Article

Collusion/Competition: A New Learning?

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Abstract

Ever since the U.S. Supreme Court opinion in *Matsushita*, various U.S. district courts have issued a series of rulings that appear to constitute a new learning on the economics of collusive behavior and to elevate the *economic* evidentiary bar for successful proof of price-fixing and bid-rigging. The rulings use game theory constructs expressed as pure, interdependent behavior that theoretically can result in supra-competitive prices in the absence of any agreement. The most recent explanation of this learning is contained in the 2016 titanium dioxide (TiO2) opinion *Valspar v. E. I. DuPont*, which raises the bar for proving a Sherman Act Sec. 1 violation. This and earlier rulings appear counterintuitive when their reasoning is tested against the context of Judge Richard Posner's opinion on the value of circumstantial evidence in *High Fructose Corn Syrup* and *In re Text Messaging*. This article identifies market structure and behavioral features typically found in cartel arrangements, and tests the efficacy of what is perceived as a new learning on collusion/competition with empirical data from twelve alleged price-fixing conspiracies successfully litigated over the past two decades.

Keywords

Economic characteristics of collusive behavior

For many years, the U.S. Supreme Court and federal district courts seemed undaunted in making inferences regarding the existence of illegal price-fixing agreements from circumstantial economic evidence. At least that was the case up until *Matsushita*,[1] which essentially adopted defense contentions that circumstantial evidence was ambiguous—that is, was consistent with two or more interpretations—and thus should not be taken at face value. The opinion has generally been regarded as an artifact, unique to the unusual nature of the complaint (an alleged agreement among foreign companies *not to raise, but rather to sell, electronics products in the U.S. at low, predatory prices*).

Nonetheless, over the past two decades the ambiguity language in *Matsushita* has been followed by a series of opinions in Section 1 Sherman Act cases that appear to proclaim a new learning on the

1. *See* Matsushita Elec. Indus Co. v. Zenith Radio Corp., 475 U.S. 574, 588–97 (1986).

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economics of collusive behavior, which elevates the economics evidentiary bar for successful prosecution of price fixers.[2] The strangest aspect of this trend—as it concerns the role of economic analysis—is that the opinions essentially have turned traditional cartel theory on its head,[3] co-opting oligopoly theory itself to characterize, and acquit, collusive behavior under the guise of "rational, interdependent decision making."

This paper is organized in three parts. Part I reviews standard economic theory with respect to the anatomy and behavior of cartels.[4] Part II examines the court's opinion in the titanium dioxide case. Part III presents some empirical data concerning the structural and behavioral characteristics of twelve litigated U.S. price-fixing and bid-rigging cartels.

I. Overview of Cartel Theory

A. Anatomy of Cartels

There is widespread agreement among economists that certain market structure characteristics are conducive to the formation and operation of cartels: namely, high seller concentration; commodity-like products with relatively inelastic demand; few substitutes; large number of buyers; barriers to entry of new firms; excess productive capacity; a mature industry with stable or declining industry demand; and participation in and exchange of private firm statistical information on production, capacity utilization, inventories, costs, and market share through industry trade associations.[5] Empirical studies indicate that under these conditions collusion, either tacit or overt,[6] is highly likely to emerge out of shared knowledge and trust developed over time, especially in mature industries. The Hay and Kelly study of sixty-five Section 1 Sherman Act cases found that there was a high degree of correlation between the formation of price-fixing conspiracies and certain structural features, especially in markets with few sellers and high concentration.[7]

B. Physiology of Cartel Behavior

The economic literature cited provides strong empirical evidence confirming that not only are the foregoing characteristics conducive to the *formation* of cartels, but, more importantly, they serve to *facilitate and implement* joint/collective action on pricing, especially where firms have interacted with

