mid F_1] / P[C \mid F_1]$ is the odds against a cartel given plus factor F_1 and $S_{2 \mid 1} = P[F_2 \mid C, F_1] / P[F_2 \mid \text{not } C, F_1]$ is the strength of plus factor 2 given plus factor 1.

In the general case of n plus factors, F_1, . . . , F_n, then

$$P[C \mid F_1 , \dots , F_n] = 1 / (1 + O_{n-1}/S_{n \mid n-1}),$$

where $O_{n-1} = P[\text{not } C \mid F_1 , \dots , F_{n-1}] / P[C \mid F_1 , \dots , F_{n-1}]$ is the odds against a cartel given $n-1$ plus factors and $S_{n \mid n-1} = P[F_n \mid C, F_1 , \dots , F_{n-1}] / P[F_n \mid \text{not } C, F_1 , \dots , F_{n-1}]$ is the strength of plus factor n given plus factors 1, . . . , $n-1$.

As a mathematical property, adding plus factor n increases the inferred probability of collusion, that is, $P[C \mid F_1 , \dots , F_n] > P[C \mid F_1 , \dots , F_{n-1}]$ if and only if the strength of plus factor n given plus factors 1, . . . , $n-1$ is greater than one, $S_{n \mid n-1} > 1$. The plus factor strengths can be related to one another through the recursive formula, $S_{n \mid n-1} = S_n/S_{n-1}$, where $S_n = P[F_1, \dots , F_n \mid C] / P[F_1 , \dots , F_n \mid \text{not } C]$.

128.   As a rough approximation, we can translate general legal standards into percentage probabilities. For a finding of guilt in a civil matter, assuming no direct evidence of a conspiracy, the probability of collusion given the economic circumstantial evidence must be at least

sion, we can ask what strength would be required of an individual plus factor in order for the 90 percent threshold to be passed conditional on the observation of that single plus factor. For example, suppose a particular factor F_1 has a strength of $S_1 = 10$. This means the factor is ten times more likely conditional on collusion than conditional on no collusion. Suppose we assume a baseline of even odds for collusion so that $O_0 = 1$. (Note the change: in our earlier discussion, we had $O_0 = 3$.) It then follows from Bayes' Theorem that the probability of collusion given that factor is

$$P[C \mid F_1] = 1 / (1 + O_0/S_1) = 1 / (1 + 1/10) = 91 \text{ percent.}$$

Thus, this factor would be sufficient for the inferred probability of collusion to exceed 90 percent.

We can define a somewhat less strong set of plus factors to contain those plus factors such that the observation of two plus factors from this set is sufficient to conclude that the probability of collusion is at least 90 percent, assuming the two plus factors are conditionally independent, that is, their strengths are independent so that $S_{2|1} = S_2 = P[F_2 \mid C] / P[F_2 \mid \text{not } C]$.[129] We refer to these plus factors as level-two plus factors and denote a level-two plus factor by F^2. A plus factor would be level two if it has a strength of $S = 4$, so that it is four times more likely conditional on collusion than conditional on no collusion, assuming a baseline of an even chance of collusion. To see this, note that when $O_0 = 1$, two conditionally independent plus factors each with a strength of four deliver a probability of collusion that exceeds 90 percent:

$$P[C \mid F_1, F_2] = 1 / (1 + O_1/S_{2|1}) = 1 / (1 + (1/4) / 4) = 94 \text{ percent,}$$

where $S_{2|1} = S_2 = 4$ and $O_1 = P[\text{not } C \mid F_1] / P[C \mid F_1] = O_0/S_1 = 1/4$.

Similarly, one can consider how many plus factors one would need to reach the 90 percent threshold if the plus factors were independent and each were three times more likely conditional on collusion than on no collusion. The results are summarized in the table below.

50.1 percent. When the FTC proceeds under a pure section 5 theory, the requirement may fall somewhat below 50 percent. To survive summary judgment in any matter, it must be the case that the probability of collusion given the economic circumstantial evidence available at the time of summary judgment exceeds the prior (i.e., baseline) probability of collusion. On the application of section 5 of the FTC Act, see generally William E. Kovacic & Marc Winerman, *Competition Policy and the Application of Section 5 of the Federal Trade Commission Act*, 76 ANTITRUST L.J. 929 (2010). *See also* DANIEL A. CRANE, THE INSTITUTIONAL STRUCTURE OF ANTITRUST ENFORCEMENT 135–41 (2011).

129. *See supra* note 123 and accompanying text. The assumption of independence is made here for ease of exposition to illustrate how multiple plus factors can be combined for probative value.