2. *See especially* Monsanto Co. v. Spray-Rite Serv. Corp., 465 U.S 752, 761 (1984); *In re* High Fructose Corn Syrup Antitrust Litig., 295 F.3d 651, 661 (7th Cir. 2002); *In re* Flat Glass Antitrust Litig., 385 F.3d 350, 357 (3d Cir. 2004); Bell Atl. Corp. v. Twombly, 550 U.S. 544 (2007); *In re* Hydrogen Peroxide Antitrust Litig., 552 F3d 305 (3d Cir. 2008); *In re* Chocolate Confectionary Antitrust Litig., 801 F.3d 383, 395 (3d Cir. 2015); and Valspar Corp., v. E.I. Du Pont de Nemours, Civil Action No. 14-527-RGA (U.S. Dist. Ct., Delaware).
3. The classic reference, often cited as the "father" of cartel theory, is Donald Patinkin, *Multi-Plant Firms, Cartels, and Imperfect Competition*, 61 Q. J. Econ. 173 (February 1947).
4. It needs to be noted at the outset that "cartels" as such, come in many varieties. The standard, classic cartel originated in Europe, notably Germany, and had formal rules and penalties the parties agreed to. Various devices have been used in arranging and operating cartels, including some arranged and enforced by the state. The term is used herein to characterize collusive arrangements organized by corporate officials to implement agreements to fix prices, rig bids, restrict supply, or allocate markets.
5. *See* G. Hay & D. Kelly, *An Empirical Survey of Price Fixing Conspiracies*, 17 J.L. & Econ. 13 (1974); Richard A. Posner, *A Statistical Study of Antitrust Enforcement*, 13 J.L. & Econ. 365 (1970); Richard A. Posner, Economic Analysis of Law 287 (4th ed., 1992); D. Carlton & J. Perloff, Modern Industrial Organization (4th ed., 2005); A. Fraas & D. Greer, *Market Structure and Price Collusion: An Empirical Analysis*, 26 J. Indus. Econ. 1 (1977).
6. *See* William H. Page, *Tacit Agreement Under Section 1 of the Sherman Act*, Antitrust L.J. (forthcoming), for a comprehensive legal analysis, (1) sharply defining and clarifying the meaning of "tacit agreement" as "interdependent conduct coordinated by prior communications of competitive intentions;" and arguing (2) that "tacit agreement, properly understood identifies a necessary category of Sherman Act agreement that is distinguishable from both simple interdependence and express agreement."
7. *See* Hay & Kelly, *supra* note 5.

one another over a number of years in trade association meetings. Although simple participation in trade association meetings by itself has generally been regarded as an insufficient basis for inferring collusion from subsequent coordinated industry behavior, the Antitrust Division of the U.S. Department of Justice recently published a paper suggesting that there is a relatively high probability of collusion in industries with these characteristics: "Collusion is more likely if the competitors know each other well through social connections, trade associations, legitimate business contacts, or shifting employment from one company to another."[8]

The economic literature and deposition testimony of corporate executives with price-making responsibilities clearly indicate an understanding of the motive behind sharing of corporate production, cost, and sales information with competitors. These considerations have been characterized and recognized by the courts as "plus factors" in price-fixing complaints. More specifically, certain plus factors have been demonstrated by economic analysis to represent evidence of illegal collusive behavior, and are routinely evaluated by the courts in ruling on a price-fixing complaints, including:[9] (1) motive of defendants: avoid price competition in favor of maximizing joint industry profits; (2) engaging in actions contrary to a firm's individual self-interest; (3) price signaling; (4) a pattern of historical, disciplined follow-the-leader pricing; and (5) intercompany sales at below market prices.

II. The Titanium Dioxide Opinion

The most recent rendering of the new learning on collusion/competition is contained in Judge Richard G. Andrews' Memorandum Opinion in the titanium dioxide (TiO2) litigation. Plaintiff allegations state that defendants (DuPont, Huntsman, Kronos, and Millenium) participated in numerous industry meetings, beginning in 2002, to fix the price, as well as industry capacity and supply of TiO2. Additionally, it is alleged that the conspiracy was facilitated by the use of industry consultants and industry publications to signal or confirm intended price increases, despite declining demand, reduced costs, and higher industry productive capacity. Defendants also allegedly announced and implemented multiple, nearly simultaneously price increases over a five-year period, following the actions of the alleged price leader DuPont.

Judge Andrews rejected plaintiff allegations, reasoning as follows:[10]

> [T]he titanium dioxide industry is an oligopoly.... To successfully bring a § 1 horizontal price fixing case... there must be evidence of an actual agreement to fix prices.... In the oligopoly context, lawful conduct can bear a great resemblance to unlawful conduct....

In brief, the titanium dioxide opinion concludes that absent "smoking gun" evidence it apparently is perfectly legal for competitors not only to share, but also to discuss private operational data exchanged through trade associations, including production, capacity utilization, costs, and market share. Moreover, it apparently is consistent with competition for rivals to provide advance public notice of planned price changes, routinely engage in follow-the-leader price behavior, and even occasionally discuss pricing and other matters via emails and telephone calls—provided there is no record of an actual agreement—that is, a smoking gun.[11]

8. U.S. Dep't Justice, *Price Fixing, Bid Rigging, and Market Allocation Schemes: What They Are and What to Look For* (n.d.), http://www.justice.gov/atr/public/guidelines/211578.htm.
9. *See* W. Kovacic, R. Marshall, L. Marx, & H. White, *Plus Factors and Agreement in Antitrust Law*, 110 MICH. L.R. 393 (2011).
10. *Cf. Valspar v. E.I. Du Pont*, *supra* note 2, at 29.
11. The ambiguity argument has been raised by defendants in Daubert hearings regarding economic evidence presented through expert testimony. *See* Robert F. Lanzillotti & James T. McClave, *Meeting the "Ambiguity" Test Under Daubert*, 17 ANTITRUST 44 (Spring 2002).

Economic analysis. The obvious questions begged by this new learning from the viewpoint of economic analysis are:

(1) What competitive justification exists—either in economic theory or in industry practice—for corporate executives to share and discuss with one another (one-on-one, at trade association committee meetings, or via emails) pricing, costs, demand, market share, or other private corporate data?
(2) Does the exchange and sharing of private corporate data by ostensible rivals reflect the purely self-interest of a firm or the joint, collective industry interest?

Standard oligopoly theory instructs us that if ostensible competitors' conduct tends to facilitate joint competitors' interest, and against the self-interest of a given firm, there is a strong presumption such conduct constitutes economic evidence of illegal collusion, especially if other "plus" factor activity is present. The presumption is especially strong where there is a finding that rivals have engaged in a series of sequential actions encouraging, then adopting cooperative implementation of price changes, bids, or restricted output. Accordingly, under these circumstances should this bundle of evidence not also meet the legal standard of proof that such actions are tantamount to agreement under Section 1?

Judge Posner's analysis. Judge Richard Posner has observed that while there might not be "smoking gun" evidence of a horizontal conspiracy, it could nonetheless be established through circumstantial evidence. Ruling on behalf of the three-judge 7th Circuit panel in 2010, in support of the district court judge's decision denying defendants' motion to dismiss the complaint, and allowing plaintiffs class action suit to proceed to discovery, Posner reasoned as follows:

> Parallel behavior of a sort anomalous in a competitive market is thus a symptom of price fixing, though standing alone it is not proof of it; and an industry structure that facilitates collusion constitutes supporting evidence of collusion . . . the four defendants sell 90 percent of the U.S. text messaging services, and it would not be difficult for such a small group to agree on prices . . . [and] exchange price information at association meetings . . . a practice not illegal in itself, facilitates price fixing that would be difficult for the authorities to detect . . .
>
> [D]efendants . . . met with each other in an elite "leadership council" . . . [whose] stated mission was to urge its member to substitute "co-opetition" for competition . . . that all at once the defendants changed their pricing structures, which were heterogeneous and complex, to a uniform pricing structure, and then simultaneously jacked up their prices by a third . . . complex and historically unprecedented changes in pricing structure made at the very same time by multiple competitors, and made for no other discernible reason would support a plausible inference of conspiracy . . . . That is the kind of "parallel plus" behavior alleged in this case.
>
> . . . [A]llegations of a mixture of parallel behaviors, details of industry structure, and industry practices that facilitate collusion [constitute a plausible claim] . . . the plausibility standard is not akin to a "probability" requirement . . . because plausibility, probability, and possibility overlap. Probability runs the gamut from a zero likelihood to a certainty. What is impossible has a zero likelihood of occurring and what is plausible has a moderately high likelihood of occurring . . . the complaint must establish a non-negligible probability that the claim is valid; but the probability need not be as great as such terms as "preponderance of the evidence" connote . . . . All we can conclude at this early stage is that the district court judge was right to rule that the second amended complaint provides a sufficiently plausible case of price fixing to warrant allowing the plaintiffs to proceed to discovery.[12]

12. *In re* Text Messaging Antitrust Litig., No. 10-8037, 2010 WL 5367383 (7th Cir. Dec. 29, 2010).

When *Text Messaging* suit came before the 7th Circuit for the second time in 2015, Judge Posner again addressed the value of circumstantial evidence in proving conspiracy, and concluded that (1) despite extensive discovery by plaintiffs, and (2) despite the presence of "plus factors" that appear consistent with price fixing, plaintiffs did not produce sufficient evidence of an agreement, explaining as follows:

> What is missing, as the defendants point out, is the smoking gun in a price-fixing cases: direct evidence .... Direct evidence of conspiracy is not a sine qua non, however. Circumstantial evidence can establish an antitrust conspiracy...
>
> It is of course difficult to prove illegal collusion without witnesses to an agreement. And there are no such witnesses in this case.... The plaintiffs have presented circumstantial evidence consistent with an inference of collusion, but that evidence is equally consistent with independent parallel behavior.
>
> We hope this opinion will help lawyers understand the risks of invoking "collusion" without being precise about what they mean. Tacit collusion, also known as conscious parallelism, does not violate section 1 of the Sherman Act. Collusion is illegal only when based on agreement. Agreement can be proved by circumstantial evidence, and the plaintiffs were permitted to conduct and did conduct full pretrial discovery of such evidence. Yet their search failed to find sufficient evidence of express collusion to make a prima facie case. The district court had therefore no alternative to granting summary judgment in favor of defendants.[13]

Judge Andrews's opinion. Andrews's analysis separates itself from Posner's reference to the value of circumstantial evidence and moves the economic evidentiary proof bar up a notch. Although there was circumstantial evidence of what appeared to be illegal collusive behavior, Andrews ruled otherwise, weighing the evidence in piece-meal fashion, concluding *seriatim*:

(1) **Re motive:** "evidence of motive does not create a reasonable inference of concerted action because it merely restates interdependence."
(2) **Re stable market shares:** "stability of market shares is entirely consistent with market shares in a concentrated oligopolistic market [but] this fact does not support an inference of conspiracy."
(3) **Re signaling to one another via parallel price increases:** "for parallel price increases to go beyond mere interdependence, it must be so unusual that in the absence of an advance agreement, no reasonable firm would have engaged in it.... Indeed, oligopolists may maintain supra competitive prices through rational, interdependent decision making, as opposed to unlawful action, if oligopolists independently conclude that the industry as a whole would be better off by raising prices... [to characterize such signaling as collusive] neglects the theory of interdependence, as well as the distinction between tacit and express collusion..."
(4) **Re intercompany sales at nonmarket prices:** "These sales are just as consistent with non-collusive activity as with conspiracy."
(5) **Re sharing of statistics on capacity utilization, inventories, and market share:** "Participation in the mutual sharing of such information is conduct as consistent with permissible competition as with illegal conspiracy."

The Andrews opinion implicitly argues that, unlike crude price-fixing arrangements of earlier periods (e.g., the infamous "Gary Dinners" in the steel industry) modern day executives are (1) better educated; (2) more sophisticated in understanding oligopolistic interdependence; and accordingly (3) do not need to execute formal, or even informal agreements to accomplish joint/collective industry

13. *In re* Text Messaging Antitrust Litigation, No. 14-2301, 782 F.3d 867 (2015).

goals on pricing or other matters affecting industry profits. Moreover, concentrated market structure, exchange of corporate data under trade association cover, signaling, and uniformly implementing proposed price changes nearly simultaneously *considered separately, in theory, are just as consistent with competition as with collusion.*

In short, the titanium dioxide and earlier court opinions provide Section 1 defendants with a plausible answer to the arcane economic query regarding collusive oligopoly disguised as rational, interdependent behavior: *"The theory is clear; but can it work in practice?"* Judge Posner's model for evaluating circumstantial economic evidence poses the burden of proof in terms of probabilities, namely, *Does the entire pattern of behavior more likely portray illegal collusion than pure, rational independent decision-making*?

Andrew's opinion would appear to be at odds with both the economics and the law regarding circumstantial evidence, as Posner explained. More specifically, if the titanium dioxide managers were truly sophisticated and well-versed in the workings of oligopolistic interdependence, why, in practice, was it necessary to monitor, and occasionally "educate," one another with e-mails, telephone calls, and face-to-face meetings? Below is a small sample of the copious documentation in the titanium dioxide court record of inter-firm communications:[14]

May 2002: Maas of Kronos email to Fisher at International Business Management Associates (IBMA) "Huntsman has announced a North American price increase of $150/mt?? It sounds weird to me. I think they got it wrong. Can you confirm anything from your lofty position???"

September 13, 2004: Millennium CEO meeting with President of Huntsman.

September 14, 2004: Internal Millennium email: "We now have competition on board for Oct 1 price increase . . . "

August 29, 2007: Du Pont's Connie Hubbard internal email summarizes phone call with Fisher at IBMA "[V]ery confident that Tronox, Kronos, and Huntsman will all follow Du Pont's price increase."

September 20, 2004: Additionally, there are numerous documents in the record regarding data in the Global Statistics Program [GSP] of the trade association TDMA, including the following from Basson of Kronos who forwards email from Cianfichi of Millennium:

> Any TDMA statistics that are shared with you or . . . your co-workers should UNDER NO CIRCUMSTANCES BE DIVULGED TO ANY THIRD PARTIES. . . .[15]

Under what legal standard could these interfirm communications be considered simply normal, independent business conducted "consistent with non-collusive activity"? On their face, they appear to be more than the pure "conscious parallelism." Using Posner's probabilities standard to evaluate the communications within the entire mosaic of circumstantial economic evidence (declining industry demand, reduced costs, and excess industry capacity) is there "a non-negligible probability that the claim [price-fixing] is valid"? By this standard, it is difficult to characterize the communications

14. Confirming what Adam Smith observed in his classic work *The Wealth of Nations*, interfirm communications still are not unusual and cooperation in price-setting is extensive in U.S. industry. Various experienced executives were quoted in 1975 as follows: "The overwhelming majority of businessmen discuss pricing with their competitors. . . . Price-fixing has always been done in this business, and there's no real way of ever being able to stop it. . . . It's just the way you do business. There's an unwritten law that you don't compete. It's been that way for 50 years." *See Price-Fixing: Crackdown Under Way*, Business Week, June 2, 1975, at 42.