TABLE 1

PLUS FACTOR CATEGORIZATION

Conditions to exceed a 90 percent probability of collusion
assuming baseline odds against collusion of $O_0 = 1$ and conditional independence

		Plus factor strength	**Number of plus factors required**
Super plus factor	F^s	10	1
Level-two plus factor	F^2	4	2
Level-three plus factor	F^3	3	3
Level-four plus factor	F^4	2	4

Although the analysis based on Bayes' Theorem can in theory be used to calculate the exact probability of collusion given a particular constellation of plus factors, this table provides a way to categorize plus factors into distinct categories based on the number of times more likely it is to observe the plus factor conditional on collusion than on no collusion.[130] The different levels of plus factors allow a loose interpretation that a level-*k* plus factor would require *k* plus factors in order for the inference of collusion to exceed 90 percent. Given more detailed information about the interactions between plus factors, one could take that information into account using a more sophisticated analysis. But even without such information, this categorization emphasizes the value of considering constellations of plus factors rather than artificially focusing on the implications of plus factors on an individual basis.

We emphasize that this categorization of plus factors applies to a 90 percent threshold, which we assume appropriate for criminal proceedings. For civil cases, presuming a 50.1 percent probability threshold would apply, when the baseline odds of collusion are even, $O_0 = 1$, the plus factor strengths required to reach each given level are close to one.[131]

B. *Estimating Probabilities*

The aforementioned probabilities can emerge from economic theory. For example, theory can tell us that the strength *S* of a plus factor is high if the plus factor is highly unlikely to emerge from noncollusive conduct. Thus, economics alone can provide us with super plus factors. But for many plus factors, it is not the case that theory provides such stark implications for the probabilities in question. For example, if *F* is "fixed and temporally stable market shares," then theory does not provide us with a definite statement about the plus factor's strength independent of the specific product/industry/market. As an example, consider the linerboard

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130.   This table is for the specific value $O_0 = 1$. An analogous table can be constructed for any other specified value of O_0.

131.   In order to meet a threshold probability of 50.1 percent given baseline odds of collusion of $O_0 = 1$, one need only have one plus factor with a strength of at least 1.004.

industry.[132] Linerboard is produced by machines that run at a single speed for twenty-four hours a day, seven days a week. Machines typically are turned off for maintenance for ten days per year. Production market shares will be essentially fixed and stable in such an industry without any collusion,[133] so the strength of the factor "fixed and temporally stable market shares" would be low. Alternatively, in the vitamins industry where production is more variable, relatively fixed and stable production market shares are relatively less likely without explicit collusion. In this case, the strength of the factor is high.

We could enumerate all cartel decisions by the Department of Justice and European Commission in recent years and identify a number of conducts by the cartels for each case. However, this will almost surely not provide useful information about the strength S of various plus factors. First, none of the cases have anything to do with noncollusive conduct; these are apprehended cartels. Second, apprehended cartels are only a subset of the set of cartels C. If apprehension is not random, then there is an unknown bias in extrapolating from the apprehended cartels to all cartels. Third, as noted above, the strength S of a plus factor is a function of the specifics of the product in question, including the specifics of the market and the industry that makes the product. Aggregating over different products, different markets, and different industries to construct measures of plus factor strength is not sensible.

If aggregation over products/industries/markets is not sensible, then, except for some super plus factors, we are left assessing plus factor strength for a given product/industry/market. For a given product/industry/market, for example, stable market shares during a period of price increases may be viewed as a strong plus factor if buyers vigorously resist price increases, but it may be viewed as a weak plus factor if buyer resistance is weak or nonexistent.

C. *Harms from Decisions and Types of Errors*

In the previous Section, we considered specific probability thresholds relevant to findings of criminal, civil, or FTC section 5 liability. Use of such probability thresholds to test liability balances the harms associated with the possible ways that a decision can be wrong. In the contexts where these tests apply, there are two ways a decision can be wrong: (1) a party can be found liable when in fact they are not (a "Type I Error") or (2) a party can be found nonliable when in fact they are (a "Type II Error").

To see how this balance works, suppose the harm associated with a Type I Error is some number, h_1, whereas the harm associated with a Type II Error is h_2. It is convenient and appropriate to think of h_1 and h_2 as dollar amounts. Suppose also that the probability of collusion, based on all the evidence E is $p = P[C \mid E]$. Then the expected harm of a finding of liability can be shown

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132.   Linerboard is the brown, flat outer layer on cardboard boxes and packaging.