15. It is difficult to interpret such private "eyes only" communications among rivals containing a strong warning that under no circumstances should these data become public, as anything other than as means of facilitating coordination.

as something other than messages by titanium competitors to reach a consensual agreement on the price increase.[16]

III. Empirical Surveys of Price-Fixing Cartels

This interpretation is supported by extensive published research in economic literature on the market characteristics associated with price-fixing conspiracies that have been detected and successfully prosecuted by antitrust authorities. The most prominent of this research is the Hay and Kelly study,[17] which focused on identification of market structure features that serve as determinants of cartel-like behavior. Their findings corroborate the predictions of oligopoly theory, namely, that agreements are easier to arrange when the number of sellers is small, that is, ten or fewer, selling homogeneous-like products in mature, slowly growing, or stagnant markets. The principal finding of that study was the high incidence of formal, illegal price-fixing agreements that emerged in tight-knit oligopolies (few sellers), in which, under standard oligopoly theory, tacit collusion might have been expected instead. That finding poses troublesome questions regarding the validity of the pure, interdependent behavior theory cited in *Valspar v. E. I. DuPont* and other recent court opinions as vindication for suspect interfirm behavior.

Empirical economic literature also discloses that cartels and cartel-like arrangements have come in many varieties, the most notable of which is the large realm of price-fixing agreements ranging from tight pacts to loose, informal understandings.[18] What is common to all, however, is that price is the key element in the agreements, as documented by Hay and Kelly. Of special interest for this analysis is the role played by trade associations in facilitating cooperation among sellers using information disseminated as a basis for eliminating price cutting or outright price fixing.

A. Survey of Recent U.S. Cartels

As noted earlier, not all courts have jumped on board with the new learning. In the interest of tracing the efficacy of what appears to a new learning, the author has reviewed publicly available complaints, discovery documents, and court decisions from a dozen prominent price-fixing conspiracies that were detected over the past ten to twenty years. One-half of the cases were successfully litigated; other cases involve class action suits in which class certification was granted, some of which are still in the discovery phase, are on appeal, or set for trial. The explanation for the successful identification and proof of price fixing and bid rigging in these actions is a mixture of more diligent work by plaintiff attorneys in digging out smoking gun evidence from interfirm communications, trade association activities, strong reports by economic experts, and more generous inferences of illegal collusive behavior by the courts.

The data uncovered in these cases document both **market structure** characteristics, and the role of **behavioral** features, including "plus factors," in the price-fixing or bid-rigging arrangements.[19] The findings are presented in Table 1, in the form of a "matrix" displaying the author's identification and inference of the structural factors and behavioral conditions associated with the incidence of cartelized markets, based on publicly available documents. The table is organized with a stub on the left listing three separate groups of market features: (1) market structure characteristics; (2) interfirm behavioral

16. In short, as Page has observed the data suggest the presence of "tacit agreement as interdependent conduct coordinated by prior communications of competitive intentions." *See* Page, *supra* note 6.
17. *Id.* at 32–39.
18. *See* the literature cited above, plus A. N. Madhavan, Robert T. Masson, and W. H. Lesser, *Cooperation for Monopolization? An Empirical Analysis of Cartelization*, 76 Rev. Econ. & Stat. 161 (February 1994).
19. The author wishes to note that he served as economic consultant on some of the cases listed and testified as expert witness for the state plaintiffs in the school milk litigation.

Table 1. Collusion Detection Matrix.

Industry	Milk	Auto Parts	Flat Glass	Urethanes	Air Cargo	Container board	Packaged Ice	Steel	Capacitors	Liquid Crystal Display	Cathode Ray Tubes	Titanium Dioxide
Market Structure												
High concentration	X	X	X	X	X	X	X	X	X	X	X	X
Entry barriers	X	X	X	X	X	X	X	X	X	X	X	X
Homogeneous production	X	X	X	X	X	X	X	X	X	X	X	X
Inelastic demand	X	X	X	X	X	X	X	X	X	X	X	X
Large no. of buyers	X	X	X	X	X	X	X	X	X	X	X	X
Excess capacity	X	X	X	X	X	X	X	X	X	X	X	X
Stable/declining industry demand	X	X	X	X	X	X	X	X	X	X	X	X
Active trade associations	X	X	X	X	X	X	X	X	X	X	X	X
Interfirm behavior												
Data sharing	X	X	X	X	X	X	X	X	X	X	X	X
Trade association members	X	X	X	X	X	X	X	X	X	X	X	X
Intercompany sales	X	X	X	X	X	X	X	X		X	X	X
Price signaling	X	X	X	X	X	X	X	X	X	X	X	X
Follow-the-leader pricing	X	X	X	X	X	X	X	X	X	X	X	X
Plus Factor												
Emails	X	X	X	X	X	X	X	X		X	X	X
Telephone calls	X	X	X	X	X	X	X	X				X
Meetings	X	X	X	X	X	X	X	X		X	X	X

activity; and (3) plus factors. The names of the industries included listed across the top. An "X" inserted in a cell represents the author's deduction that the structural factor or behavior was present in the particular industry listed.[20]