133.   Note that here we reference production market shares, not sales market shares.

to be[134] the harm, h_1, multiplied by the probability that there was *no* collusion given the evidence, $(1 - p)$—that is, the expected harm of a finding of liability is $(1 - p)h_1$. Similarly, the expected harm of a finding of no liability equals ph_2. Applying the principle of choosing the decision that results in the least expected harm, it follows that a finding of liability should be returned when (and only when)

$$(1 - p)h_1 < ph_2 .$$

After a little algebra to rearrange this inequality,[135] it follows that a finding of liability should be returned when

$$p > 1 / (1 + h_2/h_1).$$

The term on the right represents the probability threshold required for a finding of liability. This means that any probability threshold, such as .9 (criminal), .501 (civil), or .4 (FTC section 5), corresponds to a specific harm ratio, h_2/h_1, that balances the harms.

For example, consider the harm ratio corresponding to the criminal liability test, .9. Setting $1 / (1 + h_2/h_1) = .9$ and solving for h_2/h_1, we obtain $h_2/h_1 = .111$. This says that the .9 criminal threshold embodies the view that the harm h_1 of finding an innocent party criminally liable is nine times greater than the harm h_2 of finding a guilty party not criminally liable.

A similar computation shows that the harm ratio corresponding to the civil test (.501) embodies the view that the two harms are about the same ($h_1 = 1.004h_2$). On the other hand, suppose the threshold for an FTC section 5 test is .4. Since .4 is less than .5, this embodies the view that the harm h_1 of a liability finding in the absence of a true violation is less than the harm h_2 of finding no liability in the presence of a true violation. With a .4 threshold, the harm ratio implies $h_1 = .667h_2$.

A significant implication of this analysis is that real-world applications of fixed probability thresholds may or may not accurately reflect the true underlying relative harms corresponding to the two different decision errors for a given matter. This may lead to decisions that violate the principle of least expected harm; however, such fixed thresholds have the considerable virtue of practicality in situations in which the true harm ratio h_2/h_1 may not be easy to determine.

We close this Section by noting that the analysis of harms relates directly to plus factors. Specifically, some algebra shows that a liability finding that results in the least expected harm occurs when (and only when) the plus factor strength, S, exceeds the inverse harm ratio, h_1/h_2, multiplied by the baseline odds, O; that is, when $S > (h_1/h_2)O$.

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134.   This follows from elementary rules of probability and the calculation of expected values, assuming, as is standard and appropriate, that the harm associated with a correct decision of liability or no liability is zero.

135. $(1 - p)h_1 < ph_2$ implies $h_1 < p(h_1 + h_2)$. This implies $p > h_1 / (h_1 + h_2)$, which gives the result above.

CONCLUSION

The resolution of many antitrust cases hinges on the determination of whether observed conduct is the product of unilateral behavior or collective action. In a large number of disputes, the plaintiff seeks to establish the fact of concerted conduct by way of circumstantial evidence. Because antitrust conspiracy doctrine does not recognize proof of parallel price movements by itself to sustain an inference of agreement, plaintiffs seek to introduce plus factors to show that it is more likely than not that parallel conduct resulted from concerted action.

The analysis of plus factors is one of the most unsettled and perplexing doctrinal issues of modern antitrust law. This Article proposes a formal definition of plus factors, a taxonomy for plus factors, and a coherent methodology for ranking them in terms of their probative values. We identify super plus factors, which lead to a strong inference of collusion. Plus factors should be considered in groups or constellations whenever such groups are present, because the probative value of a constellation of plus factors can be far greater than each individual plus factor that comprises the constellation. In fact, a group or constellation can be a super plus factor when none of the individual plus factors that make up the constellation is itself a super plus factor.

In closing, we offer a review of the partial list of super plus factors discussed in Part III:

1. A subset of firms restricts production when prices and profits are relatively high or increasing.

2. Among a subset of producers, market shares, customer incumbency, or geographic dominance is stable when the firms have excess capacity, and prices and profits are relatively high or increasing.

3. A reliable predictive econometric model that accounts for all material noncollusive effects on price, estimated using benchmark data where conduct was presumed noncollusive, produces predictions of prices that do not explain the path of actual prices in the period or region of potential collusion, at a specified high confidence level.

4. A firm or subset of firms has knowledge of the details of another firm's transactions, production, sales, and/or inventories where the latter firm would be competitively disadvantaged by conveying that information unilaterally.

5. Firms engage in interfirm transactions that are transfers of resources and are largely void of productive noncollusive motivations.

6. In an industry where the product made by different firms is largely homogeneous, there is a discrete change in the intrafirm incentives of sales forces, across a subset of firms during a given period, that shifts from the pursuit of market share to maintenance of elevated prices (such as a shift to "price before volume").

7. A subset of firms with an aggregate market share large enough to have dominant-firm market power jointly engage in a dominant-firm conduct when no single firm has the market power to act unilaterally as a dominant firm by engaging in that dominant-firm conduct.