School milk. Fluid milk has been marketed under a cartel system ever since the 1930s, largely under the operations of the U.S. Department of Agriculture. Raw milk pricing is set by federal marketing orders (FMOs), and most retail milk prices are controlled by various state regulations. Because of the historical regulatory framework and culture in the dairy industry, it is no surprise the price-fixing/bid-rigging schemes in the school milk markets reflected all of the collusion matrix features in Table 1, including hard circumstantial evidence of communications and agreements hatched and implemented through dairy cooperatives under cover of state milk marketing commissions. The results reported in the table are from information uncovered in cases ending with guilty verdicts, or guilty pleas, in various conspiracies in Florida and Kentucky, among a dozen southern states that successfully prosecuted dairies during the period from 1988 to 1993.[21] The Florida cartel included nine national dairies involved in rigging bids on half pints of milk sold to thirty-two Florida school districts over the period 1979 to 1989.

Auto parts. In 2012 the U.S. Department of Justice (DOJ) launched a long-running probe into price-fixing in the auto parts industry by Japanese manufacturers (Fujikura, Stanley Electric, Furakawa, Bridgestone, et al.) that spanned a period from January 2001 to December 2008. Subsequently, many private complaints were filed (combined as multidistrict litigation [MDL]), which resulted in over $1.6 billion in total fines.[22] As of April 2016, Hitachi, Mitsubishi, Sumitomo Electric, and other defendants reached settlements with MDL plaintiffs involving payments of more than $288 million.[23] The cartel activity uncovered by investigators involved dozens of auto parts conspiracies, covering multiple types of auto parts, and billions of dollars in commerce. The complaints claimed that the defendants conspired during meetings and conversations, often in remote locations, using code names to sell parts at noncompetitive prices to U.S. automobile companies. Once again, it is not surprising that the auto parts cartels reflected all the characteristics in the collusion detection matrix.

Flat glass. The flat glass antitrust litigation consists of class action suits filed in 2008, alleging that beginning at least as early as 2004 under the cover of trade associations—Glass Association of North America (GANA) and Primary Glass Manufacturers Council (PGMC)—defendants agreed to price-fixing arrangements in two principal ways: (1) to raise prices to customers in a coordinated fashion and (2) to implement identical "energy surcharges."[24] The complaints charged that defendants met, discussed, and agreed upon (1) the level and timing of price increases, and (2) which company was to lead the price increase, which resulted in identical percentage-based price increases on construction flat glass products.

At the same time U.S. defendants were fixing prices in the U.S., their European counterparts (except PPG) were similarly fixing prices in Europe, which triggered actions by the European Commission (EC). The EC uncovered definitive evidence of a price-fixing cartel which operated through face-to-face meeting in restaurants and hotels, in which European affiliates of AGC, Guardian, Pilkington, and Saint-Gobain agreed on prices, the timing of price-increase announcements, and minimum prices to be

20. The presence of these factors was determined by examination of both publicly available complaints and court opinions rendered in each of the cases cited.
21. *See* Robert F. Lanzillotti, *The Great School Milk Conspiracies of the 1980s*, 11 Rev. Indus. Org. 413 (1996).
22. *E.g.*, *see* USA v. Fujikura Ltd., Case No. 2:12-cr-20154 (U.S Dist. Ct., E.D., Mich.); and USA v. Bridgestone Corp., Case No. 3:14-cr-00068 (U.S. Dist. Ct., No. Dist., Ohio).
23. *See Mitsubishi to Pay $84 M in Parts Antitrust MDL*, Law 360, Apr. 15, 2016.
24. *See* Perilstein Glass Co. et al. v. Asahi Glass Co., AGC Flat Glass, Guardian Industries, Pilkington No. Amer., and PPG Industries (Jan. 31, 2008); and *In re* Flat Glass Antitrust Litigation, Misc. No.: 08-180 (DWA), MDL. No. 1942 (Sept. 5, 2008).

charged in the sale of construction flat glass. The EC actions resulted in fines totaling €486.9 million, among the highest fines ever assessed by the EC.

Urethane (polyether polyol products). Class action suits were consolidated in 2006 against Bayer AG, Bayer Corp., BASF, Dow Chemical, Huntsman International, and Lyondell Chemical, alleging that from January 1, 1999, through December 31, 2004, defendants engaged in a combination to fix, raise, stabilize, or maintain prices and to allocate customers in the markets for polyether polyol products in the United States. The complaint alleges that defendants met secretly at meetings and in communications to discuss prices, customers, and markets, and for giving false and pretextual reasons for price increases. Plaintiffs won a $1.06 billion jury verdict, which was upheld by the Tenth Circuit on appeal.[25] Dow, the only company still fighting the case, recently announced that it has agreed to a $835 million settlement instead of continuing its appeal to the U.S. Supreme Court.[26] In addition to this settlement with the class, Dow recently paid an additional $400 million to settle with a group of opt-outs.

Air cargo shipping services. This antitrust litigation consists of both criminal and civil actions, charging international airlines with a conspiracy between 2002 and 2006 to inflate fuel and security surcharges. In February, 2006 the DOJ and EC raided airline offices and seized documents in the U.S. and Europe, followed by DOJ indictments of twenty-two airlines and twenty-one airline executives, plea agreements, $1.8 billion in criminal fines, and prison sentences for four airline executives. The conspirators took advantage of the DOJ's Corporate Leniency Policy and pled guilty to taking part in meetings, conversations, and other communications—facilitated by the industry's principal trade association, the International Air Transport Association (IATA)—to fix fuel and security surcharges.

The DOJ actions led to widespread multidistrict litigation comprised of more than ninety lawsuits, filed in 2006 against more than two dozen airlines,[27] which resulted in more than $500 million in settlement payments by the air carriers. To date, the twenty-six groups of defendants have settled with plaintiffs, agreeing to payments totaling $1.2 billion. Once again, the complaints and plea agreements disclosed that the cartel satisfied all of the structural and behavioral features of the collusion matrix.

Containerboard products. This case involves a consolidated class action complaint alleging that defendants (Packaging Corp. of America, International Paper, Cascades Canada, Norampac Holdings, Weyerhaeuser, Georgia Pacific, Temple-Inland, & Smurfit-Stone Container) colluded to restrain supply in order to raise, maintain, and stabilize the price at which containerboard products (linerboard, corrugating medium, sheets, boxes, and other containers) sold during February 15, 2004, through at least November 8, 2010.[28] The court certified the class in March 2015.

The industry has all the structural and behavioral earmarks characteristic of cartels (significant entry barriers, capital-intensive start-up costs, standardized products with no close substitutes, inelastic demand), and activities associated with a number of important groups and trade associations (Fibre Box Association [FBA] and the American Forest & Paper Association). The collusive activities can be traced to a June 2005 industry conference where pricing strategies were discussed, followed by an FBA conference in September, followed by coordinated price increases, plus allegations of coordinated reductions in industry production capacity to restrict supply.

25. The case is *In re* Urethane Antitrust Litigation, Case No. 13-3215 (U.S. Court of Appeals, 10th Cir.). The jury assessed damages at just over $400 million, which after trebling and offsetting the settlements with the other defendants, left Dow facing a $1.06 billion judgment.
26. *See Dow Opts for $835 M Price-Fix Deal After High Court Shake-Up*, Law 360, Feb. 26, 2016.
27. *See* the master No. 06-MD-1775 (JG)(VVP).
28. *See* Kleen Products LLC, et al. v. Packaging Corporation of America, et al., Case No. 1:10-cv-05711 (U.S. Dist. Ct., N.D. Ill., E.D.).

Packaged ice products. This litigation involves a class action complaint filed in 2008 alleging an international conspiracy by defendants (Artic Glacier, Inc., Artic Glacier International, Inc., Reddy Ice Holdings, Inc., and Home City Ice Co.), to fix raise, maintain, and stabilize prices, and to allocate markets of packaged cubed, crushed, block, and dry ice (packaged ice) in the U.S. during the period from January 2002 to the present.[29] The class action suit was filed following investigations of the packaged ice business by the DOJ and the Canadian Competition Bureau.

The defendants are the largest manufacturers of packaged ice in the U.S., accounting for 70% of third-party manufacturers' sales. The industry is characterized by virtually all of the structural features conducive to collusive behavior (high barriers to entry, homogeneous products, inelastic demand, mature industry) and evidence of agreements not to compete head-to-head in any markets in which one of the defendants was dominant. The case was settled with payments by defendants before class certification.

Steel products. This litigation involves a consolidated class action suit alleging an agreement among defendants (Arcelormittal, U.S. Steel Corp, Nucor Corp., Gerdau, Ameristeel Corp., Steel Dynamics, AK Steel Holdings, SSAB Swedish Steel Corp., and Commercial Metals) to restrict output and to fix, raise, stabilize, and maintain artificially high prices charged for steel products in the U.S. from 2005 to the present.[30] A number of separate actions were filed against the defendants. In September 2015, Judge Zagel certified the class.[31] All defendants have settled.

Capacitors. Various investigations into alleged cartel activity were triggered in China and the United States (later by Japan and Korea) after a capacitor manufacturer approached officials in those countries with a request for "leniency" under both countries' respective amnesty programs.[32] Subsequently, in October 2014, a class action lawsuit was filed, on behalf of plaintiff Quathimatine Holdings, Inc. (d/b/a Divicom, USA) and other direct purchasers, against major capacitor manufacturers (now numbering fifteen defendants) for allegedly engaging in a multiyear conspiracy beginning in 2000 to fix, raise, maintain, and/or stabilize the prices of capacitors sold in the United States.[33] The litigation is still in the early stages of discovery and other pretrial activity.

Capacitors are passive components that are found in nearly all electrical products. Their function is to store an electrical charge and stabilize the flow of current through a circuit. The two principal types of capacitors are those made of aluminum and others made of tantalum. Capacitors are also made of ceramic materials, but producers of those products are not involved in this litigation. The capacitor market has all of the features that are conducive to cartel activity. The top six aluminum capacitor manufacturers account for 65% of industry sales, and the top seven tantalum capacitor manufacturers account for 95% of that part of the market.

Cathode ray tubes. This litigation consisted multidistrict (MDL) Section 1 actions, consolidated in 2008, involving claims against televisions parts makers (Chunghwa Pictures Tubes, LG Electronics, Hitachi, et al.) for conspiring to fix the prices of cathode ray tubes used in TVs and computer monitors between 1995 and 2007. Direct purchasers agreed in 2013 and 2015 to accept $577 million in settlement payments. Some indirect purchasers objected to the $577 settlement, contending that the settlement

29. The Complaint is Mall Mart, Inc., D/B/A Midway BP, et. al. v. Artic Glacier Income Fund, Artic Glacier, Inc., Artic Glacier International, Inc., Reddy Ice Holdings, Inc., and Home City Ice Co.
30. See Standard Iron Works v. ArcelorMittal, et al., Case No. 08-cv-5214.
31. See *In re* Steel Antitrust Litigation, Memorandum Opinion and Order No. 08 C 5214 (Sept. 9, 2015).
32. The Department of Justice of the United States' "Corporate Leniency Policy" provides an amnesty applicant with immunity from criminal prosecution in exchange for disclosing the existence of a cartel and assisting the DOJ in the prosecution of cartel members under the Sherman Act.
33. The case is *In re* Capacitors Antitrust Litigation, No. 14-cv-03264 (N.D. Cal.).

is unfair and that legal fees awarded were excessive.[34] The remaining cases proceeding to trial in late 2016 involve some indirect purchaser "opt-outs."

Liquid crystal display. This litigation concerns a claim against AU Optronics Corp., LG Display Co., Toshiba Corp. and several other companies alleging the companies engaged a price-fixing arrangement on liquid crystal display (LCD) panels, overcharging direct purchasers, as well as indirect purchasers (consumers). In April 2012, Judge Susan Illston ruled that the trial would be split into two parts, the first stage focusing on whether the companies conspired to raise prices and overcharged the direct purchasers, and the second devoted to indirect purchaser claims.[35] In late April 2012, the companies reached a settlement with indirect purchaser plaintiffs and the state attorney generals of eight states with payment of over $500 million. In September 2012, AU Optronics was ordered by a federal judge to pay $500 million in penalties, and two of its executives were fined $200,000 each and sentenced to three years in prison for their roles in the conspiracy. In January 2013, direct purchaser Dell reached a settlement agreement. In January 2014, the U.S. Supreme Court refused to review a Fourth Circuit Court ruling that the South Carolina's attorney general's price-fixing suit against LCD manufacturers belongs in the state court.[36]

IV. Summary and Conclusions

In summary, the foregoing review of many antitrust cases confirms that, both theoretically and empirically, price-fixing agreements are most likely to occur and succeed in markets with this mixture of structural/behavioral features: (1) a small number of sellers (i.e., relatively high concentration/ Herfindhal-Hirschman Index [HHI]) (2) producing homogeneous products with relatively inelastic, stable, or declining industry demand; (3) significant barriers to entry; (4) excess industry capacity; and (5) distinctive evidence of cooperative interfirm behavior, including face-to-face activity in industry trade association meetings, consistent price signaling, a historical pattern of disciplined follow-the-leader pricing, and intercompany sales at below market prices.

Finally, these conclusions, supported in part by the economic evidence of collusive behavior uncovered in the group of twelve industries discussed above, admittedly are at odds with many court opinions referenced herein regarding the legality of parallel behavior, characterized as a theory of simple interdependent behavior, that have passed muster under the new learning standard. Examination of the rulings in all these cases also disclosed that the extent to which circumstantial economic evidence alone can establish an antitrust conspiracy remains somewhat moot. Because of the importance of this issue in resolving price-fixing complaints, I hope that this article will stimulate debate from both the economics and legal communities. A suggested starting point for discussion might focus on the collusion detection matrix identifying structural and behavioral economic characteristics, which I believe can provide a useful analytical framework for antitrust agencies, independent analysts, and trial courts in identifying noncompetitive pricing behavior that violates Section 1 of the Sherman Act.

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34. For most recent settlement agreement, *see Best Buy to Settle Claims Against Chunghwa*, Law 360, Mar. 11, 2016.
35. *See In re* TFT-LCD (Flat Panel) Antitrust Litigation, Case No. 3:07-md-01827 (N.D. Cal.).
36. *See* AU Optronics Corp. et al. v. South Carolina, Case No. 12-911 (U.S. Sup. Ct.).